Swedavia – McGregor Report

Review of Civil Aviation Safety Regulations and the Resources, Structure and Functions of the New Zealand Ministry of Transport Civil Aviation Division

Swedavia AB
Sweden

McGregor & Company
New Zealand

April 1988

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Prepared under the auspices of a Steering Committee representing
Ministry of Transport
The Treasury
State Services Commission
Department of Trade and Industry

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Abstract

The civil aviation system in all developed countries is subject to rules and regulations reflecting the particular State's international obligations and domestic laws. The level of detail embodied in regulations varies from one country to another. In the public interest there is a division of responsibility between the State and the operator over matters of civil aviation safety. The principles for this division must be clearly defined to establish the State's legislative framework and responsibilities for setting standards, licensing individuals, delegating authority and carrying out surveillance. This review considers the need for regulatory controls in civil aviation, identifies the appropriate level of regulation and determines the resources needed for a civil aviation safety authority in New Zealand. The review distinguishes between the minimum level of regulation to comply with international obligations (viz ICAO) and discretionary levels of regulations which may be desirable but are not obligatory. The costs and benefits of civil aviation regulations are identified. How best to administer civil aviation regulations in New Zealand is determined. The review concludes that a stand-alone State institution is the most appropriate for a civil aviation safety authority in New Zealand and that cost-benefit analysis should, whenever practicable, be a mandatory tool for rule making in discretionary areas.

Keywords: civil aviation: safety: regulation: legislation: authority: New Zealand; organisational structure: ICAO: costs and benefits

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GLOSSARY

ACNZ	Airways Corporation of New Zealand Ltd
Act	Civil Aviation Act 1964
AGME	approved glider (and powered glider) maintenance engineer
AI	Airline Inspector
AIP	Aeronautical Information Publication
Air NZ	Air New Zealand Limited
AKL	Northern region of CAD
ALPA	New Zealand Airline Pilots' Association
ANC	Air Navigation Commission (ICAO)
AOPA	Aircraft Owners' and Pilots' Association (New Zealand) Inc
ASLA	Air Services Licensing Authority
ASL Act	Air Services Licensing Act 1983
ATC	air traffic control
ATCO	air traffic control officer
ATPL	Airline Transport Pilot Licence
ATS	Air traffic service
BCAR	British Civil Aviation Requirements
BNZ	Bank of New Zealand
CAA	Civil Aviation Authority (UK)
CAD	Civil Aviation Division, Ministry of Transport
CADMOT	Civil Aviation Division, Ministry of Transport
CAIC	Civil Aviation Information Circulars
CAIC-AIR	CAIC airworthiness
CAIC-GEN	CAIC general
CAIC-PEL	CAIC personnel licensing
CAP	Civil Aviation Pamphlet
CASA	Civil Aviation Safety Authority
CASO	Civil Aviation Safety Order
CBA	cost-benefit analysis
CHC	Southern region of CAD
C*of*A	certificate of airworthiness
CPL	Commercial Pilot Licence
CVR	cockpit voice recorder
DFC	Development Finance Corporation
Director	Director of Civil Aviation
DME	designated medical examiner
ECAC	European Civil Aviation Conference
EPM	engineering procedures manual
FAA	Federal Aviation Administration (US)
FAI	Federation Aeronautique Internationale
FAR	Federal Aviation Regulations
FDR	Flight data recorder
GAI	General Aviation Inspector
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IFR	instrument flight rules

IMC	instrument meteorological conditions
JAR	Joint Airworthiness Requirement
LAME	licensed aircraft maintenance engineer
M	million
MAANZ	Microlight Aircraft Association of New Zealand (Inc)
MAUW	maximum all up weight
MCTOW	maximum certified take off weight
MEL	minimum equipment list
MET	meteorology
MOT	Ministry of Transport
NDT	non-destructive testing
NOTAM	Notices to Airmen
NTSB	National Transportation Safety Board (US)
NZAAC	New Zealand Amateur Aircraft Constructors Association (Inc)
NZAIP	New Zealand Aeronautical Information Publication
NZCAR	Civil Aviation Airworthiness Requirement
NZFPC	New Zealand Federation of Parachute Clubs
NZGA	New Zealand Gliding Association (Inc)
NZMS	New Zealand Meteorological Services
OECD	Organisation for Economic Cooperation and Development
pa	per annum
PANS	Procedures for Air Navigation Services (ICAO)
PANS-RAC	PANS – Rules of the Air and Air Traffic Services
PANS-OPS	PANS – Aircraft Operations
PANS-ABC	PANS – Abbreviations and Codes
PMO	Principal Medical Officer
PPL	Private Pilot Licence
RAS	Regional Airworthiness Superintendent
Regulations	Civil Aviation Regulations 1953
RNZAC	Royal New Zealand Aero Club
SAR	search and rescue
SARPS	Standards and Recommended Practices, designated as Annexes to the Convention
SCPL	Senior Commercial Pilot Licence
SFAR	Special Federal Aviation Regulations (US)
SI	International System of Units
SIU	strategic issues unit
SLAET	Society Licensed Aircraft Engineers and Technologists (NZ) Inc
SOE	State-owned Enterprise
SPL	Special Pilot Licence
STC	supplemental type certificate
superDME	a DME who has completed a post-graduate diploma in aviation medicine
UK	United Kingdom
UN	United Nations
US	United States of America
VFR	visual flight rules
USAFSAM	United States Air Force School of Aerospace Medicine
WLG	Central region of CAD

SUMMARY

PURPOSE OF THE STUDY

The purpose of this study is to:

- consider, from the viewpoint of safety, the need for regulatory controls and enforcement requirements;
- recommend the appropriate level of regulation with regard to safety, economics and New Zealand's international commitments; and
- recommend institutional arrangements, organisational structure and resource requirements for the regulatory authority.

PURPOSE OF A CIVIL AVIATION SYSTEM

The primary purpose of a civil aviation system is to transport people and cargo safely and efficiently. To achieve this requires a civil aviation system – comprising the aircraft operations system, the aerodrome system and the airspace system. These three subsystems are governed by two sets of requirements:

- transport requirements, to meet the primary objective of the system, which may involve rules and regulations of a commercial nature; and
- safety requirements, to achieve an appropriate level of safety, which may involve rules and regulations

CONTROL OF CIVIL AVIATION IN NEW ZEALAND

Civil aviation in New Zealand is controlled by an Act of Parliament supported by Regulations. The Director of Civil Aviation is empowered to issue technical standards and rules in the form of instructions, orders and requirements as necessary to implement the Act and Regulations.

ICAO AND THE CHICAGO CONVENTION

The International Civil Aviation Organisation (ICAO) had its origins in the 1944 Chicago Convention on international civil aviation. The main objective of the Chicago Convention was to ensure safe and orderly development of international civil aviation. On a technical level the Convention has been very successful through the adoption of technical annexes prescribing standards and recommended practices to be followed by ICAO Member States. The obligation on ICAO members is to *adhere* to the standards and to *endeavour to follow* the recommendations.

DUTIES OF A CIVIL AVIATION SAFETY AUTHORITY

Based on ICAO commitments, the following functions define the duties of a national civil aviation authority:

- to define goals and objectives for safety levels;
- to develop and maintain national rules, regulations and standards;
- to ensure that all participants in the system are competent and operate according to rules and standards;
- to support persons and organisations in the system with information and advice;
- to analyse information to identify potential hazards, adverse safety trends and system shortcomings; and
- to investigate accidents and incidents.

Although the above safety authority functions are found in all developed countries, ambition levels and resource allocations will vary, depending on national resources and the nature of the national air transport system.

CIVIL AVIATION ACT AND REGULATIONS

The contents of New Zealand Civil Aviation Act and the Regulations comprise a complex and, in many areas, detailed patchwork of rules and regulations which are: difficult to understand, confusing, incomplete (*eg* with respect to responsibilities), out of date, too detailed and inappropriate. Overall, the legal basis and framework of civil aviation legislation does not provide the civil aviation authority with an appropriate instrument to do its job. As well, the present civil aviation legislation does not make life easy for the industry in an operational, technical and administrative sense.

The scope of activity within the New Zealand civil aviation system is wide and various. The technology used within the system ranges from Tiger Moths and Dragon Rapides to Boeing 767s and Flacon 200s. Helicopters are a feature of the New Zealand aviation scene. The environment ranges from isolated mountainous terrain to rolling farm lands and plains. Similarly, weather conditions make aircraft operations demanding. The individuals within the system range from enthusiast and farmer pilots to professional flight crew with worldwide operating experience. The rules and regulations for the civil aviation system must cater for all these participants, their operations and the technology in use. At the same time the rules and regulations must provide an appropriate balance between third party, commercial and regulatory powers.

CONSULTATION WITH INDUSTRY AND CAD

Members of the review team travelled extensively throughout New Zealand and interviewed 114 people from 46 companies or organisations involved in civil aviation. As well, 13 written submissions were received. It is evident that the civil aviation industry at large seeks:

- simple and easily understood regulations;

- a civil aviation safety authority that has the knowledge, skill and experience (in terms of people and systems) to monitor and enforce the regulations;
- recognition of the changing economic, technological and practical environment in which they operate;
- appropriate standards and practices for the operation of aerodromes and the air navigation system; and
- a regulatory system that permits them to do their job in the most practical, economic and safe manner.

Within CAD, 20 people from the regions and 27 from head office were interviewed, and 16 written submissions were received.

Regarding the regulatory system, CAD people share concerns and expectations similar to those of the industry. CAD people recognise the problems of ambiguity and non-conformity in interpretation of the regulations. CAD's and the industry's reviews on enforcement coincide.

There is widespread agreement that the Civil Aviation Act and Regulations should be completely revised. The revised legislation should address:

- a framework for the total civil aviation system
- provision for the Civil Aviation Safety Authority
- flight safety requirements
- enforcement provisions

NEW ZEALAND'S SAFETY RECORD

Comparison of New Zealand safety levels with those overseas is made difficult by lack of standardisation of definitions. Nevertheless we are able to conclude that there is no cause for New Zealand to be complacent about safety levels in civil aviation. This applies to all sectors of the aviation industry.

THE ECONOMIC SAFETY LEVEL

Safety and, conversely, risk can be considered in two dimensions: the *probability* of an accident and the *consequence* of an accident. If the consequence of an accident is catastrophic the frequency of such accidents will need to be very low – compared with a general acceptance of frequent accidents having minor consequences. It follows there is an acceptance of a higher level of risk in those parts of the aviation system where few people are placed at risk on each flight. Lower levels of risk are expected as more people are carried on each flight. The consequence of this is seen in aircraft design. Today's design standards for large aircraft represent a target safety level of at least:

- 1000 million flight-hours per catastrophic accident for *each* catastrophic system failure condition; and
- 10 million flight-hours per catastrophic accident taking into account the combined effect of *all* system failure conditions.

Small aircraft (less than 30 passengers) are built to less stringent designs.

A wide range of measures are taken to reduce the risk of fatal accidents. To find the economic level of effort to devote to such risk reduction the benefits must be assessed so they can offset the costs. This is to ensure that the resources used to reduce risk are used efficiently.

The fundamental economic principle in the determination of aviation safety policy should be:

> *in all sectors of the economy, even when life and limb are at risk as an unfortunate by-product of the productive process, the simple fundamental principle should be that the benefits to society should outweigh its costs to society.*

THE NEED FOR REGULATIONS

If every consumer and producer in the system had perfect knowledge and foresight there would be no need for safety regulations. In the real world these conditions are not met and it is clear that:

- the travelling public wants the feeling of complete security in the air;
- most operators in commercial aviation consider there should be common standards for all;
- one wide-bodied jet accident is a catastrophe, and avoiding one such accident every 50 years could justify in economic terms having a safety watchdog; and
- the history of safety-motivated civil aviation regulations suggests that governments have not trusted free market forces.

NEW ZEALAND’S ICAO OBLIGATIONS

As an ICAO Member State New Zealand’s obligations are limited to international civil aviation. New Zealand is bound to have a comprehensive set of safety regulations based on the principles laid down in the ICAO Annexes. The national regulatory framework must ensure that, in exercising the discretions of the individual State, aviation system safety for international civil aviation is not downgraded below the level defined by the Annexes.

New Zealand’s ICAO obligations cannot be met unless those parts of domestic aviation interfacing with international aviation comply with the same requirements as are imposed on international aviation. In practical terms, New Zealand has no discretion to decide whether or not to use ICAO minimum requirements for major domestic airlines.

The areas where the State could apply a lower standard, outside the ICAO umbrella, are:

- domestic commercial aviation and
- private flying

operating outside those parts of the aviation system used by international airlines.

As an ICAO Member State New Zealand must: develop and promulgate national legislation, regulations and standards to comply with ICAO commitments; and decide on the remaining, discretionary areas of civil aviation regulations and standards.

RESPONSIBILITIES OF PARTICIPANTS

To make the system more effective there should be a clear-cut division of responsibilities for safety between the State authority and the participants, designed on the assumption that approved firms and licensed individuals will act in a responsible way. The responsibility for ensuring that operations are performed properly must rest with the approved organisation. Quality assurance and comprehensive manuals will assist. In recognition of this transfer of responsibility the safety authority should reduce the attention it gives to personnel at lower levels. The safety authority should confine its interest to the organisational structure and key personnel. The same logic applies to the Airways Corporation.

To ensure the system works safety and efficiently, well-established procedures and requirements are needed before participants can enter the system. The safety authority should provide standards, exercise entry control, perform functional supervision, perform exit control and amend regulations and standards based on analysis of change. There should be a consultative process with the industry when changes to the regulations and standards are proposed. The safety authority should continue to support the industry through provision of safety information. The safety authority should not, however, provide a consulting service; to do so could result in a blurring of responsibilities between the authority and the industry and is more properly the latter’s responsibility. It should be noted that when corrective action is required the main objective should be to bring performance back to within the prescribed framework. The approach should be constructive, rather than punitive or confrontational.

The creation of independent aerodromes and airways indicates a need for clearly defined responsibilities. The Airways Corporation and airports are approved organisations and need to be regarded as such by the safety authority. The safety authority should set entry qualifications, establish standards, monitor performance and take necessary corrective action – the same as for airlines.

Procedures and responsibilities for investigating airways incidents require resolution. Within the aviation community there is widespread concern about the air traffic incident situation. It is therefore of great importance that the present conflict about incident investigation be resolved as soon as possible. The Office of Air Accidents Investigation has a discretion over which incidents it investigates. We propose that the safety authority be given powers to *require* the Office of Air Accidents Investigation to investigate incidents that the safety authority considers warrant such investigation.

PROPOSED NEW SAFETY AUTHORITY

The recommended form for the New Zealand civil aviation safety authority is a stand-alone State institution limited to dealing with safety-related issues. The civil aviation safety authority should be taken out of the Ministry of Transport and be established as a separate department of the public service. With the exception of the Aviation Security Service and management of some airports, CAD is today a regulatory and safety authority. There is no competition for or conflict over resources between CAD and the other modal divisions of the

Ministry of Transport. Nor is there a technical or operational interest by CAD in the affairs of the other two modal divisions, and *vice versa*. There is, however, presently some degree of competition and conflict for administrative support services within the Ministry.

It is proposed that the stand-alone *Civil Aviation Safety Authority of New Zealand* (CASA) be headed by a Director General and that the authority be organised in seven divisions:

- Standards Development
- Personnel Licensing
- Commercial Air Transport
- General Aviation
- Aerodromes and Air Navigation
- Airworthiness
- Support Services

There should also be a Quality Assurance Manager reporting to the Director General.

The institutional consequences of creating a purely safety-oriented civil aviation safety authority as a stand-alone public institution are not significant.

As a consequence of the institutional and organisation recommendations of this review, it is appropriate to review whether the Air Services Licensing Authority will serve any useful function.

The present organisational structure creates barriers around disciplines and is not directed towards meeting clients' needs. A client-oriented, output-oriented structure is proposed that will meet the current and potential needs of the civil aviation system more efficiently. Attention should be directed towards selecting management personnel based on managerial attributes and skills rather than specialist capabilities.

COST SAVINGS

As a result of the working methods and principles proposed, regional units can no longer be justified. We recommend that all resources of the safety authority be centralised in Wellington, a convenient location with good access to the rest of the country. The benefits of a united authority will be considerable, including uniformity in application of standards, improvement in efficiency, better staff utilisation and use of expertise, and considerable reduction in expenditure. The tasks of each division have been defined and analysed. The total staff required to fulfil the new role of the Civil Aviation Safety Authority has been assessed at 154, plus 14 extra staff during the implementation period. This is a reduction of 186 staff from the assessed figure of 340 for 1988/89. Combined with other savings, this leads to a reduction in expenditure of $9.5M a year. (The current staff complement of 340 is derived from the 1988/89 expenditure budget and the expenditure allocation made by Corporate Services).

SECURITY SECTION

CAD is responsible for setting standards and for operating and monitoring security services at the three international airports. Operating functions are inconsistent with the standard-setting and monitoring role of a safety authority. We recommend that operating functions transferred to the airport companies which, moreover can carry them out more cost-effectively.

IMPLEMENTATION

Release of this report will undoubtedly create considerable unrest within CAD and the civil aviation industry. The government should decide as soon as it can what steps it proposes to take pursuant to the report. It is very important that action is seen to be taken to gain the confidence of the industry and staff.

The Director General should be appointed as soon as the government gives its approval in principle to the report.

Because of the considerable reduction in safety authority personnel proposed, and because of the proposed closure of regional offices, it will be in the interest of the new safety authority, as well as its personnel, to make quick decisions as to which persons will have a place in the new authority.

We expect the new safety authority to be fully operational at the end of three years, and recommend that this be the target date for completion of the programme of change. Most of the changes should be capable of implementation within eighteen months. At that stage the staffing would be down to 154 plus the 14 additional people needed for the next eighteen months.

The difficult part will be changing the attitudes and behaviour of the people involved – both in the industry and the safety authority. Training seminars will be required for all staff, to: explain the new safety philosophy, teach new technical and personal skills, and demonstrate how to relate with the aviation industry. All this will take time and good management.

CHAPTER 1

INTRODUCTION

1.1 TERMS OF REFERENCE

A copy of the terms of reference for the review of Civil Aviation Regulations and the resources, structure and functions of the Ministry of Transport, Civil Aviation Division, is found in Appendix XIII. The salient points of the terms of reference are discussed below.

1.1.1 Purpose Of The Review

The Purpose of the review is threefold:

- to *consider* the need, in the interest of safety, for regulatory controls of civil aviation and their enforcements;
- to *identify* the appropriate level of regulation; and
- to *determine* the resources needed for a civil aviation safety authority (currently the Civil Aviation division of the Ministry of Transport).

1.1.2 Focus Of The Review

The focus of the review is:

- the need for civil aviation regulations;
- the costs and benefits of civil aviation regulations; and
- how civil aviation regulations should be administered

Regard is to be given to the Government's "user pays" policy and its intention to fully recover the costs of a civil aviation safety authority from the civil aviation industry.

1.1.3 Scope Of The Review

The scope of the review is divided into four separate but related area.

- *Identification of the legal basis for civil aviation regulations* to distinguish between:

    - the minimum level of regulation to comply with New Zealand's international obligations (*viz* ICAO); and
    - Discretionary levels of regulation which may be desirable but not obligatory.

- *Identification of the needs and expectations* of the various organisations and individuals making up the civil aviation system in New Zealand.

- *Identification of the costs and benefits of civil aviation regulations* in terms of:

  - Increased safety or savings in operating costs (*ie* benefits);
  - Compliance costs; and
  - Administrative, surveillance and enforcement costs (*ie* to the Government).

- *Identification* of the best organisational structure and institutional arrangement for a civil aviation safety authority including the resources required to support the structure.

1.1.4 Methodology

The consultants (*ie* the review team) were expected to have the appropriate technical, legal and economic skills and to have some international standing in these three fields as they relate to civil aviation.

During the conduct of the review the review team was to report to, and take direction from, a steering committee of New Zealand government officials. The steering committee consisted of:

- Mr Tim Sanger, Ministry of Transport (Chairman)
- Mr Gary Adams, State Services Commission
- Mr Greg Hedges, Department of Trade and Industry
- Mr Michael James, Treasury
- Air Commodore Stuart McIntyre, Ministry of Transport (Observer).

1.2 REVIEW TEAM AND ORGANISATION

The review team consisted of consultants from Swedavia AB lead by Lars-Erik Nordstrom (Project Leader) and McGregor & Company lead by Michael Murray (Deputy Project Leader).

Swedavia AB is a Swedish consultancy firm providing consultancy services and training services in civil aviation. The Swedavia participants were:

- Mr Lars-Erik Nordstrom
- Mr Torbjorn “Asterix” Rehn
- Mr Caj-Aage Johansson

McGregor & Company is a New Zealand consultancy firm providing advisory and analytical services in transportation. The McGregor & Company participants were:

- Dr Ron Allan
- Mr Ian Brown
- Dr Jan Owen Jansson[1]
- Mr Michael Murray

Mr Johansson and Dr Jansson spend three weeks each in New Zealand and made further contributions from their home offices.

The review team based itself in Wellington, New Zealand, for the duration of the review but also received support from:

- Swedavia's head office in Norrkoping, Sweden, and
- McGregor & Company's Auckland and Tauranga offices.

After mobilisation, initial briefing and planning, the review team formed two teams (one technical and one economic) to progress in parallel all the phases and tasks of the review. This team organisation:

- Enabled maximum ground to be covered in the specialist technical, legal and economic areas, and
- Facilitated good communication within the whole review team..

The technical team comprised:

- Lars-Erik Nordstrom
- Torbjorn "Asterix" Rejm
- Michael Murray
- Caj Aage Johansson

The economic team comprised:

- Ron Allan
- Ian Brown
- Jan Owen Jansson

In the latter stages of the review, after the investigatory and analytical phases were completed, the two teams merged again to develop and formulate the proposals and recommendations.

[1] Dr Jan Owen Jansson, Professor of Transport Economics, Swedish Road and Traffic Research Institute, Linkoping University, is associated with McGregor & Company

The review team met with the steering committee on:

24 November
22 December
12 February
19 February
4 March
18 March
23 March

The review team met with the Minister of Civil Aviation and Meteorological Services on 1 December and 8 March.

1.3 TASKS & METHODOLOGY

To meet the terms of the reference and satisfy the scope of the review, the following tasks needed to be accomplished as quickly and completely as possible, within the overall time constraints and budget of the job.

- Identification of the civil aviation system in New Zealand;

- Determination of the relevant capabilities of the system (that is the capabilities of CAD and all its clients);

- Determination of the needs and expectations of the organisations and individuals within the civil aviation system (eg airlines, aero clubs, airports, engineers, etc) and those affected by the system (eg passengers);

- Identification of the legal basis of the civil aviation system in terms of restrictions and possibilities;

- Identification and evaluation (where practical) of the effect of additional or discretionary levels of regulation; and

- Development of the best organisation to fulfil the regulatory role of the civil aviation safety authority.

To accomplish these tasks the review team decided on the following work plan.

1. Visit various organisations and individuals involved in or with civil aviation in New Zealand.

2. visit people working in the regional and district offices of the Civil Aviation Division.

3. Use in-house resources in both Sweden and New Zealand to research and analyse the various technical, legal and economic issues that arose from the field work or formed part of the general scope of the terms of reference.

5. Analyse, develop and discuss various technical, legal and economic alternatives to meet the purpose of the terms of reference (as well as some issues that go beyond the terms of reference, but needed to be canvassed for the sake of completeness and accuracy).

6. Formulate proposals and recommendations.

7. Write the report.

The first four steps were accomplished separately by the technical and economic teams. This allowed the review team, early on, to acquire different perspectives of the civil aviation system, its participants and their needs and expectations, as well as the legal basis of the system in terms of restrictions and possibilities. The last three steps were accomplished jointly, merging the two teams (and so knowledge, skill and experience) to achieve the final result.

1.4 STRUCTURE OF THE REPORT

The report is divided into four parts:

Part I An introductory section introducing the terms of reference, describing and introducing the concept of aviation safety and what it means.

Part II A factual review of the total civil aviation system in New Zealand describing the dimension capabilities, needs and expectations of the organisations and individuals involved in the civil aviation system.

Part III The analytical part of the report in which our proposals are developed by using a "green field" approach; here the economic principles are expounded, as well as the general principles for establishing the framework for a new regulatory system plus the role and functions of a regulatory authority. This part describes a new legislative framework in broad terms, recommends an organisational structure for the new civil aviation safety authority and looks at some aspects important for orderly implementation.

Part IV Summary of recommendations.

CHAPTER 2

THE CIVIL AVIATION SYSTEM

2.1 OBJECTIVES AND MAJOR SYSTEM COMPONENTS

The primary objective of the civil aviation is to transport people and cargo safely and efficiently from one place to another. The functions necessary to carry out this primary task together and constitute the *air transport system*. The system is centred around the passengers and cargo to be transported; they are the very reasons for the system's existence.

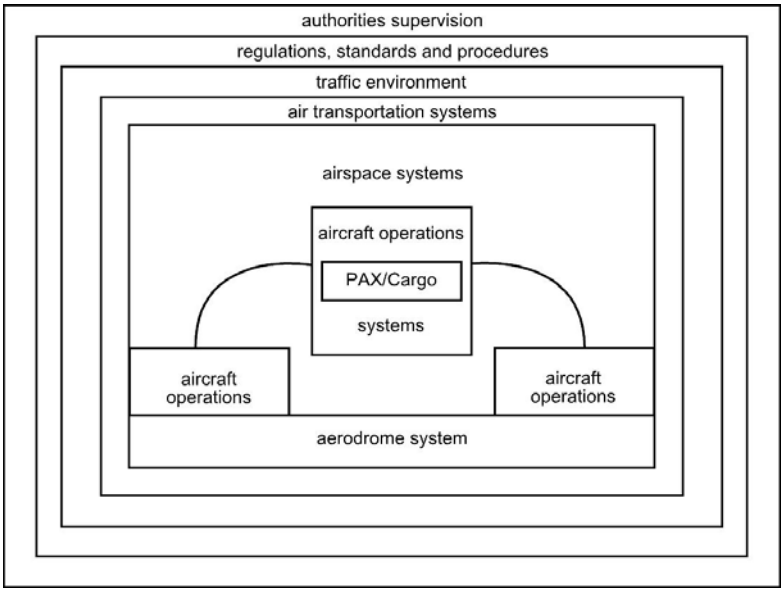
To perform the transport work three major subsystems are needed, as shown in Figure 2.1 and as listed below.

- *The aircraft operations system*, comprising all functions involved in making the aircraft fly safely and efficiently, including the functions serving aircraft on the ground.

- *The aerodrome system*, providing the necessary facilities on the ground for take-off and landing and for loading and unloading passengers and cargo.

- *The airspace system*, providing the airspace for aircraft movement and the required navigation, air traffic services and information services needed for safe completion of flights.

Figure 2.1 – Civil Aviation System

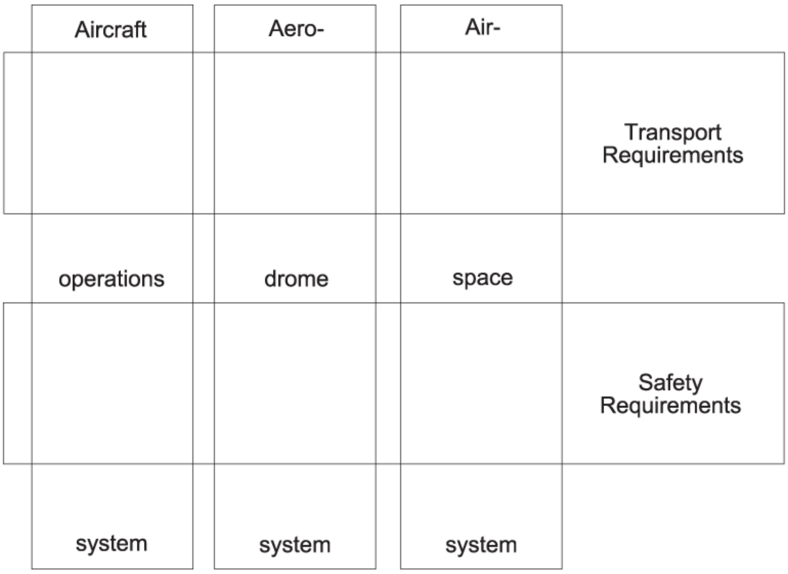


These three subsystems work in a *traffic environment*, which also comprises other transport modes (sea, rail, road). Governing these systems are *laws, regulations, standards and procedures,* and *governmental authorities* perform *supervision* to see that rules and requirements are respected.

Looking at the air transport system in a different way, as in Figure 2.2, the system contains three operational subsystems:

- the *Aircraft Operations System*,
- the *Aerodrome System*, and
- the *Airspace system*.

Figure 2.2 - Air Transport System



These three subsystems are all affected and governed by two sets of regulatory functions and requirements, namely:

- *transport requirements*, meaning policies, regulations and requirements to satisfy transport demands, allocating traffic rights domestically and internationally, and setting tarrifs; and

- *safety requirements*, meaning policies, regulations and requirements to achieve an appropriate level of safety in the air transport system.

Transport and safety policies/requirements are set by governments and State authorities.

Aircraft operations are generally carried out by private enterprises, and sometimes by State-owned enterprises. Aerodromes can be operated by a State, a local community or a private enterprise. In the vast majority of countries, the airspace system is considered to be a State responsibility, and its operation is the task of a State agency. In a few countries, New Zealand being one, the operation is carried out by a commercial organisation, State-owned *or* private.

2.2 INTERNATIONAL OBLIGATIONS IN CIVIL AVIATION

Towards the end of the Second World War it was recognised that international civil aviation would have enormous potential in post-war development. To provide for such development, international agreement on basic principles for international civil aviation was seen to be required. In 1944 the Chicago Convention on International Civil Aviation was agreed.

The main objective of the Convention was, and still is, *to ensure safe and orderly development of international civil aviation.* The long term goal was to achieve freedom of travel by air across national borders. To a large extent the Chicago Convention has achieved its purposes, although there are still many constraints in traffic rights and tariffs, which are mostly handled bilaterally. On the technical level, however, the Convention has been very successful.

This has been achieved through adoption of technical *Annexes* to the Convention. In a number of technical and operational areas, the Annexes prescribe *standards* and *recommended practices* to be observed by member States.

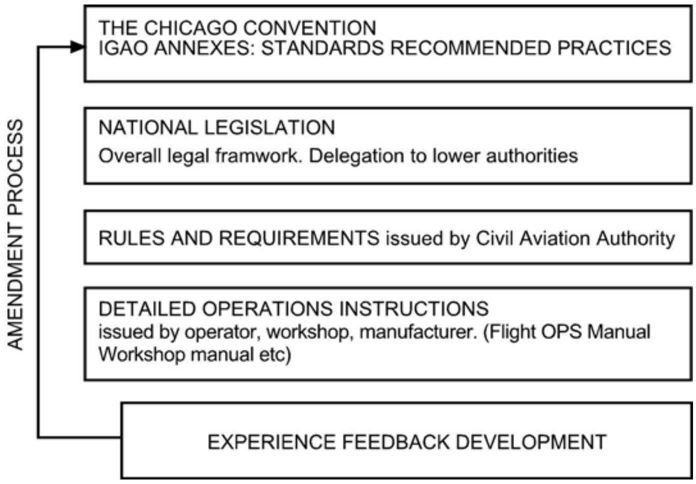
The obligations of member States are to *adhere to standards* and *endeavour to follow recommendations*. If, for some reason, a State finds it impossible to comply with a standard, the State must *file a deviation* with ICAO, which will notify all member States.

The benefits of the ICAO system are that States can have mutual reliance on each other to ensure an acceptable level of safety in operations under their jurisdiction. There can be mutual acceptance of licences, airworthiness certificates, certificates of approval, declarations of competency, *etc*. Each State has the responsibility to supervise its own operators; with mutual confidence there is very little need to monitor other State's operators.

2.3 THE LEGAL STRUCTURE OF THE CIVIL AVIATION SYSTEM

States that have ratified the Chicago Convention (and other related conventions and agreements) have to transfer their commitments into national legislation. Figure 2.3 shows the principal legal structure that is needed.

Figure 2.3 - The Legal Structure of the Civil Aviation Safety System



Legislation is generally on two levels:

- *the aviation act and regulations*, decided at parliamentary level, and
- *government orders*, decided at governmental level.

Under these statutes authorities (*eg* a civil aviation authority) are delegated to issue *technical standards, rules* and *requirements* necessary to implement the objectives of the appropriate act and regulations.

The final step in the regulatory chain is then for the operator (airline, workshop, manufacturer, airport, ATS organisation, *etc*) to issue *detailed instructions* for their personnel to carry out their functions in compliance with legislation, orders, authority standards and the operator's own objectives.

To avoid rigidity and to cope with technological development, there must be an *amendment process* at all levels in the legal structure.

2.4 DUTIES OF NATIONAL CIVIL AVIATION AUTHORITIES

Based on the commitments to the Chicago Convention and a general interpretation of how States carry out their responsibilities, the following functions can be listed as duties of national civil aviation authorities. Such authorities are at different levels of the State machinery, and duties may be distributed among several authorities. To simplify the picture we now consider only *regulatory State functions* and not "provider" functions (airlines, airports, air traffic services, *etc*).

Policy duties relating to transport demands, traffic rights, tariffs, etc.

Safety authority duties:

- to define goals and objectives for safety levels in the different parts of the system;
- to develop and maintain national rules, regulations and standards;
- to ensure, by licensing and certification procedures, that no person, organisation, facility, equipment or procedure is allowed into the civil aviation system without complying with the relevant requirements;
- to ensure, by surveillance, that licensed persons and certificated organisations maintain competence and operate according to rules and standards and that facilities and equipment are maintained to prescribed standards, and to initiate corrective action and/or enforcement if a deficiency is found;
- to support persons and organisations in the system with information feedback on:

    - service difficulties and malfunctions,
    - accident/incident information, and
    - feedback shortcomings to rulemaking, certification and surveillance.

Investigative duties

- to investigate accidents and incidents to determine causes and contributory factors, formulate recommendations and eliminate shortcomings in the system.

Although the above authority functions are found, in principle, in all developed countries, ambition levels and resource allocations for their performance vary depending on national resources and the nature of the national air transport system.

CHAPTER 3

CIVIL AVIATION SAFETY PERFORMANCE

3.1 METHODS OF MEASURING SAFETY AND RISK

The main objective for the air transport system is to move passengers and cargo safely and efficiently from one place to another.

In this chapter we summarise the present safety performance of the civil aviation system. Appendix 1 provides a more extensive aviation safety review, from which data are selected for discussion here.

There are a number of different ways in which accident rates or, inversely, safety levels, can be measured. Generally we consider accidents in the following categories:

- *fatal accidents*, meaning accidents in which one or more persons have been killed; and
- *all accidents*, meaning all occurrences classified as accidents according to ICAO Annex 13 (which may include fatal accidences, injury accidents and accidents with more or less material damage – material damage on wing tips or propeller tips excluded).

In order to measure a level of risk or level of safety we cannot use just the number of accidents. We have to relate these numbers to some measure of accident exposure. The most common measures are:

- number of accidents (total or fatal) for a given number of flight-hours (*eg* 10 000 or 100 000 or 1 million); and
- number of accidents (total or fatal) for a given number of flights (departures).

These measures can be inverted to give a number of flight-hours or departures per accident. Such figures provide an easily understandable measure of safety level.

Another measure, which is especially useful when comparing safety levels of various modes of transportation, is:

- number of passenger fatalities for a given number of passenger-kilometres[2].

[2] Passenger-kilometres is one measure of the transport "product".

3.2 TARGET LEVELS FOR SAFETY IN AIRCRAFT DESIGN

Safety and risk need to be considered in two dimensions, namely:

1. the *probability* of an accident, and
2. the *consequence* of an accident.

In aircraft design we can tolerate a malfunction that occurs frequently provided the consequences are negligible. If the consequences are serious, we require the probability of occurrence to be low. If the consequences are catastrophic, the occurrence needs to be extremely improbable.

No transport operation of any kind can be carried out at zero risk. We have to accept some risk level in order to carry out the transport tasks required.

The two-dimensional aspect of *risk* and *consequence* leads to the logical result that we are (or should be) prepared to accept:

- higher probabilities of accident to aircraft where few people are placed at risk on each flight; and
- lower probabilities of accidents to aircraft where more people are involved in each flight.

The consequences of this approach can be seen in aircraft design; and the aircraft design provides the basis for what can be operationally achieved.

Today’s design standards for large aircraft represent a target safety level of at least:

- 1000 million flight-hours per catastrophic accident for *each* individual catastrophic system failure condition; and
- 10 million flight-hours per catastrophic accident taking into account the combined effect of *all* system failure conditions.

Aircraft designed today to meet these very stringent requirements carry some 30 to 500 passengers.

Smaller aircraft are built to less stringent safety requirements. This is due to practical limitations of size, as well as the economic consideration that there are fewer passenger seats to carry the costs of sophistication. Since there are fewer people involved in an accident, we tend to accept a somewhat higher accident rate.

3.3 SAFETY LEVELS ACHIEVED IN ACTUAL OPERATION

From Figure 2 in Appendix 1 it can be seen that major air carriers in the United States achieved an average safety level of *2.8 million flight-hours per fatal accident* over the years 1980-1984. From other sources we know that the best airlines achieve a rate of over 5 million flight-hours per fatal accident, which approaches the target level set by aircraft design.

For ICAO countries an average of 750 000 flight-hours per fatal accident has been achieved. From other sources we know that some ICAO regions achieve only 250 000 hours. In terms of safety performance a factor of 10 may separate some world airlines.

Still addressing Figure 2 of Appendix 1, we can conclude that for the same period fixed-wing air taxis in the UK achieved 230 000 flight-hours per fatal accident. This is a good figure for that particular set of aviation, but it is three-times worse that the ICAO average for large aircraft, and 10-times worse than for the US carriers. This illustrates the inherent differences between aircraft categories and the differences between achievable safety levels.

If we regard private and club flying and helicopter activities, we move into different aircraft categories and different operator categories. Safety levels are much lower, about 30 000 to 40 000 flight-hours per fatal accident.

3.4 AVIATION SAFETY COMPARED TO OTHER MODES OF TRANSPORT; PUBLIC REACTIONS TO ACCIDENTS

We now refer to Figure 5 of Appendix 1. In ICAO countries, a feature of the safety development of scheduled and non-scheduled passenger services is the very great improvement that has taken place over the last 15 years. Major factors in this development lie in the aircraft technology of the big jets, with improved reliability and improved cockpit facilities. No doubt more advanced training methods and training aids for pilots have also played an important part.

Until the early 1970s, railway transport was recognised as the safest mode of passenger transport. At least in comparison with Swedish railways, ICAO scheduled air transport has since then been safer than rail[3]. Figure 4 of Appendix 1 provides additional information on various modes of transportation. The general picture that emerges is the following:

- where transportation has the character of mass transportation (many passengers at a time), the safety level is very high; and
- where transportation carries one or a few passengers at a time, the safety performance is very much lower.

This is a situation which, to a certain degree, seems to be in line with public reaction to accidents.

Frequent road accidents, with a few people killed each time but with a very high number killed each year, seem to create very little reaction among the public of any country. “It doesn’t happen to me” is an attitude which may explain acceptance of a high risk when one believes oneself to control the situation.

[3] We lack information about other railways’ performances.

The picture is quite different when people turn themselves over to a mass transportation system. They expect it to be safe. People who value their time so much that they use air transport are most likely to be willing to *pay* for their safety, and undoubtedly believe they have done so.

As we know, major air accidents create strong reactions from the general public. As stated by J C Chaplin (Group Director, UK CAA)[4], the public may be more accepting of pilot error than maintenance faults because the pilot must respond to emergencies in a short time, whereas faults on the ground "could have been avoided".

Public reaction can be severe for private aviation accidents also. Considering only a few people are involved, the degree of reaction can seem out of proportion to consequences, given that much worse happens weekly on the roads. It seems that aviation is still somewhat "exotic". For that reason, air accidents create media interest.

Although the aviation safety policy should be based on rational grounds, public reaction to air accidents will continue to be an important factor for those who take the policy decisions and face the public after something has gone wrong.

3.5 MAJOR FACTORS BEHIND AIR ACCIDENTS

3.5.1 Air Carrier Operations

Figure 8 in Appendix 1 shows a breakdown of causes and related factors behind fatal accidents to US certificated route air carriers for 1969-1978. In order of frequency, the causes and related factors are as follows:

	%
Pilot	62
Other Personnel	47
Weather	43
Miscellaneous	14
Systems	9
Powerplant	8
Airport/airways/facility	6
Landing gear	6
Airframe	6
Undetermined	5
Terrain	3
Instruments/equipment	3

Figures do not sum to 100 as more than one factor may be behind each accident.

[4] Chaplin, J C, *In Perspective – The Safety of Aircraft, Pilots and their Hearts,* 2nd UK Workshop on Aviation Cardiology, 7-9 May 1987

This is a traditional picture which may place too much emphasis on a simplistic interpretation of "pilot error". The pilot is in the position of being the last person in the chain with a chance of correcting a critical situation. If he fails he becomes a "factor", although he may not have created the primary cause.

Major airlines are complex organisational systems. The overall safety performance of such systems depends, to a high degree, on their management. Accident investigators have not addressed management factors very much. Below is a list of common organisational causes of system failure, found to have applied in some well known major accidents.

1. Lack of written goals and objectives, or insufficiently comprehensive goals and objectives.
2 . Lack of willingness or authority to make decisions.
3. Inadequate or uncontrolled standard procedures.
4. Personnel planning, recruiting, training and allocation not consistent with goals and objectives.
5. Vague or incomplete instructions.
6. Tools, equipment and facilities not up to a standard consistent with goals and objectives.
7. Problems of coordination and control.
8. Insufficient time or finance.

For accident prevention, management problems should receive attention in large organisations.

3.5.2 Private Flying

At the other extreme amongst air operators is the private pilot. Table 10 of Appendix 1 gives the top ten factors behind fatal accidents in Sweden for 1973-1982.

	% of fatal accidents
Failed to obtain/maintain flying speed	28
Failed to follow procedures, instructions, etc	28
Inadequate pre-flight preparation or planning	16
Attempted operation beyond experience/ability	16
Continued VFR into adverse weather	14
Improper in-flight decision or planning	14
Low ceiling	14
Exercised poor judgement	12
Initiated flight in adverse weather	9
Became lost/disoriented	7

Figures do not sum to 100 as more than one factor may be behind each accident.

Although this list may look slightly different in other countries due to other conditions, some general conclusions can be drawn.

Private pilot accidents seem to be largely related to skill, experience and attitudes. Attitudes are difficult to change and, because the private pilot may not fly many hours per year, skill and experience may develop slowly. Improvement in private aviation safety is therefore rather slow at present.

3.6 SAFETY LEVELS ACHIEVED IN NEW ZEALAND COMPARED TO SOME OTHER COUNTRIES

3.6.1 Limitations Of The Available Information

We have attempted to compare New Zealand safety levels with those achieved in some other countries. A major obstacle to achieving good comparisons is lack of standardisation of definitions of the different sectors of the aviation system. And even *if* the number of accidents in each category of operation can be established, the "production" figures[5] necessary to calculate accident rates may not be available.

For these reasons it has been possible to make only a few comparisons. These must be interpreted with great care, but some general conclusions about New Zealand's safety standards are possible.

3.6.2 Major Airlines

Air New Zealand's total flight time was about 101,000 flight-hours in 1987. It has varied between some 80,000 and 100,000 over the past 15 years, averaging about 90,000 hours a year.

If Air New Zealand were on the same safety level as major US carriers, fatal accidents over a long period of time would average one for every 30 years. At the level of the ICAO average, a fatal accident could be expected in every 8 years on average.

Air New Zealand has experienced two fatal accidents since its creation in 1978: the Erebus DC10 accident and the F27 accident at Mangere, both in 1979. Although the latter accident was a non-revenue positioning flight, it was still an Air New Zealand flight. Due to the nature of random events, no firm conclusions can be drawn from 2 fatal accidents in 9 years (or, looking back to the companies forming Air New Zealand, 3 fatal accidents in 21 years). The figures point, however, to Air New Zealand being closer to the ICAO average to the US air carriers.

Considering *all* accidents involving major New Zealand airlines (Air New Zealand, Mt Cook and Safe Air), in Figure 3.1 we compare the accident rates (all accidents) of these airlines with US domestic carriers for 1975-1987. Note that

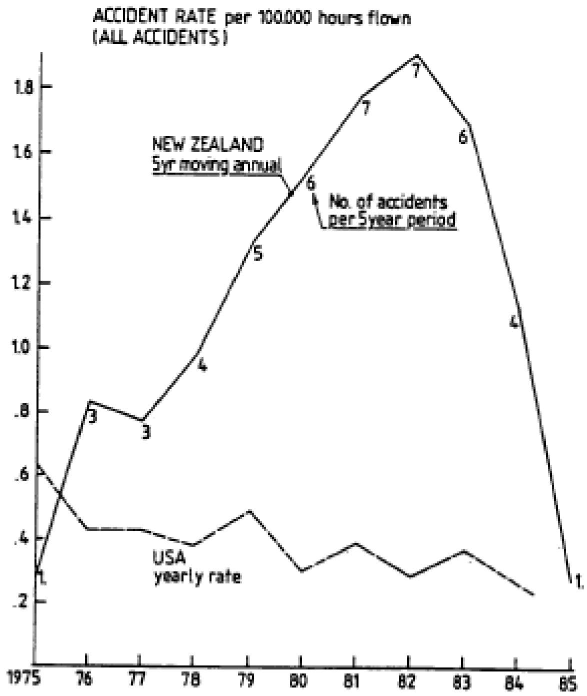
[5] For example, passenger-kilometres.

because of the small number of accidents per year in New Zealand, a five-year moving average annual rate has been used (for New Zealand).

The outcome does not look favourable to New Zealand, although there has been a steady improvement since 1980. If the progress achieved over the last five years continues, New Zealand airlines may become comparable to US airlines.

Figure 3.1 - Domestic Airline Accident Rates

Accidents per 100 000 hours flown
NZ (Air NZ domestic, Mt Cook, Safe Air) compared with US (cat 21, 127,125)

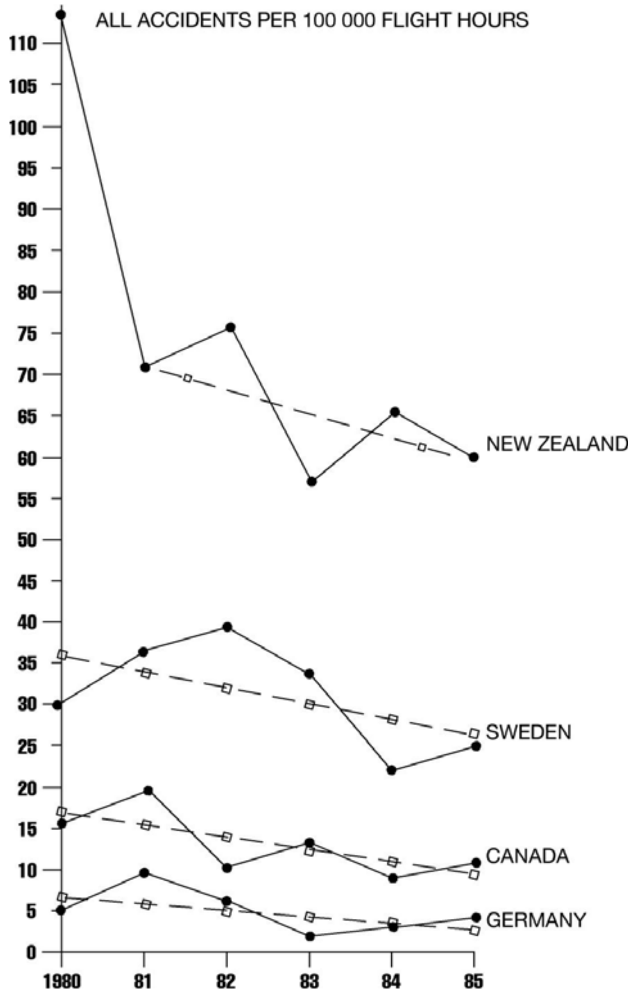


3.6.3 Helicopter Accidents

Figure 3.2 compares helicopter accident rates (all accidents) for New Zealand, Sweden, Canada and the Federal Republic of Germany. The New Zealand accident rates stand out as being extremely high: about twice the rate of Sweden, which in turn has more than twice the rate of Canada. Germany has a very low rate compared to these other countries, which may be due to entirely different operational conditions (*eg* performing more straightforward transport and less aerial work).

Figure 3.2 - Helicopter Accident Rates

Accidents per 100 000 hours flown
New Zealand, Sweden, Canada, Federal Republic of Germany



Looking at New Zealand helicopter accidents there is no detailed analysis of causal factors available. From page by page scrutiny of accident report summaries the following messages emerge.

- During the early years, venison hunting/recovery started out with small piston engined helicopters. Many accidents occurred that can be traced to pilots operating outside the performance capabilities of their helicopters. Since the introduction of the turbine engined helicopters, the number of performance-related accidents has decreased.
- When the turbine helicopter entered the scene, many accidents arose because pilots did things the helicopter designers had never envisaged. In the piston engine years, the pilots were power-limited. Now the pilots started to exceed other structural and dynamic design limits. This trend had decreased by 1983, probably as a result of learning (the hard way) just where the limits were.

- Looking at engine-related accidents, piston engine related accidents have decreased steadily, but a smaller number of turbine engine related accidents have increased with the change to turbine power. The types of failure mode look similar to those in other countries.
- On top of these trends there are some activity-related accidents such as sling chains flicking up into the tail rotor, and nets entangled in the rotor or skid. In the agricultural area there are other types of activity-related accidents such as broken spray equipment, and also more fuel starvation.
- Collisions with the terrain, and especially wires, represent a high proportion of the total, irrespective of the type of helicopter. This accident mode takes its toll every year, without significant fluctuation.

In summary, *the high accident rate for New Zealand helicopters is primarily pilot-oriented*. Over the years, many pilots have been young, gaining experience the hard way. The trend to split up companies into “owner drivers” may seem, in a short term perspective, to have the effect of making pilots more careful with their equipment. In a long term perspective, the safety implications may well be negative. Inexperienced pilots starting their own operation will not benefit from the transfer of knowledge and experience from older colleagues.

Helicopter safety can be improved by having larger organisational units that can allocate resources to procedures, recurrent training, and experienced operations managers who can “foster their flock”. One alternative to this is to require a person to have extensive experience before he can have an air service licence of his own. This approach could be regarded as a restraint on trade, however, and contrary to principle of freedom to set up new enterprises. The future development of accident rates in the helicopter sector will show whether the price for this freedom will be too high.

3.6.4 Private Aviation

For private aviation a useful basis for comparison is the statistical information available from 22 European countries forming ECAC, the European Civil Aviation Conference.

An obstacle to a really valid comparison of accident rates is that New Zealand has no information on the annual hours flown by private aircraft. The only comparisons possible are to calculate accident rates in terms of:

- number of all accidents per year per 10 000 aircraft; and
- number of fatalities per year per 10 000 aircraft.

Figure 3.3 illustrates the results of these calculations. The following conclusions can be drawn.

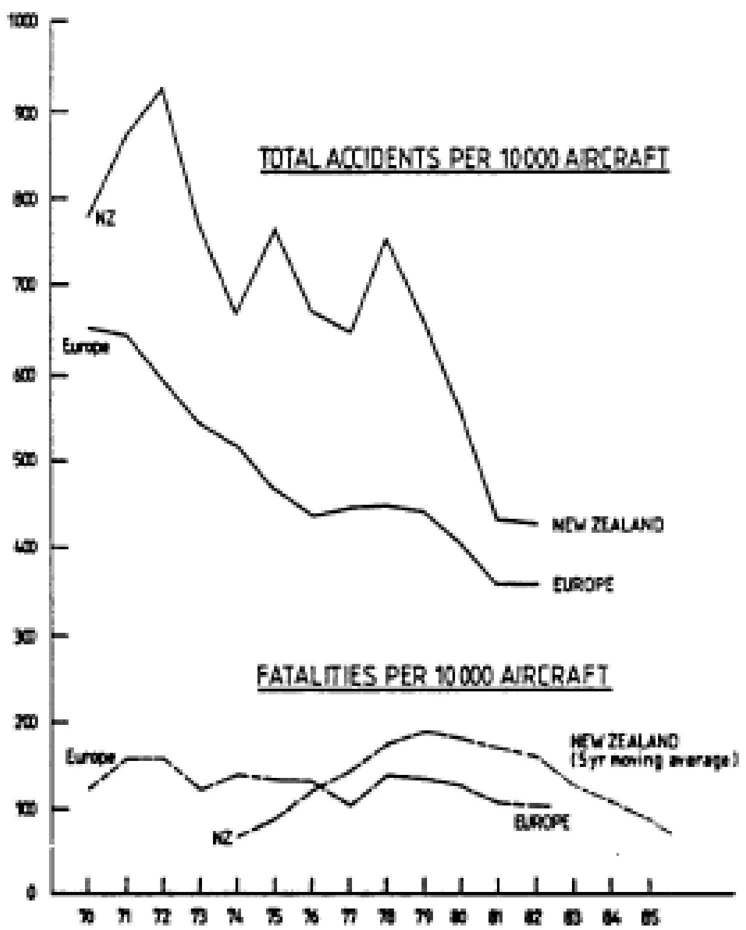
- In the period 1970-1980, the number of accidents (all accidents) per private aircraft has been about 40% higher in New Zealand than in Europe (ECAC countries). We cannot conclude whether this was due to higher utilisation of New Zealand aircraft or whether it represents more accidents per hour flown, or a combination of both. Since 1980 the difference seems to have decreased.

- Over the years 1976-1984, the number of fatalities per aircraft was also higher in New Zealand than in Europe, but lately the figure seems to have improved.

Figure 3.3 - Private Aviation Accident Rates

Accidents per 10 000 aircraft

New Zealand compared with ECAC (22 European countries)



3.6.5 Summary

Notwithstanding the caution we have expressed about not extracting more information from the above comparisons than is realistically possible due to the data limitations, the following conclusions can nevertheless be drawn. *There is no cause for New Zealand to be complacent about safety levels in civil aviation; and this conclusion applies to all sectors of the aviation industry.*

CHAPTER 4

ICAO AND THE CHICAGO CONVENTION

A comprehensive presentation of New Zealand's commitments as a member State of the International Civil Aviation organisation (ICA) is found in Appendix II[6]. This chapter summarises the issues involved, and analyses the implications for a minimum level of regulatory control in New Zealand.

4.1 HISTORICAL BACKGROUND

The development of aviation resulting from the First World War made it necessary to establish technical and commercial regulations to cater for the rapid growth of international air transport. Thus a *Convention Relating to the Regulation of Aerial Navigation* was concluded in 1919 and a Convention on Commercial Aviation concluded in 1928. A special international committee (CITEJA) was established in 1926, responsible for the development of a code of private international law, amongst which was the still operative *Warsaw Convention* of 1929 regulating the liability of air services to passengers.

The Second World War had a major effect upon the technical development of the aeroplane, telescoping 25 years of normal peace-time development into six years. This development brought with it international problems far beyond the ability of individual governments to solve, such as: coordination of laws, dissemination of technical and economic information, questions of commercial rights, and rights to fly into and through foreign territories. Also there were concerns on how to maintain existing air navigation facilities (which had been set up for military activity) many of which were located in sparsely settled areas.

These factors prompted the United States government to invite allied and neutral States to meet in Chicago in November 1944. For five weeks the delegates of 52 States considered the problems of international civil aviation. The outcome was the *Convention on International Civil Aviation* (the *Chicago Convention*) the purpose of which was to "agree on certain principles and arrangements in order that international civil aviation may be developed in a safe and orderly manner and that international air transport services may be established on the basis of equality of opportunity and operated soundly and economically."

A matter to which the Chicago Conference attached great importance was the question of the exchange of commercial rights in international civil aviation. It was not possible to reach an agreement satisfactory to all, but the conference set up two supplementary agreements which had a bearing on this subject, the International Air Services Transit Agreement and the International Air Transport Agreement.

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[6] Appendix II *Report on the International Civil Aviation Organisation (ICAO) and the Obligations of Member States with Respect to Related Conventions.*

4.2 INTERNATIONAL CIVIL AVIATION ORGANISATION (ICAO)

With the signing in 1944 of the Chicago Convention, International Civil Aviation Organisation (ICAO) was established as an inter-governmental organisation. In 1947 it became a specialised agency in a relationship with the United Nations. Today the organisation has 157 Contracting States (as of January 1988) and is headquartered in Montreal, Canada.

The aims and objectives of ICAO are to develop the principles and techniques of international air navigation and to foster the planning and development of international air transport so as to:

- ensure the safe and orderly growth of international civil aviation throughout the world;
- encourage the arts of aircraft design and operation for peaceful purposes;
- encourage the development of airways, airports, and air navigation facilities for international civil aviation;
- meet the needs of the peoples of the world for safe, regular, efficient and economical air transport;
- prevent economic waste caused by unreasonable competition;
- ensure that the rights of Contracting States are fully respected and that every contracting State has a fair opportunity to operate international airlines;
- avoid discrimination between Contracting States;
- promote safety of flight in international air navigation; and
- promote generally the development of all aspects of international civil aeronautics.

ICAO has a sovereign body, the *Assembly,* in which all the Contracting States are represented. The Assembly meets at least once in three years to review in detail the complete work of the Organisation in the technical, economic, legal and technical assistance fields and give guidance to the other bodies of ICAO for their future work.

A *Council* is elected by the Assembly for a three year term. It is a permanent body responsible to the Assembly and is composed of 33 Contracting States. One of the main duties of the Council is to adopt International Standards and Recommended Practices and to incorporate these as Annexes to the Convention on International Civil Aviation.

The *Air Navigation Commission* (ANC) advises the Council on technical and operational matters, and the *Air Transport Committee* advises on air transport matters. Other permanent committees with specific work programmes are: the Finance Committee, Legal Committee, Committee on Unlawful Interference and Committee on Joint Support of Air Navigation Services. A *Secretariat* supports the Council and the total organisation.

4.3 INTERNATIONAL CIVIL AVIATION INSTRUMENTS

The basic instrument within the ICAO framework is the Convention on International Civil Aviation (Chicago 1944) – the Chicago Convention. This Convention establishes the ICAO organisation and contains governments' agreements on certain principles and arrangements in order that international civil aviation may be developed in a safe and orderly manner and that air services may be established on the basis of equality of opportunity and operated soundly and economically.

There are ten law conventions or protocols regarding liability of the air carrier. These conventions or protocols cover: death or injury to passengers; loss or delay of, or damage to, cargo and baggage; and damage to third parties.

Three conventions have been adopted regarding security. These are:

- conventions on offences and certain other acts committed on board aircraft (Tokyo 1963);
- suppression of unlawful seizure of aircraft (Hague 1970); and
- suppression of unlawful acts against the safety of civil aviation (Montreal 1971).

There is also the Geneva Convention (1948) which aims to secure international recognition of property and other rights so that, when an aircraft crosses a frontier, the interests of holders of such rights will be protected.

4.4 SUMMARY OF THE CHICAGO CONVENTION

The Chicago Convention is the basic instrument governing principles and arrangements for international civil aviation. ICAO is created by this Convention and is charged with the administration of the principles and arrangements Contracting States have agreed upon in the Convention.

The 96 articles of the Convention establish the privileges and restrictions of all Contracting States. The Convention accepts the principle that every State has complete and exclusive sovereignty over the airspace above its territory. It provides that no scheduled international air service may operate over or into the territory of a Contracting State without its consent. The Convention suggests facilitation of air transport by the reduction of customs and immigration formalities.

The Convention provides for the adoption of International Standards and Recommended Practices regulating air navigation, published as Annexes to the Convention. The Convention itself states that each Contracting State shall provide airports, radio services, meteorological services and other air navigation facilities and appropriate standard systems and operational rules in accordance with these Annexes. Each State also undertakes to collaborate in securing the highest practicable degree of uniformity in regulations, standards, procedures and organisation.

4.5 ANNEXEX TO THE CHICAGO CONVENTION: Standards, recommended practices and procedures; technical manuals and guidance material.

Article 37 of the Chicago Convention states that ICAO shall adopt international standards and recommended practices and procedures regarding safety, regularity and efficiency of air navigation. Standards and Recommended Practices (SARPS) are designated as Annexes to the Convention. At present there are 18 Annexes.

A *Standard* is a specification recognised as necessary for the safety or regularity of international air navigation. Under the Convention, any State finding it impracticable to comply in all respects with any Standard must give immediate notification to ICAO of any differences between its national regulations and practices and the Standards in the Annexes.

A *Recommended Practice* is a specification recognised as desirable in the interest of safety, uniformity or efficiency of international air navigation. States are invited to notify ICAO of any differences from the Recommended Practices in the Annexes, when this is important for the safety of air navigation.

One of the main duties of ICAO is to develop specifications in the Annexes. The *Air Navigation Commission* is the principal body concerned with this development. All Annexes, except Annex 9 (Facilitation), are the responsibility of the Air Navigation Commission, indicating that they primarily deal with flight safety; although Annex 7 (Aircraft Nationality and Registration Marks) and Annex 16 (Environmental Protection) have only a limited impact on flight safety.

The Annexes can be divided into five groups covering man, machine, operations, airspace/air navigation services and aerodrome.

Man	Annex 1	Personnel licensing
Machine	Annex 7	Aircraft nationality and registration marks
	Annex 8	Airworthiness of aircraft
	Annex 16	Environmental protection
Operations	Annex 2	Rules of the air
	Annex 6	Operation of aircraft
	Annex 18	Transport of dangerous goods
Airspace/ Air Navigation Services	Annex 3	Meteorological service
	Annex 4	Aeronautical charts
	Annex 5	Units of measurements
	Annex 10	Aeronautical telecommunications
	Annex 11	Air traffic services
	Annex 12	Search and rescue
	Annex 15	Aeronautical information service
Aerodrome	Annex 9	Facilitation
	Annex 14	Aerodromes
	Annex 17	Security

In addition to the Annexes, ICAO has developed and adopted the following *Procedures for Air Navigation Services (PANS)*:

PANS-RAC	(Doc 4444)	Rules of the Air and Air Traffic Services
PANS-OPS	(Doc 8168)	Aircraft Operations
	Volume I	Flight Procedures
	Volume II	Construction of Visual and Instrument Flight Procedures

Member States must conform to these procedures, and to Regional Supplementary Procedures (Doc 7030), when providing for international civil aviation.

A number of technical manuals have been issued under the authority of the Secretary General. These manuals, which cover most of the areas of the Annexes, have not been agreed by Member States. They have been developed by the ICAO Secretariat, for the convenience of States, to provide guidance about means of complying with standards and recommended practices. It is entirely up to Member States whether to use these manuals, and to what degree. Many States find them quite useful.

Some guidance material is also incorporated in Annexes, without having any formal status.

4.6 SUMMARY OF ANNEXES

ANNEX 1 - PERSONNEL LICENSING

In the Chicago Convention itself it is stated that members of the operating crew of aircraft engaged in international navigation shall be provided with licences issued or rendered valid by the State in which the aircraft is registered.

Annex 1 is established for licensing of flight crew, air traffic controllers, flight operation officers, aeronautical station operators and aircraft maintenance personnel.

A State having issued a licence shall ensure that the privileges granted by that licence are not exercised unless the holder maintains competency and meets the requirements for recent experience established by that State.

Requirements for licences and ratings are presented in detail, including the medical provisions.

ANNEX 2 - RULES OF THE AIR

In the Convention each State undertakes to keep its regulations uniform, to the greatest possible extent, with those established from time to time under the Convention. Over the high seas the rules *shall* be those established under the Convention. As this is stated in the Convention itself, and not in an Annex, no deviation is possible by a contracting State.

States also undertake to ensure the prosecution of all persons violating the regulations regarding rules of the air. Annex 2 specifies flight rules to be applied and establishes the responsibility and authority of the pilot-in-command to comply with the rules of the air. The Annex pays special attention to procedures for interception of civil aircraft. Interception shall be governed by appropriate regulations and directives issued by the State in compliance with the Convention. Principles to be observed by States regarding interception are prescribed.

ANNEX 3 - METEOROLOGICAL SERVICES FOR INTERNATIONAL NAVIGATION

According to the Convention, States undertake to provide meteorological services to facilitate international air navigation in accordance with the Annex. The regulatory material in the Annex is identical with the technical regulations of the world Meteorological Organisation.

The State shall determine the service to be provided over international water and other areas outside its territory, and shall designate a Meteorological Authority. States shall arrange for regional forecast centres in accordance with detailed rules in the Annex. States shall also establish meteorological offices, meteorological watch offices, aeronautical meteorological stations and arrange for observations to be made by aircraft.

ANNEX 4 - AERONAUTICAL CHARTS

States shall, when so specified in the Annex, ensure the availability of charts and ensure they are adequate, accurate and maintained up-to-date by a revision service.

The Annex establishes detailed operational requirements for all charts concerned and specifies which charts shall be available, specifying aerodrome obstacle charts, precision approach terrain charts, enroute charts, area charts, standard departure and arrival charts, instrument and visual approach charts and world aeronautical charts.

ANNEX 5 - UNITS OF MEASUREMENT to be used in air and ground operations

The standardised system of units in the Annex is based on the International System of Units (SI) and certain non-SI units necessary to meet requirements of international civil aviation.

ANNEX 6 - OPERATION OF AIRCRAFT

The Annex contains minimum standards applicable to operation of aircraft in scheduled and non-scheduled international air transport operations.

The Annex describes in detail the responsibilities of the operator and the operating supervision a State shall perform. The operator's method of supervision of flight operations shall be approved by the State of the operator.

An operator shall have an operations manual and the State shall be provided with a copy; such mandatory material will be incorporated in it as the State shall required.

Regarding operating performance limitations, aeroplanes shall be operated in accordance with a comprehensive and detailed code of performance established by the State of Registry.

Provisions are given for instruments, equipment, flight documents and aeroplane maintenance. Regarding flight crew and cabin attendants, the State of the operator shall approval training programmes.

ANNEX 7 - AIRCRAFT NATIONALITY AND REGISTRATION MARKS

The Annex provides detailed specifications for nationality marks, common marks and registration marks, and specifications as to how they shall be selected and positioned on the aircraft.

The State shall maintain a current register showing the information recorded in the certificate of registration.

ANNEX 8 - AIRWORTHINESS OF AIRCRAFT

The Convention states that every aircraft shall be provided with a certificate of airworthiness issued or rendered valid by the State in which it is registered.

The standards in Annex 8 are broad specifications stating the objectives – rather than the means of realising these objectives. National codes of airworthiness are required as the basis for the certification of airworthiness of each aircraft.

ANNEX 9 - FACILITATION

The provisions of this Annex require that States shall provide certain minimum facilities for passenger convenience and that States shall not impose more than certain maximum requirements in the way of paper work, restrictions on freedom of movement, *etc*. As a general rule it is stated that the governmental regulations and procedures applicable to the clearance of aircraft shall be no less favourable than those applied to other forms of transportation.

The Annex gives detailed provisions for entry and departure of aircraft, persons, baggage and cargo, and for traffic passing through the territory of a State.

ANNEX 10 - AERONAUTICAL TELECOMMUNICATIONS

This Annex covers equipment and systems, radio frequencies and communications procedures.

The technical provisions for radio equipment used for air navigation, and its radio frequencies, are very detailed and are directed to experts and to manufacturers of equipment.

The Annex contains detailed procedures for the international aeronautical telecommunication service. Each State shall designate the authority responsible for ensuring that the international telecommunication service is conducted in accordance with the procedures in the Annex.

ANNEX 11 - AIR TRAFFIC SERVICES

This Annex concerns the establishment of airspace, units and services. Its purpose is to ensure that flying on international air routes is carried out under uniform conditions.

States shall determine those portions of the airspace, and those aerodromes, where air traffic services will be provided, and shall arrange for such services in accordance with the Annex. A State having accepted that it should provide services for portions of the high seas, shall arrange for the service to be established and provided in accordance with the provision of this Annex. The State shall designate the authority responsible for providing the services.

The Annex contains standards and recommendations for the organisation of the airspace and of air traffic services units; also procedures to be applied by units. It establishes requirements for communications and information.

ANNEX 12 - SEARCH AND RESCUE

The basic provision of this Annex is that States shall arrange for search and rescue services within their territories. Such services shall be provided on a 24-hour basis. States having accepted responsibility to provide search and rescue services in portions of the high seas, or areas of undetermined sovereignty, shall establish and provide services in accordance with the provisions of the Annex.

States shall establish a rescue coordination centre in each search and rescue region. States shall designate, as rescue units, public or private service elements and shall define the relative functions of these elements. States shall coordinate their organisation with those of neighbouring States. Each rescue coordination centre shall prepare a detailed plan for the conduct of search and rescue operations within its search and rescue region.

ANNEX 13 - AIRCRAFT ACCIDENT INVESTIGATION

The Convention itself states that, in the event of an accident to an aircraft of one State occurring in the territory of another State, the State where the accident occurs shall institute an inquiry, so far as its laws permit, under procedures which may be recommended by ICAO.

According to the Annex, the State of Occurrence shall take all reasonable measures to protect the evidence and to maintain safe custody of the aircraft for the purpose of an investigation. The State of Occurrence shall institute an investigation and also be responsible for the conduct of the investigation. Reports of the State conducting the investigation must forward to other States and organisations are prescribed in the Annex.

ANNEX 14 - AERODROMES

For aerodromes, this Annex prescribes the physical characteristics and obstacle limitation surfaces, and certain facilities and technical services to be provided. The interpretation of some of the specifications expressly requires exercise of discretion, taking decisions, or the performance of functions by the appropriate authority. The responsibility for whatever determination or action is necessary shall rest with the State having jurisdiction over the aerodrome.

The Annex describes, in great detail, data and physical characteristics for an aerodrome. Most of the specifications are classified as recommendations.

The Annex requires that an aerodrome emergency plan be established at an aerodrome. The plan shall coordinate participation of all agencies, on and off the aerodrome, who could be of assistance in responding to an emergency. The Annex states that rescue and fire fighting equipment shall be provided at an aerodrome, the level of protection depending on the dimensions of the aeroplanes using the aerodrome and the frequency of operations.

ANNEX 15 - AERONAUTICAL INFORMATION SERVICES

According to this Annex each State shall provide an aeronautical information service, or delegate the authority to provide the service to a non-governmental agency provided the requirements of the Annex are adequately met. The State shall remain responsible for the information published. The service shall collect, collate, edit and publish information concerning the entire territory of the State. States shall take reasonable measures to ensure that the information provided is adequate, accurate and timely.

Information published for and on behalf of a State shall clearly indicate that it is published under the authority of that State.

The publication shall include a list of significant differences between the national regulations and the related ICAO standards, recommendations and procedures.

ANNEX 16 - ENVIRONMENTAL PROTECTION

This Annex deals with aircraft noise and aircraft engine emissions. It provides an international noise exposure reference unit for land use planning and establishes noise abatement operating procedures.

Noise certification shall be granted by the State of Registry of an aircraft on the basis of satisfactory evidence that the aircraft complies with requirements which are at least equal to the applicable standards. States shall recognise a noise certification granted by another State provided that the requirements under which such certification was granted are at least equal to the applicable standards in the Annex.

Emissions certification shall be granted by the certificating authority on the basis of satisfactory evidence that the engine complies with requirements which are at least equal to the stringency of the provisions of the Annex.

States shall recognise, as valid, certifications granted by another State provided that the requirements are no less stringent than the provisions of the Annex.

ANNEX 17 - SECURITY: safeguarding international civil aviation against acts of unlawful interference

This Annex requires that States shall: establish an organisation, develop plans and implement procedures to meet security threats; establish a national security programme; designate an authority to be responsible for the security programme; and establish means of coordinating activities between the departments, agencies and other organisations concerned with aspects of the national security programme.

States shall: develop and implement training programmes to ensure the effectiveness of its security programme; as necessary, co-operate with other States in the development and exchange of information concerning training programmes; ensure the establishment of an airport security programme; arrange for airport security committees; ensure that contingency plans are developed and resources made available; ensure that trained officers are ready for deployment; arrange for supporting facilities required by the security services; and establish measures to prevent weapons or any other dangerous devices from being introduced on board an aircraft.

States shall arrange for surveys and inspections of security measures and require operators to adopt and apply security programmes.

ANNEX 18 - SAFE TRANSPORT OF DANGEROUS GOODS BY AIR

The provisions in the Annex are based on the recommendations of the UN committee on the transport of dangerous goods and the regulations for the safe transport of radioactive materials of the International Atomic Energy Agency.

The provisions in the Annex are broad and are amplified by the detailed specifications of the Technical Instructions for the Safe Transport of Dangerous Goods by Air. Each State shall take necessary measures to comply with the detailed provisions in the Technical Instructions. The State shall notify ICAO promptly if it adopts different provisions, for publication in the Technical Instructions. The transport of dangerous goods by air shall be forbidden except as established in the Annex and the Technical Instructions. States shall establish inspection, surveillance and enforcement procedures with a view to achieving compliance with its dangerous goods regulations. Training programmes shall be established and updated as provided for in the Technical Instructions.

4.7 PRINCIPLES FOR DISTRIBUTION OF RESPONSIBILITIES

According to the foregoing, New Zealand as a contracting State to ICAO has undertaken certain commitments.

4.7.1 ICAO Representation

As a State, New Zealand must participate in the ICAO development process, at least to the extent necessary to answer State letters and to decide and declare New Zealand’s position with respect to new standards, recommended practices, procedures, regional plans, *etc.* Such functions must be carried out by a State agency with authority to speak for the State.

The same applies to most formal ICAO meetings, where a State is expected to be represented by a government or State agency officer. Such an officer may, however, be accompanied by advisors; it is up to the State to select these as it sees fit. In more informal ICAO meetings (study groups, panels, committees) representation would be expected to be based on competency and ability to contribute to the meeting; consequently, the participants could be selected from industry as well as from a State agency.

4.7.2 Mandatory State Functions

There are a number of functions within the aviation system which, according to the Convention and its Annexes, are State functions, and must therefore be carried out by State agencies. One main function is, naturally, to develop and promulgate the national legislation, regulations and standards necessary to comply with the ICAO commitments, and to implement national decisions in discretionary areas.

The Convention and the Annexes, however, also define a number of other functions as being State responsibilities. Section 4.6 has indicated some of these State functions, and Appendix II provides more details. In exercising State functions the State may select to use designated/authorised persons, if this is permitted by national law, provided the State has the means to maintain, at all times, its full responsibility.

4.7.3 Optional State Functions

There are, on the hand, a number of functions arising from ICAO commitments, for which the State has the option of either carrying out the functions within the State machinery or seeing to it they are properly carried out by other organisations. The State still maintains the responsibility to ICAO that the State's commitments are fulfilled. The State therefore must have means to be satisfied that the organisations carrying out these functions do so in a proper way.

In this area of optional State functions a variety of solutions can be seen on the international scene. The variety stems from different national interpretations of State responsibilities, and from different national attitudes, as well as legal and practical possibilities of vesting privileges in operating organisations and persons.

The outcome of these different national philosophies can be seen in vastly differing authority involvement in monitoring and checking the operational performance of operating organisations and persons. Some ICAO manuals talk about *active* or *passive* authority attitude. There are, of course, different ways of being *active*, and these different ways have direct implications for the competence and capacity needed for State functions. The implications for New Zealand are analysed later in this report.

CHAPTER 5

THE NEW ZEALAND CIVIL AVIATION SYSTEM

5.1 OVERVIEW OF THE CIVIL AVIATION SYSTEM; DISTRIBUTION OF POWER WITHIN THE SYSTEM

The civil aviation system can be broadly described as:

> *the aircraft and operators, aerodromes and airspace provided for transport of passengers and cargo and for aerial work, whether for commercial gain or recreational purposes, together with the rules and regulations which define the framework and set standards within which the system is expected to function.*

Within any civil aviation system there are three power groups influencing the system:

- regulatory power group
- commercial power group
- third party power group

This broad classification more truly reflects the commercial side of the civil aviation system. Non-commercial components (private flying and sports and recreation), however, receive goods and services from organisations in the commercial power group. Thus aero clubs, for example, can be considered to be part of the commercial power group.

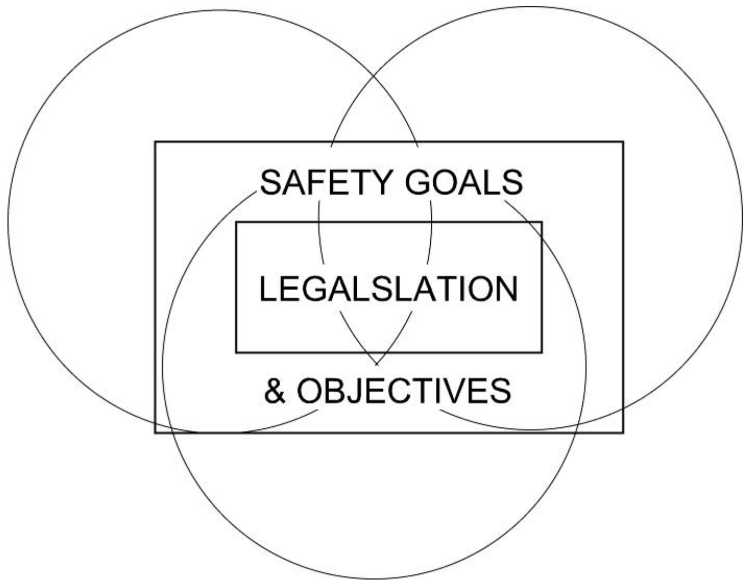
The regulatory power group defines the framework for the civil aviation system; the commercial power group provides the mechanism. It can be argued that the third party group (especially passengers) is the most important of the three, to some extent providing a check on both the framework and the mechanism. With a good balance between the commercial and third party power, groups, there would be little need for regulatory power. Chapter 9 discusses the reasons why regulations are needed to strike a proper balance between commercial powers and third party powers.

Safety expectations of passengers and cargo shippers have risen with the level of sophistication of the aviation system. A flight is not an end in itself, merely a means of achieving another objective. How much thought passengers (and other third party powers) give to the level of safety is difficult to judge, save to say their expectations are high. Most passengers automatically expect airlines (and other commercial powers) to guarantee a high level of safety. Passengers are not conscious of a civil aviation safety authority setting standards and monitoring the performance of the commercial organisations. Passengers place a high degree of trust in airlines and other organisations with commercial power. The level of trust probably increases with the size and degree of sophistication of the commercial power. The public probably places more trust in Air New Zealand, for example, than a small commuter airline with six seater aircraft.

Figure 5.1 illustrates the interplay of the power groups and their relationship to the safety goals and objectives for the civil aviation system – principally that:

- third party powers want protection from the system but also want the freedom to use the system at their will;
- commercial powers want freedom to do as they think best, but also want protection from other commercial powers and from third party powers; and
- regulatory powers want clear and simple rules, and the authority and ability to enforce the rules.

Figure 5.1 - The Power Play within the Civil Aviation System



The basic goals and objectives for the system must reflect and balance the power applied

The salient features of the three powers are discussed in the following sections.

5.1.1 Regulatory Power: The Legal Basis For Regulating Civil Aviation

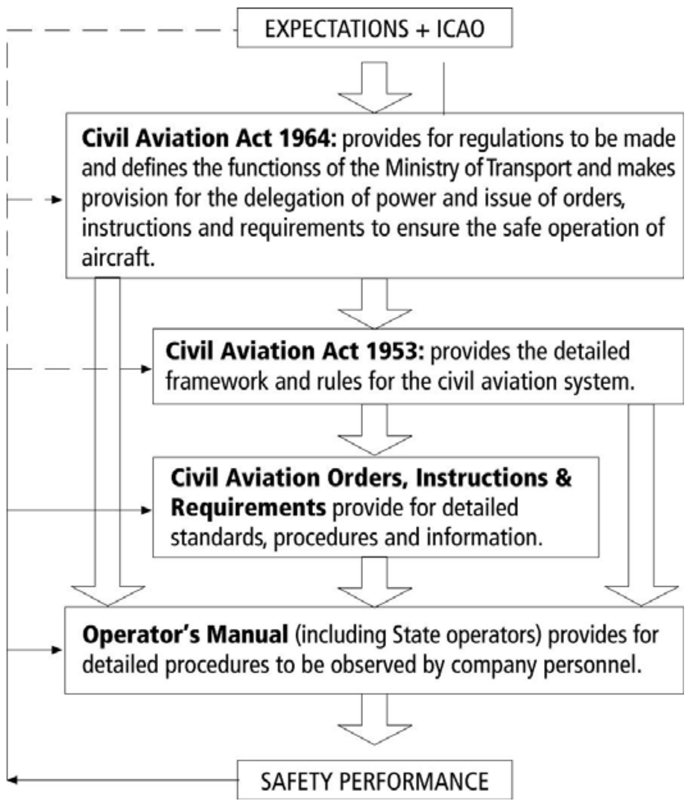
In New Zealand the main statute and prime source of power for regulating civil aviation is the Civil Aviation Act 1964 (the "Act"). Civil Aviation Regulations 1953 (the "Regulations") are made under this Act for:

- regulating civil aviation; and
- carrying out the requirements of the Convention on International Civil Aviation and the standards and recommended practices and procedures adopted by the International Civil Aviation Organisation[7].

Figure 5.2 outlines our interpretation of the current legislative arrangement for the civil aviation system in New Zealand.

The Act assumes there is a branch of the Ministry of Transport called the Civil Aviation Division[8]. The Act prescribes that the Director of Civil Aviation (the "Director") shall have such special duties and functions as may be imposed or conferred on him by regulations or by the Minister of Civil Aviation and Meteorological Services (the "Minister"). Under the Act the Director is also given authority to delegate his powers.

Figure 5.2 - The Present New Zealand Civil Aviation Legislation: an Interpretation



[7] See Chapter 4.

[8] There is no clear and unambiguous statement in the Civil Aviation Act 1964 or the Ministry of Transport Act 1968 establishing the Civil Aviation Division of the Ministry of Transport (as there is for the office of Air Accident Investigation or the Meteorological Service). But the Civil Aviation Division is *referred to* by the Act.

The Act broadly states, amongst other things, that the Ministry of Transport is to:

- promote and encourage the orderly and economic development of civil aviation;
- exercise such functions as may be necessary to ensure the safe operation of aircraft;
- be responsible for search and rescue (SAR) operations in respect of civil aircraft;
- provide for the investigation of aircraft accidents;
- provide a national meteorological service; and
- provide an aviation security service.

The Act gives the Minister power to establish, maintain and operate aerodromes and services and facilities, in connection with aerodrome operations and aircraft operations (*eg* air navigation services, crash fire services, *etc*).

The Act confers on the Airways Corporation of New Zealand Limited (ACNZ) a monopoly for the provision of some airways services[9], namely: area control, approach control and flight information. Aerodrome control and aerodrome flight information services are contestable, and may be provided by bodies other than the ACNZ. Airport companies have declared an interest in providing these services.

In broad terms the Act and Regulations establish the framework for the civil aviation system, make provision for standards to be met and define the responsibilities of the Director and the Civil Aviation Division in administering the Act and Regulations.

As will be shortly described, the current regulatory power of the State is not well defined in many areas. This diminishes the regulatory power of the State and is a major factor in the frustration expressed by members of all three power groups concerning the effectiveness of CAD in administering the Regulations.

Civil Aviation (Accident Investigation) Regulations 1978 are also made under the Act. Other statutes bearing on the civil aviation system are:

- Ministry of Transport Act 1968
- Air Services Licensing Act 1983
- International Air Services Licensing Act 1947
- Airport Authorities Act 1966
- Airport Authorities Amendment Act 198
- Carriage by Air Act 1967
- Aviation Crimes Act 1972
- Aircrew Industrial Tribunal Act 1971
- State Services Act 1962
- Commerce Act 1986
- State-owned Enterprises Act 1986.

[9] Air traffic services are referred to as "airways services" in the Act.

Clearly there is considerable *regulatory power* within the New Zealand civil aviation system, the main instruments being:

- Civil Aviation Act 1964 (referred to as the Act),
- Civil Aviation Regulations 1953 (Regulations), and
- Air Services Licensing Act 1983 (ASL Act).

Air Services Licensing Act

Air services licensing has traditionally played a major role in controlling the commercial activities of civil aviation. By replacing the Air Services Licensing Act 1951, the ASL Act 1983 altered the entry conditions for establishing new domestic air services. A qualitative licensing system replaced a quantitative one. Artificial commercial limitations on air services were replaced by controls relating to the competence of the operator.

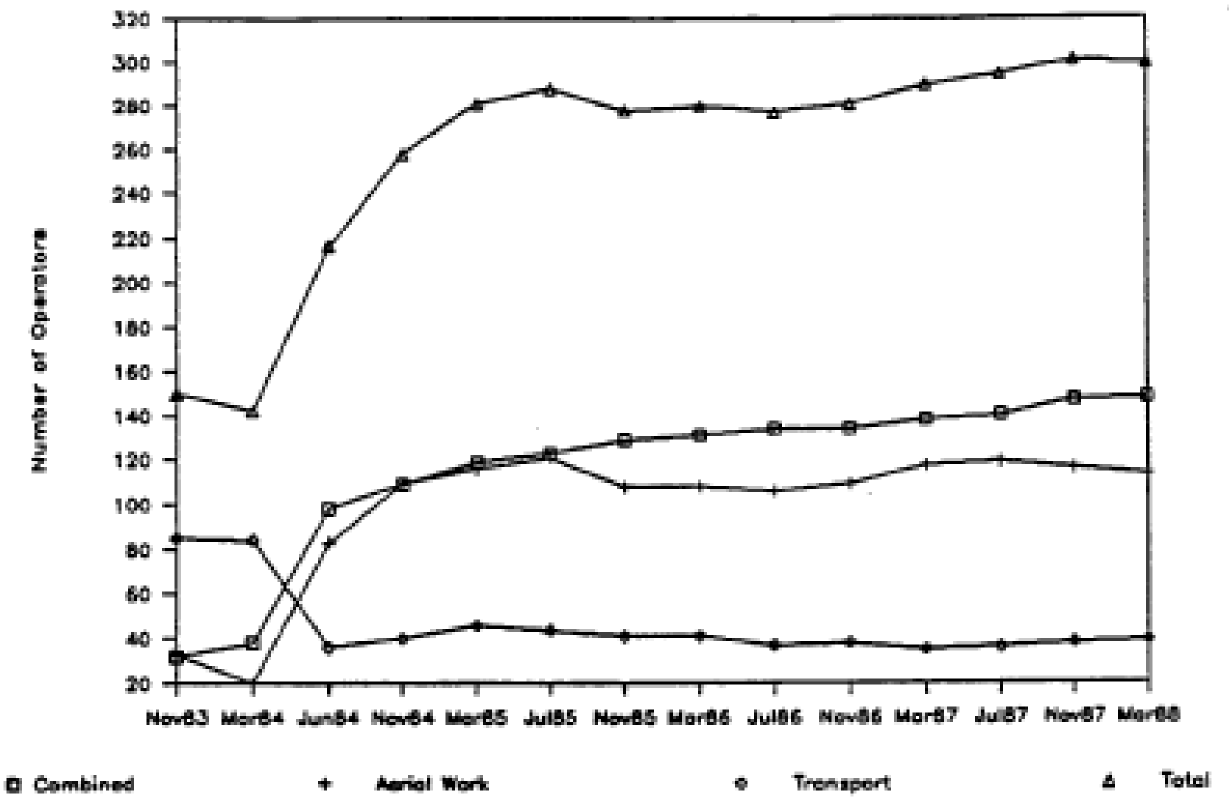
These changes have admitted a number of new entrants into commuter and third level airline services. Figure 5.3 illustrates the change in the number of licence holders since 1983. The rise in the number of aerial work operators in Q2/84[10] is a result of flying training establishments (mostly aero clubs) being required to obtain aerial work licences; the rise in the number of combined licences is a result of aero clubs with air transport licences for air taxi or charter work being required to also have aerial work licences for flying training.

There is duplication between the regulatory powers of the Civil Aviation Act and the ASL Act. The ASL Act essentially relies on the Civil Aviation Act to determine whether an operator has the appropriate competence for a licence. This duplication adds to the confusion and frustration felt by commercial operators.

[10] Q2/84 means *second quarter 1984.*

Figure 5.3 - CHANGES IN NUMBERS OF OPERATORS

Since the 1983 Licensing Act



The ASL Act is the regulatory power dealing with the civil aviation *market*, as opposed to the civil aviation *system* defined above. The *civil aviation market* can be defined as:

> *the gathering of firms and people for the supply and purchase of air transport services or aerial work services.*

In this sense, therefore, the ASL Act deals only with those aircraft operators providing air services. It does not deal with aircraft maintenance, aircraft sales firms and aircraft supply services, *etc.* Although the regulatory power of the ASL Act does not directly affect all commercial civil aviation, its influence on the system is a major factor in the “power play” within the civil aviation system.

5.1.2 Commercial Power

Commercial power is exerted by organisations large and small – rarely by individuals. Commercial organisations accept the need for rules and regulations provided they do not affect them unduly or favour a competitor or new entrant. Most organisations see regulations as a way of keeping “cowboy” operators out of the system.

Commercial power is exerted on the system by the following groups:

- major airlines, local and foreign
  (*eg* Air New Zealand, Ansett New Zealand, Qantas, American airlines);

- other scheduled airlines
  (*eg* Safe Air, Mt Cook Airlines);

- commuter and non-scheduled airlines
  (*eg* Eagle Air, Air Safari, Sea Bee Air, Corporate :Flight Services);

- aerial work operators
  (*eg* Fieldair, Motor Holdings, Griffin Ag-Air, NZ Aerial Mapping);

- helicopter operators
  (*eg* HelicopterLine, Helicopters (NZ) Ltd, Marine Helicopters, Commercial Helicopters Ltd);

- private operators
  (*eg* corporate jets, individual owner-pilots);

- aircraft maintenance organisations
  (*eg* Motor Holdings, Flight Care, Fieldair Engineering, Safe Air, Air New Zealand, Pacific Aerospace);

- airways services
  (*eg* Airways Corporation of New Zealand Limited);

- aerodromes
  (*eg* Auckland International Airport, Rotorua Airport, Nelson Airport);

- flight training
  (*eg* Nelson Aviation College, Motor Holdings, Canterbury Aero Club);

- sports and recreation
  (*eg* Nelson Aero Club, Tauranga Aero Club, NZ Gliding Association, Microlight Association, Amateur Aircraft Constructors);

- individual pilots, flight engineers and licensed aircraft maintenance engineers; and

- aircraft manufacturers
  (*eg* Pacific Aerospace, Boeing, British Aerospace, Piper Aircraft Corporation).

Some of these organisations are very sophisticated indeed (*eg* Air New Zealand, other international airlines, aircraft manufacturers). Many (*eg* Safe Air, Eagle Air, Air Safari, Motor Holdings, Helicopter Line, NZ Aerial Mapping) are at least as sophisticated as most similar sized organisations in other sectors of industry and commerce.

Within the commercial power group there is no lack of experienced, well qualified and capable people. Moreover, many of these people and their organisations have been working in the system for thirty years or more. (Indeed, a number of people can recall the introduction of the Civil Aviation Regulations 1953). These organisations and people have been largely responsible for creating, maintaining and improving the commercial power and capabilities of the civil aviation industry in New Zealand.

In response to the demand for additional air services and aeronautical facilities (especially in tourism, energy development and live deer capture) a number of new entrants joined the industry during the last 20 years, setting up their own organisations. Many are now well qualified, capable and experienced. They form part of the commercial power group and may have different ambition levels than their older, more cautious and conservative colleagues.

The civil aviation system in New Zealand is small by world standards. As elsewhere, it is a close-knit community, even between the regulatory and commercial groups. To take best advantage of this relationship, rules and regulations ought not be more complex than needed by the commercial power group to understand what is required of it. Rules and regulations can be couched at a high level since the general level of capability and sophistication of the commercial power group is high.

The close relationship between the commercial and regulatory power groups makes either vulnerable to "capture" by the other. To avoid capture of one by the other, and maintain a balance, requires checks in the system – this may not be easy to achieve.

The commercial power group's activities consist of three basic functions:

- *buying* goods and services (*eg* aircraft, fuel, maintenance services) for use in the civil aviation system;
- *producing* goods and services (*eg* provision of air transport services, aircraft, flying training, *etc*) for use in the civil aviation system; and
- *selling* goods and services for use in the civil aviation system.

As a rule, the commercial power group's success is measured by its ability to make a profit and generate assets. Not all organisations have safety as a prime objective. The regulatory power provides the restoring force needed to achieve the right balance of safety amongst the commercial objectives.

5.1.3 Third Party Power

Third party power comprises groups *outside* the civil aviation system, having a direct interest in what goes on *within* the system, and what is *produced* by the system. Third party powers are interested in both the economic and the safety performance of the system. The most important third party power is the passenger, but the full list is:

- passengers
- shippers of cargo
- travel agents
- the legal system (lawyers, courts, *etc*)

- banks
- insurance companies
- environmental groups
- residents near airports
- political groups and individual members of parliament
- societies, industrial and labour unions (ALPA, SLAET)
- news media
- shareholders or owners of organisations in the commercial power group
- society at large.

Most of these third party powers are obvious, as are their areas of concern. Some of the most influential can be the legal system, news media and industrial unions (*eg* ALPA, SLAET). But society could be, and perhaps should be, seen as a "sleeping giant" capable of stirring up ethical questions or arguments and creating considerable pressure on both the regulatory and commercial powers.

The media and global communication systems are important elements in third party power. The media can make known any performance deficiencies as soon as they occur, and sometimes before. Overnight the media can turn a local issue into an international issue.

A feature of third party power is that it is usually confined to the short term, and is often very strong. This contrasts with the long term and often low-key power play between the regulatory and commercial powers.

Another aspect of third party power is the affect of technological change on social change, and the rapid rate at which both are taking place[11]. The quickening pace of technology is important not only to the commercial power group but also to the third party power group. If the potential tension between technology (commercial power) and social trends (third party power) are to be avoided, they must be put into proper perspective by the civil aviation system. Each has a contribution to make, and the regulatory power must keep up.

Through media headlines following a fatal accident, or relating to some environmental hazard (usually noise), third party power can create an impact that can be out of proportion to the possible impact of the other two powers. Public reaction to an aircraft accident is usually out of all proportion to the risks involved; road transport carries a far greater risk than civil aviation without invoking the same strength of reaction.

In summary, third party powers have an interest in the process of regulation and in the activities of the commercial powers. The regulations must recognise this and strive to achieve a balance in the civil aviation system.

[11] Two important aspects of technological and social change are often not appreciated: the extent of change and the speed of change.

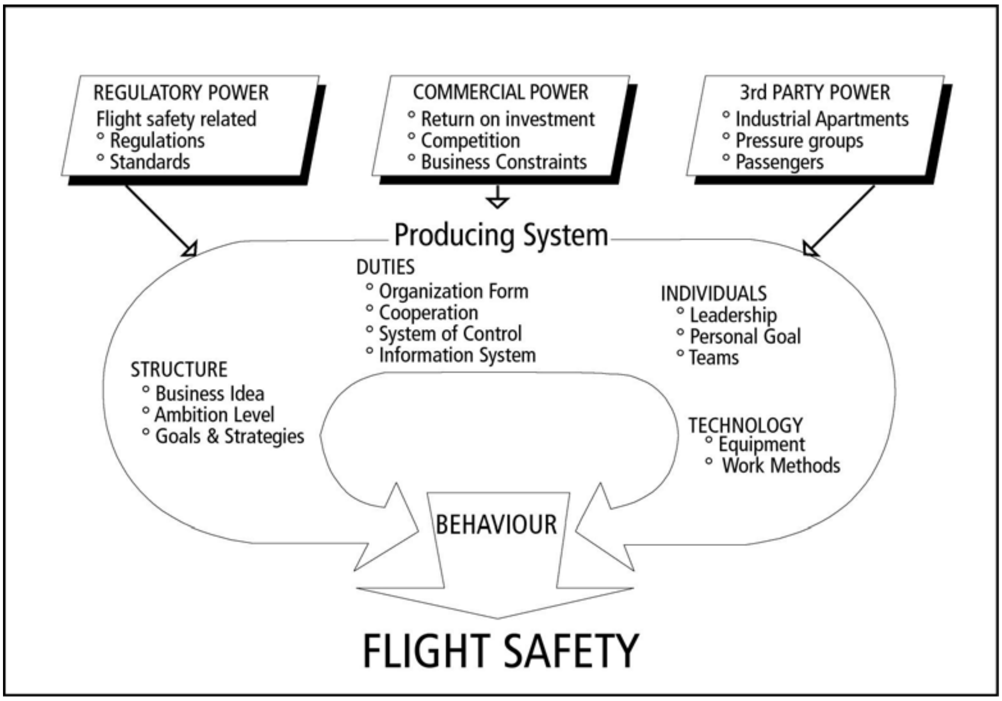
5.1.4 Civil Aviation Power Play And Flight Safety

Figure 5.4 illustrates the factors affecting flight safety performance.

The behaviour of the producing system (*viz* airlines, maintenance organisations, aerial work companies and pilots) determines the level of flight safety. The producing system has its own structure, ambition levels and goals. Its people have their own personal goals and ambitions. The producing system uses equipment and working methods that range from crude to very sophisticated.

Outside the producing system are the three powers: regulatory, commercial and third party (remembering that the producing system is itself part of the commercial power group). The important point illustrated by Figure 5.4 is that *there is no direct link between the regulatory power and flight safety performance.* To influence flight safety the three powers must work through the producing system.

Figure 5.4 - Factors Affecting Flight Safety



5.2 SOME RULES OF THE SYSTEM

New Zealand civil aviation has various definitions and explanations of air services, aircraft operations, aircraft types, airworthiness and "approvals" in official and unofficial use. They stem from the Act, Regulations, ASL Act and requirements, orders and circulars published by CAD. Lack of standard terms accounts for much of the confusion and complexity of civil aviation legislation and its interpretations.

5.2.1 Air Operations & Air Services

Confusion exists over the various types of air services. The ASL Act and Regulations both offer definitions:

The *ASL Act* definitions are as follows.

Air Service means "an air transport service or an aerial work service; whether regular or casual, in respect of any journey beginning and ending in New Zealand; and includes any such service in which the aircraft used leaves and returns to the same aerodrome without any intermediate stop";

Air transport service means "any service provided by means of an aircraft for the carriage of passengers or goods for hire or reward; but does not include any such service:

a) Carried on solely for the purpose of giving instruction in the control or navigation of aircraft in flight; or

b) In which fertilisers, chemicals, poisons, seeds, baits, or similar agricultural substances are dispersed from an aircraft in flight for agricultural, horticultural, or pest destruction purposes."

Aerial work service means "any service provided by means of an aircraft for hire or reward, other than an air transport service."

In terms of the ASL Act, aerial work therefore covers flying training, aerial survey, aerial photography, aerial advertising and the "usual" agricultural aviation activities. But an air service in which goods are unloaded or dropped from an aircraft while it is in flight is an air transport service (*eg* lifting fence posts by helicopter). The phrase "the carriage of passengers and goods for hire or reward" seems to place survey work, photography and advertising in the aerial work category.

The ASL Act definitions apply to domestic air services, as opposed to international air services, and relate to the market for air services, as opposed to the civil aviation system.

The *Regulations* define an air service as follows.

Air Service means "any flight performed by aircraft for the transport of passengers or cargo for hire or reward."

This is a very broad definition and relates to domestic and international flights.

Regulation 131, Classification of Operations, divides flight operations into four classes:

- private operations
- aerial work operations
- air transport operations
- special operations

This is where some confusion between the Regulations and the ASL Act originates. There is a difference between *air transport services* and *air transport operations*, also between *aerial work services* and *aerial work operations*.

Private operations essentially include all aircraft operations which are not for hire or reward. These include: personal transport, flight checking (testing), and ferry flights by airlines and other air transport operators.

Aerial work operations include non private operations in which the aircraft is used for:

- aerial advertising
- aerial photography
- aerial survey
- aerial construction
- aerial lifting, carriage or positioning of equipment or suchlike
- air ambulance services in undeveloped areas
- agricultural and farming operations
- carriage of supplies in undeveloped or remote areas
- carriage of goods (for trade) belonging to the aircraft operator or pilot
- the support of oil or mineral exploration and production
- the support of air accident investigations
- flight training
- other approved and "similar" aircraft operations

Aerial work operations, in terms of the Regulations, include aircraft operations in which people (passengers[12]) may be carried in connection with: aerial construction; lifting, carriage or position of equipment; air ambulance; the support of oil and mineral exploration and production; and air accident investigations.

Air transport operations essentially include all aircraft operations in which the aircraft is used for the carriage of passengers or goods for hire or reward. This specifically includes regular air services over specific routes as well as: air charter, air taxi, scenic flights, joy rides and air ambulance services (except in undeveloped areas).

[12] Both the Regulations and ASL Act have similar definitions for "passengers", *viz* any person carried in an aircraft other than a crew member or other than a person assisting in the operation of the aircraft or in the performance of any service in which the aircraft is engaged.

Special operations are aircraft operations in which the aircraft is used for aircraft type approval, aircraft type certification, experimental purposes or other approved “similar” aircraft operations.

In addition, the definitions in the Regulations define **agricultural operations** to be “operations in which the aircraft is used to provide work service to those persons engaged in agricultural of farming; and includes:

i) topdressing, seed sowing, dusting, spraying, dropping of poison baits, and laying of poison; and

ii) supply dropping on farms and forests, farm and forest inspection, stock feeding and stock location, inspection, and mustering, carried out by an agricultural operator.” [13]

Civil Aviation Safety Order Number 4 (CASO 4) [14], Aircraft Performance Requirements, introduces an additional type of operation called executive operations and defines the term general aviation[15].

Executive operations means “all private operations in which an aeroplane is used for the transport of persons who are required by an employer, so to travel.”

In terms of section 131 of the Regulations, executive organisations are a particular type of private operation.

General aviation means “any operation by aircraft having a maximum certificated take-off weight of 5700 kg or below, but may include the operation of aircraft having a maximum certificated take-off weight in excess of 5700 kg engaged in private or aerial work operations.”

The term general aviation applies to all classifications of operations (see Regulations 131).

In terms of the CASO 4 definition, aircraft larger than 5700 kg and not engaged in private or aerial work operations could presumably be described as commercial air transport – but there appears to be no complementary definition term for other aircraft over 5700 kg, in the CASOs or elsewhere.

The definitions prescribed in the Regulations and various requirements, orders and circulars, and used to describe various air services and aircraft operations within the New Zealand civil aviation system, apply to air services and aircraft operations, both international and domestic. This is the essential difference between the definitions in the ASL Act and those contained in the Regulations.

[13] This definition would apply to the classification of aerial work operations spelt out in Regulations 131 relating to agricultural and farming operations.
[14] CASOs are issued, by the Director of Civil Aviation to give effect to Regulations. They are specifically used for promulgating orders or procedures relating to flight operations, *etc.* See Regulations 8A.
[15] As far as we are aware, CASO 4 is the only official document defining executive operations and general aviation. Therefore it would not be unreasonable to assume that the meaning and use of these terms is strictly limited to CASO 4.

Arising from the definitions are some interesting differences between the ASL Act and the Regulations. The ASL Act talks about “air transport service” and “aerial work service” whereas the Regulations talk about “air transport operation” and “aerial work operation”. Aerial work services are also aerial work operations, but not all aerial work operations are aerial work services. Likewise many air transport services are not air transport operations. For example: the carriage of passengers by helicopter to and from an oil rig is an air transport service but is not an air transport operation; a lifting operation with a helicopter is an air transport service but not an air transport operation. Both these air transport services are defined as aerial work operations within the Regulations.

The significant point is that, under section 136 of the Regulations, an *air service certificate* is required for an air transport operation. But because there are some air transport services that are not air transport operations, an air service certificate is not necessarily required to operate the air transport service (*eg* oil rig support, aerial lifting). This distinction is not understood by all in the regulatory and commercial power groups.

The ASL Act and the Regulations address two different aspects of civil aviation. The ASL Act deals with the “market” for air services and the commercial activities of air service operators. The Regulations deal with safety, operational and airworthiness issues of the total civil aviation system, of which air service operators are only one component. Differences in some terms, definitions and usage between the ASL Act and the Regulations could therefore be expected. Notwithstanding this, however, there is needless confusion and misunderstanding of the proper meanings and usage of the terms: air transport service, air transport operations, aerial work service, aerial work operations, and others.

From an aircraft owner or operator’s viewpoint, the standards and requirements placed on an air service operator (by the ASL Act) can be significantly more demanding for an air transport service than for an aerial work service, yet not all air transport services require an air service certificate. An operator who knows his air service to be an aerial work operation in terms of the Regulations can be frustrated by, and even hostile to, the standards and requirements “imposed” by the Air Services Licensing Authority and CAD (primarily regarding documentation and administrative matters).

In summary, the definitions do not facilitate understanding the civil aviation system in New Zealand.

5.2.2 Aircraft Types

Of a more technical nature are definitions to describe aircraft categories and classifications for various purposes. There are many definitions; from the Regulations we find the following.

Aircraft: “any machine that can derive support in the atmosphere from the reactions of the air, otherwise than by the reactions of the air against the surface of the earth” [16].

[16] This definition is consistent with the Civil Aviation Act 1964 and the ICAO definition. The definition excludes hovercraft.

Aircraft category: "any one of the following classes of aircraft, namely, aeroplane, helicopter, glider, and balloon".

Aeroplane: "a power-driven heavier-than-air aircraft deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight." [17]

Helicopter: "a rotorcraft that depends principally on power-driven rotors for its horizontal motion".

Glider: "a non-power-driven heavier-than-air aircraft which derives its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight".

Balloon: "a non-power-driven lighter-than-air aircraft".

Rotorcraft: "heavier-than-air aircraft which derives its lift in flight from the reaction of the air on one or more rotors on a substantially vertical axis".

Gyroplane: "a rotorcraft whose rotors are not power-driven and whose means of propulsion consist of a power driven propeller on a substantially horizontal axis" [18].

Regulation 162 further classifies aircraft on its certificate of airworthiness into three categories.

Standard category aircraft which may be used in any class of operation (*ie* private, aerial work, air transport, special).

Agricultural category aircraft which may be used in any class of operation other than air transport.

Restricted category aircraft which may be used in specific classes of operations specified in an approved document but shall not be used for air transport.

In addition to section 162 of the Regulations, section 4(2), Interpretation, states that for the purposes of the Regulations, aircraft shall be classified in accordance with the Second Schedule to the Regulations. Figure 5.5 displays the Second Schedule.

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[17] This definition is consistent with the ICAO definition. The definition excludes hovercraft.

[18] If the definitions in the Regulations are strictly interpreted then *either* a gyroplane is not an aircraft category *or* it is outside the category of aircraft because it refers to helicopters not rotorcraft, but it is classified as an aircraft according to the Second Schedule (See Figure 5.5).

CASO 4 groups aeroplanes for the purpose of establishing performance requirements for all classes of operations:

- Groups A, X, C, D and E for aeroplanes carrying out executive operations, private operations, aerial work, training operations and air transport; and
- Groups F, G and H for agricultural operations.

Figure 5.5 - Classification of Aircraft

1980/88 – Civil Aviation Regulations 1953 (Reprint) 121

- Aircraft
  - Lighter-than-Air aircraft
    - Non-power-Driven: balloon
      - Free balloon
        - Spherical free balloon
        - Non-spherical free balloon
      - Captive balloon
        - Spherical captive balloon
        - Non-spherical captive balloon (1)
    - Power-driven
      - Airship
        - Rigid airship
        - Semi-rigid airship
        - Non-rigid airship
  - Heavier-than-air aircraft
    - Non-power-driven
      - Glider
        - Land glider
        - Sea glider (2)
      - Kite (4)
    - Power-driven
      - Aeropane
        - Land plane (3)
        - Sea plane (2)
        - Amphibian (2)
      - Rotorcraft
        - Gyroplane
          - Land gyroplane (3)
          - Sea gyroplane (2)
          - Amphibian gyroplane (2)
        - Helicopter
          - Land helicopter (3)
          - Sea helicopter (2)
          - Amphibian helicopter (2)
      - Ornithopter
        - Land ornithopter (3)
        - Sea ornithopter (2)
        - Amphibian ornithopter (2)

(1) Generally designated “kite balloon”
(2) “Float” or “boat” may be added as appropriate
(3) Includes aircraft equipped with ski-type landing gear (substitute “ski” for “land”)
(4) For the purpose of completeness only

The classifications for Groups A, X, C, D and E are essentially based on single engine performance and the maximum all up weight (MAUW) of the aeroplane. There are four MAUW classifications:

Group X	above 5700 kg (12 566 lb)
Group C	equal to or below 5700 kg
Group D	equal to or below 5700 kg but above 2270 kg (5004 lb)
Group E	equal to or below 2270 kg

Group A aeroplanes may have any MAUW. The only requirement for this classification is capability of continuing flight in instrument meteorological conditions (IMC) after failure of a critical engine at V1 speed (the decision speed for take-off) and proceeding to a suitable aerodrome for landing.

The specified MAUW of 5700 kg is not entirely arbitrary. ICAO has considered the cut-off point between aeroplanes used for (international) air transport operations and those used for non air transport operations. ICAO specifies a maximum certificated take-off weight (MCTOW) of 5700 kg as the cut-off point for standards and recommended practices relating to the airworthiness of aircraft intended for the carriage of passengers or cargo or mail. Annex 8 to the ICAO Convention details the standards aircraft manufacturers and aircraft operations of Contracting States must meet.

Aeroplanes with a MAUW greater than 5700 kg are designed and constructed to stringent standards. They are complex aeroplanes governed by sophisticated airworthiness requirements and flight operations requirements, and requiring a high level of personnel training. Aircraft with a MAUW of up to 5700 kg are designed to lower standards, are not as sophisticated, and have correspondingly lower training requirements.

An aeroplane in the vicinity of 5700 kg MAUW is designed to carry up to about 20 passengers. The Bandierante, DHC Twin Otter and Beech King Air B200 have a MCTOW of about 5700 kg and have seating capacities of 20, 19 and 15 passengers respectively.

For aeroplanes less than 57000 kg MAUW but designed to carry 10 or more passengers, the United States has issued regulations[19] to ensure higher standards of airworthiness and aircraft performance than for other aeroplanes less than 5700 kg. These standards are aimed at commuter aeroplanes and those used in air charter or air taxi operations. As most of the aircraft operating in this market are of US manufacture, operators worldwide are presented with these US FAR standards as a base line[20].

[19] The United States Federal Aviation Regulations (FAR) 135 Appendix A define these standards and requirements.

[20] The philosophy behind the US FAR standards for small aeroplanes carrying 10 or more passengers is that the US Civil Aviation Authority (*ie* the FAA) considers that a higher level of safety standards is required when passengers are carried. They have chosen 10 passengers as the “cut off” point.

Section 16 of the ASL Act defines "classes and categories of licences" applying to an air transport service. There is no distinction as to the type (or class) of aircraft, *ie* aeroplane, helicopter or even a balloon. There are three categories of licence based on MCTOW:

Category A licence applying to an air transport service with any aircraft;

Category B licence applying to an air transport service with aircraft having a MCTOW of 7200 kg or less; and

Category C licence applying to an air transport service with aircraft having a MCTOW of 2500 kg or less.

Thus the licence applicable to an operator of an air transport service is determined by the heaviest aircraft of his fleet.

Aircraft used by New Zealand domestic airlines (F27, DHC Dash 8, HS 748, B737, Argosy 200 and DC3) have MCTOWs greater than 7200 kg. Some aircraft (*eg* BAe 125) used by private operators offering air charter services also have a MCTOW greater than 7200 kg. Operators of these aircraft (Air New Zealand, Ansett, Safe Air, Mt Cook Airlines and Corporate :Flight Services) require a category A licence.

Most aircraft used by third level and commuter airlines, air charter and air taxi operators have a MCTOW between 2500 kg and 7200 kg. The Bandierante, Twin Otter, Bell 212 helicopter, Nomad, Britten Norman Islander[21] fall into this category. Operators such as Eagle Air, Air Safari, Sea Bee Air and Motor Holdings require a category B licence.

The smaller air charter and air taxi operators with Piper Aztecs, Piper Senecas, Cessna 210s, Partenavia P68s, operate aircraft below 2500 kg. Thus organisations like the Canterbury Aero Club, Aspiring Air, Motueka Air, Pegasus Aviation and Taupo Air Charter require category C licences.

There is only one category of aerial work licence. It applies to all aircraft (including helicopters and other aircraft) involved in activities such as flight training, aerial survey, aerial photography, as well as agricultural aviation. A helicopter operator providing an air transport service (in terms of the ASL Act) and also involved in aerial work (say photography or surveying) requires a category B or category C air transport licence *plus* an aerial work licence. Similarly, aero clubs and flying schools offering air charter services require an air transport licence (probably category C) as well as an aerial work licence.

The ASL Act does not distinguish between aeroplane (*ie* fixed wing) operations and helicopter (*ie* rotary wing) operations. Indeed, the operator of a balloon or glider requires at least a category C licence to conduct an air transport service.

[21] The Cessna Citation II, Learjet 36A and BAe Jetstream 31 are aircraft with MCTOWs just below 7200 kg, whilst the Beech Baron 58 has a MCTOW close to 2500 kg. There is a significant difference in the performance and capabilities of these aeroplanes.

5.2.3 Aircraft Registration And Airworthiness

An aircraft operating within the New Zealand civil aviation system must have a:

certificate of registration[22]**.**

certificate of airworthiness (*C of A*) or, where an aircraft cannot comply with the requirements for the issue of a *C of A*, a **permit to fly**, which is issued to the aircraft and is transferable between operators or owners.

[*Cs of A* may be terminating or non-terminating. A terminating *C of A* has a maximum validity of four years and may be renewed if the Director is satisfied the aircraft is airworthy. A non-terminating *C of A* may be issued for an aircraft if the *approved* maintenance schedule or maintenance programme specifies all maintenance necessary to ensure the continued airworthiness of the aircraft[23].]

certificate of type approval showing that the aircraft or component complies with airworthiness design standards, issued to the manufacturer of the aircraft or component.

The basic airworthiness design standards for aircraft applicable in New Zealand are those defined in the United States Federal Aviation Regulations (FAR) [24] and by the United Kingdom Civil Aviation Authority (CAA). [25] New Zealand has also adopted either US or UK basic airworthiness design standards for engines, propellers, aircraft equipment, radio communications and navigation equipment, *etc*. So the basic airworthiness design standards for civil aviation in New Zealand are those applying in the US and UK, both English-speaking countries with significant aircraft design and manufacturing industries.

5.2.4 Aircraft Maintenance And Airworthiness

Section 171 of the Regulations prescribes that the owner and the operator of a New Zealand aircraft[26] shall ensure that the aircraft and every component of the aircraft is maintained and certified in accordance with the Regulations. NZCARs (F1) detail the responsibilities of the owner and operator for maintenance. In essence the owner and operator shall ensure that the aircraft is maintained in an airworthy condition.

Maintenance is defined in NZCAR F1 to mean "the overhaul, major repair, or major modification of aircraft and aircraft components; and includes minor

[22] There appears, however, nothing in the Regulations or elsewhere to require the owner of an aircraft operated in New Zealand to have a foreign or New Zealand certificate of registration. the Regulations do require that an operator wishing to use an aircraft on an air transport operation shall do so in accordance with an air service certificate issued by the Director. This Regulation (Regulation 136) would effectively capture all those aircraft in air transport operations and presumably require them to have a certificate of registration, foreign or New Zealand. But aerial work, private and special operations, do not appear to be similarly captured, except perhaps by New Zealand Certificate of Airworthiness requirements.
On the other hand, Regulation 153 prescribes that when a registered aircraft has been destroyed or permanently withdrawn from use, the owner shall forward to the Director the certificate of registration and notification of the destruction or withdrawal from use of the aircraft. (Provided, of course, the aircraft has been registered in the first place).

[23] Civil Aviation Airworthiness Requirements (NZCAR) B8 refers.

[24] Part 23 (normal, utility, acrobatic category airplanes), Part 25 (transport category airplanes), Part 27 (normal category rotorcraft), Part 29 (transport category rotorcraft), Part 31 (manned free balloons).

[25] Joint airworthiness requirement (JAR 22) for sail planes and powered sail planes.

[26] A New Zealand Aircraft is an aircraft entered on the register of New Zealand aircraft.

maintenance and major maintenance." The Regulations also define maintenance as: "all work and inspections performed to ensure the continued airworthiness of an aircraft or aircraft components; and includes minor maintenance and major maintenance."

Given there are differences between these two definitions, the definition in the Regulations should prevail. Both the Regulations and NZCAR F1 differentiate between types of maintenance.

Major Maintenance means "the overhaul, major repair, or major modification of aircraft and aircraft components; and includes any work involving the extensive dismantling and reassembly of aircraft or aircraft components and the fabrication of replacement parts in accordance with approved data."

Minor Maintenance means "all work relating to the maintenance of aircraft other than major maintenance."

The Regulations and NZCARs prescribe that, as a rule, aircraft maintenance can be performed only by approved firms and in compliance with a schedule of conditions that relate to the firm's approval. An unpressurised piston engine aircraft not exceeding 2730 kg (6000 lb) MCTOW[27] and used solely on private operations need not, however, have its minor maintenance performed by an approved firm. It may be performed by any licensed or approved aircraft maintenance engineer. In addition, an owner-pilot or any licensed aircraft maintenance engineer (LAME) may perform a limited number of maintenance tasks.

The operator of aircraft used in air transport operations shall provide (or ensure there is) an adequate maintenance organisation as the Director may require. This means that either the operator performs his own maintenance or the operator nominates and uses a principal maintenance contractor to perform the maintenance. In either case the operator is responsible for ensuring that the aircraft is properly maintained (*ie* to airworthiness standards) as the Director may require.

In practical terms, for an aircraft's certificate of airworthiness to remain valid a prescribed schedule of maintenance to *approved* standards and procedures must be adhered to. An approved **maintenance programme** contains a series of **maintenance schedules** which collectively prescribe the minimum schedule maintenance necessary to ensure continuing airworthiness. A maintenance programme will, amongst other things, identify:

- daily or pre-flight (or both) inspection schedules;
- periodic maintenance schedules;
- abnormal occurrence inspection schedules
  (*eg* after a heavy landing or excessive inflight loading);
- component overhaul and retirement life periods; and

[27] There are 2218 aeroplanes and helicopters on the New Zealand register. Of these there are 1752 below 5700 kg MAUW. 2730 kg MAUW is broadly the weight above which most aircraft are pressurised or may be powered by turbine (or turboprop) engines; there are many of these but not all will be used solely on private operations.

- major inspections.

A maintenance schedule is a list of items to be inspected, tested, or otherwise maintained after a specified period or event. Maintenance programmes must be approved by the Director.

5.2.5 Certificate Of Approval And Airworthiness

Regulation 176 gives the Director authority to "grant a certificate of approval to a firm or a person for the purpose of design, construction, maintenance, processing, or supply of aircraft and aircraft components". Oil companies supplying jet fuel, aircraft sales firms selling aircraft, maintenance and repair organisations making aircraft airworthy and an engineering firm designing and manufacturing a topdressing aircraft, all require certificates of approval. The holder is required to notify the Director of any proposed changes that would affect the certificate of approval, schedule of conditions that are part of the certificate, or changes to premises or nominated persons. Provided these notifications are made, the certificate of approval is non-terminating.

A firm or person with a certificate of approval may also, if granted by the Director, issue reports or certificates within the scope of the approval.

In this connection, NZCARs (D1) elaborate on the delegation of responsibility by stating that "the Director may delegate certain powers which he holds under the Civil Aviation Regulations 1953, to employees of an approved firm or to an approved person. Persons with delegated powers will be nominated, and terms and conditions relating to a delegation will be specified, in appendices forming part of the certificate of approval". People exercising such delegated powers are acting on behalf of the State; that is, they are carrying out State functions on behalf of the Director.

An application for the issue of a certificate of approval is made by a firm or a person to the local Regional Airworthiness Superintendent (RAS). Approval will be granted if and when the Director (through the RAS) is satisfied that: the firm or person is capable of performing the activities for which the approval is sought; all the conditions for approval[28] have been met; and the engineering procedures manual (EPM) provides for adequate control of the firm's or person's airworthiness-related activities. The criteria for approval are detailed but commonsense.

There are five types of approved firms (or persons) for which certificates of approval are granted:

[28] To obtain a certificate of approval, a firm must meet the following criteria or conditions of approval:
nominate the firm's Chief Executive (in the application);
nominate a senior staff member to be responsible for the control of all airworthiness matters and for liaison with the CAD, this person to be directly responsible to the Chief Executive for airworthiness functions;
have a sufficient number of appropriately qualified staff to handle the work;
have adequate facilities and equipment; and
provide an appropriate engineering procedures manual (EPM).

Design and delegated authorities when the approval relates to:

- issuing technical assessments and reports to show compliance of complete designs with airworthiness design standards,
- approval of approved aircraft design changes or flight manuals;

Construction of aircraft and aircraft components where approval is for aircraft, parts, equipment and materials for aircraft in the standard or agricultural categories;

Maintenance where the approval is for minor and major maintenance for one or more of:

- aeroplanes
- rotorcraft
- engines
- propellers (major only)
- avionics; and
- equipment (major only)

Processing where the approval relates to activities such as non-destructive testing and welding; and

Supply where the approval relates to: aircraft parts, materials and fluids.

According to NZCARs, an approved firm (or person) is to be inspected at least annually by CAD to determine whether the firm is complying with the terms and conditions of its approval.

5.2.6 Airways Services

Airways services are defined by the Act and Regulations as follows:

"(a) Air traffic control service for aerodrome traffic
(in these regulations called *aerodrome control service)*:

(b) Air traffic control service for controlled flights in control areas
(in these regulations called *area control service*):

(c) Air traffic control service for arriving or departing controlled flights
(in these regulations called *approach control service*):

(d) A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights
(in these regulations called *flight information service*):

(e) A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights in the immediate environment of an aerodrome, irrespective of whether or not any aircraft to which such advice or information is directed is in the immediate environment of an aerodrome
(in these regulations called *aerodrome flight information service*):

(f) Aerodrome rescue fire services".

Air traffic control is defined as "a service provided for the purpose of

(a) Preventing collisions between aircraft:

(b) Preventing collisions on the manoeuvring area between aircraft and obstructions;

(c) Expediting and maintaining an order flow of air traffic".

Airway is defined as "a control area or portion thereof established in the form of a corridor equipped with radio navigation aids".

The Regulations also define: **control area, control zone, controlled airspace** and **controlled flight.**

5.2.7 Aerodromes

Aerodromes is defined by the Act and the Regulations as "any defined area of land or water intended or designed to be used either wholly or partly for the landing, departure, movement, and servicing of aircraft; and includes any buildings, installations, and equipment on or adjacent to any such area used in connection with the aerodrome or its administration".

Designated aerodrome[29] is defined by the Act to be "an aerodrome for the time being designated as a security aerodrome pursuant to section 21c of this Act."

Airport is defined by the regulations as "any aerodrome at which facilities available to the public are provided for the shelter, servicing, or repair of aircraft, and for receiving or discharging passengers or cargo."

Customs airport is defined by the regulations as "any aerodrome designated by the Minister of Customs as a Customs aerodrome."

Government civil aerodrome is defined by the regulations as "an aerodrome operated by the Minister."

[29] There are three designated aerodromes: Auckland, Wellington and Christchurch.

Licensed aerodrome is defined by the regulations as "an aerodrome licensed under these regulations." The Regulations define five classes of aerodromes:

public aerodromes available to all aircraft;

private aerodromes which may be:

- **licensed** and available for general use;
- **licensed** with restricted availability; and
- **unlicensed** and available only with prior agreement of the owner, lessee, or user;

military aerodromes available only with the prior approval of the military base commander;

civil/military aerodromes available to specified air transport operators or with the prior approval of the military base commander; and

places authorised for use as aerodromes available only to air transport operators included within the authorisation or with the prior agreement of the owner, lessee or user.

The Director grants public or private licences for aerodromes to the owner, lessee or person with the right to use the land (or water) as an aerodrome. This allows the owner, *etc* to use the place for which the licence was sought as an aerodrome. Aerodrome licences are non-terminating until either surrendered by the licensee or cancelled or suspended by the Director. Licensed aerodromes are supposed to be inspected by an authorised person[30] at least once a year.

Under the Regulations the Director prescribes some operational conditions, in the interests of safety, for eight aerodromes in New Zealand[31].

Section 34 of the Regulations prescribes that no aircraft shall use a licensed aerodrome in contravention of the conditions of the aerodrome licence. Similarly, no aircraft shall use a place that is not a licensed aerodrome unless prior written approval is obtained from the organisation administering that place or from the occupier of that place or prior approval has been obtained from the Director.

Unlicensed aerodromes may be used for air transport operations with the authorisation of the Director.

To sum up, the Regulations defining the provision and use of aerodromes appear to be straightforward and unambiguous.

[30] In terms of the Regulations an authorised person is "any person authorised in writing by the Minister to exercise the functions specified in these regulations as being exercisable by any such person".
[31] CASO 2 sets out the operational conditions for Auckland, Wellington, Christchurch, Dunedin, Hamilton, Invercargill, Palmerston North, and Paraparaumu airports.

5.2.8 Individuals

Individuals within the civil aviation system are granted, by way of licences and ratings, certain privileges to work within the system. The Regulations define a:

licence as "a licence granted by the Director pursuant to this part of these Regulations" [32], and a

rating as "an authorisation entered on a licence or certificate, and forming part thereof, stating special conditions, privileges, or limitations pertaining to the licence or certificate".

The Regulations set out the privileges of, and limitations on, holders of licences and ratings, but they do not always clearly define corresponding responsibilities.

Individual licences and ratings are granted to aircraft maintenance engineers, flight crew, and airways services personnel. The following lists the licences and ratings that the Director may grant:

Aircraft maintenance engineer licences

- aircraft maintenance engineer type I licence
- aircraft maintenance engineer type II licence.

Aircraft maintenance engineer ratings

- type I licence ratings are divided into three categories: airframe, powerplant and avionics; within these categories the ratings apply to various technology groups
  (*eg* piston engines, turbine engines, propellers); and

- type II licence ratings are divided into six categories: aeroplane, rotorcraft, powerplant, electrical instrument, radio; within these categories ratings apply to various technology and system groups
  (*eg* basic flight instruments, flight director systems, *etc*, inertial navigation systems).

Flight crew licences

- student pilot licence (aeroplane or helicopter)
- private pilot licence (aeroplane or helicopter)
- commercial pilot licence (aeroplane, helicopter, glider or free balloon)
- senior commercial pilot licence
- airline transport pilot licence
- flight navigator licence
- flight engineer licence
- CADet flight navigator licence
- CADet flight engineer licence

[32] The part referred to is Part XIII, Flight Crew Licences and Ratings; there is no similar definition or interpretation for Part XII, Licensing and Approval of Aircraft Maintenance Personnel.

Flight crew ratings

- A, B, C, D, E category flight instructor ratings (for aeroplanes or helicopters)
- aircraft type rating (for pilot or flight engineer)
- instrument rating (aeroplane or helicopter)
- flight radio telephone operator
- glider towing
- agricultural
- chemical
- compass.

Airways services personnel licences

- air traffic controller licence
- aeronautical station operator licence

Airways services personnel ratings
- aerodrome control
- approach control
- area control
- approach control (radar)
- area control (radar).

All personnel licences and ratings require renewals. This may involve medical examinations but, in all cases, involves knowledge, skill and experience requirements. The licences are generally granted only after the applicant has passed written examinations and demonstrated competency in the skills required by the licence. The Civil Aviation Division is responsible for issuing and supporting the personnel licensing system.

Currently there are about 9600 pilots in New Zealand and more than 2500 professional flight crew. Table 5.1 summarises the personnel licensing situation as at 31 March 1987.

Table 5.1 – Personnel licensing (for year ending 31 March 1987)

Serial		Issues	Renewals	Total Current
1	Airline Transport Pilot Licence (ATPL)	71	1243	627
2	Senior Commercial Pilot (SCPL)	18	71	45
3	Commercial Pilot Licence (CPL)	133	2015	1734
4	Total Professional Pilots Licence	222	3329	2406
5	Private Pilot Licence (PPL)	631	2018	3966
6	Student Pilot Licence (SPL)	1460	576	3248
7	Total pilots licence	2313	5923	9620
8	Flight Navigation Licence	1	4	4
9	CADet Flight Navigator Licence	1	1	1
10	Flight Engineer Licence	26	104	98
11	CADet Flight Engineer Licence	15	13	20
12	Total professional flight crew	265	3451	2529
13	*Total all licences*	*2356*	*6045*	*9743*
14	License Aircraft Maintenance Engineer			1300
15	Airway Services Personnel Licence	18	n/a	282

Notes:

3 Commercial Pilot Licences:

	Issues	Renewals	Total Current
CPL aeroplane	105	1671	1429
CPL helicopter	28	338	301
CPL glider	-	2	1
CPL balloon	-	4	3
	133	2015	1734

5 Private Pilot Licences:

	PPL	SPL
aeroplane	3849	3040
helicopter	117	208

15 Airways services personnel have their licences renewed by the Airways Corporation under delegated authority

5.3 THE MAIN PARTICIPANTS

The main participants in the New Zealand civil aviation system can be grouped as follows:

- aircraft
- air transport operators
- aerial work operators
- maintenance organisations
- airports
- airways services
- sports and recreation
- other organisations.

The following discussion will use the present CAD regional boundaries as geographic boundaries. The northern region will be denoted as AKL, central region as WLG and southern region as CHC.

5.3.1 Aircraft

There are 91 aircraft in the transport or commuter category used to transport passengers or cargo. For the purposes of this report the *transport category* is defined as aircraft over 5700 kg MCTOW. The *commuter category* is defined as aircraft with 11 to 19 passenger seats. Table 5.2 lists these aircraft by type and owner or operator. It has been compiled from the latest information available on aircraft ownership and air transport licences.

Table 5.2 – Transport and Commuter Aircraft

Type	Number	Operators
DC3	5	Fieldair
HS748	6	Mt Cook Airlines
F27	17	Air new Zealand, Civil Aviation Division
B737	16	Air New Zealand, Ansett New Zealand
B767	4	Air New Zealand
B747	5	Air New Zealand
AW650-222	2	Safe Air
B170	5	Hercules Air, R S Owens
BAe125	3	Private - corporate
DHC8	2	Ansett New Zealand
DC4/ATR	2	
DC8	1	Air New Zealand
Falcon 200	1	Private - corporate
Merlin Metro	1	Pacifica Air
CASA 212	1	Friendly Islands Airways
	71	

Commuter Category (aircraft over 10 passengers)

Type	Number	Operators
EMB 110P	3	Eagle Air
GAF Nomad	5	Air Safari, Waterwings, Northern Districts AC
DHC6	1	Mt Cook Airlines
King Air 200	2	Private – corporate
King Air 890	1	United Pacific
Airliner 899	1	Bell-Air
Cessna 421	4	Air Gisborne, capital, Corporate FS, CAD
DN114	3	Nationwide Air, Rotorua Airlines, Air Rarotonga
	20	

Notes:

1. Compiled from different CAD sources but mainly the Register of Aircraft
2. The available passenger seats include the right hand cockpit seat.

There were 3017 aircraft on the New Zealand register of aircraft as at 31 March 1987. Table 5.3 summarises the types of aircraft in New Zealand.

Table 5.3 – New Zealand Aircraft – *(on aircraft register at 31 March 1987)*

	Number	Percent
Aeroplanes > 5700kg	70	2
Aeroplanes < 5700kg	1755	58
All aeroplane	1825	60
Helicopters	393	13
Gliders	318	11
Microlights	469	16
Balloons	12	0
	3017	100%

For its population, New Zealand has a large number of aircraft by world standards; 943 aircraft per million of people. Table 5.4 compares New Zealand with selected European countries.

Table 5.4 – Aircraft Ownership Rates for Selected Countries

	(millions)	Aircraft	Total	Powered	Gliders*	>5700kg
New Zealand	3.2	3017	943	693	250	22.8
Denmark	5.0	1603	321	208	112	17.4
FRG	60.0	20330	339	122	216	5.5
France	10.0	11346	189	120	69	7.3
Finland	4.9	1202	245	127	118	9.2
Netherlands	14.0	1317	94	46	49	9.6
Norway	4.1	1259	307	280	27	36.0
Sweden	8.3	2181	263	193	70	14.5

** including microlights*

Even the Federal Republic of Germany, boosted by its 8200 gliders and 4400 microlights, has an ownership rate of only 339 compared with New Zealand's 943 aircraft per million people. It is obvious that, *for its population, New Zealand is aeronautically a very active country: the civil aviation system is "busy"*.

As shown by Table 5.5 New Zealand's geographic distribution of aircraft does not precisely mirror the distribution of population. Table 5.5 is based on the aircraft *known* to be operating in the various regions[33].

[33] The total number therefore varies from the number of aircraft on the New Zealand register. There seem to be 10% more aircraft on the register than are known to be operating; *ie* for which the regional offices have records.

Table 5.5 – Regional Distribution of Aircraft

	AKL %	WLG %	CHC %
Aeroplanes >5700	32	13	54
Aeroplanes <5700	44	29	27
Helicopters	33	21	47
Gliders	39	38	22
Microlights (Class II)	63	14	23
Balloons	31	54	15
	—	—	—
	43	28	30

Note: Comparative statistics for the general population (people) are AKL 48%, WLG 29%, CHC 23%

(Source: CAD regional offices)

Table 5.5 shows that aircraft are reasonably well dispersed throughout New Zealand. The high number of large aeroplanes in the southern region is because Christchurch is the base for the B737s of Air New Zealand and Ansett, the F27s of Air New Zealand, Mt Cook Airlines' HS748s and Ansett's Dash 8s. The high number of helicopters in the southern region is largely due to tourism.

5.3.2 Air Transport Operators

Analysing air transport operators in a flight safety context it may be somewhat misleading to use the Air Services Licensing Authority's definitions and categories of licences. The scope of air transport services covered by the ASLA's three categories of licences is wide and varied. Since this is the way the industry is partitioned, however, we must first look at the industry in terms of these categories.

In Category A there are six airlines, one charter operator and one helicopter operator. These eight firms operate a total of 103 aircraft, not all of which are greater than 7200 kg[34] MCTOW (*eg* the charter operator and the helicopter operator). The category A licence holders are:

Air New Zealand	37	aeroplanes
Ansett New Zealand	6	aeroplanes
Mt Cook Airlines	27	aeroplanes, 1 helicopter
Fieldair Freight	3	aeroplanes
Safe Air	2	aeroplanes
Corporate Flight Services	7	aeroplanes, 1 helicopter
Helicopters (NZ) Ltd	16	helicopters
Hercules Airlines	3	aeroplanes

Air New Zealand flies international air transport services with B747s, B767s, B737s and DC8s. Corporate Flight Services also flies internationally with the BAe125.

In category B there are 40 operators. They operate 243 aircraft. Seven licence holders operate helicopters, but only two[35] do so exclusively. The category B

[34] See Table 5.6, note 2.
[35] Heavylift Helicopters (NZ) Ltd and Whirlwide Helicopters Ltd.

licence holders operate a variety of air transport services: 14 scheduled airlines operating 81 aircraft (*eg* Eagle Air, Great Barrier Airlines and Motueka Air); 24 air charter, air taxi operators operate 146 aeroplanes; and two charter helicopter operators have 16 helicopters in all. Most category B air transport services are based in the central (WLG) region.

Table 5.6 presents a full list, including category C.

Table 5.6 – Air Transport Services (As at 31 December 1987)

	AKL	WLG	CHC	NZ
Category A				
Licences	2	3	3	8
Aircraft	21	21	61	103
Category B				
Licences	14	17	9	40
Aircraft	93	95	55	243
Category C				
Licences	44	45	43	132
Aircraft	218	177	164	559
Total				
Licences	60	65	53	180
Aircraft	324	292	257	903

Notes:

1. Category A licence authorities the holder to operate an air transport service with any aircraft. Air New Zealand base international aircraft at Auckland and domestic at Christchurch and so appear in both the northern and southern regions; the total is adjusted for the Air NZ licence appearing twice.
2. Category B license authorises the holder to operate an air transport service only with aircraft with a MCTOW of 7200kg or less.
3. Category C licence authorises the holder to operate an air transport service only with aircraft with a MCTOW of 2500kg or less.

A more meaningful grouping of aircraft and operators in the category B air service licence is to separate the larger operators (those offering a scheduled air transport service, *or* using aircraft with a MCTOW greater than 5700 kg or more than 10 passenger seats[36]) from the smaller operators (those flying non-scheduled services with smaller and lighter aircraft) [37].

Table 5.7 makes this distinction, showing *Category B air transport operators*. There are 20 such operators flying 119 aircraft. 14 run scheduled air transport services and 6 fly non-scheduled (charter, air taxi) air transport services using at least one aeroplane with a MCTOW greater than 5700 kg (but less than 7200 kg[38]) or with more than 10 passenger seats (including the right-hand front seat).

[36] Including the right-hand seat in the cockpit; this similar to saying "more than nine passenger seats excluding the pilots' seats".
[37] Scheduled air transport services require a relatively sophisticated operational, technical and administrative organisation. The demands on all parts of the organisation can be great; keeping an air transport operation to schedule is not easy. Air transport operators operating aircraft with a MCTOW greater than 5700 kg or with more than 10 passenger seats (eg Nomads), whether on scheduled services or not, also require a relatively sophisticated organisation because of the relative complexity and sophistication of the aircraft. From a flight safety point of view, it is sensible to group these two types of operations together. They require similar levels of knowledge, skill and experience. The cut-off point for helicopters is 2700 kg or 6000 lb; helicopters above 2700 kg MCTOW have more sophisticated performance and airworthiness characteristics than helicopters below 2700 kg MCTOW.
[38] See Table 5.6, note 2

Table 5.7 – Category B Air Transport Operators

Schedule Services and Aircraft above 5700kg or 10 passengers

	AKL	WLG	CHC	NZ
Schedule operations				
Licences	4	6	4	14
Aircraft	16	43	22	81
Non-scheduled operations >5700kg or > 10 pax				
Licences	3	2	1	6
Aircraft	22	12	4	38
	—	—	—	—
Total				
Licenses	7	8	5	20
Aircraft	38	55	26	119

A good indication of the air transport and commuter capacity of the civil aviation system can be found combining the category B licensed air transport operators in Table 5.7 with category A licensed air transport operators. This grouping can conveniently be termed *commercial air transport operators*. They operate scheduled airline or commuter services, *or* use aircraft with a MCTOW greater than 5700 kg *or* use aircraft with more than 10 passenger seats (including the right-hand front seat).

This grouping is displayed in Table 5.8. It brings together 28 operators with 222 aircraft who must meet more stringent airworthiness and operational requirements (in terms of aircraft design). About 70 aircraft are greater than 5700 kg and a further 10 or so have more than 10 passenger seats. The remainder are smaller aircraft belonging to these operators.

Table 5.8 – Commercial Air Transport Operators

	AKL	WLG	CHC	NZ
Category A Air Transport Service				
Licences	3	3	3	8
Aircraft	21	21	61	103
Category B Air Transport Operators				
Licences	7	8	5	20
Aircraft	38	55	26	119
	—	—	—	—
Total				
Licenses	10	11	8	28
Aircraft	59	76	87	222

Operators flying non-scheduled air transport services with aircraft lighter than 5700 kg MCTOW or with no more than 10 passenger seats, do not have to meet the same requirements as the commercial air transport operators of Table 5.8. The aircraft are not designed to the same stringent design requirements and the operation is not as demanding in a technical and operational sense. A different level of knowledge, skill and experience is needed for this type of operation.

Table 5.9 summarises these minor air transport operators. In the minor air transport operator group, 20 operators with category B air transport licences operate 124 aircraft; and 132 operators with category C air transport licences fly 559 aircraft. Some operators with category C licences have comparatively big fleets.

For example: Fieldair Holdings Ltd (34 aircraft), Canterbury Aero Club (21), James Aviation Ltd (28), North Shore Aero Club (25).

Table 5.9 – Minor Air Transport Operators

	AKL	WLG	CHC	NZ
Category B minor non-scheduled				
Licences	7	9	4	20
Aircraft	55	40	29	124
Category C air transport services				
Licences	44	45	43	132
Aircraft	218	177	164	559
	—	—	—	—
Total				
Licenses	51	54	47	152
Aircraft	273	217	193	683
Aircraft per operator	5.4	4.0	4.1	4.5

Note:

Category B minor non scheduled operators are those with aircraft having:
more than 2500kg but no more than 5700kg MCTOW; or
more than 2500kg MCTOW but no more than 10 passengers.

On average there are 4.5 aircraft per operator. About 30 operators have only one aircraft, four being in category B. For some licence holders it appears that a category C air transport licence may be a convenience (“nice to have”). They may operate the aircraft for private use in the main, rather than a commercially viable air transport service.

Helicopters are used extensively in air transport services, as defined by the ASLA. Table 5.10 describes the situation.

Table 5.10 – Helicopters and Air Transport Services

		AKL	WLG	CHC	NZ
1.	**Category A**				
	Licences	1	1	1	3
	Helicopters	1	16	1	18
2.	**Category B**				
	Licences	2	3	2	7
	Helicopters	4	5	15	24
3.	**Category C**				
	Licences	24	25	22	71
	Helicopters	80	53	63	196
4.	**Total**				
	Licences	27	29	25	81
	Helicopters	85	74	79	238

Notes:

1. Helicopters (NZ) Ltd fit into this category with 16 helicopters on its licence. Corporate Flight Services and Mt Cook Airlines also operate helicopters on their licence.
2. Two all-helicopter operations are in this category: Heavylift Helicopters (NZ) Ltd (2 helicopters) and Whirlwide Helicopters Ltd (14). Apart from these two operators, the other operators in this category use their helicopters for mainly passenger transport.
3. Amongst the category C operators there are many pure helicopter operations: AKL 17, WLG 18 and CHC 16 a total of 51 indicating that 20 fixed wing licences also operate helicopters. Passenger transport is likely to be the main use of all helicopters in this category, but some may be used primarily for private transport.
4. of the 81 licences, 54 are helicopter-only operations.

Turning back to the larger aircraft, a total picture of the "upper end" can be obtained by adding to the commercial air transport operators of Table 5.8 those private aircraft with either a MCTOW greater than 5700 kg or more than 10 passenger seats. Table 5.11 summarises these so-called *augmented commercial air transport services*. Table 5.11 is similar to Table 5.8, but is described by type of operation rather than licence.

Figure 5.5 depicts the geographic distribution of augmented commercial air transport operations.

Figure 5.5 - Augmented Commercial Air Transport Operations

Includes all operations involving scheduled services and aircraft with MCTOW greater than 5700kg or with more than 10 passenger seats

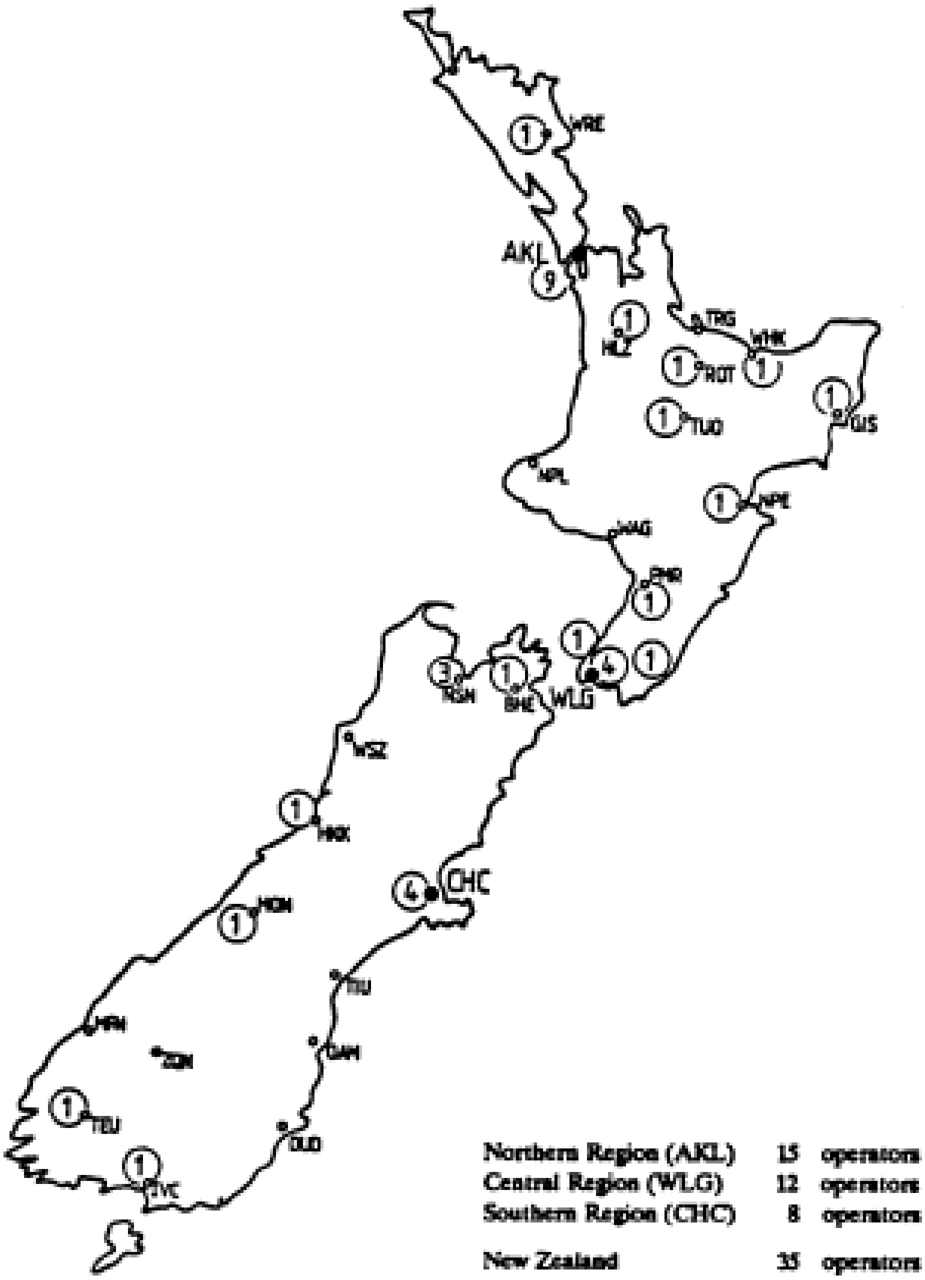


Table 5.11 – Augmented Commercial Air Transport

Commercial air transport (as in table 5.8) plus private operations with aircraft over 5700kg or 10 passengers

		AKL	WLG	CHC	NZ
1.	**Scheduled air services**				
	Operators	6	8	7	21
	Aircraft	29	48	83	160
2.	**Non-scheduled air services**				
	Operators	4	3	1	8
	Aircraft	30	28	4	62
3.	**Private operations**				
	Operators	4	2	-	6
	Aircraft	4	5	-	9
4.	**Total**				
	Operators	14	13	8	35
	Aircraft	63	881	87	231

Notes:

1. Scheduled air service operators are Category A & B licence holders operating scheduled services today, make up as follows:

	AKL	WLG	CHC	NZ
Category A	2/13	2/5	3/61	7/79
Category B	4/16	6/43	4/22	14/81

Air NZ is recorded twice: AKL for international operations and CHC for domestic.

2. Non scheduled air services include charter, air taxi for aircraft heavier than 5700kg or carrying more than 10 pax; they are made up as follows:

	AKL	WLG	CHC	NZ
Category A	1/8	1/16	-/-	2/24
Category B	3/22	2/12	¼	6/38

3. Private operations include all operators with aircraft greater than 5700kg MCTOW or capable of carrying more than 10 pax (eg corporate jets – BAe 125, Falcon 200) and includes the Ministry of Transport. This is an estimate based on the aircraft register at 31 March 87.

Table 5.12 – Aerial Work Services

	AKL	WLG	CHC	NZ	%
Total aerial work					
Licences	99	81	73	253	100
Aircraft 416	324	263	1003	100	
Aircraft per licence	4.2	4.0	3.6	4.0	
Flight training					
Licences				91	36
Aircraft				512	51
Photography & survey					
Licences				107	42
Aircraft				322	32
Other aerial work *(see note)*					
Licences				42	17
Aircraft				151	15

Note:

"Other aerial work" has been determined by deduction from the total aerial work licences and aircraft; some licence holders will be involved in more than one type of aerial work but they need only one licence.

5.3.3 Aerial Work Operators

There are about 250 aerial work operators throughout New Zealand, with more than 1000 aircraft engaged in a variety of aerial work activities. Table 5.12 summarises the aerial work operators based on ASLA airwork licences issued at 31 December 1987.

Most aerial work operators run small fleets, but some have large fleets: Air New Zealand[39] (45 aircraft – Safe Air and Mt Cook Airlines aircraft are included on the Air NZ licence), Fieldair (40), Mt Cook Airlines (29), Auckland Aero Club (19), Associated Airlines (11), Canterbury Aero Club (21).

Flying training operations account for 36% of the licences (or operators) but involve 51% of aircraft engaged in aerial work operations. The other major activity is agricultural aerial work, accounting for 42% of the licences and 32% of the aircraft.

Helicopters are significant in aerial work other than flying training and photography.

In Section 5.2.1 *general aviation* was defined as aircraft operations by aircraft with a MCTOW of up to 5700 kg, and larger aircraft if engaged in private or aerial work operations. It was further explained that "aerial work operations" (a term used in the Regulations) is not the same as "aerial work services" (a term used in the ASL Act).

From an airworthiness perspective it is logical to group together all aircraft with a MCTOW of 5700 kg or less[40]; they have a common level of sophistication and performance. We can group the aerial work operators with the category C air transport services to form what we shall term *commercial general aviation*; see Table 5.13. We have removed organisations such as Air New Zealand and Mt Cook Airlines and added in those operators with category B licences not qualifying as commercial air transport.

[39] Air NZ require an aerial work licence to carry out flying training for other airlines.
[40] The cut-off point for rotorcraft is 6000 lbs or about 2700 kg.

Table 5.13 – Commercial general Aviaiton

		AKL	WLG	CHC	NZ
1.	**Air transport services**				
	Licences	51	55	47	153
	Aircraft	273	233	193	699
2.	**Aerial work services**				
	Licences	98	81	72	251
	Aircraft	371	324	234	929
3.	**Total**				
	Operators	149	136	119	404
	Aircraft	644	557	427	1628

Notes:

1. Air transport services include all non-scheduled services with aircraft up to 5700kg MCTOW or up to 10 passenger seats plus all category C air transport services. Category A licence holders with pure helicopter operations are also included:

	AKL	WLG	CHC	NZ
Cat A: ATL	-/-	1/16	-/-	1/16
Cat B: ATL	7/55	9/40	4/29	20/124
Cat C: ATL	44/218	45/177	43/164	132/559
Total All	51/273	55/233	47/193	153/699

2. Aerial work services shown do no include Air NZ and Mt Cook Airlines but include all other operations, such as Air Safari, Associated Airlines who might be involved in flying training, or have some other aerial work capability.

3. the total figures are too high due to double counting of air transport services that also appear under serial work.

The *total* figures for commercial general aviation in Table 5.13 are misleading. Many licences with air transport licences also have an aerial work licence and so there will be a degree of double counting.

A broad estimate of total commercial general aviation activity can be made by deleting those aerial work operators engaged in flying training. Most of these operators will also have a category B or C air transport licence. Allowing for Air NZ and Mt Cook Airlines and subtracting flying training operators, the total commercial general aviation sector involves about 315 operators and about 1190 aircraft.

Figure 5.6 illustrates the geographic spread of commercial general aviation operations throughout New Zealand. Each dot represents one operator. The diagram has been based on category C air transport licence holders and aerial work licence holders.

Figure 5.6 - Commercial General Aviation
One dot represents one operator

5.3.4 Maintenance Organisations

Section 5.2.4 described the regulatory framework for airworthiness and approved organisations. CAIC-AIR 7 details the list of approved firms. Table 5.14 summarises the CAIC. Many organisations hold more than one type of approval and rating. For example, Air New Zealand at Mangere holds 12 "approvals".

Table 5.14 – Airworthiness Organisations – Approved Firms

Type of Firm	AKL	WLG	CHC	NZ
Design	15	1	3	19
Construction				
Aircraft and parts	16	7	5	28
Equipment and materials	10	11	3	24
Maintenance				
Aeroplane	37	16	16	69
Rotorcraft	15	17	12	44
Engines & propellers	42	20	26	88
Other*	18	20	8	46
Processing				
All ratings	41	19	15	75
Supply				
All ratings	64	48	21	133
	258	159	109	526
	49%	30%	21%	100%

* Avionics and equipment

(Source: CAIC-AIR 7, 22 Feb 88)

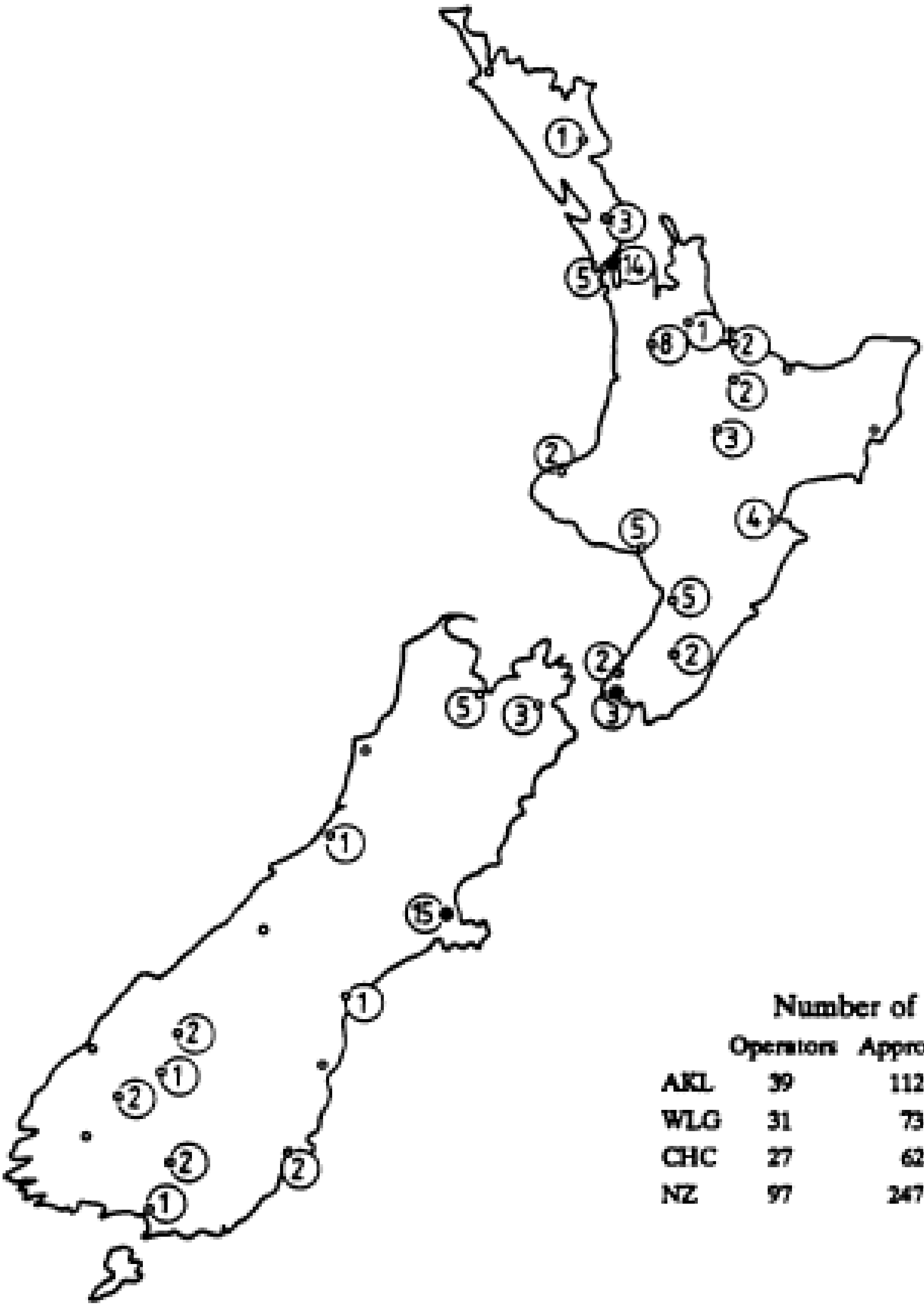
For our purposes we are mainly concerned with maintenance organsiations. These organisations can be loosely linked to various aircraft operations. Table 5.15 does this.

Table 515 – Maintenance Organisations

	AKL	WLG	CHC	NZ
Organisations				
Air transport	5	5	3	13
Aerial work	6	7	6	19
Maintenance only	28	19	18	65
	39	31	27	97
Approvals	112	73	62	247
Approvals per organisation	2.9	2.4	2.3	2.6

13 approved maintenance organisations primarily support air transport operations, and 19 supper aerial work operators. The remainder (65) are independent, mainly small, maintenance organisations servicing general aviation. Figure 5.7 illustrates the geographic spread of maintenance organisations throughout New Zealand. Not surprisingly, they are located near concentrations of general aviation activity. For example, 14 approved maintenance organisations are at or near Ardmore aerodrome, eight are at Hamilton, five at Nelson, five at Palmerston North and 15 at Christchurch.

Figure 5.7 - Maintenance Organisations



Number of

	Operators	Approvals
AKL	39	112
WLG	31	73
CHC	27	62
NZ	97	247

5.3.5 Aerodromes

Table 5.16 summarises the numbers and locations of aerodromes in New Zealand.

The travelling public think in terms of airports into which scheduled air transport services fly. In this regard airports may be divided into:

International airports	3
B737 airports	4
F27 or provincial airports	16
Tourist airports	4
Total	**27**

Figure 5.8 shows the geographic locations of these 27 airports. Air New Zealand operates into 23; Mount Cook operates into 8 airports (and into two others, Alexandra and Kerikeri); and Ansett operates into 7 airports.

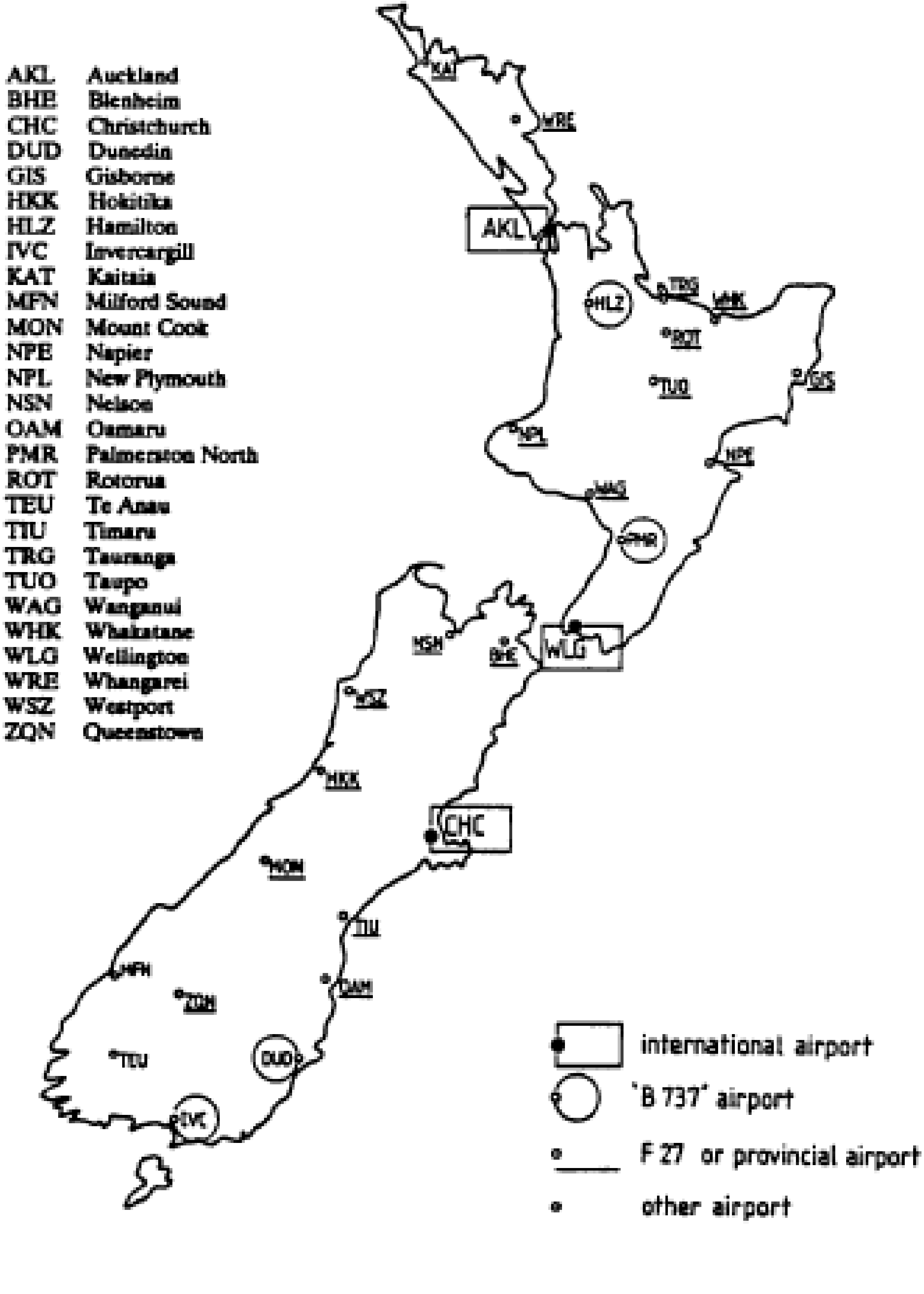
Table 5.16 – Aerodromes

	AKL	**WLG**	**CHC**	**NZ**
Licensed				
Public	19	22	22	63
Private	41	21	39	101
Military	2	2	1	5
Water	4	4	-	8
Heliport : private	4	2	5	11
	70	51	67	188
Unlicensed (estimated)				
Top dressing strips	1000 1450	50-200	200-250	1350
Private strips	50-60	20-30	50	120-140
Landing ground Authorisations*	60-70	35-40	250	345-360

* for air transport operations

(Source: CAD)

Figure 5.8 - Main Airports



As well as these 27 main airports there are numerous aerodromes (airstrips) scattered throughout New Zealand. No records are kept of private airstrips or airstrips used for agricultural aerial work. Unlicensed aerodromes are, from time to time, used in air transport operations for limited periods – their use is authorised as "approved landing grounds". The number of unlicensed aerodromes is therefore an approximation.

5.3.6 Airways Services

Provision of airways services in New Zealand has entered a new phase. Opportunity now exists for more than one organisation to provide airways services.

On 1 April 1987 the Airways Corporation of New Zealand Limited (ACNZ) was formed from the ground services branch of the Civil Aviation Division. Amendments to the Act and Regulations associated with the creation of the ACNZ make it possible for organisations other than ACNZ to provide airways services. But ACNZ has a statutory monopoly over area control, approach control and flight information services. Aerodrome control and aerodrome flight information services may be provided by any organisation. The large airports are contemplating offering these services. It is also possible for airlines to provide aerodrome control and aerodrome flight information services, at public and private aerodromes.

An **airways services certificate** is issued by the Director to an applicant if the Director is satisfied the applicant is competent to operate and maintain the airways services safely.

5.3.7 Sports And Recreation

Aviation sports and recreation are a significant part of the New Zealand civil aviation system. 318 gliders and 469 microlights account for 27% of the aircraft register. 398 aircraft (aeroplanes and a few helicopters) used by flying training organisations[41] provide the basis for *ab initio*, and some commercial flying training.

The sports and recreation sector is made up of the following.

- **Aero clubs**. 46 clubs are affiliated to the Royal New Zealand Aero Club (RNZAC) and about 6 are not. Aero clubs not affiliated to the RNZAC generally distinguish themselves by the use of the term "flying club" as opposed to "aero club" and usually have a special membership qualification, *eg* Air NZ employees or air force personnel. RNZAC aero clubs are open to all. The RNZAC represents the Federation Aeronautique Internationale (FAI) in New Zealand and, in this role, controls light aviation and international sporting activities in New Zealand.

[41] Excluding Air NZ, Fieldair, Mt Cook Airlines.

- **Owner-pilots.** The Aircraft Owners and Pilots Association (New Zealand) Inc (AOPA) is probably the biggest aviation association in terms of numbers, representing about 400 aircraft and pilots. Most of the aircraft are less than 2500 kg and membership is roughly half farmer-pilots and half enthusiasts who fly for recreation and pleasure. The majority of members are private pilots (as opposed to commercial pilots) and are not instrument rated.

- **Gliding clubs.** There are 1140 members in 36 gliding clubs (including the gliding divisions of aero clubs) affiliated to the New Zealand Gliding Association (Inc) (NZGA). The NZGA administers the sport. Gliding is largely autonomous in pilot training and aircraft maintenance. The NZGA issues FAI certificates and badges.

- **Microlights**. 16 microlight clubs have 450 members. The Microlight Aircraft Association of New Zealand (Inc) (MAANZ) is responsible for the administration of all microlight activity for sports and recreation, including the licensing of pilots and club instructors.

- **Parachuting.** About 20 parachute clubs or schools belong to the New Zealand Federation of Parachute Clubs (NZFPC). Individual clubs carry out training and local competitions. Annual competitions are run by the Federation. The NZFPC is affiliated to the RNZAC and FAI.

- **Amateur aircraft**. The New Zealand Amateur Aircraft Construction Association (Inc) (NZAAC) is organised into 19 regional chapters providing local focal points for people constructing their own aircraft within the permit-to-fly category. There are about 200 amateur-built aircraft flying in New Zealand and some 400 aircraft, of 40 to 50 types, under construction. NZAAC has more than 650 members. NZAAC officials maintain close liaison with CAD in all matters of airworthiness and safety. Currently it is not mandatory for an aspiring home builder or amateur constructor to join NZAAC.

- **Hang gliding.** There are many hang gliding clubs throughout New Zealand. The governing body is the New Zealand Hang Gliding Association Inc.

- **Vintage and specialist clubs.** There are several clubs such as: The NZ Vintage Aero Club, NZ Sport and Vintage Aviation Society, Tiger Club of NZ (Inc), NZ Warbirds and the NZ Wing of the Confederate Air Force (Inc). All restore and fly old aircraft.

As well as clubs, there is an unknown number of individuals who own and flay aircraft for pleasure.

5.3.8 Other Organisations

The more important of the remaining organisations of an advisory or regulatory nature impinging on civil aviation are mentioned below.

- **Air Services Policy Branch** of the Policy Division of the Ministry of Transport. Chapter 15 discusses aspects of the Air Services Policy Branch as they relate to the civil aviation safety authority.

- **Office of Air Accidents Investigation** established under the Civil Aviation Act 1964 as an independent agency to investigate aircraft accidents. The aim is to avoid future accidents by determining their causes, not to assign blame or determine liability. The Chief Inspector of Air Accidents reports directly to the Minister of Civil Aviation. There are five air accident inspectors including the Chief Inspector. The office has inspectors based in Auckland and Christchurch, and a head office in Wellington.

- **Air Services Licensing Authority** established under the Air Services Licensing Act 1983 for the purposes of licensing all domestic air services. The authority is a quango comprising a chairman, who is a lawyer, and two other people usually chosen for their knowledge and experience in aviation. Section 5.2 discussed aspects of the ASLA.

- **New Zealand Meteorological Services (NZMS)** responsible for the provision of a meteorological service for the benefit of all sections of the community, and the promotion of the advancement of the science of meteorology[42]. The provision of services to civil aviation is a major function of NZMS. NZMS issues a series of area and aerodrome forecasts at regular intervals, which are available at Meteorological Offices or Airways Services Offices at various aerodromes. Special forecasts are available from Meteorological Offices on request. At the principal airports, weather reports are prepared hourly between 0600 – 1900 hrs. As well as being responsible for domestic weather forecasts, NZMS is responsible for the provision of meteorological information for much of the South-west Pacific. This service is provided in conjunction with the Fiji Meteorological Service. Routine area forecasts for international aircraft are prepared by the Wellington office of NZMS.

- **Aviation Safety Board** consisting of three persons appointed by the Minister of Civil Aviation to advise the Minister on specific aspects of aviation safety. The Board has the authority to investigate, and review findings on, major accidents and or accidents of particular interest to the public. The secretariat of the Aviation Safety Board is within the Ministry of Transport.

[42] Ministry of Transport, *Brief for Hon W P Jeffries,* Aug 87

5.4 SUMMARY

Superficially, the Civil Aviation Act 1964 and Civil Aviation Regulations 1953 seem to provide a straightforward legal basis for the New Zealand civil aviation system. In practice, however, the Act and Regulations make a complex and, in many areas, detailed patchwork of rules and regulations which are: difficult to understand, confusing, incomplete (*eg* with respect to responsibilities), out of date, too detailed and largely inappropriate. Orders, instructions and requirements emanating from the Act and Regulations do not use consistent definitions. The rules and regulations tend to suggest a separate between flight operations and airworthiness standards and requirements.

The legislation does not provide an appropriate instrument for the civil aviation safety authority to do its job. Nor does it make life easy for the aviation industry. Chapters 7 and 8 address these matters in more detail.

The Air Services Licensing Act 1983 adds further confusion. The need for the Air Services Licensing Act is questionable. Safety matters should be left to safety regulations administered by the civil aviation safety authority.

Aircraft operations cover the whole spectrum: from microlight flying to international scheduled air transport operations; from Tiger Moths to helicopters and Boeing 767s; from flat plains to alpine terrain; from enthusiasts and farmer pilots to professional flight crew with worldwide operating experience. The rules and regulations for the civil aviation system must cater for all these participants, at the same time balancing the third party, commercial and regulatory powers.

CHAPTER 6

ORGANISATION, FUNCTIONS, STAFFING AND COSTS OF CAD

The Mission Statement of the Civil Aviation Division is:

The Civil Aviation Division exists to promote the safest operation of aircraft for which New Zealand has responsibility, and also to promote a healthy aviation environment. It achieves this by the provision of cost effective and timely services information, consultation and the judicious administration of safety regulations.

6.1 HEAD OFFICE: ORGANISATION AND FUNCTIONS

The Civil Aviation Division is headed by the Director, responsible to the Secretary for Transport who reports to the Minister of Transport and of Civil Aviation and Meteorological Services.

There are eight positions reporting to the Director: three are technical – Flight Operations, Airworthiness and Airways (including Security); three are regional (the Regional Managers); one medical; and one administrative. These positions are described below.

Deputy Director

Responsible to the Director for:

- airways;
- setting, review and enforcement of *airways operations standards* within New Zealand and those areas of the South Pacific where New Zealand has a responsibility;
- establishing and maintaining a *national aviation security system* and a programme to ensure that assets, personnel and information of the Ministry of Transport are properly secured;
- developing and managing the *information services* for the Civil Aviation Division and projects as required; and
- developing and monitoring approved policy and standards for *airports* and *rescue services*.

Manager (Flight Operations)

Responsible to the Director for:

- prescribing standards for aircraft operations;
- monitoring airline and general aviation operations;
- ensuring *flight training* and *flight testing standards* are maintained to ICAO recommendations;
- assessment of operators applying for *air services certificates*;
- promoting flight safety awareness;
- developing policy and procedures for the *enforcement of civil aviation legislation*;
- operating and maintaining the *Civil Aviation Flying Unit*; and
- developing standards and setting examinations for *flight crew licences*.

Manager (Airworthiness)

Responsible to the Director for:

- prescribing standards for aircraft maintenance;
- monitoring airline and general aviation aircraft maintenance;
- formulating continuing *airworthiness policy*;
- developing standards for design and manufacture of aircraft;
- assessments for *type certification of aircraft* and type acceptance of amateur built aircraft and microlights;
- providing *specialist aeronautical engineering advice* to the Ministry and outside agencies;
- prescribing conditions for approval of *repairs and modifications* to aircraft; and
- developing standards and setting examinations for *maintenance engineers' licences*.

Principal Medical Officer

Responsible to the Director for:

- *medical assessment* for licensing flight crew and air traffic controllers;
- providing an aviation medicine consultative service; and
- organisation of aviation pathology services.

Controller (Administration)

Responsible to the Director for:

- overseeing and ensuring coordination of administrative staff of the Division;
- providing assistance to the Director and Managers, as required, relating to *Ministerial submissions and correspondence*;
- coordinating *expenditure control and financial management* including staff ceiling reports; and
- *assistance* as required.

6.2 REGIONS: ORGANISATION AND FUNCTIONS

New Zealand is divided into 3 regions, based at Auckland, Wellington and Christchurch with district surveyors at Ardmore, Hamilton and Palmerston North. The responsibilities of the regional civil aviation managers for CAD functions were reduced in 1987.

Regional Manager(s)

Responsible to the Director for:

- acting as the Director’s representative in the region;
- managing airports for which the Secretary for Transport is the licensee;
- ensuring adequate administration support for other CAD functions in the region; and
- keeping the Director informed.

Regional Airworthiness Superintendent(s)

Responsible to the Manager (Airworthiness) for:

- ensuring the airworthiness of all civil aircraft and the proper approvals and performances of all firms, operators and individuals;
- approvals of design changes;
- evaluation of organisations seeking design or manufacturing approvals;
- inspecting first-of-type aircraft;
- issue and renewal of certificates of airworthiness; and
- monitoring approved firms and inspecting organisations seeking firms’ approvals.

Superintendent(s) Flight Operations

Responsible to the Manager (Flight Operations) for:

- conducting flight tests for issue of pilot qualifications;
- inspecting activities of aircraft operators, private and sporting groups;
- periodic inspection of airports; and
- investigate incidents, accidents and complaints.

Administration

Responsible to the Regional Controller, Corporate Services, and to the appropriate regional technical superintendent for administrative support services for:

- flight operations;
- flight standards;
- airworthiness;
- medicals; and
- licensing.

6.3 SUPPORT SERVICES: ORGANISATION AND FUNCTIONS

The Director of Corporate Services and Director Finance report through the Deputy Secretary to the Secretary of Transport. CAD is not independent in terms of administrative resources. It relies on staff and equipment supplied by Corporate Services (at head office and the regions) to meet CAD's administrative needs. As well, Corporate Services is responsible for supplying other services such as accommodation, staff training, internal audit, telephones, EDP systems, financial and accounting services, *etc.* Corporate Services does not bill CAD for its expenditure on CAD's behalf.

There was a great deal of adverse comment within CAD about the Director being accountable for administering the Act and Regulations and being "beholden" to another organisation for the resources needed to carry out his responsibilities. The Peat Marwick management report addresses this issue and we concur with the recommendation that CAD's support services be under the control of CAD.

6.4 STAFFING OF CAD

The present authorised level of staffing, approved by Cabinet Minute, is 289 plus 3 positions transferred from Corporate Services. Added to this an allowance should be made for other Corporate Services staff employed servicing CAD.

Present Authorised Staff	292
Actual Staff – 10 March 1988	260
Proposed Establishment 1988/89	292
Estimated Staff – Corporate Services	48
Total Staff	340

On the basis that section heads have assessed their workloads for 1988/89 and that staff numbers required to carry out this work have been subject to a rigorous inspection by the Director, we have used the projected 1988/89 staff strength number of 292 as our base. We have neither the time nor the responsibility for assessing the staff numbers needed to meet the requirements imposed by the existing regulations and practices of CAD. We respect the judgement of the Director of Civil Aviation and his assessment of staff numbers required to meet his responsibilities for the 1988/89 year.

Added to this number is an estimate of staff in other branches of the Ministry of Transport who are employed on CAD activities. We have based our assessment on discussions and on financial information supplied by Management Accounting. Management Accounting examined the assumptions on which we based our assessment of staff numbers and did not consider them unreasonable[43].

[43] Staff numbers have been estimated using an average salary for the occupational class and the amount apportioned by Management Accounting (with the agreement of the Director of Civil Aviation and the other Directors of the Ministry of Transport) as an appropriate charge for CAD services.

Table 6.1 - Assessment of MoT Staff Servicing CAD (but not employed by CAD)

Additional Staff	Staff No.	Basis
Administration	14	CAD usage assessment at 20% of $2.573M Assume average salary of $35,000pa
Typing	8	CAD usage assess at 21% of $1.317M Assume average salary of $35,000pa including minimal overhead
Legal	2	CAD usage assessed at 25% of $0.375M
Corporate Finance Services	2.5	CAD usage assessed at 14% of $.748M Assume average salary of $40,000pa
EDP Processing	8	CAD usage assessed at 14% of $1.685M Assume average salary of $30,000pa
EDP Systems	0.5	CAD usage assessed at 14% of $.188M Assume average salary of $40,000pa
Staffing & Personnel	4.5	CAD usage assessed at 14% of $1.163M Assume average salary of $335,000pa
Management Support	1.5	CAD usage assessed at 14% of $0.356M Assume average salary of $35,000pa
Training & Development	1	CAD usage assessed at 14% of $0.346M Assume average salary of $40,000ps
Economics	3	2.5 persons on statistics and 0.5 economist
Public Affairs	2	CAD usage assessed at 12% of $0.640M Assume average salary of $40,000 pa
Secretary's Branch	1	CAD usage assessed at 14% of $0.567M
Total	48	

6.5 COSTS OF CAD

The estimated cost of operating CAD is set out below.

Table 6.2 - Cost of Operating CAD

		$ (Millions)
Estimates 1988/89 – based on 292 staff		
Salaries & wages	13.24	
Travel, transport, communications	1.50	
Maintenance & operations, rents	3.13	
Material, supplies & servicing	1.31	
Other operating expenditure	2.14	
		21.32
Corporate Services (apportioned share)		3.41
Total Cost		24.73
Less Revenue (Flying Unit)		2.60
NET COST		**$22.13M**

The purpose of identifying staff numbers and expenditure is to permit a comparison to be made between the existing situation and the resources required by the proposed new safety authority. The above $22.13 million does not purport to be the total cost for running CAD. There is no allowances for depreciation and interest.

CHAPTER 7

INDUSTRY'S ASSESSMENT OF CAD AND THE REGULATORY SYSTEM

7.1 ORGANISATIONS AND INDIVIDUALS CONSULTED

A total of 13 written submissions were received by the review team, and members of the review team personally met with 114 people representing 46 organisations. These organisations included:

- airlines (domestic and international)
- commuter airlines
- air taxi and air charter operators
- aerial work operators
- maintenance organisations
- sports and recreation organisations
- airports
- Airways Corporation
- government departments
- individual pilots and engineers
- industry associations
- flying training organisations
- an aircraft manufacturer

These organisations were located in both the North and South Islands and were involved in a variety of activities within the civil aviation system, ranging from helicopter alpine flying and aerial topdressing to scheduled domestic air transport organisations. Some people consulted had a long history in civil aviation; others were relative newcomers.

Appendix III details all the organisations and individuals visited and consulted, as well as the people who made written submissions to the review team. We have thoroughly considered all information and comments, whether made orally or in written form. The following section summarises the civil aviation industry's assessment of CAD and their expectations and requirements of the regulatory system.

7.2 SUMMARY OF INDUSTRY COMMENTS

Appendix IV we record, as faithfully as possible, the comments made by the organisations and individuals listed in Appendix III. They are stated as they were presented to the review team, whether favourable or unfavourable, implying neither our support nor our opposition. We have, of course, drawn our own conclusions in the context of the costs and benefits to the nation as a whole, as required by our terms of reference.

We are satisfied that the comments detailed in Appendix IV present a balanced view of the civil aviation industry's perspective of CAD and the regulations. It is evident that some individuals and organisations are unclear about the legislative arrangements concerning civil aviation, especially the Air Services Licensing Act and its relationship to the Civil Aviation Regulations.

There is a certain amount of repetition in the comments detailed in Appendix IV. For the sake of completeness and good order we have included, word for word, the ways various individuals and organisations have expressed their concern about given issues or subjects. The following paragraphs summarise the salient comments and draw out the consistent message that emerges. In doing so, comments are arranged into seven sections:

7.2.1 Quality of Regulations
7.2.2 Appraisal of CAD
7.2.3 Special Area of Concern
7.2.4 Enforcement
7.2.5 Industry Situation and Prospects
7.2.6 Aerodromes and Air Navigation Services
7.2.7 What Should be Done to the Regulatory System?

7.2.1 Quality Of Regulations

There is widespread and general agreement amongst all organisations and individuals that the present regulations are:

- out of date
- complex
- contradictory
- ambiguous
- repetitive

This makes the regulations difficult to understand, apply and enforce. The language used is regarded as being more fit for the court room than for the aircraft owner or operator. There are too many separate documents associated with the regulations.

There are many grey areas making interpretation of the regulations difficult. This may contribute to the apparently inflexible attitude of CAD, as seen by some organisations and individuals.

There is widespread agreement that the current regulations are inappropriate for helicopter operations.

7.2.2 Appraisal Of CAD

There is a general perception within the civil aviation industry that CAD people lack *practical* industry experience in the areas of flight operations (air transport and general aviation) and airworthiness (aircraft maintenance and engineering). As well, as common criticism of CAD is the lack of management skills at head office and a tendency to focus on details rather than on the overall system. The industry has expressed a wish that CAD should delegate more responsibility for flight safety matters to organisations and individuals.

Throughout the industry it is commonly thought there is inconsistency in the interpretation and application of the Regulations, as between head office and the regions, and also between regions. This inconsistency extends to advice also.

A major criticism from many organisations and individuals is that CAD: is not commercially attuned; does not always appreciate the commercial consequences of decisions (or, often, *lack* of decisions); is sometimes inflexible in approach; and has its priorities wrong.

On the question of the calibre and qualifications of the people working within CAD, opinions differ. There is no common thread, with the exception of “there are too many ex-airforce types in CAD”. As a very broad comment, the people at regional level seem to be more highly regarded than those at head office. The airworthiness surveyors appear to have earned greater respect from the industry than airline inspectors and general aviation inspectors (but there are, of course, exceptions).

7.2.3 Special Areas Of Concern

There are a number of special areas of concern throughout the industry. The most common (or popular) concerns are: licensing, training, introduction of new aircraft into New Zealand, helicopter accident rates; and the acceptance of overseas certifications. The following lists a number of such concerns:

- there is a shortage of licensed aircraft maintenance engineers (LAMEs) and tradesmen – and, in general, LAME education and training is not structured;
- the syllabus for CPL, ATPL is outdated;
- aero clubs are losing experienced instructors to commuter airlines, which is thought to be a consequence of poor manpower planning (for pilots) within the airlines – as a result, the level of knowledge, skill and experience in aero clubs is low at a time when they are increasing their flying training activities;
- since 1983 some operators have been logging only one in every three hours (for airworthiness);
- there are too many helicopter accidents during night flying, and as a result of hitting (unmarked) wires – wire marking is particularly unsatisfactory.

- a flight crew licence should be "evergreen", subject only to satisfactorily passing medical examinations;
- the cost of sending CAD flight operations and airworthiness staff overseas for training, as a prerequisite for the introduction of first of type aircraft into New Zealand, is now prohibitive for aircraft importers and, moreover, is not considered to be necessary – this additional cost and inconvenience is a major reason why imported corporate aircraft are operated under an N-registration, without surveillance from CAD; and
- CAD should automatically approve some (or many) foreign training facilities and manufacturers' flight operations and maintenance manuals and procedures, because New Zealand does not have the resources to re-certify these standards and procedures.

7.2.4 Enforcement

There is widespread agreement that CAD needs the "teeth" to enforce the regulations, and that the current regulations, CASOs, CAICs, and NZCARs are difficult to enforce, even through the courts. It is also generally accepted that any aircraft owner or operator can "beat the system" if he chooses.

7.2.5 Industry Situation And Prospects

The industry finds it difficult to attract and hold people in the aircraft engineering trades. General aviation reports a high turnover of LAMEs. This also applies to pilots. The general opinion is that within the air transport and aerial work sectors the experience level of pilots is falling.

Aerial work operators are concerned about the ability of organisations and individuals to cope with more than a *gradual* upturn in aerial work; the industry has been scaled down, especially in the agricultural sector.

The general aviation sector, as a whole, is extremely sensitive to economic factors. General aviation lives off small profit margins, as a rule, doing what is *adequate* in terms of airworthiness and flight operations. In this regard, what *works* is considered to be adequate. Flight safety expectations are tailored to what they can afford (in terms of cash flow).

7.2.6 Aerodromes And Air Navigation Services

Two major issues regarding aerodromes and the air navigation system have been raised by most organisations and individuals. They are: the monopoly positions of the Airways Corporation and airport companies; and the lack of standards within the air traffic control or air navigation system.

It is feared the Airways Corporation and airport companies might abuse their monopoly positions and over-charge for the facilities and services they alone supply. There is no defence mechanism for air transport operators, aerial work operators and recreational/private operators to ensure they receive "value for money".

A confusing factor is the precise division of responsibility between the Airways Corporation and the airport companies. It is important from both flight safety and operational points of view that this division is defined as soon as possible. This has yet to be done at the three international airports; as yet it seems not to have even been contemplated at the provincial airports.

As far as the air navigation system is concerned, or what is referred to as the airways system, there is general accord that: air traffic control procedures are out-dated; non-standard procedures are evident throughout New Zealand; and there is a general lack of standards within the air navigation system.

So, overall, the industry's concerns are threefold:

- the monopoly position of the Airways Corporation and airport companies;
- the division of responsibility between airports and the Airways Corporation; and
- the poor performance and standards of air traffic control.

7.2.7 What Should Be Done About The Regulatory System?

There is total industry recognition: that regulations are needed to provide a basic framework to enable the industry to do its job, and to provide an information base or platform from which this can occur; and that regulations should be simple and enforceable.

There is a general call for regulations to reflect the basic and differing needs of air transport operators, aerial work operators, and the different sporting and recreational operators (*eg* gliders, balloons, light aeroplanes, experimental aircraft, *etc*). A strong appeal has been made for the regulations to recognise the different needs and performance capabilities of rotary wing aircraft versus fixed wing aircraft.

The most common call is for the regulatory system to allow the industry to accept more responsibility, placing the responsibility on the industry to be more self-regulating, disciplining itself wherever practicable (*eg* sports and recreational activities).

Finally, there is an unanimous appeal from throughout the industry for the regulatory system to provide for an improved consultative process with the industry.

7.3 CONCLUSIONS

It is evident that the civil aviation industry seeks:

- simple and easily understood regulations;
- a civil aviation safety authority that has the knowledge, skill and experience (in terms of people and systems) to monitor and enforce the regulations;
- recognition of the changing economic, technological and practice environment under which the industry operations;
- appropriate standards and practices for the operation of aerodromes and the air navigation system; and
- a regulatory system that enables operators to do their job in the most practical, economic and safe manner.

Part III of our report picks up these expectations and requirements and matches them with a philosophical approach that enables the civil aviation authority to meet all these objectives, and more.

CHAPTER 8

CAD'S ASSESSMENT OF THE REGULATORY SYSTEM

8.1 INDIVIDUALS CONSULTED

The review team visited each of the regional offices and the various branches within head office. In all, the review team held discussions with 20 people from the regional offices and 27 people from head office; a number of people were consulted more than once. As well, 16 written submissions were received by the review team, and detailed information was supplied by a number of CAD staff.

Appendix V lists those people with whom the review team held discussions, either individually or collectively, plus those who made written submissions.

Without exception, all people with whom the review team met took a constructive approach to the review and were co-operative and open with their individual views and with provision of information. This is evident from the various comments and suggestions made in written and oral submissions; some of these are reproduced in Appendix VI. The co-operation and openness of CAD staff has greatly helped the progress of the review, for which we are very grateful.

8.2 SUMMARY OF COMMENTS BY CAD PERSONNEL

In Appendix VI comments made by CAD personnel in written submissions and in discussions with the review team are reproduced, as faithfully as possible. We have included all comments, favourable and unfavourable, except those that could be taken out of context. The review teams does not necessarily support or oppose the views and opinions expressed.

The comments presented in Appendix VI represent a balanced view of how CAD personnel see the regulatory system and their own organisation. Where there is repetition this reflects that a particular issue or concern is shared by a number of people. What cannot be shown are the contradictory views of some (but not many) with respect to problems with regulatory systems and the organisational and management structure of CAD.

It was evident that people working in the regions had a different perspective of the industry than their colleagues in head office. For this reason the comments in Appendix VI are divided into comments from the regions and comments from head office.

In this chapter, a summary of CAD comments are arranged in six sections.

8.2.1 The Role and Functions of CAD
8.2.2 The Regulatory Structure and Quality of Regulations
8.2.3 Enforcement
8.2.4 CAD Organisation and Management
8.2.5 Special Areas of Concern
8.2.6 Industry Needs and Expectations

8.2.1 The Role And Functions Of Cad

There is a difference of opinion within CAD as to who is primarily responsible for aviation safety. Some see the Director and CAD as responsible. Others see the end user or operator as responsible. People in the regions generally see the operator as being responsible for safety; people in head office are divided. On the other hand, there is general belief that the broad role of CAD is to protect the fare-paying passenger. Some people in the regions see CAD's role as being divided between commercial aviation and recreational and sporting aviation. A few people perceive CAD to have two functions: to regulate; and, to disseminate safety-related information.

There is a view that sporting and recreational aviation should be self-policing (which is not the same as self-regulating).

There is a recognition that to monitor safety trends CAD needs good statistics, which are not currently available. This recognition is not widespread within CAD; nor is the availability of statistics.

The potential problems created for CAD by offering consultancy services (free or not) was recognised and well expressed in a written submission (not included in Appendix VI) and elaborated in discussions with the review team.

A major concern expressed by many people, both in the region and at head office, is the dividing line in terms of responsibility between CAD and the Airways Corporation. It is the opinion of all that this dividing line is not yet clearly defined.

8.2.2 The Regulatory Structure And Quality Of Regulations

There is almost total agreement at regional and head offices that the regulations are:

- ambiguous
- hard to read
- out of date
- complex.

The regulations need to be:

- simpler
- easier to read
- less detailed
- more structured
- up to date
- unambiguous

It has been expressed that the main problem area in terms of complexity, readability and ambiguity are CASOs. Regulations concerning flight operations, and especially airworthiness, are regarded as a patchwork of "add-ons". This creates many of the fundamental problems that result in the overall poor quality of the civil aviation regulatory umbrella.

There is unanimous agreement as to the need for one interpretation of the regulations.

It is recognised that the regulations do not cater for helicopters.

A number of people commented that the Civil Aviation Act is deficient, and does not provide an appropriate framework for industry or the aviation safety authority. The appropriateness of CAD's mandate to *foster* civil aviation was questioned.

The wisdom and appropriateness of using criminal law to enforce social standards was questioned by a number of people.

The administrative difficulty in getting amendments to regulations drafted and "through the system" was mentioned as the biggest problem in updating the regulations.

8.2.3 Enforcement

Most comments about enforcement came from people in the regions.

CAD must be able to enforce the regulations. The regulations are considered to be "the teeth" when all else fails. CAD must have the will to enforce the regulations.

There is doubt as to the strict legality of CASOs, CAICs and NZCARs.

In dealing with persistent offenders, the withdrawal of privileges by lifting licences is seen as the most effective penalty.

8.2.4 Cad Organisation And Management

At regional level there is frustration and criticism about lack of communication between head office and the regions, lack of support from head office, and unilateral head office interference in regional matters. This was considered to be the biggest burden carried by the regions – perhaps accounting for some lack of consistency in the interpretation of the regulations.

The management ability of senior people in head office is considered to be very poor in both the flight operations and airworthiness branches. Poor management skills from the top down is rated as one of CAD's biggest problems. Lack of delegation and a tendency to focus on detail were given as examples of the "head office management problem" – good people but bad managers.

The lack of formal training for new airworthiness surveyors and new aviation inspectors makes like difficult for surveyors and inspectors. Also, it does not enhance CAD's client reputation.

The current functional organisation is considered to encourage "empire building".

8.2.5 Special Areas Of Concern

There are three main areas of special concern:

- inability of CAD to properly keep track of aircraft in terms of ownership, operator, use and airworthiness;
- lack of liaison between the Office of Air Accident Investigation and CAD over aircraft accidents and repairs; and
- pay scales (especially in the flight operations branch).

8.2.6 Industry Needs And Expectations

It is considered that by spending more money on general aviation, CAD will not materially affect the accident rate. In other words, more CAD resources applied in the same way will not decrease the general aviation accident rate. Third level operators, air charter and air taxi operators are seen as the biggest problem for CAD in terms of maintaining flight safety standards.

There is recognition of an industry need for better and more formal flying instructor training.

A number of CAD staff commented that Air New Zealand has very many delegations and tends to do things "their own way".

The Airways Corporation is keen to obtain delegated authority to control all the airspace.

8.3 CONCLUSIONS

Regarding the regulatory systems, CAD people share concerns and expectations similar to those of their clients. This is perhaps not surprising. CAD also recognises the ambiguity problem and non-conformity in interpretation of regulations. CAD's views on enforcement coincide with those of the industry.

Many consider the current functional organisational structure of CAD to be inappropriate and counter productive to both the aviation safety authority and the needs of its clients. Moreover, the clearly perceived lack of management skills within CAD head office is considered to be the main problem behind the lack of lateral and vertical communication within CAD, the frustrations expressed by a number of people regarding job satisfaction, and the perceived poor performance CAD gives it clients.

Part III of our report picks up the concerns and expectations of CAD personnel regarding the regulatory system and develops an organisational structure for a civil aviation safety authority that will:

- be appropriate for the job to be done;
- match the needs of both CAD personnel and their clients;
- facilitate internal and external communications; and
- provide a better platform for managers to manage their people and other resources.

CHAPTER 9

BASIC ECONOMIC PRINCIPLES IN THE DETERMINATION OF AVIATION SAFETY POLICY

9.1 THE GOAL

In all sectors of the economy, even where life and limb is at risk is an unfortunate by-product of the productive process, the simple fundamental principle should be that the benefits to society of any activity should outweigh its costs to society[44].

This principle should therefore be the "guiding star" for aviation safety policy.

Because the benefits of safety policy are measured in human lives saved, this guiding principle may seem difficult to apply to civil aviation in a practical way. It would appear that we are cornered into cold bloodedly placing a monetary value on loss of life.

Fortunately the dilemma is more apparent than real. When considering the desirability of different safety-promoting measures, the relevant representation of the expected benefits is *the reduction in the risk of accidents*. Conceptually this is a benefit which is possible to quantify.

9.2 EVALUATION OF ACCIDENT RISK REDUCTION

Over the last twenty years a great deal of research work has been devoted to the quest for an economic "value of life". First, let us agree that this term is a misnomer.

A value of life is not what we should be seeking. As common sense suggests, an economic "value of life" is strictly speaking an absurdity – *no* prize would be high enough to entice an individual to give up his life (unless for some noble cause, in which case the "value of life" is really the value placed not on life but on some high ideal).

In reality, however, a wide range of measures are taken in the public and private sectors to *reduce the risk* of fatal accidents. To find the economic level of effort to devote to such risk reduction, it is necessary to assess the *benefits* so that they can be set alongside the *costs*. This is in order to ensure that the resources used to reduce risk are used efficiently, and that the total budget for accident risk reduction is reasonable.

[44] In certain circumstances the cost to society is overridden by the freedom of the individual to choose. For example, we regard an individual as having the right to choose to engage in a "risky" activity (such as mountain climbing or hang gliding) provided the lives and property of others are not put at risk. As this chapter explains, even if the lives and property of others is not put at risk by an individual activity, society still suffers a loss if the individual is killed. If it so wishes, society has the opportunity, at least in principle, to "internalise" that loss to society in the decision making of the individual; this might be achieved by taxation policy, for example (*eg* by placing a tax on hang gliders!).

Unfortunately most of the work on "value of life" is largely a waste of effort, because it seeks to do the impossible, namely, value life. The first and still best comprehensive treatise on the principles for valuing a reduction of the risk of death was presented by Mishan[45]. He summarised four competing approaching.

1. *"Future earnings" approach.* The loss to society is regarded as a person's future gross earnings, discounted to a present value[46].

2. *"Net output" approach.* Gross earnings are reduced by his future consumption to yield a *net* cost to society[47].

3. *"Implicit value" approach.* A value of life is inferred from analysis of investment decisions that have an influence on numbers of deaths[48].

4. *"Insurance value" approach.* Insurance premiums are related to probabilities of death.

After evaluating each in turn, Mishan concluded:

The crucial objection to each of these four methods is that none of them is consistent with the basic rationale of the economic calculus used in cost-benefit analysis.

9.2.1 Three Components In The Value Of Accident Risk Reduction

We follow Mishan's basic principle that the total benefit of a safety-promoting measure is the sum, over all members of society, of each individual's willingness-to-pay.

From a theoretical as well as an empirical point of view it is useful to divide society into three groups, each having a different willingness-to-pay:

a) the group at risk, that is, those directly affected (eg an airline's passengers, in the case of a safety measure involving the airline);

b) persons closely related to those directly affected (notably, close relatives and friends); and

c) those who are unrelated to those directly affected, but who belong to the same "society" (the same *nation*, in the present context).

Is quantification of these values empirically practicable?

To begin with, consider group *c*, "the rest of the society". The cold blooded approach to estimating the willingness-to-pay of group *c* is to argue that members

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[45] Mishan, E J, *Evaluation of Life and Limb: A Theoretical Approach,* Journal of Political Economy (1971).
[46] This should include only a person's human capital; non-human capital endures after a person's death.
[47] Since this approach can attribute *negative* values to some people (*eg* the very young and the very old) this method asserts that the death of such people confers a *benefit* on society!
[48] For example, the costs of compliance with building codes, fire codes, etc and such overt safety measures as median barriers on motorways, restraining devices in cars, *etc*.

of society who are unrelated to the group at risk care only about the net product forgone if a "statistical life" is lost. The reasoning is unethical, but perhaps realistic. A workable proxy for group *c* willingness-to-pay is the expected different between the total value of future production and future net income of the group at risk (group *a*) [49].

In the same vein, the approach to estimating the willingness-to-pay of group *b* can start by arguing that the *dependants* of the individuals in group *a* would at least care about that part of the future income of group *a* that finances their own consumption.

There is certainly some "warm blooded" value to add to this, to reflect grief and suffering, but no readily available proxy is at hand. Some often-used proxies can be discarded as irrelevant; *eg* compensation to dependants of accident victims paid on court orders, and accident insurance pay-outs. A more promising approach would be to use survey techniques.

The same goes for the estimation of the willingness-to-pay of group *a*. The work of Howard[50] on risk-aversion values is interesting in this connection. Howard demonstrates how the value of risk reduction may be an increasing linear function of risk level up to a point where the risk is high, after which the value of risk increases very rapidly towards an asymptote at a risk of death of about one-in-ten. Other empirical work in this area (of Lee-Jones and others) is promising, although final answers are not yet to hand.

9.3 IS THE FREE PLAY TO MARKET FORCES SUFFICIENT TO ENSURE OPTIMAL SAFETY LEVELS?

Looking at risk reduction as a marketable "good", safety policy is essentially about optimal production and consumption of that "good". In this zero-based review, the starting point is to ask whether market forces can do the job for us: will aviation take an optimal amount of safety-promoting measures, without intervention?

The most common reason for market failure is the existence of externalities[51]. They exist also in markets for aviation accident risk reduction. Their nature is somewhat involved, and the solution to the externality problem in aviation safety is far from self-evident.

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[49] This difference is essentially the total future tax payments by the group at risk.
[50] Howard, R A, *On Fates Comparable to Death,* Management Science (1984).
[51] Externalities are positive or negative effects appearing in either consumers' utility functions or in producers' production functions, and which cannot be bought or sold in market. A classical example of a negative externality for consumers is smoke from a factory spoiling the air for residents in the vicinity.

9.3.1 The Externality Problem

The above discussion of accident risk-reduction is helpful in coming to grips with the externality problem. it was pointed out that, in principle, any safety-promoting measure affects *all* members of society, not just the aviation users at risk (group *a*). For reasons discussed in 9.2.1 the risk reduction "good" (which the safety-promoting measure produces) appears also in the utility functions of others.

The importance of the externality problem is indicated by comparing the total willingness-to-pay of groups *b* and *c* with that of group *a*. As previously stated, empirical evidence is lacking, but a good guess is that these two sums are of comparable order of magnitude. In other words, the willingness-to-pay for risk reduction of those who are directly exposed to risk is about half of the total willingness-to-pay of all three groups combined.

It is clear that the level of safety obtained as a result of the free play of market forces would be much too low.

9.3.2 Economic Solutions To The Externality Problem

The ideal remedy is to bring market forces into line with safety policy objectives, by making the demand for safety measures of groups b and c effective in the market place. In theory this can be done in either of two diametrically ways:

- *either* a subsidy reflecting the willingness-to-pay of groups *b* and *c* is paid to enterprises taking particular safety measures,

- *or* accident liabilities of enterprises are arranged to reflect the willingness-to-pay of groups *b* and *c*[52].

Where liabilities for accidents have to be paid, airlines and others would insure themselves so as to be able to meet claims made as a result of accidents. Raising the liabilities would result in higher premiums *unless* extra safety-promoting measures are taken. In this way, the willingness-to-pay of groups b and c leads to higher safety levels, as it should. The apparent simplicity of this mechanism ought not give a false impression that solving the externality problem by instituting a certain liability for accidents and airline insurance is simple and straight forward. On the contrary, these insurance issues are complicated, both legally and technically. It would take us too far off the main track to pursue a more exhaustive discussion of these matters.

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[52] An algebraic example may help to clarify the issue. Suppose a certain safety-promoting measure is considered by an airline. It will cost Z dollars to undertake. The passengers flying would be prepared to pay A dollars for it, *ie* over and above what they would pay for air transport in the first instance. If A is less than Z, the safety-promoting measure will not be taken by the airline. Groups *b* and *c*, however, also have an interest in reduced risk for airline's passengers. If the government offers a *subsidy* equal to $B + C$ (being the willingness-to-pay of groups *b* and *c*) the government can ensure that the benefits of a socially profitable safety-measure are realised (assuming that the airline responds in the appropriate way).
Alternatively, a *liability* for accidents can be instituted. The government may stipulate that, in the event of an accident, the airline pays a liability equal to $X + Y$ (X to relatives of victims and Y to the government). Suppose that the risk of an accident falls from r_1 to r_2 due to the safety-promoting measure in question. The expected cost *saving* for the airline of taking the safety-promoting measure is consequently $(r_1 - r_2)(X + Y)$. Assuming as before that A can be extracted from group *a* if the measure is taken, the profit-seeking airline will do so as long as $A + (r_1 - r_2)(X + Y) > Z$. Socially optimal behaviour on the part of the airline is ensured by determining X and Y such that $(r_1 - r_2)(X + Y) = B + C$.

The solution involving subsidies has distributional effects to speak for it. In this case it is the taxpayers who pay for the benefits which fall upon the rest of society (as distinct from those that fall on the aviation users). On the other hand, the practical problems would be quite considerable. Subsidies should not, of course, be unconditional. They should be tied to safety-promoting measures. The advantages of general market-influencing correctives are lost, and some form of quasi-regulation has to be introduced. A subsidy policy is then not far from fully-fledged safety regulations.

9.3.3 Safety Regulation As A Solution To The Externality Problem

Regulation is a third method of coming to grips with the externality problem. in this context, regulation means stipulation of particular safety-promoting measures, rather than just providing incentives to take them.

These stipulations normally take the form of “safety requirements” or “safety standards” (*ie* a set of required qualities of personnel, aircraft, maintenance procedures, *etc*). in return for permission to operate an air transport business.

Two general disadvantages of safety regulation can be discerned.

Firstly, in the absence of a direct economic incentive to meet the stipulated requirements, the standard-setting regulatory body will also be obliged to carry out the complementary task of seeing that standards are met. Solving the externality problem by setting safety standards gives rise to the need for a “watchdog”. It is for the watchdog role that aviation safety authorities are best known; in civil aviation it is taken too much for granted that a safety watchdog is needed. The point is that, instead, the need for a watchdog is created by the chosen solution to the externality problem.

Secondly, a controlling authority easily forgets the ultimate purpose of its activity. Safety standards are means to ends. There is a tendency for a safety authority to elevate the means to become ends in themselves. This unfortunately can give rise to inflexibility and rigidity, the twin sins of regulatory bodies.

9.4 RATIONALE FOR SAFETY REGULATION

By a subsidy or liability policy, to internalise externalities, a largely self-regulating system could well be imagined. So, is there really a need for safety regulation, in the sense of setting standards and enforcing their adherence?

With perfect knowledge and foresight every producer in the system would, out of self-interest, take all those safety-promoting steps that have higher benefits than costs. There is seemingly no need for further regulatory action. In the imperfect real world, however, some additional considerations that might justify outright regulation are conceivable.

> *Firstly*, it is apparent that the travelling public wants the feeling of complete security in the air. It is probably not sufficiently reassuring that (i) air transport companies are made liable for all costs of any accident, and (ii) that

the aviation industry knows that the travelling public reacts very strongly (over-reacts) to an accident occurrence. The travelling public is most likely prepared to pay for an "expert watchdog" to keep an eye on existing safety systems.

The question is, just how great is this demand? It seems virtually impossible to put this demand to the test in the market place. The service provided by a safety watchdog has the character of a "public good" – once the service is produced it benefits *all* travellers, irrespective of their preparedness to pay for the service. "User pays" in this context works as an unavoidable tax.

Secondly, there is a demand for a watchdog from the producer-side too. Most operators in commercial aviation want to play a fair game, abiding by strict rules regarding safety. They would feel very frustrated if a less responsible competitor relaxed his safety standards in order to lower costs and prices. Watching for possible safety-neglecting mavericks is one task for the safety-regulating body. This has strong support in the industry, but it is important not to confuse this motive with the general wish for protection from new entries that would make competition keener.

Thirdly, it must be remembered that the loss of just one wide-bodied jet is a catastrophe. If, thanks to a safety watchdog, just one such accident could be avoided every 50 years it would probably be enough to justify the watchdog's existence in economic terms. There is no way of ever being able to prove or disprove that a safety regulatory body has such an effect. Under these conditions, how could anyone dare to abolish the watchdog?

The combination of *infinitesimal probability* of a *catastrophic consequence* presents a particular problem for aviation. Together they (the probability and the consequence) represent a significant potential for loss. Over a long period of time the expected loss is the same as if the probability were a thousand-fold higher but the consequences a thousand-fold lower. What differs is the number of occurrences within a given time span. To enhance his competitive position in his start-up years, a new entrant might save costs by deciding to "take a chance" knowing there was an insignificant likelihood of being caught out by having an accident. Of course, taking a change in the early years would be just as uneconomic as at any other time; it would be contrary to the interests of the travelling public[53].

Aviation safety measures can be likened to precautions taken at nuclear power plants, or the rationale for measures taken in military defence system. No one can tell whether the abolition of, say, an armoured corps would increase the probability of an attack from a hostile country, let alone by how much the probability would increase. The catastrophic nature of the event makes most people markedly risk-averse. The argument for an armoured corps would probably not be more precise than "national security requires it". In the same

[53] To illustrate the attractiveness of something that is seemingly *illogical*, when viewed in average terms, consider taking a ticket in the national lottery. Only half the value of ticket sales is returned through prizes. In spite of this, tickets are sold – because the cost of the ticket is low but the potential (though unlikely) return is high. In the case of the hypothetical new entrant to the airline business, this equation works in a negative sense; the "prize" is a catastrophic accident, and the "cost" of taking the risk is a small saving that gives the new entrant a competitive edge.

way, it may be concluded that the security of air travellers requires a governmental regulatory body.

The history of safety-motivated civil aviation regulation strongly suggests that governments have not trusted free-market forces to do a completely satisfactory job, insofar as airline safety is concerned. Comparatively early in the development of the airline industry, international agreements were reached on regulations to assist the "invisible hand" of the market place. The Chicago convention of 1944 (and its later amendments by ICAO) is still a basic fact of life in international air transport today.

In the next chapter the relevance of these international commitments for New Zealand civil aviation safety policy will be discussed. Beyond the need for *some* regulations, if only to implement ICAO standards, there is the practical matter of how to institute change if it is radically different from the *status quo*. Change must be wrought in the environment of the real world. Thus we must work with the knowledge, skills and manpower available to us. It would be impractical to follow an ideological approach and immediately abandon regulations wherever they could be substituted by alternative economic means – particularly if we would then be totally out of tune with the rest of the world. Change needs to take place by stepping out from the *status quo* in a planned process of evolutionary change and education.

CHAPTER 10

IMPACT OF ICAO COMMITMENTS ON THE CIVIL AVIATION REGULATORY SYSTEM

10.1 INTRODUCTION

This review study is required to identify "the minimum level of regulations to comply with the relevant safety and international obligations" and to identify "the areas of discretion in application of regulations, so that the benefits and costs of exercising this discretion can be examined".

The international obligations of New Zealand as a member state of ICAO and signatory to the Chicago Convention have been outlined in detail in Appendix II and summarised in Chapter 4. The implications are that New Zealand is obliged to have a comprehensive set of safety regulations based on the principles laid down in the Annexes to the Chicago Convention. Although individual member states can exercise some discretion, the regulatory framework must ensure that the safety of international civil aviation is not degraded below the levels that would have been achieved by adhering to the Annexes[54].

Beyond the areas of discretion, a member state may depart from ICAO requirements if it files notice of non-compliance with ICAO. Significant non-compliance could result in its aircraft being denied entry to other states. In practice, non-compliance is usually confined to matters of little significance or to different ways of achieving the intended objectives of the requirements.

It should be borne in mind that the Annexes provide for a safety system of many parts, covering all the disciplines and services that together constitute the civil aviation system. The overall safety level achieved by the system depends on the contribution of each part.

10.2 INTERNATIONAL CIVIL AVIATION

From a legal point of view, New Zealand's obligations arising from its ratification of the Chicago Convention are limited to *international* civil aviation. That means New Zealand is responsible for ensuring compliance with ICAO requirements for all New Zealand aircraft, operators and flight crew engaged in international operations. Furthermore, New Zealand must ensure that all services to international civil aviation (whether for New Zealand registered or foreign aircraft) are in compliance with ICAO requirements. This applies to services such as air traffic control, flight information services, communication and navigation services, meteorological services, alerting services, search and rescue and

[54] It should also be noted that ICAO requirements sometimes define an objective, states being required to develop for themselves the detailed requirements needed to meet it. The level of safety that results may be open to interpretation.

aeronautical information services. It also applies to airports and ground aids on the airports.

10.3 DOMESTIC AVIATION

10.3.1 Factual Description

The ICAO obligation to protect international civil aviation cannot be met unless those parts of domestic aviation that could interfere with international aviation are made subject to the same requirements (in the relevant areas).

Since the airways system has to be designed to meet the needs of international aviation, domestic aviation using the same airspace and the same airports must be able to cope with the requirements imposed on them by the airways system; the pilots must have the necessary qualifications and the aircraft must have the required equipment.

In the case of domestic airline operations that do *not* interfere with international aviation, New Zealand has the legal right to set standards at *lower* levels than ICAO minima. The question is whether that would be a reasonable line of action.

We are unaware of any country that has not, in principle, adopted a policy of applying the ICAO requirements to domestic public transport by air. One reason for this is obvious. ICAO standards, recommended practices and procedures have been developed by specialists, from all over the world, who are the most competent people the member states could provide for the task. Their proposals have passed through an extensive process of scrutiny, in which all member states have had the opportunity to voice their opinions. Given the broad spectrum of nations belonging to ICAO it is unlikely that the standards are unduly high. The end result should reflect, in a balanced way, the state of the art of the aviation industry at the time the standards are issues.

Except for the major aviation countries, lack of resources and competence makes it impracticable to determine a level of requirement different from ICAO[55].

Considering the New Zealand situation, the above factors appear to have guided past actions. In terms of this ”zero-base” study, we shall, however, discuss the feasibility of applying a *different* philosophy, namely the possibility of lowering the minimum safety level for domestic aviation if the change can be defended on a cost-benefit basis. The possibilities and limitations of cost-benefit analysis are discussed in Chapter 11. First, however, we have to review the feasibility of the concept of lower minimum standards.

[55] Countries are allowed to exercise direction as to the *timing* of implementation, recognising that levels of skills and resources vary between countries.

10.3.2 Airline Operations

To run an airline professionally and efficiently imposes requirements much higher and more detailed than ICAO requirements[56]. In talking to operators we have had no indication that any airline would contemplate deliberately lowering its safety standards, even if the regulations were changed.

Consider first the airworthiness side. Annex 8 prescribes basic principles having little direct effect on airline operations. This Annex requires states to apply ”a detailed and comprehensive airworthiness code” as a basis for a certificate of airworthiness. Not being a manufacturer of major aircraft, New Zealand accepts the airworthiness codes of the main manufacturing countries as the basis for its own certificates of airworthiness. To gain a type certificate, the aircraft manufacturer will have complied with the detailed airworthiness code in the state of manufacture. Attaching to the type certificate there will be manuals and documents governing operation of the aircraft[57]. On the basis of these manufacturer-developed document the operator will derive his own operations manual and maintenance instructions, taking account of the particulars of his own operation. Hence it is not Annex 8 but the requirements of the state of manufacture, as applied by the manufacturer, that impose the technical requirements on operators.

Turning to personnel licensing, the implication of Annex 1 is that pilots and licensed mechanics must have type ratings endorsed on their licences. The associated training will generally be arranged by the manufacturer, or by specialised training organisations in co-operation with the manufacturer. The amount of training needed will be a consequence of the aircraft design, and not really a consequence of the Convention. The aircraft type certificate will also define the minimum flight crew needed.

Turning to the provisions of Annex 6, many provisions are of the type “the operator shall establish…” or “the operator shall ensure…”. For the issues concerned, it is common sense that a responsible operator will address them and that the operator has the freedom to address them in ways that suit his operation.

Other provisions of Annex 6, however, are somewhat detailed. They can be very detailed, *eg* in terms of requiring particular equipment for specified flight conditions. For these provisions it is natural that New Zealand exercises judgment and evaluates which of the detailed Annex 6 requirements are appropriate as minimum standards for domestic airline operations. We have heard no complaints from the major airlines that significant minimum requirements based on Annex 6 are considered to be unduly restrictive. (Complaints do arise when operational requirements are embroidered on top of the ICAO minimum).

[56] The ICAO Annexes directly related to airline operation are: Annex 1 for Personnel Licensing; Annex 6 Part I for Operations; and Annex 8 for Airworthiness.

[57] The aircraft flight manual defines the handling and the limitations of the aircraft under normal, abnormal and emergency conditions. The aircraft maintenance manual defines the basic maintenance requirements for the type. The Master Minimum Equipment List specifies whether certain equipment can be out of service, and under which operational conditions, for the aircraft still to be considered airworthy.

The actual operational standards of a major airline are, thus, largely a consequence of the aircraft type selected for the operation; so, too, are the training and technical standards mentioned above.

In summary, for major domestic airlines the discretion whether or not to use ICAO minimum requirements is not an issue. Some details in the Annex 6 equipment requirements could be questioned as to their domestic applicability, but they can be resolved through consultation between the industry and the safety authority.

For minor domestic airlines the same conclusions apply, but with more flexibility as to Annex 6 matters due to the characteristics of their operations. Compared to major airlines, the safety standards actually achieved by small airlines will inevitably be much lower. This is due to different standards of aircraft and to different levels of experience. In the context of recently "opened skies", there is reason not to be too relaxed about the safety standards of minor airlines.

10.3.3 Airways Services And Airports

In all air space where air traffic services are provided, domestic airlines have to be able to comply with the requirements of the system.

At the "far end" of domestic airline operations, there is *no* interaction with international traffic; New Zealand has the discretion to set its own standards. This discretion is in fact practised. Scheduled flights are sometimes permitted into unattended aerodromes, and some airports used by scheduled services would not comply with ICAO requirements.

10.3.4 Other Domestic Commercial Operations

Outside the airports and airspace used by international and domestic airlines, New Zealand has freedom to exercise judgment in deciding appropriate levels of regulation.

In New Zealand, commercial operations below airline level consist of IFR/VFR charter operations, agricultural and other forms of aerial work (fixed wing and helicopter), and a number of special activities supporting tourism in some parts of the country.

For these commercial operations, New Zealand has freedom to decide its requirements on whatever grounds it may find appropriate[58]. Protection of fare-paying passengers and third parties are the main considerations. Given there are rules of the air, we consider the appropriate entry ticket to the system to be the commercial pilot licence and airworthiness certificate for the aircraft. This view is shared by the industry.

Since commercial operators will meet basic ICAO standards they can be given access to any airport and airspace for which the aircraft is equipped.

[58] As long as there is no interaction with traffic that should be afforded the protection of ICAO requirements.

10.3.5 Private Aviation And Recreational Activities

For private aviation an ICAO member state is free to set its own requirements as long as the activity does not interfere with the international traffic.

For the private pilot who wants access to airports and airspace used by such traffic, the logical entry requirement is a private pilot licence issued according to ICAO requirements; this will ensure the minimum level of knowledge, skill and experience needed to cope with system demands. The aircraft must have the equipment specified for that airspace. To protect third parties, non-paying passengers and people on the ground, it is reasonable that the aircraft is airworthy; for which airworthiness requirements are necessary.

For sports and hobby activities each state must decide its own levels of regulation, having consideration for other traffic and third parties who may be in need of protection.

10.4 CONCLUSIONS

Where safety requirements do not depend on, or must be deduced from, ICAO obligations, the State can adopt a lower standard. Such areas of discretion can be found in:

a) commercial activities and private flying outside airports and airspace used by international aviation;

b) sports and recreational activities not interfering with other traffic.

This does not imply that regulations would be unnecessary in these areas. All it implies is that New Zealand can *choose* its level of regulation. Although the foregoing discussion has been couched in terms of *lowering* standards, in every area of regulation the State always has the option *higher* requirements than those implied by the ICAO Annexes. In practice, leading aviation nations frequently choose high levels of requirements.

The ICAO commitment and associated factors drawn out in this chapter influence the safety goal so simply stated at the commencement of Chapter 9. Given these further considerations we can develop the statement of the goal a step further.

> The aviation safety goal is: *that the civil aviation system takes all measures that would improve safety at reasonable cost, subject to the State meeting its minimum obligations under ICAO.* Reasonable cost is interpreted as meaning that the cost to the nation is exceeded by the benefit to the nation[59].

[59] The costs and benefits to be considered are those to the nation as a whole, not just the costs and benefits contained within the civil aviation system.

Two qualifications are appropriate.

1. If it is judged that consumers are *willing to pay* for a level of safety *higher* than that judged to be in keeping with the goal, there should be no impediment to that higher level of safety being provided[60].

2. To the extent possible, pursuit of the goal should not be hindered by cost-recovery issues.

[60] Strictly, this is in keeping with the goal when one adopts the viewpoint that the true economic value of safety is that revealed in the market place by consumer preferences.

CHAPTER 11

ECONOMIC CONSIDERATIONS IN DISCRETIONARY AREAS OF SAFETY REGULATION

11.1 INTRODUCTION

In this chapter we continue the economic analysis of safety regulation on the basis of the Chapter 9 discussion of the economic rationale for a safety regulatory body, and the Chapter 10 discussion of international commitments.

Given the existence of a safety regulatory body, and the minimum safety requirements set by ICAO, the purpose now is to explore the discretionary areas of safety regulation.

Before the analysis starts, a word of caution is appropriate: there are important limitations on what aviation safety policy can achieve. We must not deceive ourselves in believing that the desired state of affairs can always be achieved by regulation.

11.2 A GENERAL WORD OF CAUTION: LIMITATIONS ON AVIATION SAFETY POLICY AMBITIONS

It should be recognised that a State's acceptance of ICAO standards and recommended practices does not automatically mean that a defined safety level will be achieved. Adherence is a necessary but not a sufficient condition for achievement of the State's safety goal.

The process by which ICAO requirements are implemented, the competence and commitment of operating organisations and individuals, the working methods and competence of the State's safety authority, as well as economic, geographic and climatic conditions, will all influence the safety level actually attained. These factors underly the large differences between the safety records achieved in various regions of the world, and between individual airlines. It has been shown in Chapter 3 that the best air carriers in the United States have safety records between 5 and 10 times better than the ICAO average, whilst there are parts of the world where the safety level is 5 times lower than the ICAO average. All the countries concerned may well claim adherence to ICAO standards.

One implication of this is that, for a particular operator in a particular country, the safety level achieved is a result not only of specific requirements but also of the *state of the art* within *that* country, and of *that* operator. Removing or adding a safety requirements may not necessarily change the operator's behaviour because his professional understanding of the state of the art has placed his operation at a *higher* level of safety.

11.3 BALANCING COSTS AND BENEFITS TO FIND THE OPTIMAL SAFETY LEVEL – PART 1: THEORY

Bearing in mind the above qualifications, and the acceptance of ICAO standards as minimum safety requirements for New Zealand's international aviation, the following two questions remain.

1. In some aspects of safety promotion, should New Zealand go *further* than the ICAO standards, so far as the airlines, airways and airports are concerned?

2. Where ICAO standards are *not* obligatory, how should safety policy for general aviation be determined?

The economic nature of safety "standards" or safety "requirements" should be clear; standards and requirements are *means* to an end. The end, or goal, is to maximise net social benefits by taking all possible safety-promoting measures for which the benefits outweigh the costs. As was pointed out in Chapter 9, in an *ideal* world it would be superfluous to have a regulatory body to set safety standards. In the real world the watchdog function of such a body is demanded. The basic issue becomes one of determining how that watchdog function should be executed. The traditional method is for the regulatory body to set safety standards and enforce their adherence.

Modern thinking is advancing towards a solution which is both theoretically and practically more satisfactory. The basic idea is that the operators should themselves be responsible for their own safety systems. The watchdog should, in the first place, check that the safety *system* (rather than its individual components) is adequate, and is taken seriously by the organisation. Moreover, the higher the competence of all concerned, the less need there is for detailed standards. The role of the safety system adviser then becomes more prominent.

This does not mean that the regulatory body can, in the foreseeable future, do without standards as the means to the ends of achieving the safety policy. Standards are not immutable. Their relevance is constantly changing with technological and organisational innovation, and an evolving economic environment. In due course, technical and operational progress in aviation will lead to some requirements becoming obsolete and outdated. On the other hand, *new* requirements will be adopted from time to time, to take advantage of emerging developments; examples are extended-range operation of twin-engine aircraft (such as the B767) and use of advanced flight simulators for type-training without the need for aircraft flying time. the real challenge to the safety watchdog is to be aware of changing conditions and be adaptable, rather than making the means become the ends by zealous execution of perceived duties.

So much for more general considerations. In the following discussion of how the regulatory body should carry out its duties in accordance with sound economic principles. The next sections present salient points relevant for the airline industry, airways and airports, and general aviation. Following that, we illustrate the potential use of cost-benefit analysis in the areas of flight crew licensing, microlight type-acceptance and aviation security. We also discuss the organisation of the resource-consuming aviation security services to demonstrate the great advantage of disciplining one's judgment of pros and cons by a cost-benefit frame of thinking.

11.3.1 The Airline Industry

Concerning the airline industry, in our judgment the interplay of market forces (in plainer language, the commercial interests of the airlines) may already result in achievement of higher safety levels than implied by ICAO standards[61].

One reason for achievement of higher safety levels is that the demands placed on airlines (*eg* regularity, punctuality and service to passengers) require technical and operational standards on a higher level than the minimum implied by safety requirements. These demands can influence airline safety performance in a positive way.

Another reason can be that air travellers, at least in the judgment of the airlines' marketing policy-makers, are prepared to pay for the high safety standard offered. We can see no reason why the travellers should be denied that level of safety, if that is their wish.

The ICAO standards may seem thereby to be made redundant, and government enforcement of them a waste of effort. This would be too hasty a conclusion. The minimum requirements are useful for the control of new entrants, to see that they are up to standard. Without minimum standards, a new entrant on a restricted budget could gamble on not being caught out in the first years of operation – and would in all probability succeed, even though the risk (because the stakes are so high) is not in the public interest.

Generally speaking, in an ideal world the role of the safety regulatory body *vis-à-vis* the airline industry would be "arms length" rather than interventionist. This does not mean that in the long run the regulatory authority's role is unimportant. The authority would need to satisfy itself that the airlines were taking appropriate steps to ensure a desirable level of safety, but it would not dictate in detail what those steps should be.

In the imperfect real world, successful realisation of safety objectives, even if set by the airlines themselves, depends on people, equipment, facilities and systems. The regulatory authority has a role to play in monitoring that the safety objectives are indeed being achieved.

Another long term task for the regulatory authority is to advance the state of the art of aviation safety in its broadest sense, with the aim of fostering and promoting adoption of "best practices". This would include valuation of evidence from air accident investigations, world-wide accident statistics and the experience of different safety systems of different airlines, and dissemination of resulting information to the aviation community.

[61] The best major airlines exceed safety levels implied by ICAO standards.

As was argued in Chapter 9, if it were possible to internalise all external costs of accidents by means of legislation assigning liability in the event of an accident, an airline's own calculation concerning safety would effectively be a cost-benefit analysis also. The Warsaw Convention of 1929 is still the ruling agreement on limitation of liability for airline accidents. National legislation can overrule the Warsaw convention so far as each nation's territory is concerned. Through the Accident Compensation Act, New Zealand limits airline liability to nil. This gives rise to a potential distortion in the allocation of resources, which in turn may require offsetting regulation. This is an example of the general observation that "bad laws mean many laws".

11.3.2 Airways And Airports

The preceding arguments are to some extent applicable also to the Airways Corporation and international airports. Such organisations may also maintain safety levels above those implied by ICAO requirements. The motivation to do so stems not from market forces[62] but, rather, from a desire for trouble-free operation – which is possible to attain because, whatever the cost of achieving it, the cost is met by "user pays".

Thus these public enterprises (the state-owned Airways Corporation, and the airports owned by central and local government) are special entities in this respect. Market forces cannot be relied upon without qualification, bearing in mind that the Airways Corporation is a statutory monopoly and the airport companies enjoy *de facto* geographic monopolies.

Were these monopolies set up with the clear intention that they should be run in the public interest, cost-benefit analysis of all major decisions, including safety-promoting expenditure decisions, would be applied as a matter of course. This seems not to be the case, however. They are told to behave as *commercial enterprises*. Commercial enterprises meet the needs of customers only insofar as it benefits their shareholders. In matters of public safety a narrowly-defined commercial criterion gives little or no guidance.

Clear statement of government policy regarding these public sector monopolies would be highly desirable. *The Airways Corporation and the airport companies must have explicit guidance as to their public safety obligations. They should have incentives to take a cost-benefit viewpoint, and to regard cost-benefit analysis as a natural method of evaluation.* In an ideal world this could be achieved by obliging public sector monopolies to fully compensate all those who suffer costs when accidents happen[63].

In the uncontestable markets of public sector monopolies the only *economic* solution to the problem is to make (by stick or by carrot) the airways and airports use cost-benefit analysis to balance producer costs and consumer costs, particularly where major investments are concerned.

[62] Market forces do not work properly with regard to monopolies.

[63] At the present time, these public sector monopolies have no guidance as to the *optimum* expenditure on safety. Only the regulations administered by CAD give guidance on safety; and they set minima only. Safety benefits might well be being pursued at too great a cost. Insufficient attention might be being given to important user costs (other than safety) such as passenger delays, *eg* aircraft being detained in the holding pattern, waiting for clearance to land.

Overseas, the application of the cost-benefit analysis technique to aviation has been well established for a decade[64]. The Airways Corporation and the international airports are big enough and sufficiently resourceful to acquire the required competence and to apply the cost-benefit technique to decision making in New Zealand.

11.3.3 General Aviation

General aviation's private operations should be distinguished from its commercial side. Private aviation ranges from private aeroplanes for transport-proper to recreational machines such as microlights. The conditions for safety regulation of private operations are quite different. The distinguishing feature of private aviation is that the user (passenger) is also the owner/operator of the aircraft. This has a number of implications for safety regulation.

Firstly, the regulatory body's main role in *commercial* aviation is to represent the users' safety interests, as distinct from the interests of the producer of the service. In private aviation that is not relevant in this instance. Here it is a matter of protection against oneself, as it were. Secondly, whether the user is a farmer, or suchlike, or just a private person, it should not be assumed that he is following a sophisticated "safety system" in which the regulatory body's interest is mainly that of an observer. Private aviation requires the safety regulatory body to adopt a different role. Due to sheer numbers there is no way a regulatory authority could, to any practical degree, "observe" private aviation.

Rather, the authority should be active in providing information to improve the basis for the private pilot's decision making. Because of his information deficiency, the private pilot needs assistance in many respects as owner/user of an aircraft. For example, regarding equipment offered in the market place, he needs more information than he could reasonably be expected to gain through his own experience.

The regulatory authority might therefore set requirements concerning technical qualities of aircraft on offer. A softer approach would be simply to provide consumer information. We do not mean to imply that the safety regulatory body should have dominion over the private decisions of individuals. If an individual wishes to fly, and will not endanger the lives and property of others, he should be free to do so[65].

On behalf of private aviation the regulatory authority bears the responsibility for carrying out cost-benefit analyses to justify safety requirements or expenditure on disseminating public information. As to the technical problems of cost-benefit analysis, generally speaking these are somewhat more manageable in general

[64] The technique has been set out in an American Federal Aviation Administration manual, *Cost-benefit Analysis and the National Aviation System – A Guide* (1977). Standard data values are given in the FAA publication *Economic Values for Evaluation of Federal Aviation Administration Investment and Regulatory Programs* (1981, with subsequent updates).

[65] The value the rest of society places on his life (and his aircraft) is still an externality in his decision to fly. Society, however, has economic means at its disposal for internalising that externality in the pilot's decision making. In the case of microlights, for example, a microlight sales tax could be imposed. Then the only microlight pilots to fly would be those who gained a (perceived) benefit from flying that was greater than the total of their personal cost (including their assessment of their personal cost of risk) *plus* the cost to the rest of society.

aviation, for the unfortunate reason that accidents are more frequent than in the airline industry. This greater volume of accident data is more amenable to statistical analysis.

In section 11.4.4 an example is given of how cost-benefit analysis can be employed to evaluate type approval of microlights.

A side issue in this connection is whether or not "user pays" should be invoked. Public goods (regulations and information) are involved. From a pure economic efficiency viewpoint, recouping the costs from users would be a distortion.

11.4 BALANCING COSTS AND BENEFITS TO FIND THE OPTIMAL SAFETY LEVEL – PART II: EMPIRICAL EXAMPLES

The following examples of the application of cost-benefit analysis fulfil two purposes.

First and foremost, they illustrate how the overall goal of a cost-benefit approach to aviation safety regulation can find practical expression in different areas of the aviation sector. Only a few examples are given. There are hundreds of more or less similar decisions left to be taken by the regulatory body. A major task of this body should in fact be to develop the application of the cost-benefit analysis technique, and cost-benefit thinking, to its decision-making, especially insofar as general aviation is concerned.

Secondly, the cost-benefit analyses presented have a value in their own right by addressing real problems. Mention should be made of, in particular, the analysis of aviation security services. Security in the technical sense of the word (*ie* guarding against potential saboteurs) carries high social costs, partly in the form of passenger delays and partly in the form of CAD staff requirements.

Since the examples of cost-benefit analyses are dependent on the value of life adopted, the next section deals with the three values of life used in the ensuing examples.

11.4.1 Values Of Life

First let us repeat that "value of life" is a misleading concept that conceals the fact we are valuing *risk reduction*, not lives. The reason for the currency of the term "value of life" is that risk can be measured in terms of lives lost per unit of exposure (*eg* per 10^6 aircraft-hours), so the value of risk reduction can be converted into a dollar figure per life expected to be saved.

Even though our present state of knowledge is somewhat inadequate, all economic evaluations must adopt a value for risk reduction, and thus place a value of life. Not to do so would be to place a *zero* value on life! In America, the Federal Aviation Administration sets standard values to be used in its cost-benefit analyses. The current value of life is US$766,000[66]. It takes account of all the

[66] Escalating the 1983 figure of US$650,000 by the American consumer price index to a 1988 value.

factors mentioned in Section 9.2.1 (*ie* the values placed on risk reduction by groups *a*, *b* and *c*). Switching this to New Zealand dollars (at NZ$1.00 = US$0.66) and prorating to reflect New Zealanders' lower incomes[67], the New Zealand equivalent is NZ$527,000.

We have adopted a round figure of NZ$500,000 for the value of life.

Where the person at risk is cognisant of the risk, or has been compensated for it through remuneration, it is appropriate to consider the risk reduction values of *others* (*ie* persons in groups *b* and *c* of Section 9.2.1). This is the so called "value of a *statistical* life". As noted in Section 9.3.1 it is reasonable to halve the "value of life" to derive the "value of a statistical life".

We have adopted NZ$250,000 as the value of a *statistical* life.

This is the same as the figure the National Roads Board requires to be used in roading cost-benefit analyses. The National Road Board's cost of a serious injury is $27,500[68].

A New Zealand airline operating internationally is subject to international laws concerning liability. It carries many foreign nationals, whose "value of life" can be very much higher than ours. In international service the real cost of an air crash is dominated by the amount of airline (or its insurers) must pay in compensation to passengers. Nowadays it is not only Americans who receive high settlements; Japanese settlements are on a par, and European nationals are following suit. A good measure of the cost of a total loss of an international airliner is the amount brokers advise is a desirable level of insurance cover. For a Boeing 747, insurance cover of NZ$500M is prudent.

11.4.2 Flight Crew Licence Renewals

In this section we address, by particular reference to pilot licensing, the system of issuing and renewing flight crew licences. Central to the matter are the requirements for medical checks.

Whereas motor drivers' licences are issued for life (but can be withdrawn or endorsed if need be), New Zealand requires periodic *renewal* of pilot licences. This contrasts with the American system of pilot licensing, which is akin to New Zealand's drivers' licences. The licence is issued once, and remains valid until such time as it is withdrawn. It can also be endorsed. On its own, the licence does not entitle the pilot to fly. He must also have a current medical certificate and a log book showing the requisite certified flying experience.

In comparison with the current New Zealand system, an American-style "licence-for-life" system avoids the clerical work of reissuing licences and eliminates a problem (that inevitably arises from time to time) of a pilot not having a current

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[67] GDP per head is US$17,360 in the United States and US$7,900 in New Zealand. Since the value people place on risk reduction must in some way be related their ability to pay, we have proportionately reduced the United States "value of life" to derive a figure appropriate to New Zealand.

[68] Road Research Unit Technical Recommendation TR9, *The Economic Appraisal of Roading Improvement Projects,* National Roads Board (1986). The figures above are updated from the 1985 dollar values quoted in the recommendation.

licence for want of completion of some clerical work. Under both systems, centralised medical records are kept of all pilots. Thus the potential for cost reduction is mainly the *clerical* effort of licence *renewal*[69].

The following analysis estimates the costs and benefits of licensing-for-life and regarding the pilot as being fit to fly until such time as it is established otherwise.

Offsetting the administrative cost gains of licensing-for-life, there is a potential loss of safety because a pilot's licence is withdrawn only when it has been conclusively demonstrated that he is unfit to fly. From the time the medical check raises doubts about a pilot's fitness to fly, a month may elapse before his licence is withdrawn[70]. During this month there is a heightened chance of an in-flight incapacitation resulting in an accident that would have been avoided had his licence been withdrawn at the time of the medical check.

Performance of the Existing Licence Renewal System

Last year the directly accountable costs of 6045 pilot licence renewals amounted to $301,277. Adding margins for salary increases, CAD overhead and MoT Corporate Services (the main one) a current all-up current cost of $536,000 pa is derived. It is sensible to add a margin for the compliance costs of pilots, leading to a figure of around $600,000 – which is $100 per renewal.

Part of the Principal Medical Officer's proposal for a revised system of licensing for life is a change in the structure of medical checking. On reflection it appears to us that changes in medical administration are largely independent of the question of licences-for-life. Changes in administration of medical checking may take place anyway, irrespective of whether the licensing system is reformed.

Accordingly there is no need to take account of any changes in the costs of medicals, save to note that medical examiners would be placed in the position of having to *issue* pilots with medical certificates, and personalised blank forms may need to be posted to pilots prior to due date. On the strength of this, we estimate that a system of licences-for-life would save about $90 per licence renewal. Annually there are 1.39 licence renewals per licence, so that

> a system of licensing-for-life
> can save administrative and compliance costs of $125 pa per licence

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[69] Not at issue here is the process of licensing pilots at first entry to the system, or at transfer to higher grades of licence.

[70] Under this proposal a routine medical check may occasionally diagnose a pilot as presenting a high enough risk for the medical examiner to decline to give him a new medical certificate on the spot. More commonly, however, the pilot will be diagnosed as having entered a "group at risk", and will be referred for further evaluation. After such evaluation his medical certificate might be withdrawn.
To describe the process more fully, the first step is the medical check of the pilot by a "designated medical examiner" (DME). In a few severe cases the DME may refuse to issue a medical certificate. For example, a pilot with a recent head injury may exhibit symptoms that unquestionably justify grounding him immediately. He will then remain grounded until it is proven he is once again fit to fly.
In all other cases the DME issues a new medical certificate and sends a medical return to CAD's Principal Medical Officer (PMO). If in the DME's judgment the pilot has "entered a group at risk" he will draw it to the early attention of the PMO. The PMO will check all returns anyway. Medical returns are screened by the PMO's staff according to criteria that identify whether the pilot has entered a "group at risk". We envisage the use of established medical relationships (such as, for cardiac problems, those arising from the Framingham study) aided by a microcomputer.

Out of 2406 professional pilots, typically about 5 or 6 lose their licences annually. Hence

the average chance of loss of licence is $2x10^{-3}$ pa[71].

Flying with a Condition Warranting Loss of Licence

When a pilot loses his licence he is replaced in the aviation system by a new pilot. Pilots who lose their licences for medical reasons tend to be older and more experienced. Pilots who replace them in the system are younger and less experienced[72]. The effect on accident risk is the net effect of this exchange of medical fitness for experience.

Of course, the new pilot does not *directly* substitute for the old. There is a ripple effect throughout the aviation system, with the new pilot entering the system at the first (lowest) level. The cumulative effect of this ripple through the system is, necessarily[73], less than if the inexperienced pilot substituted directly for the pilot losing his licence. Indeed, a slight pause before a pilot loses his licence does little to change the progression of pilots through the system. There may be a slight phase change in the cycle of life of the pilot population, but the average experience level at a random point in time remains almost entirely unchanged. Thus, we can consider licences-for-life to have no effect on pilot experience.

Turning to medical fitness, the new pilot is likely to be relatively young and, on the medical evidence, far less likely to suffer an incapacitating event than the pilot losing his licence. This analysis will therefore ignore the chance of the new pilot experiencing an incapacitating event in the immediate future. The medical effect is virtually confined to the risk of the old pilot suffering an in-flight incapacitation.

Thus, to all intents and purposes, the net effect on safety is the risk that a pilot with a detectable medical condition warranting loss of licence suffers an incapacitating event resulting in an accident.

Accidents Due to Incapacitation of Pilots – Average Case

IATA figures on pilot incapacitation are available for a 13 year period, 1965-77. During that period there were 13 known in-flight cardiac incapacitations in 449 967 pilot-years. Allowing 600 flying hours pa per pilot, this is a rate of $4.8x10^{-8}$ cardiac incapacitations per pilot-hour of flying time.

Not all in-flight incapacitations are due to cardiac conditions. Only 42.4% of *losses of licence* are for cardiac reasons[74]. Assuming that medical checks apply

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[71] This simple calculation masks the fact that it is the older pilots who are at greatest risk of reaching a medical (mainly cardiac) condition warranting loss of licence. On the other hand, it is possible for young pilots to be rejected due to such things as neurological effects of injuries from car accidents or contact sports.
[72] Unless an older, experienced pilot is recruited from overseas.
[73] For otherwise the new pilot *could* just as well substitute directly for the old, which he clearly cannot do.
[74] Mohler, Stanley R, *Aircrew Physical Status and Career Longevity*, Human Factors Bulletin (January/April 1984). The figure of 42.4% applies to FAA medical certification of United States air crew from 1938 to 1981.

consistent criteria to all factors that may cause pilot incapacitation, it is fair to assume that the causes of actual cases of in-flight incapacitation are proportional to reasons given for loss of licence. Thus the 4.8×10^{-8} figure for cardiac causes scales up to 1.1×10^{-7} incapacitations per hour for in-flight incapacitation *from all causes.*

Even in a single pilot aircraft, not all incapacitations necessarily lead to a crash, even if the pilot loses consciousness for a time[75]. Given an average pilot, we will therefore assume that

> for a single pilot aircraft
> the accident rate due to in-flight incapacitation is 10^{-7} per flight-hour[76]

If an aircraft has more than one pilot, an incapacitating event does not necessarily lead to an accident. For an accident to occur, three things must combine. First, the incapacitating event strikes the pilot in control. Second, the incapacitation arises during a critical phase of *flight*. Third, the other pilot (or one of the other pilots) fails to recover the situation.

In a series of 800 flight simulator tests of incapacitation of the pilot in control there were ten instances of a significant degree of hazard, two of which resulted in crashes[77]. This indicates that the chance of a crash is one-in-400 when incapacitation strikes the pilot in control during a critical phase of flight[78].

Assuming the critical phases of a flight span a period of three minutes in total (take-off and landing), this represents 3.75% of an average flight time of 80 minutes[79]. Combining 3.75% with the one-in-400 from above introduces a factor of 0.9×10^{-4}. Coupled with the 1.1×10^{-7} from above[80], and given an average pilot in control,

> for a multiple pilot aircraft
> the accident rate due to in-flight incapacitation is 10^{-11} per flight-hour.

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[75] For example, on 21 February 1983 the pilot of a small aircraft on a charter flight from Rotorua to Wellington lost consciousness for 31 minutes. The aircraft was on automatic pilot at the time. in any case, the aircraft had dual controls and a passenger with a private pilot's licence was in the seat beside the pilot.

[76] Relating to general aviation in the United States, a rate of 3.7×10^{-7} for complete cardiovascular incapacitation has been deduced; see Booze, C F, *Sudden In-flight Incapacitation in General Aviation*, US Federal Aviation Administration (1987). The same source quotes 39% (36 out of 92) of incapacitations being from cardiac causes, bringing the incapacitation rate from *all* causes almost 10^{-6} accidents per aircraft-hour. It is not surprising that this rate of incidence for pilots in general aviation (which includes private flying) is ten-fold higher than for pilots flying with IATA airlines, given the emphasis that airlines place on pilot medical fitness.

[77] Chapman, P J C, *The Consequences of In-flight Incapacitation in Civil* Aviation, Aviation Space, and Environmental Medicine (June 1984). Conservatively, these tests simulated "subtle", rather than "obvious", incapacitation. On this count the simulated accident rate might be higher than in practice.

[78] Two crashes is a very small sample on which to base this number, but one-in-400 is the best estimate that can be made. To place a perspective on the range of possible variation, suppose the one-in-400 estimate is correct and that 800 trials are undertaken. The probability of *exactly* two events is only 27%. The probability of zero accidents is 14%, one accident 27%, two accidents 27%, three accidents 18% and the probability of more than three accidents is 13%.

[79] For scheduled services of all commercial air carriers worldwide, the 1986 edition of the ICAO publication *Civil Aviation Statistics of the World* tabulates 10.12M aircraft departures and 13.35M aircraft hours flown, an average of 80 minutes per flight.

[80] During critical phases of flight the chance of incapacitation is higher than average due to the greater stress level. Notwithstanding this, we have not increased the chance of incapacitation because one-in-400 is a high estimate of the chance of an accident ensuing: the simulator tests were all of *subtle* incapacitation when, in reality, some instances would be immediately obvious to the other pilot.

Accidents Due to Incapacitation of Pilots on the Threshold of Loss of License

The figures 10^{-7} and 10^{-11} apply to aircraft flown by average pilots. For a pilot on the threshold of loss of license the chance of incapacitation is higher.

European and American standards require that the occurrence of failure preventing an aircraft's continued safe flight and landing should be "extremely improbable", that is, a chance of one event per billion aircraft-hours, ie 10^{-9} events per aircraft-hour[81]. This suggests that pilots at the threshold of loss of license for medical reasons have a 100-fold greater chance of incapacitation.

It would be reassuring to have a more definitive indication of the relative risk levels. Whilst medical science certainly is making progress on quantification of comparative risk levels, at this seemingly early stage we can do no more than assert that the difference between the average pilot and the pilot at the threshold is two orders of magnitude. This is plausible given that, in the airline setting, there is *one* order of magnitude difference between average pilots and pilots identified as being in a group "at risk" from cardiac causes[82]. Few of the pilots "at risk" ultimately lose their licenses, so the *two* orders of magnitude separation is supportable. Accordingly we will assume that

> for pilots at the threshold of loss of license
> the in-flight incapacitation rate is 100-fold higher than for the average pilot.

For single pilot operations, this translates into a 100-fold increase in the accident risk for the aircraft.

For multiple pilot operations, the chance of an accident due to pilot incapacitation is almost *entirely* due to the contribution of the pilot at the threshold of loss of license[83]. In a two pilot operation the pilot at the threshold of loss of license has control for half the time, during which time the chance of incapacitation is 100-fold higher. This results in 50-fold increase in the chance of the aircraft having an accident. For a three pilot operation (of which there are some) the increase is 33-fold[84].

[81] Lesser failures that reduce the ability of the crew to cope with adverse operating conditions should be "improbable", which is interpreted as lying in the range 10^{-8} to 10^{-5}. See Chapman, *op cit.*
[82] This is based on the Framingham study, an exhaustive study over a long period of time of a large population in the United States.
[83] For example, if two pilots share the critical phases of flight equally, the average pilot contributes only 1% of the risk of the other pilot. Hence we can effectively ignore the average pilot, and focus on the other pilot, who is at the threshold.
[84] The more pilots in the crew the more thinly the risk is distributed. If one pilot presents an increased risk, that risk arises only for the time the particular pilot is in control during critical phases. This is half the time in the two pilot case, and one-third of the time in a three pilot operation

In summary, where pilot incapacitation is the cause, accident rates per aircraft-hour are:

	Accidents per Aircraft-hour Due to In-flight Incapacitation	
	Single-pilot Operation	**Two-pilot Operation**
Average pilot	10^{7}	10^{11}
Threshold pilot	10^{5}	$0.5x10^{9}$

Notes:

1. In the two-pilot case, only one of the pilots ia at the threshold of medical fitness.
2. The value $0.5x10^{-9}$ is twice as good as the "extremely improbable" American and European criterion mentioned above. It suggest that we should have started with a 200-fold difference between the average pilots at the threshold; but that would be to put too fine a point on the argument.

For practical purposes, the values pertaining to average pilots can be regarded as zero (*eg* in the single pilot case the increased risk of a threshold pilot is $10^{-5} – 10^{-7} = 0.99x10^{-5}$, which is essentially just 10^{-5}.) Thus our analyses need compute only the risks born by aircraft carrying a pilot who is at the threshold of loss of licence.

Cost-benefit Analysis of Licences-for-life

Separate cost-benefit analyses will be presented for the gamut of commercial passenger aircraft: the B747, B737, F27 and a 10-seater PA31-350 (Piper Chieftain, which is representative of single-pilot operation).

For the time being, we will assume that the chance that a pilot loses his licence for medical reasons does not differ between aircraft types[85]. We further assume that, for a given aircraft type, the average flying-hours pa is the same for pilots who lose their licences as for those who do not.

As we have previously indicated, we are presuming that the licence-for-life system introduces a one month lag in the loss of licence process. This briefly increases the risk of an accident, as analysed in the preceding section.

We will translate increased risks into monetary values using the following assumptions:

- an accident due to in-flight incapacitation results in total loss of the aircraft, passengers and crew;

- the aircraft average a 70% load factor for passengers;

- the value of life includes the "risk aversion" component for passengers, but not for the crew[86]; and

[85] In practice there is probably *some* difference because the age spectrum of pilots tends to vary between types of aircraft. Wide-bodied international aircraft require (or certainly attract) the highest level of skill and experience. The pilots accordingly tend to be older and thus more likely to lose their licences for medical reasons.

[86] The crew should be cognisant of the risks and it can be safely assumed that their salary scales include compensation for risk.

- the aircraft’s value is the estimated sale price on the second hand market (or the purchase price of an equivalent aircraft on the second hand market).

Tabulated below are the aircraft values, crew numbers, passenger numbers and resulting cost per accident.

Accident Statistics and Costs (*NZ$ per accident)*

	Aircraft Value	Crew Number	Passenger Load*	Accident Cost (Total)#
Boeing 747	$75M	19	290	$225M
Boeing 737	$20M	5	85	$64M
Fokker F27	$3.5M	3	30	$19M
Piper PA31-350	$0.5M	1	6	$3.8M

* At 70% load factor
# Using NZ$500,000 per passenger and NZ$250,000 per crew member

The figure derived for the B747 is far too low. Settlements in the United States and recently Japan are very much higher. Europe is also catching up with the United States. Underwriters insuring a B747 would recommend around $500M as the cover required for a B747 in international service. Accordingly,

for the B747 in international service
the assumed cost of an accident is $500M

for other aircraft types
the assumed cost of an accident is as tabulated above.

We must now place a dollar value on the loss of safety due to a system of licences-for-life. Consider a pilot at the threshold of loss of licence. He has a one month pause before he loses his licence following a routine medical check. Suppose in the multiple pilot environment he flies 40 hours during that time (a rate of 500 hours annually). In the single pilot case (Piper Chieftain) he flies about double that, *ie* 80 hours

Cost of Risk of a Pilot at the Threshold of Loss of Licence
(NZ$ per month)

	Accident Cost	Flight-hrs at Risk	Risk per Flight-hr	Cost of Accident Risk
Boeing 747	$500M	40	$0.5x10^{-9}$	$10.00
Boeing 737	$64M	40	$0.5x10^{-9}$	$1.28
Fokker F27	$19M	40	$0.5x10^{-9}$	$0.38
Piper PA31-350	$3.8M	40	10-5	$3,040

Only in the case of the single-pilot aircraft is the cost other than trivial.

For the single pilot $3,040 is cost of the risk of a pilot continuing to fly for one month before having his licence withdrawn. We assessed earlier that licensing-for-life would save $125 pa per licence. A cost of $3,040 is therefore offset by the saving on 25 licences. In other words, there is a benefit from licensing-for-life if the number of licences lost is less than one-in-25 annually, ie $4x10^{-2}$ pa. It was shown earlier that (for pilots) the average rate of loss of licence was $2x10^{-3}$ pa[87].

The benefit/cost ration is 20. To overturn this conclusion very large changes would have to be made to the underlying assumptions; for example, by assuming the degree of risk for a pilot at the threshold of loss of licence was 1000-fold higher than the average (rather than 100-fold), the value of life was double the values used, and the average load factor was near 100%.

Conclusion

Thus it *is* economic to having licensing-for-life – even in the worst case, the single pilot operation.

Note that flight crew includes flight engineers. In-flight incapacitation of a flight engineer carries an infinitesimal risk in comparison with a pilot. Inclusion of flight engineers in the savings column, without an offsetting cost of safety degradation on the other side, reaffirms that licensing-for-life is highly economic.

11.4.3 Cost-Benefit Analysis Of Intervals Between Medical Checks

The method used to evaluate licences-for-life readily lends itself to the evaluation of increasing the intervals between medical checks.

After the age of 40 years professional pilots (those with commercial or airline transport licences) are required to have medical checks six monthly rather than yearly. There is a rationale for the differential. Older pilots have more chance of incapacitation, through cardiac causes at least. Cardiac risk is proportional to age^2 according to the cardiac risk index proposed by the US Air Force School of Aerospace Medicine (USAFSAM) and based on the results of the Framingham study[88]. Thus at 50 years old a man carries four-times (*ie* 2^2) the risk he did when he was 25 years old[89].

Estimated annual rates of cardiovascular incapacitation in US general aviation vaguely resemble this pattern; the following numbers are based on accident experience.

[87] It might be argued that the chance of loss of licence is higher for single-pilot operation because the very high standards set by a major airline. On the other hand, it could be argued that this is offset by differences in the average ages of pilots in each group. Pilots often progress from single-pilot to two-pilot airline operations.
[88] The “Framingham study” is a well known epidemiological study of coronary heart disease undertaken over many years on the population of Framingham, Massachusetts.
[89] Given no change in other factors, particularly the total cholesterol level and the proportion that is high density lipoprotein cholesterol.

Estimated Annual Rates of Cardiovascular Incapacitation in United States General Aviation

Age In years	Incapacitations per 100 000 pilots
20-29	0
30-39	0.6
40-49	2.2
50-59	2.8
60^+	20.6
All	*1.6*

Source: Booze, C F, *Sudden In-flight Incapacitation in General Aviation,* US Federal Aviation Administration (1987)

Less subject to sampling error is the incidence of coronary heart attacks in males in general, figures being derived from a larger sample. The following table resembles the one above, but shows a more marked quadratic (*ie* second power) relationship with age.

Interestingly, the best relationship is found by using as the measure of age the number of years *in excess of 25*; in other words, a relationship with $(age\text{-}25)^2$ is evident.

Fatality Rate per 10^8 hours Due to Coronary Heart Attack

Age In years	Fatality Rate
25-34	0.5
35-44	4.0
45-54	12.2
55-64	29.0

Source: Tunstall-Pedoe, H, *Risk of coronary Heart Attack in the Normal Population and how it Might be Modified in Fliers,* European Heart Journal (1984)

We will take the matter no further here, since an age^2-type of relationship for cardiac incapacitation is enough to rationalise the increased frequency of medical checks for older pilots. Overall only about 40% of cases of incapacitation has a cardiac cause, but in the more susceptible, older age group the proportion may be very much higher. For the purposes of this analysis we will assume that

> for a pilot over 40 years old
> the accident rate due to in-flight incapacitation is double the average.

This assumption augments the values derived for the licence-for-life evaluation as set out below. “Threshold pilots” are those who have just reached a medical condition warranting loss of licence but who, for the time being, are still flying.

Accidents per Aircraft-hour Due to In-flight Incapacitation

	Single-pilot Operation	Two-pilot Operation
Average pilot	10^{-7}	10^{-11}
"Over 40" pilot	$2x10^{-7}$	$2x10^{-11}$
Threshold pilot	10^{-5}	$0.5x10^{-9}$

Note*:*
In the two-pilot case, only one of the pilots is at the threshold of medical fitness

For practical purposes all values other than those relating pilots at the threshold can be regarded as zero. (In the case of the single pilot over 40 years old, the increased risk of a threshold pilot is $10^{-5} – 2x10^{-7} = 0.98x10^{-5}$, which is essentially just 10^{-5}). This our analyses need compute only the risks born by aircraft carrying a pilot who is at the threshold of loss of licence.

To be consistent, however, the assumed doubling of the incidence of incapacitation in the "over 40" group should be coupled with a doubling of the incidence of loss of licence for medical reasons. Hence, adjusting the figure derived in the licence-for-life analysis,

for the "over 40" pilot
the chance of loss of licence is $3x10^{-3}$ pa

A pilot who loses his licence as a result of a routine periodic medical check can be expected to have reached a medical level warranting loss of licence at some point during the interval between checks. Increasing the time interval between medical checks increases the length of time that a pilot may carry a defect that, had it been detected, would have resulted in his loss of licence. The increased risk lasts for three months, this being the difference between six-monthly and yearly checks[90].

In the licence-for-life analysis a cost (in dollars per month) was derived for the increase in risk due to a pilot flying whilst carrying a medical condition warranting loss-of-licence. Trebling these costs to reflect the three month extra risk now being addressed:

Cost of Accident Risk

Boeing 747	\$30.00
Boeing 737	\$3.84
Fokker F27	\$1.14
Piper PA31-350	\$9,120

In the two-pilot cases the cost is trivial. Only the single-pilot example, the Piper Chieftain, bears further scrutiny.

Against the \$9,120 cost derived above we must weigh the savings from yearly rather than six-monthly checks. Savings would include: the cost of a \$55 medical check; about two hours (say, on average) of a pilot's time; travel cost; and some cost of processing the pilot's information by the Principal Medical Officer's staff.

[90] Considering the interval between medical checks, assume that the threshold medical condition is equally likely to be reached at any time during that interval. The average time a pilot carries the medical condition before the next check is 3 months in the case of six-monthly checks and 6 months in the case of yearly checks. The difference is 6 – 3 = 3 months.

The total saving is rather dependent on the value placed on the pilot's time, and that in turn is dependent upon whether the medical check is regarded as taking place in the pilot's work time or leisure time. suffice to adopt a round figure of $100 for the saving, per pilot, of dispensing with six-monthly medical checks.

If, annually, a pilot over 40 years has a 4×10^{-3} chance of loss of licence, only one in 250 such pilots will present the risk that led to the $9,120 cost. This needs to be weighed against a 250x$100 = $25,000 saving from less frequent medical checks.

On the face of it, it would appear that six-monthly medicals are not warranted on cost-benefit grounds, even for single-pilot operations. This may well be so, especially for small aircraft with very little passenger seating. But we should be cautious of placing too much reliance on the figures used in the cost-benefit calculations. The difference between $9,120 and $25,000 is well within the margin of error, and the figures used in the calculation need refining before a firm conclusion is reached.

Also, formulating the question in different ways may yield different answers. For example, analysis of the "over 50" age group might show that *they* should be checked six-monthly if flying single-pilot passenger aircraft.

Conclusion

To meet New Zealand's ICAO obligations, pilots flying internationally need medical checks six-monthly after the age of 40.

On safety grounds switching to six-monthly medical checks is not justified at age 40 (but may be at some later age). This conclusion is subject to further analysis of the single-pilot operation.

That there are medical reasons to believe checks should be more frequent after age 40, or thereabouts, raises doubts about the need for pilots *under* 40 to be checked as frequently as yearly. In the case of two-pilot operations the cost of the risk is so low that one might be tempted to challenge the need for medical checks at all. To go that far, however, would be to disregard the effect medical checks have had on the low incidence of accidents through in-flight incapacitations. That no one has fallen over the cliff is not a sound reason for removing the fence at the top!

Thus one might argue against stretching checks to two-yearly on the grounds that the discipline that has led to high standards of medical fitness may be lost. The medical check is a chance for aviation medicine practitioners to counsel pilots on how to stay fit enough, for long enough, to see out their useful flying lives. Although this has an economic benefit to the country, it is a matter outside the purview of the safety regulator.

On the strength of the analysis presented above, a case needs to be made before compelling professional pilots to have routine medical checks more frequently than yearly. Professional pilots may warrant no more stringent requirements than those placed on private pilots, namely; to age 40, medical checks every four years, with declarations as to health in the intervening even years; between 40 and 50, checks every two years; between 50 and 65, yearly checks; and over 65, six-monthly checks.

The ICAO requirement for six-monthly checks of professional pilots over 40 years is a matter that New Zealand should raise with ICAO.

A Side Issue: qualifications and authority of aviation medical examiners

The above cost-benefit analyses of licences-for-life and medical checks omit reference to certain facets of proposed reforms initiated prior to this study. We owe an explanation for this, and take the opportunity to present our own judgments on needed reforms.

SuperDMEs

New Zealand now offers a post-graduate diploma in aviation medicine, which is in its second year. The diploma can be taken part-time over four years and is run by the Wellington clinical school of the Otago University medical school. It is intended that many places on the diploma course will be taken by fee-paying students from overseas.

Taking advantage of this development, it has been proposed that designated medical examiners (DMEs) who complete the diploma (call them *super*DMEs) be awarded a higher status and be made responsible for checking professional pilots. Regional medical officers (RMOs) could then be dispensed with as an intermediate step between the DME and the principal medical officer (PMO).

It would be wrong, however, to *compel* professional pilots to be checked by superDMEs. Well equipped, and with the requisite computer-screening aids, there is no reason why the PMO's office cannot deal with aspects of medical checks currently handled by RMOs.

Compelling professional pilots to use superDMEs would imply that screening by regular DMEs does not reliably identify those at risk. To our knowledge this has never been suggested. Rather than *failing* more pilots (*ie* referring more pilots to the PMO), superDMEs have the extra competence to assess and to *pass* more pilots, referring *fewer* pilots to the PMO.

The choice of using a superDME should be left as a voluntary action on the part of the pilot[91]. It is not a matter to concern the safety regulatory authority.

[91] It would, of course, be sensible of professional pilots to *prefer* to avail themselves of the expertise of the superDMEs. To protect his own livelihood, the professional pilot's self-interest should direct him to a superDME. This is for two reasons. Firstly, through superior *counselling* by superDMEs, pilots should be better able to maintain satisfactory medical fitness. Secondly, pilots should be motivated to use superDMEs by virtue of the reduced chance of being needlessly referred to the PMO for further assessment.

Computer-aided Screening

Our two cost-benefit analyses have highlighted:

- that the aim of medical checks is to identify pilots who have "too high" a risk of incapacitation; and
- that "too high" can be given a precise quantitative meaning (*eg* 10^{-6} events per aircraft-hour).

Every day, the world over, aviation medicine practitioners are making decisions as to whether individual pilots present a risk that is "too high". No one would deny that, with rare exceptions, these decisions are made by sincere application of the best knowledge and judgment that can be brought to bear. Furthermore, we should expect that the multiplicity of decisions being made have a good measure of consistency.

This being so, it is possible in principle to work backwards from the decisions of aviation medicine practitioners and deduce the quantitative risk factors implied by their decisions. It matters not whether the practitioners consciously think in bald quantitative terms when making their decisions. The fact that they make decisions implies a quantitative judgment, whether conscious or not.

An analyst (not necessarily with a medical background) could, in principle, construct quantitative decision rules that reproduce the practitioners' decision processes. Only a microcomputer would be needed to apply those decision rules. Of course a computer could not wholly take over from the practitioner; there must always be room for judgment if for no other reason than the futility of trying to programme a computer to deal with every possible combination of circumstances. But the computer could provide a screening function, determining those cases it could and setting aside those demanding individual assessment.

In some respects the computer could *improve* upon an assessment process solely reliant on the practitioner's judgment. Some relationships between a pilot's measured medical factors and his incapacitation risk can be quite complex. A computer can quickly combine measured medical factors in a complex formula that digests the information and reveals a pilot's level of medical fitness to fly. In cases too complicated even to be reduced to a complex formula, the computer can store multi-dimensional "look up" tables against which the pilot's measured medical factors can be compared. Examples of both (complex formulae and tables) are found in the results of the Framingham study of coronary heart disease and their application by the USAFSAM.

As well as the advantage of objectively processing complex data, once the information is in the computer it can routinely be manipulated to yield insights that would not otherwise have been gained. Imagine a system where a pilot's latest medical data are entered into the computer which recalculates his "Framingham" cardiac risk level. The computer than extrapolates forward to see if a critical medical condition might be reached before the next check, in which case the next check can be brought forward. By taking the *trend* of the pilot's cardiac condition into account, the "warning system" is more discerning than simply checking whether the Framingham score is close to the level justifying loss of licence. A pilot who has *consistently* been hovering close to losing his licence may *not* be of great concern. On the other hand, great concern would be engendered by a pilot whose former record was consistently good but who has shown rapid deterioration to reach a point close to loss of licence. The latter pilot is more likely to reach the threshold medical condition for loss of licence before the next routine check.

A by-product of this system (which lies beyond the concerns of the safety regulatory body) is that, with little cost, each pilot could be advised of his Framingham score, its trend, and his position relative to other pilots in his licence category. He would have early warning of emerging problems and could take remedial action in good time (*eg* stop smoking) to lessen the likelihood of loss of licence. This should reduce the economic loss to the nation from early retirement of highly trained and experienced pilots.

Specialist Medical Advisers

The PMO is not and cannot be expert in all branches of medicine. He is a specialist in his chosen field of occupational health, namely aviation. To resolve particular medical conditions in certain cases the PMO from time to time seeks assistance from specialist medical practitioners, *eg* cardiologists and neurologists. The specialist may apply more sophisticated tests before reporting his findings to the PMO.

We understand that specialist advisers exceed their bounds of competence by also declaring whether the pilot is fit to fly. Only a specialist who also has expertise in aviation medicine on a par with that of the PMO is equipped to make such a judgment; and even then it would be out of place for him to do so since the final decision should rest with the PMO, who carries the responsibility to decide.

The first step in occupational health is to gain an understanding of the work task and assess the demands placed on individuals undertaking the task. The next step is to measure the abilities of individuals to perform the task. In the case of aviation, the PMO may need to solicit help from specialist medical disciplines for this second step, to measure and assess *particular* aspects of the individual's ability. But it is the PMO alone who has the occupational health knowledge and competence to balance the medical factors against the demands of the task to be performed, and to decide whether an individual is *fit for the task*. Through the PMO, consistent and scientific judgment can be brought to bear in each and every case. Part of the PMO's job is to keep up to date with the changing technology of the cockpit and the aircraft, and no one is in a better position to balance the ever-changing risk levels of the "hardware" of aviation with the risk levels on the human side.

There is of course a need for an appeal authority to whom pilots may air grievances. The Director of Civil Aviation is well suited to this role, since it is he who is ultimately responsible for safety. Because of this ultimate responsibility, were the appeal authority to be other than the Director, the appeal authority could logically have power of recommendation only. Thus there is no need for the appeal authority to be anyone other than the Director. If the Director needs advice to assist him determine appeals, he may elicit help from whomsoever he considers appropriate[92]. In this respect there is useful function to be served by the existing Aircrew Licensing Appeal Board. Consistent with the above, the Board should have power of recommendation only.

In similar vein, the PMO should be free to seek specialist advice from whosoever he considers best in any given circumstance. There is no need for a list of "approved" medical specialists. Indeed such a list may be counterproductive in that the most appropriate specialist in any given instance may not be on the list.

11.4.4 Type Acceptance Of Microlights

Regulation of microlights has been selected for quantitative consideration since it is representative of a wide area of government discretion in the regulation of aviation. There are no ICAO obligations to meet. Indeed, in some circumstances there may be no moral or economic justification either. Below, we analyse the costs and benefits of government intervention with particular reference to type acceptance of microlights.

The Development Of Microlights

Since the mid-1970's (also known as ultralights) have evolved from hang gliders fitted with go-cart engines. Microlights have become progressively more sophisticated and now have three-axis control systems, landing gear and reduction-drive engines. Nowadays a microlight is typically 5 or 6 metres long with a wing span of about 10 metres. It has an empty of less than the 150kg and commonly cruises at speeds around 100km/h. An increasing number have two seats rather than one. In round figures, a two seater cost about $15,000 and a single seater costs virtually the same.

Microlights have enjoyed an upsurge of popularity in the 1980's. The Microlight Association of NZ has had 600 members, 450 of whom are currently paid-up.

New Zealand micro light pilots do not need to be certifies and microlights are not required to have airworthiness certificates. Two seater microlights must be type accepted; *ie* each aircraft type (make/model) must be checked for the competence of its design. All microlights are required to be registered, but some are not Air accident records suggest that 10% of New Zealand microlights are not registered.

There are currently 510 registered microlights – 319 single seaters (Class 1 microlights) and 191 two seaters (Class 2 microlights). Adding 10% to allow for unregistered aircraft, our best estimates of the current numbers of microlights are 350 single seaters and 210 two seaters.

The current rate of increase in the numbers of microlights flying in 55 new registrations per year, of which 75% are two seaters. Allowing for 10% not

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[92] In dealing with any aspect of aviation safety, medical or not, it is our interpretation of past court actions that the legal system has difficulty balancing very tiny risks against the very high stakes represented by catastrophic accidents. The "tiny risk" aspect predominates. It is difficult to demonstrate in a judicial setting that a given action carried an unacceptably high risk when the magnitude of the risk itself is extremely low (such as 10^{-6}) and no accident ensued. Judicial or quasi-judicial processes would best be confined to considering whether the correct *process* of decision making had been followed, and not have jurisdiction over the decisions themselves.

registered, the rate of addition to the fleet is 15 single seaters and 45 two seaters per year.

A well maintained microlight can last more than 10 years, but 10 years is a reasonable average life span to use for computational purposes. As well as wear and tear, technological obsolescence reduces a microlight's useful life. In New Zealand the state has not yet been reached when retirements of older models generates demand for sales of newer models. Whereas sales might be expected to increase in the next few years as older machines are retired, this is the offset by a tapering off of the initial rapid rise of the sport in its early years.

For the purposes of this analysis we will consider the microlight population as it will be in about three years time, when the number of microlights can be expected to stabilise.

Given a higher attrition rate of the older single seater aircraft, in about three years the population if microlights will probably comprise approximately 350 single seaters and 350 two seaters.

For the analysis of type acceptance, we may reasonably expect the current rate of purchase of new machines to continue for several years to come. The numbers of new *types* introduced may lessen due to a significant share of the market being captured by competitively priced machines of New Zealand and Australian manufacture. On the other hand, continued introduction of new types is an inevitable consequence of continuing development of microlight technology. In the last two years, nine new types of single seater microlights and five new types of two seaters have been introduced in New Zealand. For the purposes of this analysis we will assume that in the years ahead there will be *latent*[33] demand for six new types to be introduced per annum.

There is less work to check a new type if it is supported by design calculations, overseas acceptance or documented overseas flight experience. To assess the costs and benefits of type acceptance we must therefore decide how many new types will or will not be supported by overseas evidence or detailed design calculations. To simplify terminology, these two cases will be differentiated as with or without overseas type acceptance[34]. Specifically we will assume that the numbers of new types introduced is as set out in the summary below.

Summary of Assumed New Zealand Microlight Fleet Statistics

For the quantitative analyses we adopt the following figures.

For the immediate future, the introduction of new types will have the following profile:

two per year	single seaters *with* overseas type acceptance
one per year	single seaters *without* overseas type acceptance
two per year	two seaters *with* overseas type acceptance
one per year	two seaters *without* overseas type acceptance.

The numbers of new machines sold in New Zealand will be:

15 single seaters pa
45 two seaters pa.

The numbers of microlights in New Zealand in about three years time will be:

350 single seaters
350 two seaters

The new price of a microlight is $15,000 for a one or two seater, and the average life of a microlight is 10 years.

Microlight Safety and Accident Record

Not being designed with the same robustness as larger aircraft, microlights may be more susceptible to accidents, and accidents are likely to have more severe consequences. Yet, given their lightness and limited speed, microlights are *low energy* vehicles and do not possess the larger aircraft's potential for third party damage. Moreover microlights are still predominantly recreational vehicles flown in areas away from towns.

These contrasting aspects of microlights (presumed higher accident risk on the one hand, but lesser risk of third party involvement on the other) led countries to treat microlights very differently. Some exempted microlights from regulation whilst other countries placed stringent requirements on them.

The United States left microlights free from regulation[93]. But in response to an increasing number of incidents involving microlights in controlled airspace, however, the National Transportation Safety Board investigated all fatal microlight accidents occurring between March 1983 and September 1984 and published detailed assessments[94]. To our knowledge, this is by far the most detailed and informative source of information on microlight accidents.

Accident Rates from the American Study

The NTSB believes it has reported on virtually all fatal accidents over the 18 month period. As well as the 88 fatal accidents covered, a number of other (mainly serious) accidents were investigated. Many non-fatal accidents will not have come to the attention of the NTSB; only the *fatalities* can be used as a guide to accident *rates*.

[93] In 14 CFR 103 the Federal Aviation Administration states:

> *The justification for allowing the operation of these vehicles without requiring aircraft and pilot certification has been that this activity is a "sport" generally conducted away from concentrations of population and aircraft operations. Like any sport, the participants are viewed as taking personal risks which do not affect others not involved in the activity.*

[94] *Safety Study: Ultralight Vehicle Accidents*, National Transportation Safety Board, Washington DC (1985).

In brief, the accidents investigated by the NTSB had the following characteristics.

Accidents:		
Fatal	88	(5 of which were double fatalities)
Serious	74	
Minor/none	14	
	176	

In 14 accidents there were two people on the aircraft. The analysis of injuries is thus slightly different from the above.

Injuries:	
Fatal	93
Serious	76
Minor/none	21
	190

The damage to the aircraft itself was as follows.

Aircraft Damage:	
Destroyed	86
Substantial	80
Minor/none	10
	176

There being no registration requirements for microlights in the United States, these accidents relate to an uncertain number of aircraft. At the time (1983/4), estimates ranged from 15,000 to 40,000. Taking the mid-point of 27,500, in 18 months the 88 fatal accidents represent a rate of approximately

2.1 fatal accidents pa per 1000 microlights

but within bounds of 1.5 and 3.9, taking the extremes of the range of estimates.

Australian Accident Rates

In 1987 a thorough evaluation of Australian sports aviation by the House of Representatives committee on transport safety was published[95]. Submissions were made to the committee by a wide range of interested parties. No definitive conclusions were reached as to the *rates* of accidents because "without flying hours and participation rates, only very broad and general conclusions can be drawn".

In the period 1978-86 there were 77 microlight accidents reported to the Bureau of Air Safety Investigation. These accidents caused 35 fatalities, 28 serious injuries and 8 minor injuries. The only data regarded as reliable were the data for fatalities.

[95] *Sports Aviation Safety*, a report of the House of Representatives Committee on Transport Safety, Australian Government Publishing Service, Canberra (1987)

The report states that the Department of Aviation estimated that:

- the fatal accident rate for microlights is 10 times greater than that for general aviation aircraft; and

- microlight fatalities attributable to airworthiness causes are likely to be 50 times higher than for general aviation aircraft.

On the other hand, based on different assumptions of participation rates the Australia Ultralight Federation concluded that ultralights compared quite favourably with general aviation aircraft.

The Queensland Region of the Department of Aviation stated that “when you look at the figures, ultralights are not doing too badly”.

New Zealand Accident Rates

In the past six years 77 microlight accidents were investigated by the inspector of air accidents[96]. The New Zealand accidents investigated may be summarised as follows.

Accidents:		
Fatal	9	(3 of which were double fatalities)
Serious	27	
Minor/none	41	
	77	

In 16 accidents there were two people on the aircraft. The analysis of the injuries is thus slightly different from the above.

Injuries:	
Fatal	12
Serious	29
Minor/none	51
	92

These accidents relate to an increasing population of aircraft during the six years, averaging about 380 microlights. The nine fatal accidents therefore represents a rate of

4.0 fatal accidents pa per 1000 microlights.

This is the same as the American figure for the low estimate of 15,000 microlights.

[96] It is coincidental that the figure of 77 is the same as the number of Australian accidents cited above.

There were exactly three times the number of serious injury accidents in New Zealand during the six years, making that rate

16 fatal or serious injury accidents pa per 1000 microlights.

(There is no comparative American figure since not all serious injury accidents were investigated by the NTSB).

Comparative Accident Rates with General Aviation

To meaningfully compare the accident record of microlights with general aviation it is necessary to make some assumptions as to the annual flying hours of microlights.

In the first year a microlight owner might use his aircraft for 100 hours, but usage would soon taper off to 50 hours or even 20 hours a year. Weather is a limiting factor in microlight flying. Assuming the average microlight flies for 40 hours a year, the New Zealand fatality accident rate of 4.0 per thousand aircraft translates into 4.0 per 40,000 hours, or

$10 x 10^{-5}$ fatal accidents per microlight flight-hour.

This compares with a United Kingdom (1976-84) figure of $2.6 x 10^{-5}$ fatal accidents per flight-hour for fixed wing general aviation below 2300 kg.

For Australian general aviation (1977-81) the fatal accident rate per flight-hour is $1.2 x 10^{-5}$. This remains the figure if only single engine operation is considered; private/business flying is a little higher, at $1.9 x 10^{-5}$.

The Swedish rate (1975-82) for *all reported* accidents involving private and aeroclub flying is around $25 x 10^{-5}$.

Accident Causes in the American Study

The 88 fatal accidents were classified by the NTSB according to the nature of the first event to trigger a mishap. In the following table a comparison is made with the results of 229 general aviation accidents in the same period. (Parenthesised are comparative Australian figures, from the report mentioned above).

Fatal Accidents Classified by First Event
a comparison of microlights with general aviation aircraft

	Microlight Aircraft	General Aviation Aircraft	Australian Microlights
Airframe / system failure	32	5	(27)
Loss of control	42	28	(38)
Weather	2	28	(38)
Loss of power	9	11	(8)
Collision	11	27	(19)
Other	4	6	(4)

The differences between microlights and general aviation are illuminating.

> Firstly, a third of microlight accidents are triggered by airframe or system failure or malfunction, an infrequent cause of accident amongst general aviation aircraft.
>
> Secondly, approaching half the microlight accidents resulted from loss of control. Although this is a major cause of accidents amongst general aviation too (28%), the gap between microlights and general aviation is revealed if the effect of airframe/system failures is removed from the comparison. *Excluding* airframe/system failures, 62% of remaining microlight accidents are due to loss of control, compared with 29% for general aviation.

Loss of control accidents. Setting airframe/system failures to one side, the proportion of fatal accidents due to loss of control is, for microlights, double that for general aviation. And whereas few general aviation accidents are due to airframe/system failure, a third of all microlight accidents originate due to this cause.

Where the case of the accident was loss of control, the predominant reason was pilot unfamiliarity with his type (make/model) of machine. 60% of those killed had less than 10 hours flying experience in that make/model. This was so both for unlicensed and licensed pilots; many licensed pilots were highly experienced, some with a lifetime of flying behind them[97]. The flying experience of licensed pilots killed averaged 2900 hours (as against 104 hours for the unlicensed pilots).

Regarding flying experience of the crash aircraft, the NTSB report concluded that:

> … total flying experience (which may include experience in other make and model ultralights) does not necessarily result in safe operation of the low experience make and model. (Page 9).
>
> The ultralight fatal accidents involving in-flight loss of control were primarily related to improper handling techniques due to the operator's limited experience or training in operation of the vehicle. (Page 11).

[97] Although 60% of fatalities involved inexperienced pilots in that make/model, with no differentiation between licensed and unlicensed pilots, it cannot be inferred that flying experience is of no advantage. We have no knowledge of the proportion of unlicensed pilots who are killed *versus* the proportion of licensed pilots killed.

A significant number of accidents arose because the pilot exceeded the design speed or manoeuvring limitations of the microlight. This often led to structure failure or to a change in the microlight's control characteristics, increasing the microlight's susceptibility to operator-induced oscillation and subsequent loss of control.

Airframe/system failure accidents. 3.5% of fatal microlight accidents[98] had as their cause "design or material defect". These are the defects that could be detected by type acceptance. There were no such instances in the comparison with accidents from general aviation, which has a system of airworthiness checks.

Between microlights and home-built general aviation aircraft there was little difference in terms of the *percentages* of: accidents due to improper assembly and maintenance; and, accidents due to the design limit being exceeded by the pilot[99].

Conclusion Regarding Microlight Safety

Two causes of microlight accidents stand out. One is the airworthiness of the design and construction of the aircraft. The other is pilot knowledge, skill and experience of the particular microlight being flown.

Summary of New Zealand Microlight Safety Assumptions

The New Zealand experience is that fatal microlight accidents occur at a rate of 4.0 pa per 1000 microlight aircraft. Since in later years some of these aircraft have been two seaters and have therefore been subject to type acceptance, the *latent* accident rate[100] could be said to be a little higher. This accident rate is already at the high end, however, of the estimated range for the United States; and the New Zealand sample is, after all, very small. We will therefore adopt as the latent fatal accident rate the figure of 4.0 per 1000 microlight aircraft per annum.

If accidents involving serious injury are included, the figure rises from 4.0 to 16. The ratio increase is very much higher than reported by the Australian and American studies – not that they claimed comprehensiveness for other than the fatal accidents. Accordingly the relativity of 4.0 to 16 will be retained.

We will therefore assume that the *latent accident rate in the absence of type approval* is:

4.0 fatal accidents pa per 1000 microlights

12.0 serious injury accidents pa per 1000 microlights.

We will ignore accidents of lesser severity since accidents caused by airframe/system failure are generally fatal or cause serious injury.

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[98] 11% of 32% of microlight accidents due to airframe/system failure.

[99] Once again, this does not mean that these accidents are unimportant in the content of microlights, because the overall accident frequency may be higher for microlights than for general aviation.

[100] The accident rate in the absence of type acceptance.

Likewise we will ignore third party property damage. Of the fatal accidents in the American study, 81% caused no property damage and all but 2% caused no damage other than to trees, crops and wires.

We will assume that the crashed aircraft is totally destroyed.

Based on the American and New Zealand histories of reported accidents it is fair to assume that if a two seater microlight has an accident carrying two people, both will suffer the same severity of injuries.

The American statistics reveal that 3.5% of fatal microlight accidents are due to airframe/system failures that might have detected by type acceptance checks. We will assume that such checks would indeed identify nearly all such defects and, moreover, would include a check on the adequacy of the assembly[101] instructions. Taken together, we will assume that

> type acceptance will reduce accidents by 5%[102].

Cost-Benefit Analysis of Type Acceptance

We are now in a position to assess the costs and benefits of applying an airworthiness test to each new aircraft type.

The proposal is that, before they are introduced to New Zealand, new types of microlight be checked in the same way as two seater microlights are currently checked. There are two questions to be answered.

- Should the present vetting of two seaters be discontinued?
- Should the system of vetting be extended to include single seater microlights?

Given that a system is up and running, the cost of vetting a new type is about $10,000. The division of this cost between the applicant and the aviation authority is immaterial, especially under "user pays". The cost would be much less, about $2,000, if the new type has an overseas approval or has a proven record of safe flying.

The benefits of type acceptance checks are savings of

> lives valued at $250,000 per life[103]
> serious injuries valued at $27,500 per injury
> microlights valued at $15,000 per aircraft.

[101] And, perhaps, maintenance.
[102] Being based on an analysis of fatal accidents, this conclusion should strictly be confined to *fatal* accidents. The conclusion is being extended to cover serious injury accidents as well.
[103] The value of life is taken to be that used by the National Roads Board for roading expenditures. Microlight pilots (and, indeed, passengers) should be aware that flying microlights entails an enhanced risk, and participate knowingly. This is a different situation from the airline passenger who expects a high standard of safety and, it can be argued, thinks he has paid for it in the price of his ticket.

The Two Seater Microlight

The average load factor of a two seater microlight is difficult to assess. In a club setting, the machine may carry two people most of the time. Pilot training largely sees to that. In private flying, however, the second seat may be occupied infrequently. We will assume that

1.6 persons is the average occupancy for two seater aircraft.

We can now estimate the value of type acceptance of two seater microlights. First we calculate the annual benefit per 1000 microlights. The expected total accident cost for fatal and serious injury accidents per 1000 aircraft pa is, assuming all aircraft are totally destroyed,

1.6 x [4.0 x $250,000 + 12 x $27,500] + 16 x $15,000 = $2,368,000

For *one* two seater microlight the average cost of fatal and serious injury accidents is thus $2,368 per annum. Over the 10 year life of the aircraft this has a present value of $14,548 at a 10% pa real discount rate[104].

Only 5% of the accident cost could be saved by type acceptance checks, *ie* $727 per aircraft. To warrant a microlight having a full check costing $10,000 it would be necessary for 14 or more aircraft to be sold in New Zealand. For a microlight with overseas approval or service record, the $2,000 cost of New Zealand type acceptance would be warranted if 3 or more were sold in New Zealand.

Considering the size of the present production run of the New Zealand designed and developed microlight, the Bantam, type acceptance of two seaters *is* justified on economic grounds, even if the more rigorous $10,000 check is necessary.

Looking at matters from the financial viewpoint of the manufacturer or importer, suppose the cost of type acceptance is recouped by adding $500 to each unit sold. At a type acceptance cost of $10,000 a batch of 20 would be needed to warrant introducing a new type; and a batch of 4 would be necessary to recoup $2,000. Thus, at $500 on the price of a new aircraft, commercial actions would promote the economic optimum. *Economics is therefore in harmony with commercial reality.*

[104] This equals the value of the aircraft itself. Thus, even before running costs are taken into account, the implied cost of purchasing a microlight is about double its purchase price

The Single Seater Microlight

Comparing single seater and two seater microlights, even though the aircraft cost does not change by a factor of 1.6, the 1.6 occupancy factor virtually determines the ratio of their total cost savings. It follows that the threshold numbers of sales per type increase 1.6-fold, to 23 and 5.

Since only 15 single seaters are sold in New Zealand annually, and given the diversity of available types of machines, it is unlikely that 23 single seater machines of the same type would be sold in New Zealand. Even if *all* three new types of single seaters (estimated above to be introduced annually) possessed overseas type approval, the average sales would be only 5 per type. This is barely on the threshold of being economic.

Hence, type acceptance of single seaters is *not* warranted.

Conclusion

The analysis, based as it is on a wide range of assumptions, happens to confirm the present practice – namely, type acceptance checks of two seater microlights but *not* of single seaters.

It would not take much to change this conclusion. Consider doubling the value of life, or halving the cost of type acceptance. Either would admit the prospect of requiring single seater microlights to have an overseas approval or service record[105].

Notwithstanding the figures used to do the sums, there is *logic* in the present system. The two seater microlight is capable of carrying passengers who may place more trust in safety of microlights than is warranted. To protect these innocent parties a system of type acceptance is sound in principle. We have determined that it is sound economics, too.

The technology of microlights is developing quickly. To restrict the types of machines allowed to fly in New Zealand might be to withhold technological development, to the ultimate detriment of safety. Another aspect is that restrictions on the types of microlights allowed to fly in New Zealand could have the effect of a restraint of trade.

For all these reasons, the present system should be confirmed.

[105] Provided we were happy to effectively exclude from consideration any single seater microlights that did not have an overseas approval or record.

Note on the value of life

Microlight participants are aware their sport involves risk. That they nevertheless fly microlights demonstrates that (in their own, intuitive cost benefit analysis) they consider their benefits to exceed their costs (including their personal assessment of risk).

It would be wrong for society to take into account (in *society's* cost benefit analysis) the cost an individual places on his own risk exposure – unless the corresponding benefit to the individual were included, to cancel it out.

The value of life used above should therefore be interpreted as reflecting solely the value the *rest of society* places on the individual's life. This can be referred to as the value of a "statistical life".

11.4.5 Aviation Security Services

Annex 17 sets out the requirements for safeguarding civil aviation against acts of unlawful interference, and has its aim:

> safety of passengers, crew, ground personnel and the general public shall be the primary consideration in all matters relating to safeguarding against acts of unlawful interference with international civil aviation.

The Government accepts responsibility for international civil aviation security within New Zealand. The State has discretion as to how it discharges this responsibility.

Present Situation

By virtue of the Civil Aviation Act, international civil aviation security is the responsibility of the Director of Civil Aviation[106]. This responsibility is exercised through an operational branch which carries out passenger checks at international airports. The Chief Controller of Aviation Security, reporting to the Deputy Director, has a team of 2 in head office, 42 in Auckland, 16 in Wellington, 20 in Christchurch; a total staff of 80.

A basic philosophy of our review is that the aviation safety authority should set standards and monitor their adherence, but should *not* itself carry out operational functions. To be an operator means that CAD monitors itself; and the independence necessary for impartial monitoring is at risk.

Notwithstanding this philosophical standpoint, there must be good reason for changing an operation such as aviation security that is functioning so very well. The aviation security branch is a close-knit and efficient unit. The Chief Controller of Aviation Security has instituted controls enabling him to monitor the regions and individuals in the region. All comments we have received about the security branch, whether with respect to head office or regions, have been

[106] Whilst the security service is a branch of CAD the Act makes the Secretary of Transport responsible.

favourable. That the United States Federal Aviation Administration has reduced its New Zealand airport inspect visits from quarterly to annually, that the Chief Controller of Aviation Security is invited by ICAO to advise other countries, and that we have heard no adverse comment from any quarter, all underline the dedication and commitment of staff in the security branch.

Statistics from the Aviation Security Review[107] show that both activity and staff productivity are increasing.

	1986	**% Change 1985-86**
International flights screened	7,034	+28
International passengers screened	1,242,755	+15
Items seized	8,243	-26
Item seizure rate per 10,000 passengers	66	-37
Incidents attended by security officers	1,453	-24

The question is not whether, under the present organisational arrangement, aviation security is being successfully and efficiently accomplished; that is beyond doubt. The question is whether fewer resources would be required by aviation security if it had a *different* organisational arrangement. Our terms of reference require us to see whether CAD safety functions can be achieved with fewer resources, and to consider the implications of “user pays”.

Aviation Security as a Task for the Airports: an alternative

Recent changes in government philosophy, the transfer of responsibilities from State bodies to SOEs, and the resultant changes in attitudes, have prompted airlines and airports to examine their expenditures and consider the potential effects of “user pays”. A complicating factor has been the transfer of ownership of the airports, the transfer of responsibility for crash fire service to airports, and subsequent industrial problems between crash fire staff and their employers, the Airways Corporation. The international airports at Auckland, Wellington and Christchurch are assuming the prime responsibility for crash fire services.

We have received submissions from airlines and the international airports stating that the present level of security can be achieved at less cost if it is integrated with airport operations. Aviation security places particularly “lumpy” demands on personnel resources, especially at Wellington and Christchurch. So do some other functions, notably crash fire. Airports can interleave a number of duties and, to some extent, even-out the work load for security personnel.

The airports have determined the number of extra staff they need to carry out airport surveillance presently undertaken by the Aviation Security Service. To avoid distorting the issue, we asked the airports to assume the new, reduced staffing levels now required for crash fire.

[107] Civil Aviation Division, NZ Ministry of Transport, *Aviation Security Service 1987* Review (1987).

Christchurch International Airport. The Christchurch submission (see Appendix VII) describes in detail the effect of integrating aviation security and crash fire responsibilities into its total activities. The Christchurch proposal takes account of peaks, shift work and staff absences.

Wellington International Airport. Wellington has adopted the same approach as Christchurch (see Appendix VII) but has not supplied the same detail. Wellington states its approach is conservative and that further (unspecified) savings would accrue at times of disruption or unusual events.

Auckland International Airport. Auckland advises the full study done in 1984 concluded that 22 extra staff would be required and this conclusion still applies today. Auckland assumed that CAD would set guidelines and standards required to meet ICAO requirements.

Analysis. The table below compares 1988/89 staff numbers budgeted by the aviation security section with the extra staff numbers the airports say they would need to perform the same functions.

	Budget 1988/89	**Extra Airport Staff Needed**	**Staff Saved**
Auckland	42	22.0	20.0
Wellington	16	10.5	5.5
Christchurch	20	12.5	7.5
Total			*33.0*

At $42,000 pa (average salary including overtime), 33 staff of the aviation security section cost $1.386M pa (not including a proportion of the $250,000 pa regional office overheads). Summed over the next 20 years, and using a 10% pa (real) discount rate, annual savings of $1.386 have a present worth of $12M.

Offsetting this $12M gain is a possible loss of safety. There is no reason why safety should be diminished in the long run, and we accordingly assume existing security levels will persist, long term. But it could happen that effectiveness of security staff takes a dip at the time of transfer to the airport companies, and lasts for as long as it takes new management and staff to learn the ropes.

The total loss of a Boeing 747 would be the worst possible outcome of a lowered security level during the transition phase. As explained in Section 11.4.1, $500M is the appropriate cost to put on the loss of a B747. This cost is 42-fold greater than the $12M benefit from transferring aviation security functions to the airports. For the transfer to be *un*economic there would have to be *more* than a one-in-42 chance that the reduction in safety during the transitional period would lead to the loss of an aircraft[108]. For such to be the case we would have to be flying in an extremely hazardous environment, where safety in the air was totally dependent upon the most meticulous checking. Even if there were no security whatsoever during the transitional period, we consider the added risk would be several orders of magnitude smaller than one-in-42.

[108] Note that we are concerned with the decrement in safety only, not the absolute level of safety.

Thus, even judged against the worst possible outcome, *viz* the total loss of a B747, the aviation security changeover to airport responsibility is highly beneficial in cost terms.

The robustness of this conclusion depends on the validity of the assumption that, at least after the transitional phase, the airports would be able to maintain present levels of security. In the next section we scrutinise this assumption.

Feasibility of Transferring Security Checking to the Airports

Given that there is clear economic advantage from integrating aviation security into airport operations, the decision whether to do so revolves around whether the airport companies can achieve the required standard.

A "complete" security check on a Boeing 747 would take 8 hours with an involvement of 15 to 20 people. In practice the degree of checking is a balance between the cost of checking and the potential risk. The manner of implementation of Annex 17 is left to the judgment of each State, subject to the required minimum level of security being met. We are advised that the level of checking in New Zealand is appropriate to the risk level present in this country.

We will now consider whether, as an airport function, this level of security can be maintained. Consider the essential ingredients of an aviation security system:

- regulations and powers
- standards
- staff
    - calibre
    - selection
    - training
    - incentive and motivation
    - control
    - corrective action
- monitoring

Regulation and Powers. These are contained in the Civil Aviation Act, the Aviation Crimes Act and the Arms Act. Civil Aviation (Security) Regulations are currently subject to drafting by Parliamentary Counsel.

We are advised that, although the draft regulations could be applied to all airports, there is no intention of implementing stricter levels of security for domestic aircraft at domestic airports unless a specific risk is identified.

CAD considers powers of detention and arrest to be essential, even though the usual practice is to *detain* suspects and hand them over to the police for formal arrest. The airport managers do not attach much significance to the power of arrest since police are usually at hand. We envisage the essence of the draft regulations remaining unchanged if authority to undertake aviation security checks were delegated to airports.

Standards. CAD's 1987 Aviation Security Service Review contains comprehensive statistics which could be a base for establishing standards. No doubt they are used for such purposes now.

Auckland accounted for 76% of the total international passengers screened and 80% of the total items seized. Wellington had a similar detection rate. Christchurch had a higher rate. It would seem, not surprisingly, a good correlation exists between passengers screened and items seized thus indicating that a standard could be set for seizure rates per 10,000 screenings.

Passing "dummy" bags containing prohibited items and noting the detection rate would be another way of establishing a standard for detection.

Staffing. Calibre of staff is determined by the selection process[109]. Enthusiasm and morale is maintained through training, motivation and supervision. The performance of the present staff of the security section reflects credit on the Chief Controller and the attention paid to management aspects of the job. But good management is not confined to the security branch. With time and dedication, there is no reason why present levels of performance cannot be achieved by airport managements.

Monitoring. The purpose of monitoring is to check that standards are being achieved and, if not, to take corrective action. If an airline or airport does not meet the regulations then CAD has the authority to withdraw the licence. In practice, however, it is difficult to imagine withdrawal of the licence of a major airline or airport (Air New Zealand or Auckland International Airport, for example). Graduated penalties are more realistic incentives than draconian threats of total loss of licence.

The effectiveness of passenger screening could be monitored by secretly passing test items through the screening check. Such a monitoring system would need to have the following characteristics.

- *Attainable Standards*. The standards set should be achievable and reasonable; and, ideally, be agreed between the parties. The standard should be tested against the present (CAD) system and staffing, thereby establishing its attainability.

- *Objectivity.* There should be a specified list of unacceptable items, some of which would fall within the "must find" category.

[109] Not all crash fire and airport traffic warden staff necessarily have the attributes required to double as security staff. It is likely that new staff would be fully trained. They may indeed include a number of CAD staff presently engaged on security.

- *Graduated scale of fines.* For an incentive to be effective, fines should be sufficiently large; but they should be graduated to avoid unduly harsh penalties for minor transgressions[110]. If, for example, the present staff (*ie* CAD security staff) achieve a detection rate of 93%, the scale of penalties might look like this:

Detection Rate (%)	**Penalty ($)**
90-100	Nil
80-89	500
75-79	1,000
70-74	2,000

With these penalties there would be a danger that the 90% penalty threshold would become the target performance level; *ie* exceeding 90% detection could be seen as a waste of effort. This could be counterproductive. The sharp edge between "good" and "bad" could be removed by allowing credits (available for later use) whenever 90% is exceeded.

Aviation Security as a Contestable Task: another alternative

It has been suggested that the aviation security operations at airports should be contestable; in other words, that security tasks should be put out to tender. The example of fire and rescue services is used in support. Together with our rejoinders, the arguments against making security tasks contestable are the following.

1. *The airports have demonstrated how improved staff utilisation of on-airport staff can yield efficiencies.*
   On the other hand, that outside security firms do not enjoy the natural advantages of airport companies is not good enough reason to *deny* outside firms the opportunity to tender.

2. *Airport companies should have a more direct vested interest and long-term commitment than an outside security company seeking early profits.*
   On the other hand a specialist security firm may bring a broader experience to bear and, with it, new approaches and technology.

3. *Overseas, outside contracts for personal baggage security surveillance are not noted for high performance levels and detection rates.*
   Compared with an airport company, however, a security firm should pose no greater problem for the safety authority's standards enforcement.

4. *In any event, the airports could themselves contract out, if it were efficient to do so.*
   Which shows the safety regulatory authority could likewise contract out, thereby keeping control of the selection process.

[110] Which enforcers would be disinclined to impose, anyway.

5. *Tendering for security checking could result in regular and needless dips in safety level at each changeover of operator.*
For the benefits of the tendering process to be worthwhile, they need to exceed the cost of the added risk at each changeover. Because airport companies enjoy a natural advantage (as stated in *1*), even *if* security firms could underprice airport companies, it seems unlikely that security companies could have *sufficient* margin of advantage to offset the risks of intermittent changeovers. And the job could not be given to just *one* security company (to avoid changeovers) because security checking would not then be contestable.

6. *Unless aviation security is in airport hands, trade-offs cannot be made between alternative means of achieving security objectives that involve airport investment.*
The number of staff required may depend on the level of airport investment in security devices (*eg* remote television monitors) and the effectiveness of security fences and gates. Unless the airport is responsible for aviation safety, these investments *vs* staff trade-offs are unlikely to be made.

Primarily for the last two reasons we consider that on-airport aviation security tasks should be transferred to the airports rather than being made fully contestable through open tendering.

Submission from the Chief Controller of Aviation Security

In a submission dated 14 March 1988 (see Appendix VII) the Chief Controller of Aviation Security referred to a number of issues that would militate against delegation of the operational tasks of aviation security to other parties. The Chief Controller's points merit response and below they are reproduced in italics with our responses following.

(a) *Security of aviation activities as discharged by the Aviation Security Service are those tasks directed at the safety and security of aircraft, passengers, crews and supporting air navigation facilities. The fact that these activities take place on airports is purely incidental.*
Agree.

(b) *Security of "airports" as such is a subsidiary activity provided as a consequence of Aviation Security Service activities, not as an aim or motivating purpose. Security of airport company assets and commercial activities of the "airport" and/or other commercial entities located on airports is no different than any other commercial enterprise. It should remain the responsibility of those organisations and carried out either by them or under contract to them.*
Agree.

(c) *The aims, tasks and responsibilities of New Zealand's national aviation security programme directly relate to Government's obligations under international agreements and, the need to protect the national investment* *and reliance upon aviation. The discharge of those responsibilities has international connotations to New Zealand's and other States' national security. The effectiveness or ineffectiveness of the national aviation security programme influences our vital tourist industry, our 98% dependence upon international air travel and air commerce generally. While "airports" contribute or rather are supposed to contribute to the national programme, their aims, strategies and responsibilities are locally and commercially orientated.*

This is true at present, although as airport licensees, they must observe the Civil Aviation Act, Regulations and other directions of CAD as they affect the airport operation. It is our view that given the authorisation of the State, airports may assume the responsibility for aviation security based on regulations and standards set by CAD, and have their performance monitored by CAD.

(d) *The threat or risk to be secured against is of a national nature as assessed by Government based upon information from Government's intelligence advisers. Counter measures should also be of national nature and not left to the whims and priorities of aerodrome licence holders.*

We would assume that this information would still be available to CAD. It is over to CAD to take the appropriate action and set priorities either through the police, if warranted, or through designated authorised personnel.

(e) *While the threat is normally of a national nature it can, in a serious situation, be manifested locally without any connection with airport activity. This creates the situation where an individual airport may be faced with the necessity of providing costly additional security measures to counter that local threat to their disadvantage and to the advantage of other and sometimes competing airports.*

This would seem to be more a police matter. It could be argued that, under "user pays", the cost should be borne where it arises. In any event, the advantage/disadvantage of airports is not a security matter.

(f) *A national system provided to protect against a national threat situation enables a national cost structure. This ensures that individual airports with smaller passenger throughput are not at a cost disadvantage over busier competing airports.*

The reverse may also be true; an airport with a smaller passenger throughput may be forced to absorb the security costs of larger airports with higher security risks. As above, the financial advantage/disadvantage of airports is not a security matter; ideally, costs should be borne where they arise.

(g) *A national system encourages consistency of procedures, practices and performance dependent upon the perceived national threat. Localised systems inevitably reflect the viability, priorities and whims of individual*

airports and their management making nationally coordinated consistent counter measures difficult if not impossible to achieve, particularly when immediate action is required.

This could be true if: common standards were not set; CAD did not monitor performance; and there were no "teeth" (financial penalties) to encourage compliance.

(h) *Staff carrying out the discharge of Government's responsibilities to security of aviation within New Zealand and contributing to the security of adjoining States through the programme should be responsible to the Minister, and have the powers and authority to discharge their own tasks and ensure that others involved discharge theirs.*

Agree. The airport company would be an approved organisation with designated persons having delegated authorities.

(i) *It is vitally important that security staff managing and carrying out front line duties have access to all relevant intelligence to ensure the level of security effort matches the threat at any given point in time and can be quickly upgraded/downgraded to meet changes in the threat. This also considerably assists job interest and motivation when staff are able to be fully informed of relevant intelligence which gives rise to changes. Sensitive intelligence detail cannot be made available to private organisations.*

Refer to (d) above.

(j) *The nature of security activities, particularly in the area of passenger screening, requires a continuous high level of motivation, skill and judgment of an instant nature. Failures rarely show up until a serious incident occurs. This makes the use of delegated tasks, with an indirect inspectorate to ensure standards, quite impractical unless constant costly supervision is maintained requiring a substantial group of inspectors. (Recent experience in Canada and the United States confirms this.)*

Agree, refer to (g) above. Transfer to airports does not necessarily mean that there is no longer supervision. This supervision will be backed up by CAD monitoring. We have not, and cannot, assume that airport staff will be lacking in motivation, be unsupervised and be untrained.

(k) *The dividing of prime aviation security tasks and responsibilities between organisations is undesirable. It inevitably leads to splintering of security operations as each organisation circumscribes as tightly as possible the limits of their own involvement rather than addressing security needs as a whole.*

Refer to (j) above.

(l) *Many tasks carried out by staff on security duties are individually mundane and repetitive. Unless a number and variety of complementary tasks are available, with duty staff being frequently rotated, motivation is impossible to maintain.*

Agree. This point was made in a UK investigation[111]. It could be that airports could offer a wider range of tasks than is possible with a stand-alone security section.

(m) *Of particular importance is the fact that while at times for short periods, because of the nature of aviation, most organisations have more staff resources available than they need, at busy periods staff of all organisations involved are heavily or totally committed to looking after their own responsibilities. Thus, while there may be times when one organisation could well undertake the work, or some of the work of another during lulls in airline activity, it is quite impractical to do so during busier periods. With respect to security activities, there is a constant basic commitment of staff resources, during peak times. At all times of heightened threat to aviation or emergency on an airport, maximum coverage is essential. In most cases all other organisations are equally heavily committed to such times.*

Possibly in most cases, but not in all cases. Airports consider that by integrating security with other functions there are considerable benefits and there is improved staff utilisation.

We have gone into some detail to answer the comments of the Chief Controller of Aviation Security for the three reasons.

- We agree with most of the issues raised, but transferring airport operational tasks to airports does not necessarily affect these issues.

- Responsibility and control through monitoring and enforcement would still lie with CAD. Transfer of the security function to airports *without controls* could result in most of his predictions coming true.

- The Chief Controller's submission is predicated on the assumption that transfer of operational tasks to the airports will automatically result in a deterioration of service. We do not agree.

[111] House of Commons, *Fourth Report from Transport* Committee (1985/86).

Conclusions and Recommendations

Although aviation security functions are currently being carried out in a most satisfactory manner by CAD, we consider the operational part of the existing aviation security branch incompatible with the future role of the aviation safety authority. Transfer to the airport authorities of aviation security tasks would permit the amalgamation of various airport activities, with fewer resources being required overall. The three international airport authorities advise they would require the equivalent of extra 45 full-time staff, a decrease of 33 on the 78 aviation security staff presently on-airport. This is a saving of $1.3M pa, not including overheads.

At Auckland, Wellington and Christchurch we recommend the transfer of airport security operational tasks to airport companies. The role of the aviation safety authority should be redefined as setting standards and monitoring their accomplishment. New regulations should contain significant financial penalties if standards are not met.

Given proper training, supervision and monitoring, we see no compelling reason why the existing level of performance should not be maintained, even during the transitional phase. We consider the monitoring role of the aviation safety authority would be enhanced through a greater degree of objectivity resulting from its independence from daily operational tasks.

11.5 LESSONS FROM THE COST-BENEFIT ANALYSES

Some important messages arise from the cost-benefit analyses.

Safety is about protecting lives and property from accidental loss or damage. Nothing is safe, in the sense there is no risk. When we talk about "increasing safety" we mean "decreasing the risk". But how much effort should we expend to decrease it? When should we stop striving to do better?

The answer is that we should stop striving for better when the value of the next increment of safety is outweighed by the cost of achieving it[112]. Our rule for determining how far to go is simply *to weigh the costs against the benefits.*

Cost-benefit analysis, as exemplified in the preceding sections, is the method of "doing the sums" when weighing the costs against the benefits. A cost-benefit *approach* is a way of *thinking* about decisions. Not all decisions warrant a full-blown cost-benefit analysis, in the sense of doing the sums. Even when the information needed to do a cost-benefit analysis is available, the decision may be insufficiently important to warrant the effort of detailed analysis.

[112] Prior to that we will have implemented many measures where the benefits outweigh the costs, *ie* where there is a positive *net* benefit. The sum of all these net benefits is the measure of achievement of the safety regulatory system.

In the present context it may seem obvious that a cost-benefit approach should always be taken to decision making. But weighing the costs and benefits is not the only way of reaching decisions. Indeed, cost-benefit thinking is often *not* the decision rule applied. Examples of other guidelines are:

- *fairness* – decisions can be motivated by the desire to treat people even-handedly;

- *consistency* – if decisions made by regulatory bodies are consistent, the regulator is better able to justify its decisions, and those being regulated are better able to anticipate the regulator's requirements;

- *conventional wisdom* – overseas experience may guide decisions since, in a small country, the regulatory agency has neither the resources nor the justification for evaluating, anew, every decision it confronts.

Weighing the costs and benefits is not necessarily in competition with these other methods of making decisions. For example, if *fairness* is interpreted as being fair to the passenger as well as to the pilot, a cost-benefit framework becomes the natural way of thinking about the decision. *Consistency* has an economic benefit in its own right, since at times it is bound to save needless waste of effort; consistency has an economic value that should be weighed in the decision[113]. *Conventional wisdom* is a valuable repository of lessons from past experience, to be drawn upon, placed in local context, and assessed in a cost-benefit manner. Cost-benefit thinking thus provides a comprehensive framework for decision making. Even when a full-blown quantitative analysis is not justified, a cost-benefit frame of mind will lead to better decisions than would be the case if other guidelines are used in its stead.

Cost-benefit thinking makes it obvious that decisions on safety measures cannot be regarded as fixed. Changing technology and management skills constantly alter the balance between the costs of safety measures and the benefits derived from them. It is not the role of this study to decree all the safety measures that should be adopted. They cannot be set in concrete. Safety measures must be constantly re-evaluated, and updated when warranted on cost-benefit grounds.

Finally, cost-benefit thinking draws attention to differences in achieved levels of safety. For example, if the design, manufacture and operation of modern passenger jets achieves a safety level of 10^{-9} fatal accidents per aircraft-hour, would it be sensible to seek a safety level of 10^{-12} for the medical fitness pilots? The thousand-fold difference would mean that out of 1000 accidents 999 would be caused by factors other than the pilots. Such an extreme emphasis on the pilots is unlikely to be justified.

[113] It is not the only economic benefit, so the decision should not solely serve consistency as an objective.

11.6 THE NEXT STEP: TOWARDS COST EFFECTIVENESS

Having considered the discretionary areas of regulation in the air transport industry, public enterprises and general aviation, and having concluded that we should apply cost-benefit analysis where market forces cannot be relied upon to achieve the optimal level of safety, it remains for us to identify the most cost-effective means of safety policy implementation.

In other words, we should now turn from the problem of balancing costs and benefits to the problem of achieving cost-effectiveness. In concrete terms this means we need to determine the most desirable organisation and responsibilities of CAD, or such other regulatory body as may be charged with the task of implementing New Zealand air safety policy.

The basic principles for the implementation phase are outlined in the next chapter.

CHAPTER 12

GENERAL PRINCIPLES

FOR A NEW CIVIL AVIATION REGULATORY SYSTEM

12.1 THE CIVIL AVIATION POWER PLAY

Chapter 5 looked at the New Zealand civil aviation system in total. It was emphasised that regulatory controls must reflect and balance the powers applied on civil aviation. It was also noted that for the commercial part of the civil aviation system, actors in the system can broadly be divided into three groups:

- actors provided with *regulatory power*,
- actors provided with *commercial power*, and
- actors, not formally part of the civil aviation system, provided with *third party power*.

The non-commercial actors (*viz* private, sport and recreational flying) can, in this context, be included in the commercial group because they are actively exercising similar privileges in the system in operating aircraft.

12.1.1 Regulatory Power

The legislators would be expected to address four major aspects.

Firstly, the legislation shall establish a framework for the total civil aviation system, define its actors and their responsibilities and provide general goals and objectives expressing the society's expectations on the system.

Secondly, the legislation should provide for the civil aviation safety authority itself. The tasks of the authority, its powers and corresponding responsibilities, and the tasks that it may further delegate should be described.

Thirdly, the Act and Regulations should, in broad but clear terms, express the flight safety requirements needed to transform Society's expectations into operational principles. These legal provisions will have to be supported by a set of technical standards. It is the technical standards that express in detail how it is possible to meet the intentions of the Act and the Regulations in order to achieve certain privileges.

Fourthly, new legislation must include some workable "teeth" for enforcement. The present inadequacy of enforcement has been one area of major concern to the industry and the authority; we strongly agree that this must be corrected.

12.1.2 Commercial Power

There are two types of actors in this area, individual persons and organisations. Basically their needs and expectations on legislation and standards are the same. They accept that there must be some minimum rules applied on the actors within the civil aviation system. The rules must be reasonable, be developed with actors' participation, and be written in a way that does not prevent improvements to the system when new proven technology or operational experience justifies a change. The actors often claim that for their own operation there is really no need for regulation. They would maintain their established standard anyway. On the other hand, the same actors express concern that without regulations, other less responsible actors would enter the market in an unscrupulous way.

It must be recognised that the commercial power in the civil aviation system has as its prime objectives to find and develop markets, provide services to satisfy these markets and, in the process, earn a return on capital employed to the benefit of shareholders and investors.

Although no serious commercial actor would openly admit it, safety requirements are sometimes seen as restrictions on the operation. An organisation under commercial pressure may try to circumvent a requirement to gain a short term advantage; sometimes by ignorance and sometimes on purpose.

In this regard there has to be a balance built into the system. Commercial powers have to come to terms with the organisation instituted to ensure the safety standard and to recognise that the standards set are for the benefit of all and not for the entertainment of a few.

12.1.3 Third Party Power

This power group consists of passengers, of other third party persons that may suffer damage from participants within the system, or of persons acting in aviation related support and pressure groups. In establishing a framework for holders of commercial and private privileges in civil aviation, the regulatory power should see as its prime responsibility the safeguarding of the interests of the fare-paying passenger and other third parties.

12.1.4 Legal Provisions To Balance Powers Within The Civil Aviation System

In order to satisfy the needs of the three groups of actors, described above, the aviation act, regulations and requirements must together provide for:

- discharge of the responsibilities undertaken by New Zealand as a Contracting State to ICAO and designate appropriate authorities;
- establishment of basic goals and objectives for the civil aviation system in New Zealand;

- establishment of a civil aviation safety authority, its objectives, powers and responsibilities, and define what tasks that may be further delegated;
- establishment of the minimum requirements for entry into the civil aviation system of individuals, organisations, systems, equipment and facilities, including provisions for vesting of privileges to individual persons and organisations;
- establishment of conditions for continued operations within the civil aviation system by persons and organisations and define their responsibilities;
- establishment of procedures for administrative and legal enforcement of requirements and conditions including suspension, limitation, and the cancellation of vested privileges as well as procedures for appeal; and
- establishment of procedures, including mandatory provisions for public comment, to facilitate change to regulations and requirements if they no longer meet their intended purpose, or when called for by industry development.

12.1.5 Delegated Authority Versus Vested Privileges

Responsibilities undertaken by a Contracting State may be discharged in various ways. Regulatory functions may be entrusted in a civil aviation safety authority. Some functions may be further delegated by the safety authority to individual persons or organisations not being part of the safety authority. Such delegation of state authority and the assignment of corresponding responsibility must be controlled by legislation. The authorised person or organisation, acting on behalf of the safety authority, must meet the same competence requirements as those imposed on the safety authority itself for the specific tasks.

There is a clear distinction between performing state functions based on delegated powers, as described above, and performing a specified role or function based on vested privileges within the civil aviation system. To make that distinction clear in this report, the word *authorised* is reserved for use as follows: *authorisations are given only to designated persons to whom any of the powers exercisable by the safety authority are delegated.* Being delegated State functions, the sole responsibility for the end result of any designee’s performance still rests with the safety authority. Therefore, the safety authority must monitor the performance of authorised persons and organisations. There must be provision to cancel a delegation at any time and without appeal.

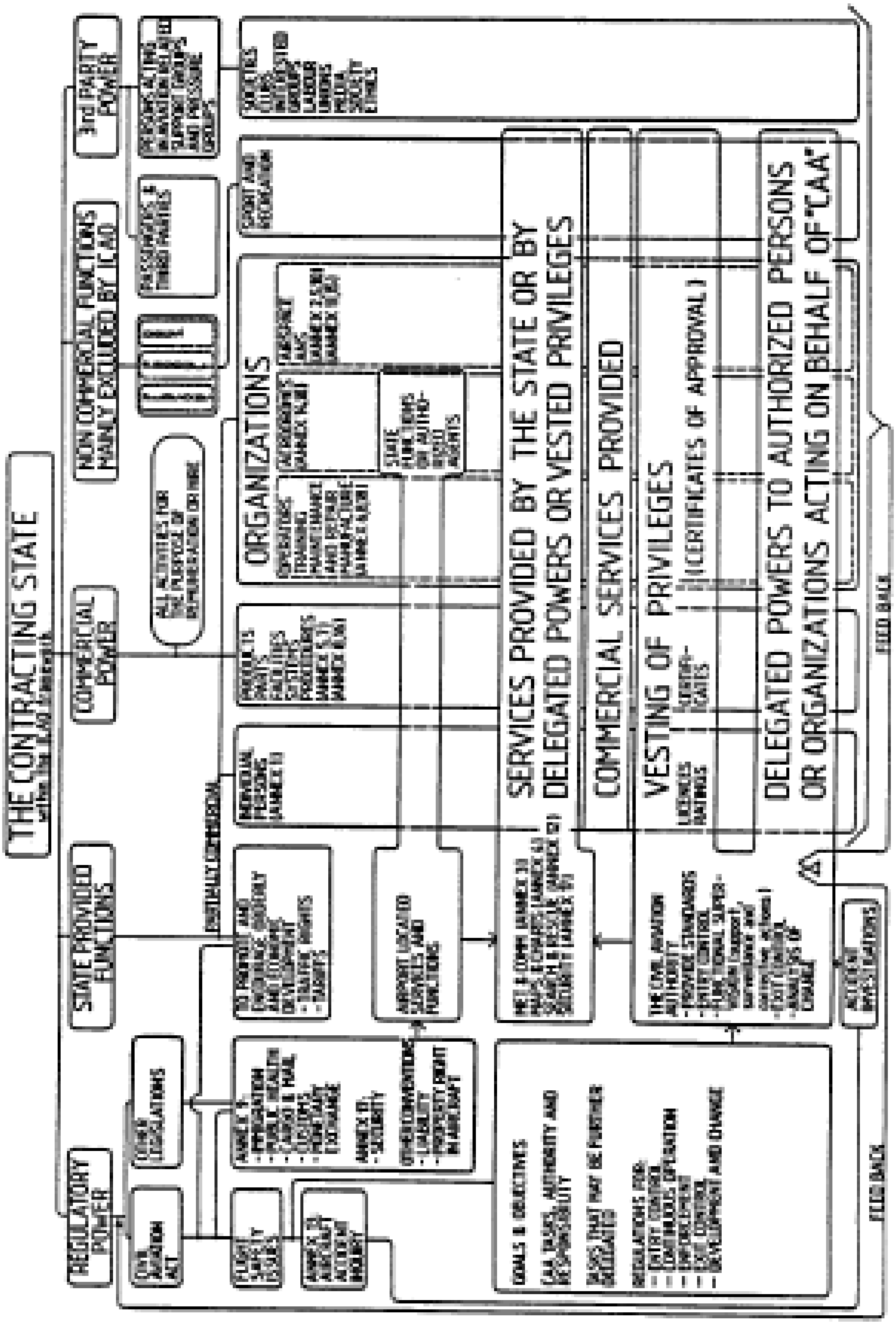
Vested privileges, on the other hand, are strictly related to licensed individual persons or approved organisations. A licence or a certificate of approval will vest a privilege to the licence or certificate holder to exercise specified functions under specified conditions. The holders of privileges will be responsible for safe conduct of their operation. This implies a responsibility to comply with any laws, regulations and standards which the Contracting State may have promulgated. It is important again to stress that all vested privileges also have corresponding responsibilities. Those operational responsibilities must not be confused with the safety authority overall responsibility to supervise and be confident that the actors, within the system, accept their responsibility and keep within the established framework of the civil aviation system.

The same individual person or organisation may well be both vested with some privileges and also designated and authorised by the safety authority to perform some State functions. These are two independent issues. It is important to make it clear to everybody involved which function the person is exercising. For example, an airline Check Captain is approved by his airline to perform pilot proficiency checks. The Check Captain is acting within the privileges vested in his employer, the airline. The same Captain may act as a Flight Examiner. This is a State function that must not be exercised unless the Captain involved is designated and authorised by the safety authority. This function is personal and has nothing to do with the airline's vested privileges or the airline itself.

12.1.6 Different Types Of Authority Functions

From the summary in Chapter 10 and the description in Appendix II of the obligations resulting from New Zealand's ratification of the Chicago Convention, and a number of other international instruments, some conclusions can be drawn on the nature of State authority functions that need to be discharged.

Figure 12.1 - The Anatomy of Civil Aviation in New Zealand



Broadly, we can divide the resulting State authority functions into three groups:

Safety related issues which are covered by the major part of the Chicago Convention, its Annexes and Procedures.

Transportation policy issues which are related to the tasks to "promote and encourage orderly and economic development of civil aviation" including the administration of domestic and international traffic rights and approval of tariffs.

Other issues which may be related to legislation other than that for civil aviation and may concern immigration, public health, customs, cargo and mail, liability, property right in aircraft, etc.

In consideration of recent and present developments in New Zealand it seems clear that transportation policy issues will receive less attention in the future at an authority level. Domestic traffic rights have been largely opened up to market forces and tariffs are subject to the Commerce Act as well as similar provisions in the ASL Act relating to pricing practices of dominant licensees. International traffic rights and tariffs are not really a civil aviation issue, but rather an issue of commerce, trade and foreign policy.

"Other issues", as specified above, will be handled more effectively and efficiently by government bodies administering the related legislation.

Against this background we consider it logical to limit the tasks of a civil aviation safety authority in New Zealand to safety related issues.

In subsequent parts of this report we talk about the "authority" or the "civil aviation safety authority" or the "safety authority". These shall be understood to mean the civil aviation *safety* authority of New Zealand.

It should be noted that parts of the safety related State functions will be carried out by the Office of Air Accident Investigation. We do not propose changes for this office other than those addressed in Chapter 13. The assignment of residual authority tasks, other than safety related, are addressed in Chapter 16.

As a summary of the foregoing discussion we refer to Figure 12.1, which illustrates the overall anatomy of civil aviation in New Zealand.

12.2 RESPONSIBILITIES FOR SAFETY

The very first issue in trying to achieve a more effective, more respected and authoritative regulatory system for civil aviation in New Zealand is to clarify and redefine the responsibilities of the actors or participants in the system.

12.2.1 General Discussion

The present system is built on the presumption that the Director of Civil Aviation (and indirectly the Minister of Civil Aviation) is responsible for civil aviation safety in New Zealand. This is an idealistic but unrealistic presumption which may stem from a time when aviation was a limited activity.

Today there is no way that the Director of Civil Aviation could carry the responsibility for control of all functions necessary for safety in civil aviation. Nevertheless the legal system requires him to do so. This has created the basis for many detailed orders and requirements. These orders and requirements are frequently disputed by the aviation community because they are thought by the operators to unnecessarily interfere with their practices and responsibilities. In acting as representatives of the Director, CAD personnel appear to feel very strongly this responsibility for safety. They are dedicated to their task and carry out the functions which the system requires of them. In turn, when the aviation community does not recognise some of these functions as being meaningful and necessary, CAD people get the blame for being “nit-pickers”; the blame should be on the system and not on the people.

We make the following proposal:

In order to make the system more effective it is necessary to establish – in top legislation – a clear cut division of responsibilities for safety between the state authority and the participants in the system. This will allow for lower order regulations and standards to recognise the responsibilities of the participants and to change the authority’s role to being one of an overview rather than being involved in operating details which should be resolved by the operators.

Incidentally, our proposal is not a new one. The following statement can be found in the “Tymms Report” from 1948[114].

> “*In general, there appears a tendency to over-regulation. This has been criticised as a device whereby officials seek to protect themselves against all contingencies. The Director of Civil Aviation is not the sole authority responsible for the safety of aviation. Everyone engaged in aviation is responsible for air safety, and the regulatory system should be such as to ensure that each carries his share of responsibility.*”

Obviously, this recommendation was never followed up by legislative action, and the problem has not been resolved by itself. As we see it as one of the keys to improved efficiency in the system, we strongly recommend that the issue now be resolved.

[114] Tymms, Sir Frederick *et al, Report of the United Kingdom Civil Aviation Mission 1948 for the Government of New Zealand,* (1984).

12.2.2 Individual Responsibility

In the civil aviation system licensed individuals play an important part. The licence has been given after the individual has passed prescribed training programmes and has shown in theoretical and practical examinations that he possesses the knowledge, skill and minimum level of experience necessary for that licence. The licence will define the privileges which are vested in the licence holder.

The legislation should make it clear that the individual is expected to carry out his privileges according to prescribed standards and to observe any limitations and conditions which may have been imposed on the licence. Failure to do so should have defined consequence. If, for instance, there is a requirement for a pilot to have a flight check every 6 months, the responsibility could be laid on him not to exercise the privileges of the licence unless the condition is fulfilled. It should not be necessary for the authority to renew the licence just as a means to check that the condition is fulfilled. If such flight checks are entered in the pilot's personal log-book (or company log system) and signed off by the check pilot, then the authority could monitor that the requirement is being met by spot-checking log books. If a non-compliance were detected, there should be defined consequences, severe enough to have corrective and preventive effects.

In summary, the system should be designed on the assumption that licensed individuals will act in a responsible way. When the opposite is proven in a particular case the reaction should be prompt, firm and adequate.

12.2.3 Responsibility Of Operating Organisations

Separation of Operating Functions from Regulatory Functions

As discussed in Chapter 2, we can view the operating organisations within the civil aviation system as falling into three major categories:

- *aircraft operators and related services*, including airlines, other air transport operators, aerial work operators, flying schools, maintenance organisations, design and manufacturing organisations, suppliers, etc;

- *providers of airways services*, including air traffic control, flight information and alerting services, communication and navigation services, meteorological services, aeronautical information services, search and rescue; and

- *providers of aerodromes with associated ground aids.*

Irrespective of whether one or more of these functions are provided by the state, it is useful to make a clear distinction, legally and in organisational terms, between providing an operational function and exercising the state's regulatory role.

In New Zealand steps have been taken to separate provider functions from the regulatory authority by creating the Airways Corporation and independent airport companies.

For the sake of this discussion we shall consider a future situation in which all provider functions have been taken out of the CAD. We assume, and we recommend, that such a process continues.

It will not matter for the principles of responsibility whether an operating function is carried out by a private company, a state-owned enterprise or by a state agency other than the CAD. The main issue is to keep the regulatory authority clean of operational functions. Only then can the roles of the regulator and the provider be clear, and the authority functions optimised.

Internal Quality Assurance within an Approved Organisation

For each organisation there will be a set of authority requirements, stemming from the principal civil aviation Act, Regulations and aviation standards which are applicable to the operation either generally or as a condition for the certificate of approval. Together these requirements form the minimum requirements for the operation. On top of these minimum requirements the organisation will, in most cases, formulate internal, additional requirements needed to meet particular safety and business objectives. The sum of all requirements will be internally promulgated by the organisation in its system of manuals[115]. The manual system shall govern the performance of all the organisation's personnel, and will be the reference for evaluating performance by the organisation and the authority.

The responsibility to ensure that operations are carried out according to the defined performance standards must rest with the approved organisation. We propose that this be clearly spelt out in top legislation.

To carry out this performance an approved organisation must be able to measure its performance against the standards. A quality system is an important tool to discharge this responsibility.

The following quote from the introduction to International Standard ISO 9000:1987(E), *Quality management and quality assurance standards. Guidelines for selection and use*, best explains quality systems:

> A principal factor in the performance of an organisation is the quality of its products or services. There is a world-wide trend towards more stringent customer expectations with regard to quality. Accompanying this trend has been a growing realisation that continual improvements in quality are often necessary to achieve and sustain good economic performance.
>
> Most organisations – industrial, commercial or governmental – produce a product or service intended to satisfy a user's needs or requirements. Such requirements are often incorporated in "specifications". However, technical specifications may not in themselves guarantee that a customer's requirements will be consistently met, if there happen to be any deficiencies in the specifications or in the organisational system to design and produce the product or service. Consequently, this has led to the development of quality system standards and guidelines that complement relevant product or service requirements given in the technical specifications. The series of

[115] Depending on the scope and size of the operation, the manual system may contain all or some of the following types of manuals: Policy and Organisation Manual, Flight Operations Manual, Engineering Procedures Manual, Maintenance Manual, Workshop Manual, Aircraft Flight Manual, Minimum Equipment List, Route Manual, Station Manual, *etc*.

> International Standards (SO 9000 to ISO 9004 inclusive) embodies a rationalisation of the many and various national approaches in this sphere.
>
> The quality system of an organisation is influenced by the objectives of the organisation, by the product service and by the practices specific to the organisation, and, therefore, the quality system varies from one organisation to another.

The same publication makes the following definitions:

> *quality management:* That aspect of the overall management function that determines and implements the quality policy.
>
> *quality system:* The organisational structure, responsibilities, procedures, processes and resources for implementing quality management.
>
> *quality control:* The operational techniques and activities that are used to fulfil requirements for quality.
>
> *quality assurance:* All those planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality.

In this context quality means that a product or service is documented to conform to specified requirements. On the basis of this internationally agreed standard the responsibility of an approved organisation can be expressed in the following way:

> *Each approved organisation has the responsibility to ensure that its operation is planned, organised, carried out, maintained, developed and documented according to applicable authority regulations, standards and operating specifications, as well as to meet the organisation's internal standards and objectives.*

It is required that an approved organisation maintains internal quality assurance to provide confidence to its management that the intended quality is being achieved. For this to be possible the organisation will have to:

- first, establish goals and objectives for the operation including safety standards equal to or above the level prescribed by the authority;
- second, establish internal responsibilities, allocate resources and define organisation and work processes suitable to enable the organisation to meet established objectives and standards;
- check that objectives and safety standards are being achieved;
- register and document deviations from standards and objectives, analyse and evaluate the deviations and institute corrective action; and
- analyse the consequences of experience trends and, if appropriate, make the necessary adjustments in the first two areas above.

The complexity of the tasks defined above will vary with the size and the complexity of the organisation concerned. It is essential, however, that a small organisation also considers the issues involved and meets the intents of the provisions.

The Manual System of an Approved Organisation

The manual system is the tool for an approved organisation to convey and document the message to its personnel as to how the operations are to be performed. The manual system is also a means by which the safety authority can determine how the organisation is intended to operate.

The present procedure in New Zealand is that the manuals are in most cases actually *approved* by the CAD as a condition for issuing an air service certificate and other approvals. All changes to the approved manual have also to be approved by the CAD before being put into practice. This time-consuming task has tended to become a bottleneck for the CAD to respond to operators' needs for change.

We propose that the procedure should be changed in the following way to fully recognise the responsibility of the approved organisations:

- For a new entrant into the system the manual should be carefully reviewed by the CAD and, if satisfactory, *accepted* (not "approved") as the basis for issuing the particular certificate or approval.
- For any subsequent amendment, within its current category of operations, the approved organisation should be required to submit a copy of the revision to the safety authority, highlighting the changes made. The approved organisation should assume full responsibility to ensure that amendments comply with minimum authority requirements and this should be expressly confirmed in the submittal. Thus the authority should not issue an approval for subsequent amendments within an organisation's current category of operations.
- The authority should have the right, at any time, to require changes in a manual when provisions are found to violate minimum requirements or otherwise allow unsafe procedures.
- Upgrading of an existing operation into a new category of operation should be handled as if it were an approval of a new entrant into the system.
- Where the approved organisation would find it necessary to depart from existing rules or standards there should be a formal process for considering possible exemptions. No exemptions should be allowed outside the formal procedure and exemptions should be given in writing only.

The general requirement on any operating manual must be that it provides an adequate tool for management to control all aspects of its field of operation and provides the necessary guidance to its staff. To eliminate authority approval of the manual will make it absolutely clear that the approved organisation is entirely responsible for its contents, and that it is produced to suit the operator rather than to please the authority.

This does not imply that the authority should not have the right to interfere when there is a good case to do so. Interference would not be on a routine basis, however, but rather as a consequence of a problem having been detected through an audit, an occurrence or a spot-check. As a consequence of this approach, there would be no bottleneck within the authority, preventing approved organisations from making changes within the limitations imposed by their certificates of approval.

For this approach to be workable it is necessary that standards are laid down for what should be the appropriate contents of an operator's manual. For international civil aviation, ICAO Annex 6 provides these standards in terms of a list of contents to be covered. We propose that the safety authority should consult with representatives of each sector of the industry and define the appropriate list of contents for an operator's manual suitable to each sector. In all cases the following criteria should apply:

- the manual must provide adequate instructions and information for the operator's personnel to carry out their functions and to take their individual responsibilities for all operations within the operator's certificate or approval; and
- the manual must reflect and describe the system for internal quality assurance laid down by the operator according to principles described in Section 12.2.3 of this report.

It is obvious that for a very small operator with a limited and uncomplicated scope of operation, the operator's manual could be quite a simple and small document. Nevertheless the basic criteria should apply.

There will still be a need for authority approval of principles and methods used by an operator for developing certain parts of the manual. Approving such principles and methods is quite a different task from actually approving the resulting contents of the manual. No operation should be allowed by the operator unless covered by the manual. For instance, if a small helicopter operator who has started out by moving people between A and B in an undemanding environment now gains a contract to move heavy external loads in a tough environment, this involves quite different conditions. There will be a need for different pilot instructions and most likely also different maintenance procedures. Consequently, the new operation should not be allowed to start until the operator has appraised himself of the operational requirements and documented the new procedures in the manual.

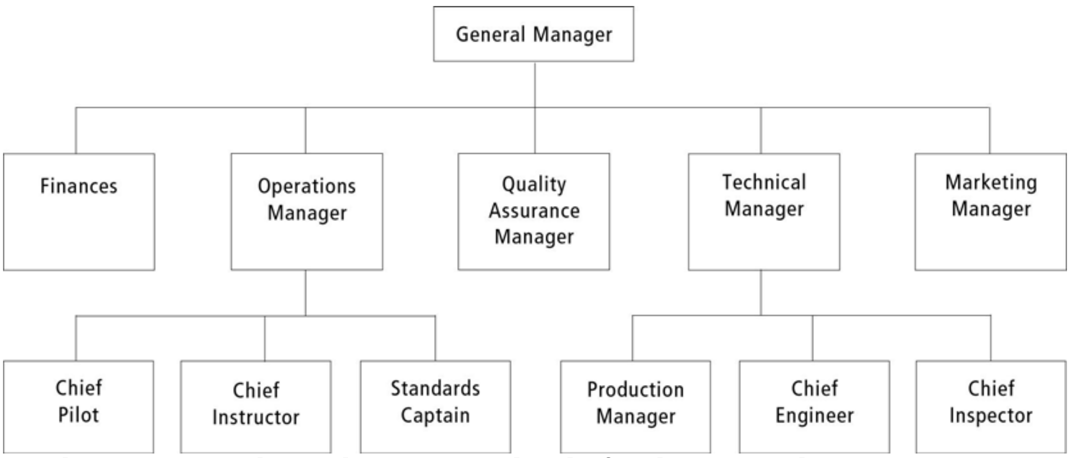
Operator's Organisation and Personnel: Level of Authority Intervention

With the recognition of operator responsibility there will follow a need for review of the present level of authority intervention in terms of approving the operator's organisation and personnel. A characteristic of the present system is that there is a high degree of authority intervention in terms of approving people on lower levels within an operator's organisation. As an example, there are some 50 persons approved or authorised or both within Air New Zealand's flight training organisation. There is also a list of 94 different privileges which can be held by these instructors or examiners. Such an arrangement does not fit very well into a philosophy of recognising operator responsibility.

Nevertheless, for the safety authority to be satisfied that the operator has the necessary competence and organisational structure to discharge its responsibilities the authority will need to have an involvement. This involvement should be limited to the organisational structure and senior levels of personnel selection. The level and the detail of authority involvement may well differ between the main categories of operators.

Considering *aircraft operators*, and starting at the small end of the system: the case of one owner-pilot, one aircraft, one maintenance engineer, is straightforward. The engineer must have a licence valid for that aircraft and he must have the necessary technical facilities. The owner-pilot must have a valid commercial pilot-licence, properly rated. But in addition to that, the safety authority has to ensure that the owner-pilot has sufficient experience to be entrusted with his own air service certificate. Whilst it will be possible to define some very crude levels of experience as conditions for acceptability, there will always be a need for an element of personal judgment and flexibility.

On the other hand, in an airline of some size, we would probably find something like the following structure:



In this situation, what is the necessary level of authority involvement in setting up this organisatio

It could be argued that it would be acceptable and sufficient to scrutinise the General Manager and give him full responsibility to take all decisions with respect to organisation and staffing without reference to the authority. We consider it would be outside the competence of a safety authority to judge the qualifications of a General Manager. A person can be a competent general manager of an airline without necessarily being familiar with the operational and technical aspects of the business. If the general manager is an aviation enthusiast who thinks he “knows all about aviation”, but is actually a bad manager, the potential problems from a safety viewpoint may be worse than no knowledge at all. Knowledge about aviation is not the sole criterion.

If the manager is diligent and recognises his own limitations he will hire well qualified people as the operations manager and the technical manager and give them full authority within their fields of competence. He will also respect their decisions and judgments. If, however, the general manager is not seriously interested in aviation, perhaps entering the business to make “quick and easy money”, he may not be interested in having strong and competent managers below him. Instead he may prefer rather weak managers who could be persuaded to cut corners to satisfy short term commercial interests.

There may also be situations when a diligent general manager finds it impossible to keep or recruit a qualified operations or technical manager. The commercial or financial pressure to cut corners might be irresistible, if there is no safeguard through authority involvement.

Authority involvement is needed at the level of operations manager and technical manager. These persons should be accepted by the authority and named in the operations specification. Any change of personnel at this level needs acceptance by the authority by way of an amendment to the operations specification. Acceptance would be based upon qualities specified in regulations and supported by guidelines established by the authority.

For levels below operations and technical managers, the needs for authority involvement and acceptance depend on the privileges of the operator and the degree to which these privileges are tied to specific individuals.

If an operator runs an approved training programme for pilots, the chief instruction needs to be named in the approval as being responsible within the airline for its approved training organisation.

If the company is big enough to have an engineering department and related privileges, these privileges will depend on special competencies offered by a chief engineer (but not necessarily the technical manager). In such a case the chief engineer will have to be recognised and named in the authority approval.

If the operator has a chief inspector in the technical area, this provides the operator with additional privileges which are tied to the personal qualifications and experience of the chief inspector. Therefore, the chief inspector will also have to be recognised and named in the approval.

Beyond this level we believe that the safety authority should not intervene in the operator's selection of personnel, unless there are very clear reasons.

In a major airline the same principles would apply, although the organisation might be much more complex. It would be expected – and it should be a requirement – that a major airline will have an independent quality assurance or quality audit function reporting to the chief executive and covering both the technical and flight operations areas. The person in charge of such a function should have the backing of the authority's acceptance, in order to have sufficient standing in the organisation to be carefully listened to and *to ensure that he cannot be removed without the knowledge of the authority.*

There are thus some basic organisational principles to be laid down in regulations as a basis for acceptability of air service operators.

- There shall be a general manager responsible for ensuring that resources allocated to the operational and technical managers are commensurate with the business objectives and the undertakings of the company.

- There shall be a flight operations manager and a technical manager, both reporting directly to the general manager and each responsible within his area for carrying out all functions in accordance with the law, regulations and applicable standards. They shall also be responsible for close coordination of operational and technical matters.
- If there is a separate quality assurance function this function shall report directly to the general manager, independent quality assurance functions should be mandatory in major organisations.
- Combinations of functions could be allowed in small organisations; if the technical function is to be provided from a contractor then a person in that organisation shall be identified as technical manager for the operator.
- An approved organisation must have tasks and responsibilities clearly defined, and these must be free of ambiguities.

We have now addressed the necessary degree of authority intervention in an air operator's organisation and personnel selection. The level of control described above is a necessary condition for the authority to take a more "arms length" approach to watching day to day operations. This approach will need much less resource input from the authority than today's system but will, in some areas, require a higher level of competence. Since decisions needed from the authority will be less frequent, decisions might well be taken on a higher level in the organisation than today, and this may contribute to increased consistency.

For completeness, we should now also consider approved organisations other than air operators.

For technical organisations, such as maintenance organisations, design organisations and manufacturers, the same logic applies with appropriate adjustments.

In the new environment of providing airways services through a state-owned enterprise, the situation has not yet occurred when matters of organisation and personnel selection have been an issue between the safety authority and the providing organisation.

It will be seen in Chapter 13 that the Airways Corporation has a desire not only to be treated as an approved organisation but also to be an organisation *authorised* to perform state functions by delegation from the safety authority. In fact, a number of such delegations have already been given to the Corporation without any reference to individual persons. This seems to be contrary to all other delegations, which have always been made to people. The legal background for this differentiation is not clear to us.

We recognise that all problems associated with the separation of Airways Corporation from CAD have not yet had time to be resolved. In the long run, however, the Airways Corporation will have to be treated on the same basis as other approved organisations. This means that key positions, requiring appropriate competence and having a direct impact on the safety of the operation, will have to be manned in occurrence with the safety authority.

It must also be recognised that some areas of service provided by the Airways Corporation are contestable. There are clear signs that some airports intend to contest these areas and set up their own services. To provide for this the safety authority will have to define standards for organisation and define competence levels as conditions for issuing certificates of approval.

The same principles will have to apply to licensing of the new airport companies now under creation, as far as safety related functions are concerned.

CHAPTER 13

ROLE AND FUNCTIONS OF THE CIVIL AVIATION SAFETY AUTHORITY

13.1 THE LIFE CYCLE APPROACH

To work efficiently and safely the civil aviation system needs requirements for::

- *entering* the system,
- *continued operation* in the system, and
- *leaving* (or being forced out of) the system,

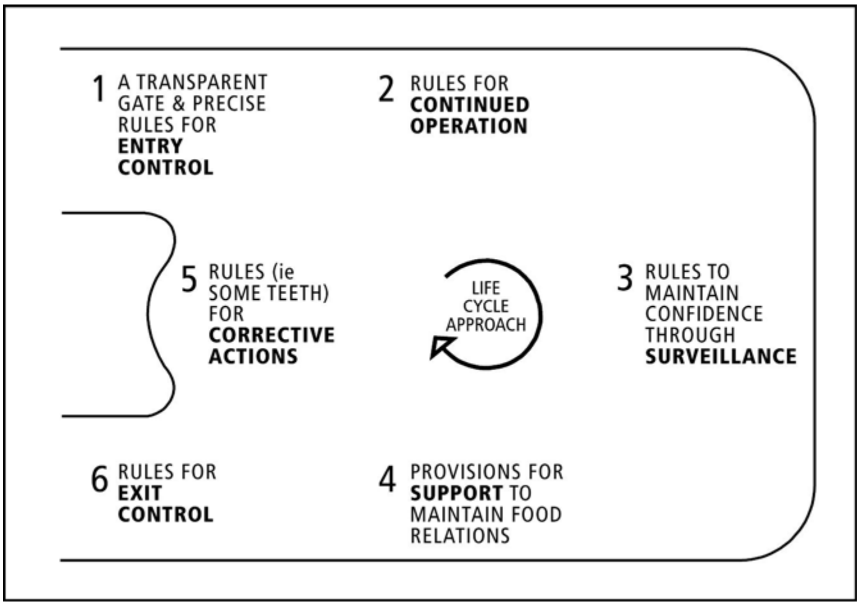
covering individuals, organisations, systems, procedures, equipment and facilities.

Based on the principles of Chapter 12, the civil aviation safety authority should be responsible for:

- providing *standards*,
- exercising *entry control*
  (by licensing, approving or certificating new entrants),
- performing *functional supervision*
  (by surveillance, support and corrective actions),
- exercising *exit control*
  (by limitations, suspensions or cancellations of licences, approvals or certificates), and
- undertaking *analysis of change*
  (to respond to changes in environment, technology and experience).

We term this safety authority involvement in civil aviation the "life cycle approach". It highlights the dynamic environment of civil aviation. Figure 13.1 illustrates the concept, and the following sections describe its constituent parts.

Figure 13.1 - The Life Cycle Approach to Regulating Civil Aviation



13.2 STANDARDS DEVELOPMENT

Current Problems: Revision of the Act and Regulations

Industry and CAD agree that the present regulatory situation is most unsatisfactory. Problems stem from the:

- Civil Aviation Act's lack of principles and objectives and inadequate definition of CAD's role;
- Civil Aviation Regulations' outdated contents and structure; and
- proliferation of third level requirements (safety orders, instructions, *etc*).

Third level requirements issued by the Director of Civil Aviation are controversial. Part of the problem stems from inadequacies in the Regulations. Amending the Regulations has been much too slow. Some changes have been stalled for years, apparently due to lack of priority in the legislative programme, a matter beyond the control of CAD.

Over the years, Directors of Civil Aviation have tried to solve problems by issuing third level requirements, when it would have been far better to have amended the Regulations. Some third level requirements lack the support of the Act and Regulations and are impossible to enforce, even though they make sense from a technical point of view.

Consequently there is:

- general disrespect for third level requirements, *and* the Regulations;
- continuous argument between the CAD and the industry, about interpretation and validity of requirements;

- preoccupation with legal matters; and
- use of the courts to determine technical and operational matters that ought to be resolved in a co-operative spirit.

The overall regulatory framework needs total overhaul. This must start from the top, with the Act and Regulations. Chapter 14 presents our analysis and proposals.

Standards should be client-oriented. Each group of users should have its own set of standards, and not be loaded with extraneous requirements relating to others. A computer-based system could provide each user with all documentation relevant to him.

Although Regulations should be long term in character and not require frequent updating, there should be regular reviews, every two years say, in order not to accumulate inadequacies that could cause problems for the industry.

Third Level Requirements

We have received submissions that *all* safety requirements should be found in the Act and the Regulations. We agree that all major principles and provisions of a *legal* nature should be in the Act or Regulations. We do not agree with those submissions proposing there should be *no* third level requirements left to the Director to decide.

Technical standards can never be set once and for all. In the interest of industry efficiency, technical standards must adapt to change. The present Regulations illustrate what happens when detailed technical matters are regulated at too high a legislative level. Adaptation proves difficult and time consuming, so that detailed technical requirements soon become hopelessly out of date. Consider three examples.

- Aircraft certification is based on detailed and comprehensive national airworthiness codes. Codes of foreign origin need to be defined in the national "airworthiness standard". The contents have great volumes, are very detailed, and are subject to continuous change.
- Through technical development, extended-range operation of large twin-engine jet aircraft is now possible. To benefit from this, detailed technical and operational requirements are needed to maintain safety levels.
- Curricula, training processes, training aids and examination tests have to be defined for personnel licensing. Detailed specifications for flight simulators have been developed internationally to provide for type-training with zero flight time in the actual aircraft. Such standards must be promulgated by individual States before airlines can take full advantage of modern training techniques.

These examples illustrate levels of technical detail quite unsuitable for higher level legislation. The Director of Civil Aviation should set such technical standards. Such technical standards should not be part of the law; they should be conditions to be met by an applicant vested with certain privileges (licences, certificates of approval, certificates of airworthiness, *etc*). Non-adherence should not be a criminal offence; it is non-compliance with the conditions of vested privileges, and is subject to corrective action as discussed in Section 13.4.3.

Consultation

It appears that one of the reasons for opposition to third level requirements is that, in earlier days, the system was misused by CAD. "Surprise" orders and requirements were dropped on the industry without proper notice and consultation. When proper consultation has taken place, as has been the case for the new system of licensing engineers, industry reaction has been positive.

Provision for consultation, and prescribed lead times for new standards to become effective, should be contained in the Act.

Provision for consultation would not, however, diminish the safety authority's responsibility for making final decisions. The Director must retain the right to issue emergency directives without consultation, when delay would be inappropriate for safety reasons.

Conclusion

The civil aviation safety authority has a major task ahead, preparing technical input for a new set of Regulations and for development and maintenance of detailed technical standards.

A cost-benefit approach (as described in Chapter 11) should guide decision making. The safety authority should ensure industry input through a consultative process, preferably by securing active industry participation in project teams.

13.2 ENTRY CONTROL

Before any privilege is vested, the person or organisation concerned must undergo an entry control. The safety authority bears the responsibility of determining whether an applicant meets the minimum requirements for entry.

The minimum requirements for entry laid down in the regulations must be clear and precise. Otherwise the responsibility imposed on the safety authority will be unclear and its decisions hard to defend.

Entry control is effected by issuing:

- *licences and ratings* vesting specified privileges on individuals accepting corresponding responsibilities;
- *certificates of approval* vesting specified privileges on organisations accepting correspondence responsibilities.

  Subject to conditions specified at entry, an approved organisation may "approve" employed persons (licensed or not) to exercise functions within the organisation, including signing of specified releases or approvals on behalf of the organisation.

- *certificates* issued to an applicant for services, products, parts, facilities, systems or procedures meeting specified minimum requirements. The system must be designed to cater for these services, products, parts, *etc* during their total life cycle.

Entry control is the time to identify the persons responsible in the applicant's organisation and to establish what they should do, as a minimum, to fulfil their responsibilities.

A "first time" entry control, with a previously unknown organisation, has to rely upon an on-paper evaluation of the capabilities of the applicant. If uncertainty remains, notwithstanding that requirements appear to be met on-paper, the property approach is to accept entry, but to limit the Certificate of Approval to a short period of time, say 3-6 months. During this period, supervision by the safety authority should be intense. It is for the new operator to prove his performance so that, with growing confidence, the safety authority can relax its supervision.

A change by an operator to an approved system that cannot be handled in accordance with previously approved procedures, is a *major change* and requires a new entry control.

Turning to the question of terminating versus non-terminating certificates of approval, from the safety authority's point of view it is easier to have the applicant prove his case for renewal of an expiring approval than it is to revoke a non-terminating approval based on evidence of misconduct. From the operator's point of view, it is better for long term planning and the image of the company to have a non-terminating certificate of approval.

On balance, we propose that no organisation be issued with a non-terminating certificate of approval. The duration of validity could be 3-6 months at start-up of an activity, but up to five years for a well-established operation. After five years so much will have happened within the industry that it is reasonable to conduct a reassessment in the form of new entry control. That will keep the safety authority and the operators "on their toes".

The safety authority should have a strict entry control philosophy. An applicant should not be accepted until he has proved his case. Either the operator is ready for entry or he is not. The cost of "getting ready" is an investment just as necessary as buying an aircraft.

13.4 FUNCTIONAL SUPERVISION

The licensed individuals and approved organisations must carry the primary responsibility for their own performance. To meet international obligations, the ICAO Contracting State must exercise a continuing measure of control. Functional supervision is a necessary task of the safety authority, comprising three types of function:

- *surveillance*, by continuous monitoring of safety performance;
- *support*, by providing information and advice (but not "consulting" services); and
- *corrective actions*, in the form of administrative and legal measures to ensure adherence to established requirements.

13.4.1 Surveillance

Surveillance is the safety authority's primary tool for actioning its responsibility to ensure that participants in the system perform according to the standards set.

Monitoring of safety performance can be done in many ways. Take an example of superficial monitoring.

> Spot checking hardware, the inspector finds that the fire extinguisher in one of the operator's aircraft is, according to the label, overdue for its periodic check. The inspector notifies the operator and orders him to do the check. The operator carries out the instruction, and the case is closed.

Unfortunately, the value of this type of action is close to zero. The inspector would bring back no information to the safety authority about the operator's *systems* performance. The more effective approach would be to start asking questions:

Was any staff member of the operator aware of the defect?

If "no", is a check on the fire extinguisher included in the maintenance requirements:

If "yes", why was the check not done? How about other aircraft?

Is it an isolated event? Are other maintenance requirements omitted?

If so, why? Lack of spares, time, manpower, or just ignorance?

Is the management aware of this?

Has any decision been taken to correct the situation?

Is that decision evident in any documentation?

In other than isolated events it is possible to track a small defect back to management. Management may be aware of the situation but may have stalled the decision process because of lack of resources (including lack of time), lack of interest or biased priorities. The safety authority inspector must have the skill to evaluate the truth, and bring back to the safety authority an assessment of management's ability to discharge its vested privileges and responsibilities.

The safety authority *must be confident* an operator:

- is aware of the requirements;
- is in full control of what is happening inside its operation;
- has a reasonable internal decision-making process;

- has adequate resources; and
- is performing satisfactorily overall.

The methods used by the safety authority to obtain this confidence may vary from time to time and between different participants in the civil aviation system. The safety authority "tool-box" may include audits, inspections, spot checks, periodical meetings with management of the operator, collection and analysis of selected data, route inspections, check flights, or simply talking to people within the system. Whatever methods are used, any defect found must be traced back to the *system* involved. The inspectors should look for symptoms of defects in the operator's management system and be particularly aware of any inconsistency in the decision making process and of any signs that management is not in control of what is actually happening. This is what the surveillance process must pick up; not stop at the overdue fire extinguisher!

The basis for all surveillance should be the operator's system of manuals, and his certificate of approval with its associated operations specifications. By definition, all high-order standards, regulations and laws, should be reflected in the manual system, but surveillance must be able to distinguish whether a deviation found constitutes a departure from safety authority requirements or from company requirements; the corrective actions will differ.

The safety authority should perform is surveillance with reference to the company's manual system because the company manual defines the standards of performance decided by management. The standards will be a combination of minimum safety authority requirements and additional company provisions. The personnel of the company may not necessarily be aware of whether a certain provision stems from the authority or from the company; they are required to follow the manual.

Any sign that company personnel and procedures deviate form the provisions of the manuals is an indication that management does not have sufficient control of its operation. And this situation is unacceptable from a safety point of view.

13.4.2 Support

The safety authority can support participants by providing information and advice.

Information includes clarification of the objectives and policies of requirements, passing on knowledge about aviation development, and distributing information about accidents, incidents and technical malfunctions, and their trends. The private pilot and the major airline obviously have different information needs. The airline might satisfy most of its information requirements through its own channels. The private pilot is in a completely different situation. Unless he belongs to a supporting organisation such as an aero club, his only source of information might be information mailed to him as the holder of a licence. Recognising that systematic surveillance may be impracticable, provision of information is one of the safety authority's best tools for promoting safety amongst private pilots.

The provision of safety information will therefore continue to be an important function for the safety authority. Information should be structured to suit main user groups.

Advice includes giving interpretations on regulations and standards. However well formulated a requirement may be, there will always be a need for interpretative advice from time to time.

The safety authority has a good overview of the participants in the system. A safety authority representative may, during a visit to an operator, find a problem which is outside the scope of that particular operator's capability to rectify. This could be an engineering task, or development of a new operational procedure for which the operator does not have the competence. Nothing need prevent the safety authority representative from advising the operator about various sources that could be capable of giving him assistance. The safety authority representative must be careful, though, not to indicate any commercial preference, or to participate in the operator's decision making.

When providing support, and especially advice, it is essential to address the borderline between advice and consultation. *Any advice that could be interpreted as involving the operator's internal decision making would be inappropriate.* This is especially true if the decision taken by the operator is later subject to safety authority approval. Two examples illustrate the traps to which safety authority personnel should be alert.

> If an airworthiness surveyor travels overseas to help an operator select a used aircraft; he places pressure on the safety authority to issue a Certificate of Airworthiness and accept that aircraft into the system.
>
> If an operator who is short of training staff is helped with type training of pilots by a safety authority inspector, the inspector puts pressure on the safety authority to issue the type rating.

Anything that blurs the division of responsibility between the operator and the safety authority must be handled appropriately. If anything goes wrong, the operator may have an excuse for not taking responsibility for his own actions, and the safety authority might be held liable for the damage that occurred.

Another important aspect is safety authority resources. Based on the provision in the Act that the Ministry of Transport shall "promote and encourage the orderly and economic development of civil aviation", the present CAD role includes consultative support to industry. This was probably the right approach in the early days of aviation. Today, when most of the provider functions have been or are being taken out of CAD, the provision is no longer appropriate. In any case it should not be the task of a purely *safety* authority.

The basic objective is to foster industry so it stands on its own feet. The safety authority must withdraw from providing consultancy services. It has been claimed that, during a transition period, it might be necessary to provide consultancy in areas where CAD presently is the holder of unique competence. But even this would be questionable from the viewpoint of distribution of responsibility. The "consultants" would have to be kept apart from the safety authority supervisory team, leaving the safety authority function without (or with less) expertise in the areas concerned.

The industry should set up programmes to overcome the transition period. It is probably that a new market will be established for providing the services concerned on a commercial basis – where CAD has, in the past, provided them free of charge.

13.4.3 Corrective Actions

When a licence or a certificate holder has been found not to comply with the conditions of his privileges, *the main objective of corrective action is to bring performance back within the prescribed framework.*

In the case of an *individual licence holder* having made a mistake or committed a minor transgression, the first action should be to make the person aware of the mistake and provide explanatory information and advice. If the occurrence indicates major inadequacies in terms of knowledge and skill, there should be provision for a re-examination or a practical (*eg* flight) check. The licence holder should be given reasonable time for re-training before the checks are made, because the objective is to establish that he is fit to be in the system, not to "catch" him. If, however, the licence holder demonstrates that he cannot be trusted with a licence, it has to be suspended or cancelled.

Only in the very rare cases of careless, reckless and dangerous exercise of privileges or wilful transgressions of the limits of privileges, should the matter be treated as a criminal offence.

In the case of an *organisation holding a certificate of approval* the following may apply:

- If it has been found by the operator or by safety authority surveillance that part of the operation is not conforming to standards laid down in the operator's manual system, immediate corrective action is needed.
- If the deviation is found to violate safety authority requirements, the only option is to bring the operation back within prescribed limits.
- If the deviation involves non-adherence with company requirements, correction is still needed but the operator has two options. He can either decide to force the operations back to company standards, or he can decide to change the standards if that seems to be a realistic and defensible approach. Whatever corrective action is taken, implementation may involve some time. for this, a programme of change is needed, with defined time limits. This "change programme" then becomes part of the system, and the operation would immediately be back in order.

The general approach of the safety authority should be to maintain constructive dialogue with approved organisations to bring about corrective action in a co-operative spirit rather than by confrontation.

When a situation is found to be unacceptable, however, the safety authority must have means to take quick action to limit, suspend or cancel the privileges of the certificate holder. Such action can be temporary, pending corrective measures, or permanent, if no improvement can be expected. The legal provisions for such corrective means are discussed in Chapter 14.

It could be argued that a system of *civil* penalties should be instituted as a complementary means of enforcement, in addition to administrative measures affecting licences and certificates[116]. Civil fines, similar to those introduced within the road transport sector in New Zealand, might be appropriate[117]. The levels of these finds should be linked to the operator's production value in such a way that it really affects him. For example, a fine could be related to the seating capacity and the number of times the aircraft was used in an un-airworthy condition. Hundreds of dollars does not have any preventive effect if millions of dollars are at stake.

For an organisation with vested privileges and responsibilities, the holder of the Certificate of Approval should be the prime subject held responsible, even though an employee (who may have even been licensed) was at fault. The rationale behind this approach is that *management should be forced to take full control of, and responsibility for, what is going on in the approved organisation.* This is a basic principle, and has to be supported by the Act.

There are important consequences of this approach. An approved organisation may employ a number of licensed pilots and engineers, *etc.* These people have vested privileges and responsibilities tied to their individual licences. When they perform functions within that approved organisation, the rules laid down in the operations manual, maintenance manual, *etc* take precedence over any personal privilege vested in the licence. For example, if the minimum flight altitude in the operations manual is set to 2000 feet, a pilot in commence in that company cannot, one day, choose to fly at 500 feet, even though that might be within the minimum requirements of the privileges of his licence. By flying below 2000 feet he would violate the conditions for the company approval. Such a case should primarily be policed by the company; but there may need to be a legal requirement on a licensed person to adhere to company requirements when working in an approved organisation.

13.5 EXIT CONTROL

The civil aviation system is a closed sector within society. It is closed because the public feels that aviation involves potential risk to passengers and to other third parties, on the ground. It has been explained that entry control for admission to

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[116] It must still be possible to prosecute an individual person if an operation is carried out in such a manner "as to be the cause of severe danger to any person or property". Bringing the case to court, however, should be limited to *severe* offences against the basic rules and regulations.

[117] The money from such fines could be collected by the safety authority and kept within the civil aviation system. A fund might be created to support development in critical safety areas or special programmes – for "establishment and award, emoluments, and tenure of scholarships or fellowships relating to aeronautical research or other matters of benefit to civil aviation" as mentioned in the Act. we do not submit a definitive proposal on the concept of civil fines; the possibilities for such a concept would need to be evaluated by legal expertise in New Zealand if the concept is considered to be desirable in principle.

the system is by way of licences, certificates of approval and certificates. “Exit controls” also are required for licence or certificate holders leaving the system.

Individual persons, performing within the scope of their licences in a responsible manner, may stay in the system as long as they maintain their knowledge, skill, experience, are medically fit and are within prescribed age limits. The only exit control required is connected with enforcement actions if the licence has to be suspended or cancelled.

Within the time limits of the certificate, an organisation holding a certificate of approval may retain its privileges so long as its operation is carried out within the conditions of its certificate and as specified in its manual system.

Provisions are needed to prevent transfer of privileges unless the safety authority has been informed, and has established that no change to approved conditions will take place. Otherwise, entry control is necessary. Under the present regulations, an air service certificate and an airways services certificate shall not be transferred except with the written consent of the Director. There are no similar provisions to prevent an approved aerodrome, training organisation, flying school, design, construction, maintenance, processing, and supply organisations from transferring privileges. This inconsistency should be removed in the proposed legislation. As another safeguard, no non-terminating approvals should be issued.

The most complicated area is the one of certificates for products, parts, facilities, systems or procedures. The holders of such certificates have certain responsibilities and they cannot simply disappear out of the system without certain provisions.

The first area of concern is the register of aircraft. Under the present Regulations, any person being a British subject may be the owner of a New Zealand registered aircraft. The operator of the same aircraft may be a completely different person or organisation. No information is kept in the register about the operator’s whereabouts. It is almost impossible to ensure that the operator receives important information pertinent to the airworthiness of that aircraft. It has also been found to be very difficult to trace aircraft for surveillance where the owner is an investor with little interest in the airworthiness aspects of his asset.

It is recommended that the aircraft register must include information about the operator, if the operator is not the same as the owner. For practical purposes, changes of operatorship for periods shorter than 14 days, should be neglected. Today, change of ownership must be notified to the register within 14 days. If overdue, the person is liable on summary conviction to a fine not exceeding $1,000 and imprisonment for up to 6 months. This kind of threat might cause a person who *forgot* to notify change of ownership to keep silent, if there were no practical implications in respect of the new owner. We propose that the Act makes it illegal to operate an aircraft within 30 days of a change of ownership or operator if the change of ownership or operator has not been registered.

Another area of concern is crash-damaged aircraft. According to the present Regulations, if an aircraft suffers damage the certificate of airworthiness shall be *deemed* to be suspended until such time as the airworthiness is restored. The certificate of airworthiness does not, in the meantime, have to be surrendered to CAD. In most cases this creates no problem. but in a case when the aircraft is damaged beyond repair, two such aircraft might become one, the state of which might be unknown and uncontrollable by the safety authority. The easiest way to overcome this is to state that an aircraft that has suffered damage involving major repair in order to be restored again automatically has its certificate of airworthiness cancelled. The rationale behind this is that, after a major repair, entry control is required to get back into the system.

Finally, there are a number of products, parts, *etc* in the system, that have certificates to show they are certified products. Large products, such as aircraft engines, and major changes to older aircraft introduced by a Supplemental Type Certificate, are included in this category. In the beginning, all these products were introduced to the market by an applicant for a certificate. Ideally, the certificate holder is the manufacturer. The certificate holder should be required to furnish the operator and the safety authority with the documentation needed for continued airworthiness of the product. But there are some problems: the product might be an old piston-engine aircraft that has been re-engined with turbine engines. Some years later the holder of that supplemental certificate ceases business and there is nobody prepared to take over his supplemental certificate. The product is therefore no longer supported by a responsible manufacturer. The safety authority must, in this case, either decide to take on the responsibility for supervision of that product without support from the manufacturer, r it must have the power to retire that product from the civil aviation system by cancelling the certificate. An even more problematic product is, if the manufacturer disappears, software for onboard computerised flight management and navigational systems. There is no solution to this problem, from a lifecycle point of view.

13.6 ANALYSIS OF CHANGE AND SYSTEM EFFICIENCY

The safety authority needs to analyse change and assess the implications for rulemaking and supervision. This analysis function should maintain an overview of safety trends in New Zealand aviation on the basis of accident and incident rates and statistics, compiled in a way that makes it possible to compare and exchange information with other countries. The analysis function must be interdisciplinary.

At present the safety analysis is carried out by CAD as well as by the Office of Air Accidents Investigation. Additionally, from time to time, the Aviation Safety Board carries out particular analyses on selected problem areas. *We propose that the safety authority takes on the responsibility of providing all statistics and basic analyses needed for assessment of aviation safety in New Zealand.* This information can then be used by the Office of Air Accidents Investigation and the Aviation Safety Board, and duplication of work is avoided. Such analyses will be a basis for the safety authority's information activities.

Finally, it is recommended that the safety authority should also have its own quality assurance function to monitor and analyse the efficiency of the total regulatory system, measured against established goals and objectives.

13.7 ROLE OF THE SAFETY AUTHORITY AFTER CREATION OF THE AIRWAYS CORPORATION AND AIRPORT COMPANIES

13.7.1 Application Of The General Princples Of Resopnsibility

With the creation of independent airport and airways organisations it has become evident that there is a need for a more clear cut division of safety responsibilities between the safety authority and the organisations providing and operating these services.

We propose that providers of services bear primary responsibility for their operations, ie for ensuring they are planned, organised, carried out, maintained, developed and documented according to applicable safety authority regulations, standards and operating specifications.

This has the following implications for the relationship between the providers (in this case, airways and aerodrome operators) and the safety authority. The safety authority must establish and maintain national standards for establishment, maintenance and operation of services provided by the corporation and the aerodrome operators. These standards must have the legal status of being conditions for a certificate of approval to provide a service.

Based on requirements in the Act, Regulations, standards and the operators' own requirements, operators must produce operations manuals to instruct and govern the performance of their personnel. Manuals must comprise adequate tools for operators to control all aspects of their operations, and to provide the necessary guidance to their staff.

Our general philosophy regarding providers' operations manuals has been outlined in Section 12.2.3. The operator must assure the safety authority, in writing, that the manuals comply with minimum safety authority requirements. The safety authority shall have the right at any time to require changes to a manual if a violation or unsafe procedure is detected.

With the main responsibility resting on the operators to ensure their operations conform, the role of the safety authority will be to set standards, certificate new entrants (new operators, licensed individuals, new facilities, systems, procedures, *etc*) and maintain supervision, so as to be satisfied that providers of aerodrome and airways services live up to prescribed standards. Supervision will have to include monitoring of the operators' quality assurance systems, analysis of accident and incident information and other reports regarding the function of the applicable parts of aerodromes and airways systems. From time to time the safety authority may need to perform special audits and inspections.

The standards need to require operators to maintain competent and efficient internal quality assurance systems to ensure that safety standards are being achieved, and to carry out such detailed checks and inspections as may be necessary for management to be confident of the performance standards being achieved.

13.7.2 Defining The Standards

Our proposal is that the regulatory framework be in the Act, Regulations and standards. With the development of independent airport authorities and providers of airways services, the need for national standards is obvious.

Thus the safety authority must establish and maintain standards for the design and operation of all disciplines concerned. The ICAO Annexes and other documents provide a basis for establishing standards, bearing in mind that most of the ICAO provisions are classified as recommendations, manuals, guidance material, *etc* on which national decisions are required.

ICAO Annexes and other documents are permanently under review and changes are frequently made because of the dynamics of civil aviation development. Thus the preparatory process within ICAO, including panels, meetings, working groups, comments on State letters, *etc* have to be carefully watched and input made in order to influence the decisions regarding international regulations and procedures. For a safety authority having no operational units it is of utmost importance for all ICAO work in the technical and operational fields to be closely co-ordinated with the providers, and that they participate throughout the rulemaking process, including provision of technical input to ICAO matters.

13.7.3 Certification, Approval And Licensing

New Provider Organisations

The Civil Aviation Amendment Act (No 2) 1987 has defined the Airways Corporation of New Zealand as the sole provider of certain airways services. For aerodrome control service, aerodrome flight information service and aerodrome rescue fire service, it stipulates that only persons holding a licence or certificate, as required by the Director of Civil Aviation pursuant to regulations made under section 29 of the Act, are entitled to provide such services.

In contestable areas, one task of the safety authority will be to certify new providers of airways services. Similarly, the safety authority will have to perform licensing of aerodromes, today addressed in Regulation 185, a task that will increase in volume and importance as new airport companies are created.

Licensed Individuals: The Air Traffic Services College

ICAO Annex 1 requires as a standard that air traffic controllers be licensed according to the provisions of the Annex. Unlicensed *State* employees, however, may operate as air traffic controllers on condition that they meet the same requirements. For aeronautical station operators the ICAO standard is less stringent. It allows non-State employees to be unlicensed, as long as the State ensures that they meet the same requirements.

New Zealand therefore must provide State licences for air traffic controllers, according to Annex 1. Today, licensing of air traffic controllers is delegated to the Airways Corporation with medical control being exercised through the CAD. We do not consider it appropriate that issuing State licences and ratings be delegated to a commercial organisation. This becomes even more obvious with the development of more provider organisations, contesting the Airways Corporation.

Nevertheless, in issuing licences the safety authority can to a large extent rely on the Airways Corporation, as an approved organisation with authorised persons, to provide the necessary basis for licensing in terms of training and competence assessment.

In areas where there is no requirement (ICAO or national) for a licence, we propose that the safety authority should limit its intervention to define the necessary competence, when such definition is needed, and to make the provider of the service responsible for adequate training and competence control.

The Regulations have provisions for approval of schools and training organisations. It states that they shall be approved by the Director, as shall the curricula, sequence of instruction and methods of training. The Air Traffic Services College (ATS College) at Christchurch, now under the Airways Corporation (but previously under CAD) trains air traffic control officers and technicians for teletechnical services. Its status has not been clearly defined in the new setting.

The safety authority should supervise the college in a manner similar to its supervision of other approved training organisations.   As air traffic control officers have to pass examinations and tests for the relevant licences and ratings, it is logical that the college be *approved* by the safety authority, the same as other approved training organisations. Such formal approval by a State safety authority would be of value to the college should it wish to train foreign students and personnel for providers of airways services.

As most of the training of cadets is performed on the job, the Airways Corporation is in the best position to judge the capabilities of cadets. Designated persons within the Corporation should therefore be *authorised* to carry out final examinations and tests of behalf of the safety authority. The safety authority should approve the curricula, sequence of instruction and methods of training and set other appropriate standards, *eg* requirements for an internal quality assurance programme for the training system.

Systems, Procedures, Facilities and Equipment

There need to be provisions for State authority functions to certify and approve new systems, procedures, facilities and equipment of providers of airways and aerodrome services wishing to enter into the system.

In consideration of the competence and capacity available in the Airways Corporation, and the need to avoid duplication of work, caution should be exercised in any building up or keeping resources for these purposes within the safety authority. The workload necessary to provide substantiations for approvals must rest with the provider. There is a case for *authorising* persons within the Airways Corporation to issue such approvals on behalf of the safety authority. But care must be taken not to *delegate* in such areas where there could be a conflict of interest between the Airways Corporation and other providers, or between different groups of end users.

One area we propose *not* be delegated is approval of IFR procedures. It has been suggested by the Airways Corporation that approval of navigation procedures could be done by them, as provider, as it cannot be considered as standard-setting.

IFR procedures have to be carefully reviewed by flight operations experts, considering the capabilities and interests of all kinds of operators. They may also need to be flight tested before approval. The competencies for this will be available within the safety authority. According to our basic philosophy, navigation procedures should be subject to entrance control performed by the safety authority.

Thus we do not propose a change from the present situation, where the provider develops the procedures and the safety authority checks they are up to the standards set for design of IFR procedures. Maximum coordination should be established so as to avoid delays between development and approval.

A new entrant (*ie* new operational and technical systems, new procedures and new types of equipment) must be carefully reviewed and approved by the safety authority before being introduced.

13.7.4 Safety Authority Surveillance

We propose that a standard be issued requiring any provider of aerodrome or airways services to have an internal quality assurance programme, stating what the programme should accomplish. There seems to be confusion regarding the definition and understanding of the concept quality assurance among the parties concerned. Thus it is important that the standard spells out what the programme is to achieve, as far as the safety authority is concerned. This will not cover everything a provider might want to include in his programme, but it should ensure that the programme provides for detailed, continuous follow-up of all systems, and that safety standards are achieved. The International standard referred to in Section 12.2.3 should be used as a basis for this development.

With this understanding, the inspection programme now carried out by CAD inspectors will change in emphasis. The inspectors will survey safety performance using a *systems* approach (rather than by inspection of details only) making sure that the operator's quality assurance programme is adequate and efficient, and that the provider lives up to all prescribed standards and conditions for the certificate of approval. This would cover the internal quality assurance programme, organisation, management, personnel training, manuals, procedures, operation, instructions, installations, equipment, *etc.*

In this context it may be mentioned that the aerodromes up to now have been inspected primarily regarding physical characteristics, and less regarding operations. With the development of independent airport organisations, taking responsibility for more and more of the operations of the aerodromes (rescue fire service, emergency plans, *etc*), it will be necessary to survey airport operations in a similar way to the airways services.

With a well-functioning internal quality assurance programme within the provider organisation, there will be less frequent need to perform detailed safety authority inspections. It must nevertheless be clear that the safety authority is free, at any time, to perform any inspection it finds necessary at aerodromes or ATS units.

For an interim period, whilst new airport companies are being formed, there will be variations in the competence levels of airport managements. The safety authority needs to take a selective approach to surveillance, depending on its confidence in the particular provider. *This changing situation underlines an urgent need to promulgate standards to govern airport operations.*

Also included in surveillance is analysis of reports regarding the function and malfunction of the systems and their components, and review of information from flight inspectors regarding their assessment of the systems. Clear guidelines are needed as to what is to be reported to the safety authority.

13.7.5 Flight Calibration And Flight Inspection

Navigation and landing aids have to be flight calibrated and inspected before they are approved for operational use, after which they have to be inspected and re-calibrated at certain intervals. In order to calibrate according to established international procedures, a rather sophisticated, permanent technical installation of calibrating equipment and instruments, *etc* is needed on board an aircraft and on ground. Specially trained personnel are also needed. Flight testing and calibration is costly, and no doubt New Zealand will wish to avoid duplication of resources.

Flight calibration of navigational and landing aids can be considered to be a task to be performed by the safety authority, because the calibration forms the basis for the safety authority’s approval of aids for operational use. In a unit called “calibration flight inspection procedures”, it is now a task within the Airways Corporation, the *provider* (at present) of all the installations. The aircraft and the pilots are provided by CAD flight operations branch. Bearing in mind that the Airways Corporation has a qualified technical environment (workshops, personnel, *etc*) the Corporation seems fit to perform calibration flights and do this as an approved organisation. First-time calibrations of new facilities should be approved by the safety authority. For subsequent recalibration, designated persons within the Airways Corporation can be *authorised* to approve the calibrations on behalf of the safety authority. The safety authority will have to set standards, however, and require the Airways Corporation to keep a manual of flight inspection procedures. The safety authority will have to satisfy itself, through surveillance, that calibrations are performed according to the standards and the manual.

Since, for practical and economic reasons, only one flight calibration unit is justifiable in the country, it is essential that this organisation also tests and calibrates navigation and landing aids that might, in the future, be provided by organisations other than the Airways Corporation. There seems to be a trend for airport operators to want responsibility for the total aerodrome ground area and installations. Approach and runway lighting installations, and some navigation equipment, could be transferred to aerodrome operators who would then need an approved testing organisation for continuous calibration of the installations.

Whether or not the actual flying is provided by the safety authority is a separate issue. There are certain advantages to be achieved through safety authority pilots flying the calibration aircraft. Flight checking of navigational procedures, flight inspection of visual aids, monitoring of communications and performance of air traffic services from a pilot's point of view, which are tasks of the safety authority, can be carried out with little additional flight time.

There is no reason to change the present situation as long as the Fokker F27 with its current calibration equipment is still in use. But the Airways Corporation has indicated that within 3-5 years it may wish to modernise the calibration system. At that time the suitable aircraft type will have to be reassessed. We propose that the safety authority and the Airways Corporation agree on future arrangements at that time. in a "user pays" environment the safety authority will have to charge the Airways Corporation for aircraft and pilots, and the Corporation, in turn, will have to charge the end users or the owners of facilities.

13.7.6 Incident Reporting And Investigation

Incident Reporting

When an incident, occurrence or defect occurs, that the affects or has the potential to affect air safety, the Regulations oblige the provider of the appropriate airways services shall, as soon as practicable, report to the CAD full details of the circumstances. For aerodrome operators the same provisions may be inscribed in the aerodrome licence bearing in mind, however, that the Airways Corporation currently has responsibility for aerodrome control, navigation and landing aids, runway markings and runway inspections.

It is published in the Aeronautical Information Publication that pilots are required to file facility malfunction and air safety incident reports and submit them to the nearest air traffic services unit.

In the ATS manual there are provisions for incident reporting within the Airways Corporation. ATS units report minor occurrences, navigation and communication facilities malfunction and aviation safety occurrences. Reports are forwarded to the CAD, as well as being actioned within the Corporation.

Aviation safety occurrences are events that affect, or could affect, the safety of operation of an aircraft, or alleged or suspected offences against civil aviation legislation. They are classified in Categories A, B and C.

- Category A relates to a loss or suspected loss of separation between aircraft within controlled airspace or a failure of established procedures that could cause a hazardous situation between aircraft in non-controlled airspace.
- Category B relates to an alleged or suspected offence against civil aviation legislation other than Categories A or C.
- Category C relates to minor offences against civil aviation legislation.

The reporting and classification system gives CAD sufficient information; there is no reason to change. The requirements for providers of aerodrome services to report should, however, also be inserted in the Regulations in the same way as it is done for providers of airways services.

Incident Investigations

Regarding accident investigations the Civil Aviation (Air Accident) Regulations state that regulation for investigation of accidents also includes an occurrence during the operation of an aircraft that, in the opinion of the Chief Inspector, carried with it the risk that an accident might have occurred. This means that the Chief Inspector may decide that the Office of Air Accident Investigation investigates a serious incident.

In amendment 26 the Regulations state that when an incident, occurrence, or defect which affects or has the potential to affect air safety occurs, the provider of the appropriate airways services shall, as soon as practicable – notwithstanding that the matter is to be investigated by an accident inspector – investigate, or cause to be investigated, the air safety incident, occurrence or defect and report to the Director on the cause and the remedial action taken.

Based on the Regulations, the Airways Corporation has established the following procedures. Classification of incidents are done within the Corporation. Based on Airways Corporation judgment, incidents in Category A are referred to CAD regional office or to a Corporation regional investigation board. All investigation reports are reviewed by CAD, which reaches its own conclusions.

The Airways Corporation has pointed out that, according to the Regulations, the Airways Corporation is responsible for investigations but does not have the authority to interview personnel outside its own organisation.

Incidents in Category B are always referred to CAD. The flight operations branch, CAD, is responsible for the investigations.

Incidents Category C are minor and not formally investigated. Details regarding incidents are logged and a monthly summary supplied to CAD.

In many respects the present situation is unsatisfactory because the responsibilities for incident investigation are not clearly defined. This has been shown to create problems through serious incidents not being investigated at the proper level, or through information flow problems between the parties concerned.

Any operating organisation would be expected to carry out its own in-house investigation when an incident has happened. The Airways Corporation is the only approved organisation or operator for which this has been spelt out in regulations. This creates an impression that the Airways Corporation has been given an ”authority” role, which it should not have. The provision weakens the position of CAD by implying a passive role inconsistent with the responsibilities of a safety authority.

For an air traffic incident the Airways Corporation may often be an involved party, as provider of airways services. There will most likely be one or more other parties. Each party would naturally be expected to do its own internal fact finding, but it does not seem proper to make one of the parties responsible for the entire investigation. Such responsibility should rest with the safety authority.

When deciding which office should investigate *incidents* it should be borne in mind that the potential consequences of an air traffic *incident* may well be much wider than those of many *accidents.* Thus, major air traffic incidents should be given more attention than minor accidents. It ahs been submitted to our review team that an *independent* body should investigate *all* incidents; the safety authority is not considered fully independent because of the possibility that the standards or surveillance could have been factors in the incident.

There is already an independent State authority available for investigation of accidents and serious incidents, namely the Office of Air Accidents Investigation. The Chief Inspector has discretion to take on the investigation of an incident or to refrain from doing so.

We have been told by the Chief Inspector that the present resources of his office allow only 30% of accidents to be property investigated. The remaining cases are briefly reviewed and closed at the desk. The office does, from time to time, undertake to investigate air traffic incidents, but the resource situation is limiting.

There were 65 Category A air safety incidents in 1987. This must be considered a high number. Out of these incidents 9 were considered serious. In the first two months of 1988 there were 19 reported Category A incidents, indicating an even higher rate on an annual basis; on the other hand it may be the result of a campaign for better reporting. Nevertheless, we wish to stress the message received from a number of sources within the aviation community that *there is widespread concern about the air traffic incident situation.* It is therefore of great importance that the present lack of clarity about incident investigation be remedied, and that a concerted effort be made, involving all parties concerned, to resolve this uncomfortable situation.

Considering resources, it does not seem reasonable to hand over some 50 to 100 incidents year to the Office of Air Accidents Investigation. There must be some screening and assessment of the importance and implications of each incident before a decision is made on the level of investigation. Such decisions must be taken at an early stage to avoid overlapping investigations by different bodies.

A prime task of the safety authority is to monitor the performance of air traffic services. And because incidents and incident investigations provide excellent information for safety authority surveillance, the most efficient course is to make the safety authority responsible for seeing that incident investigations are carried out an appropriate level.

We propose the following principles be applied to Category A incidents.

1. All Category A incidents be immediately reported to the safety authority.

2. As at present, the Airways Corporation immediately secures all possibly relevant facts, including recorded information, and makes its assessment of the severity of the incident.

3. The safety authority has a designated officer or officers to receive incident information and co-ordinate subsequent activities.

4. The safety authority assesses, on the basis of preliminary information, the severity of an incident and decides on the proper form of investigation. The following options should be considered:

   a) Near collision, potential near collision, or major failure in the airways system: *to be investigated by the Office of Air Accident Investigation* (currently 5-10 pw).

   b) Other incidents where pilots and operators have to be interviewed or investigated, as well as the Airways Corporation and/or other providers of airways or airport services:
   to be investigated by the safety authority[118].

   c) Minor incidents, where only the functions of the Airways Corporation (or other provider) are concerned:
   investigation may be delegated to the Airways Corporation (or other provider), but the report to be approved by the safety authority.

   d) In all cases there shall be a formal treatment within the safety authority of an investigation report, and decisions taken on that basis shall be recorded and disseminated to parties concerned with full background information.

   e) Incident reports and safety authority decisions shall be available to the public.

   f) If the initial assessment of an incident later turns out to be erroneous, the level of investigation should be upgraded or downgraded accordingly.

   g) In all cases, the provider of the airways or airport service and the air operator(s) concerned shall deliver facts, recorder transcripts and all relevant information to facilitate the investigation, and a duplication of investigation work should be avoided.

This proposal would *not* preclude discretion being exercised by the Office of Air Accidents Investigation as to whether to investigate an accident. A decision to do so, however, should be taken as early as possible to avoid duplication of investigations. It is therefore important that the Chief Inspector be kept informed about incidents and safety authority decisions. Critical cases should be informally co-ordinated at the time of decision.

[118] In many cases this could be done by the parties forwarding their information and assessments to the safety authority for analysis and compilation of a concluding report.

This proposal necessitates a new legal provision: *the safety authority needs the right to request the Chief Inspector to undertake an investigation.* The resulting resource implications for the Office of Air Accident Investigation need to be considered[119]. The best solution would probably be for the safety authority, the Airways Corporation and major air operators to second personnel to work under the Chief Inspector as required.

13.7.7 Airspace Designation

Responsibility for managing airspace rests with the Airways Corporation, but it has no authority to designate airspace in terms of its status of protection or allocation to particular users. CAD allocates airspace to users such as military activities. This has created some problems and will hamper the flexibility of airspace use provided by the new airways services system.

From a pure airways services operational point of view it is easy to see the advantages of one organisation both managing and designating airspace. On the other hand, airspace is a national resource, the use of which is subject to the conflicting interests of various categories of users – the different categories of commercial operators, private aviation and sports and recreational activities, as well as the Royal New Zealand Air Force and other parts of national defence.

It does not seem appropriate that airspace designation should be decided by a commercial enterprise. The task should be with the safety authority to weigh such matters, in close cooperation with the Airways Corporation, as well as with the users involved.

Whether the Director of the safety authority should have the power to *decide* an airspace designation needs to be considered at a political level. Such decisions may warrant Ministerial administration.

13.7.8 Aeronautical Information Services

The provider function for Aeronautical Information Services is vested in the Airways Corporation. There will, however, be need for some safety authority involvement in coordinating and checking input to the Aeronautical Information Publication from sources other than the Airways Corporation. Present procedures within this area need clarification and improvement.

13.7.9 Other Functions Concerning The Airways Corporation

The Airways Corporation has drawn our attention to some other functions causing concern today. One is frequency allocation, for which two authorities are involved, plus the Airways Corporation.

As in the case of airspace designation, we consider available frequencies to be a national resource for which there are competing interest. Allocation therefore

[119] The present record of 5 to 10 serious air traffic incidents per year, however, cannot be considered an acceptable, normal number, it is hopefully an abnormal peak.

should be done by a State authority. For civil aviation, the safety authority is an appropriate body to handle these matters and to coordinate interests within the aviation community.

The practical aspects of this matter, and some others the Airways Corporation has raised with us, cannot be solved within the terms of this study. They must be left to the parties involved to solve in a co-operative spirit, as experience is gained with the institutional framework. No doubt the process will be facilitated when boundaries of tasks and responsibilities have been clearly established.

13.7.10 Conclusions

In technical and operational areas, creation of the Airways Corporation and airport companies changes the role of CAD from being an operational organisation to being strictly a safety authority. According to our proposal the safety authority in this respect should set standards, certificate new entrants to the system, perform supervision of services provided, and analyse safety trends.

Within CAD the unit concerned with aerodrome and airways operations is the airways operations branch. A similar function will have to be established in the new safety authority, but with a somewhat changed profile. It will not provide any operational service, as is now the case to a certain extent. Neither will it provide consultant services.

Services to the Pacific Islands are of two kinds. One is a safety authority function carried out by special agreement; the Director acts as Director of Civil Aviation for the particular islands. As long as this arrangement is maintained, adequate resources will have to be provided for it within the safety authority. The other kind consists of functions which, according to our proposal, will be carried out domestically by the Airways Corporation as an approved and/or authorised organisation. We consider that if these services to the Islands are to be continued, the only efficient way is for the Airways Corporation to undertake them, and be remunerated by the agency requiring those services.

In consequence, the following will be the safety authority’s residual tasks for airways and aerodromes.

- Issuing and updating standards for aerodrome and ground aids, air traffic services, aeronautical information service, navigation and communications procedures and equipment.
- Implementing ICAO Annexes and procedural manuals (Annexes 3-5, 9-12 and 14-18) and coordinating the production of AIP between the Airways Corporation and the safety authority (which coordination has to be improved).
- Certificating new providers of aerodrome and airways services, approving systems, procedures, facilities and equipment, and licensing personnel for whom there is a licence requirement.
- Monitor aerodrome and airways services to ensure they meet prescribed standards.
- Investigate, or cause to be investigated, air safety incidents in Categories A and B, and review malfunction and occurrence reports and statistics.

- Analyse quality assurance and audit reports from providers, and accident, incident and other reports, regarding the function of the applicable parts of aerodrome and airways systems.

The safety authority must have personnel with broad experience of aviation because of the responsibility for implementing ICAO Annexes and for supervising the total aerodrome and airways services systems. Competence is required in the following disciplines: flight operations, airways or air traffic services, communication procedures, radiotechnical equipment, aerodrome design and operations, rescue fire services, navigation procedures, training and licensing.

It takes competent persons to produce standards and certificate and survey complicated systems and sophisticated equipment. These persons may have difficulties maintaining up-to-date competence (and hence credibility) if they are isolated too long in an environment without operational activities. Special arrangements are needed to avoid loss of competence. Possible solutions are: job rotation on time-limited appointments, familiarisation periods in operational units, career prospects in other organisations, *etc*. It is essential that appropriate agreements be set up between the safety authority and the Airways Corporation to achieve a solution which will create benefits to all parties in terms of better efficiency, more job satisfaction and a more co-operative working climate.

13.8 METEOROLOGICAL SERVICES

The Act states that the New Zealand Meteorological Service shall supply meteorological information to persons engaged in civil aviation. This service is the meteorological authority that, according to ICAO Annex 3, has to provide meteorological service for international air navigation on behalf of the State. The regulatory material contained in Annex 3 is identical with that appearing in the technical regulations of the World Meteorological Organisation. Most of this material is in the form of recommendations and national standards.

With the present organisational structure (where the CAD and the Meteorological Services are part of the same Ministry) there has been no need for CAD to formally set minimum requirements for meteorological services to civil aviation. Such matters have been agreed informally. The environment is changing. The Meteorological Services will most likely have to adapt to a “user pays” system, and will have to act more commercially. The safety authority in any event should decide minimum standards for these services, and for meteorological instruments at aerodromes, and ensure that standards are met.

When standards and recommendations are worked out, meteorological experts usually receive too little input from flight operations experts. At international meetings on requirements for meteorological services for aviation, the vast majority of delegates are meteorological experts; flight operations experts are rather scarce. This is unfortunate because the providers should not be the people to determine what the users need. It is important that operational requirements, and thus the minimum standards, be defined by flight operations experts.

With this background we consider there is a need within the safety authority for flight operations experts, interested in meteorology, to establish the operational requirements and standards for meteorological services in close coordination with the users and the providing organisation.

13.9 SEARCH AND RESCUE

The State responsibilities of New Zealand for providing search and rescue services within the country, and over parts of the high seas, have to be discharged as a State function. We propose this task be carried out by the civil aviation safety authority, as it is today carried out by CAD.

The safety authority should set standards for search and rescue and associated training and practical exercises. It should see to it that proper arrangements are made with civil and military State functions, as well as the aviation community and all other possible sources, in order to secure the necessary resources to carry out search and rescue activities whenever the need arises. To test the efficiency of organisation, the safety authority will have to supervise regular, realistic, coordinated exercises.

13.10 SECURITIY

In Chapter 11.4.5 we evaluated in detail the Aviation Security Service and concluded that the operational part should be transferred to the airports. This leaves the safety authority with the task of setting the security standards, approving airport security organisations and related training and quality assurance programmes, performing surveillance of approved security organisations, providing supporting information and advice and enforcing compliance with regulations and standards. To perform these functions, highly qualified staff are needed in the civil aviation safety authority.

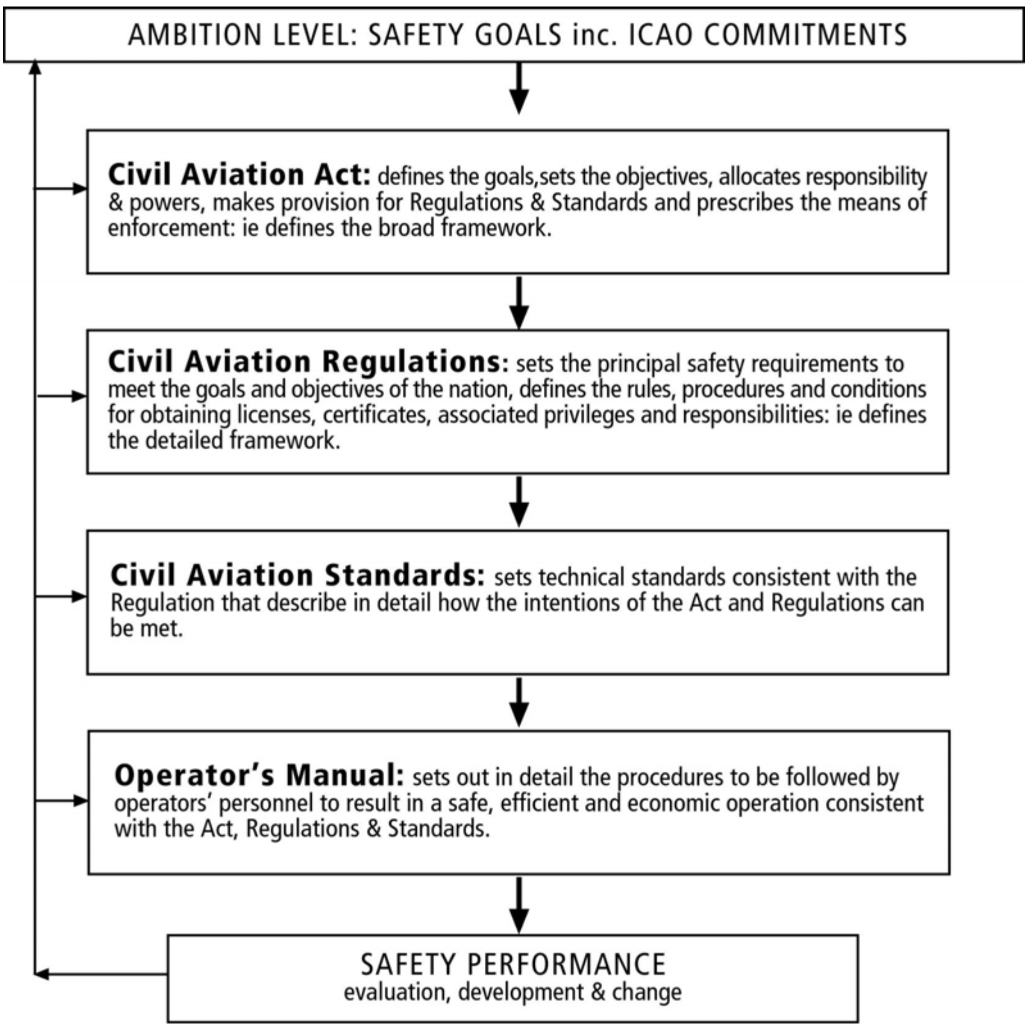
CHAPTER 14

ANALYSIS OF THE REGULATORY SYSTEM AND PROPOSED CHANGES TO MINIMISE AUTHORITY INVOLVEMENT

A prime function of this study is to address the need for civil aviation regulations, their costs and benefits, and how they should be administered.

The present regulatory system has been outlined in Chapter 5. It seems obvious to all parties involved that the present legislation must be changed. In this chapter the general principles of Chapter 12 are applied to the present legislation. The outcome is a structure of proposed legislation where the content in each part, and the relationships between the parts, are shown in Figure 14.1 below.

Figure 14.1 - Proposed New Zealand Civil Aviation Legislation



The remainder of this chapter presents the detailed provisions that have to be covered in order to minimise regulatory involvement. These changes affect the functions, structure, and manning of the proposed safety authority, as presented in Chapter 16 below. The legislation and the organisation are directly related to each other, and must be looked upon as a whole.

For the benefit of the reader who at this stage requires only a general view of the proposed Act, the suggested table of contents is presented below.

CIVIL AVIATION ACT 1988: Table of Contents

The remainder of this chapter is intended as a working tool in the future revision of the legislation. Because of its detailed level of review it is rather heavy to read.

14.1 THE CIVIL AVIATION ACT 1964: ANALYSIS AND PROPOSALS

14.1.1 Principal Functions

The functions covered by the Civil Aviation Act, including amendment No2 1987, are divided into principal functions of the Ministry of Transport and functions (called services) of the Airways Corporation.

The following key words are used in the Act to describe one of the functions imposed on the ministry.

To promote and encourage the orderly and economic development of civil aviation. This development function is presently carried out by the Air Services Policy Branch. The Air Services Policy Branch is responsible for helping to promote an efficient and economic civil aviation industry and for advice on policies for development of domestic and international air services, and on airport development and financing. The Economics Division provides required analyses to ensure that the ministry provides an efficient transport sector overall.

Although the preamble of the ICAO convention addresses certain principles and arrangements in order that international civil aviation may be developed in a safe and orderly manner and should be operated soundly and economically. *This study will not address the economic development function any further.*

Today, there is no single document in the legislation that covers all international civil aviation instruments ratified by New Zealand within the ICAO framework. We propose that the future Act, for reference purposes, identifies all ratified ICAO instruments.

To ensure the safe operation of aircraft. These functions are not explicitly spelt out in the Act. Part II Section 16 says that “the Director of the Civil Aviation Division shall have such special duties and functions as may be imposed or covered on him by regulations under this Act or by the Minister”. It is of the utmost importance that the basic goals and objectives of flight safety are expressed in the Act. Based on these goals and objectives, the functions of the new civil aviation authority (CASA) should be defined in the Act itself.

To initiate and carry out surveys into any aspect of civil aviation. CASA should have functional responsibility to collect data on a continuous basis, and analyse whether the goals and objectives concerning flight safety are achieved or not. CASA should also be responsible for proposing changes to these goals and objectives when found justified by analysis. Other surveys, including transport research, forecasting and statistics, presently provided by the Economics Division, ought to stay outside the responsibility of CASA. Statistics for the purpose of ICAO statistical publications, and all flight safety related statistics, should be the responsibility of CASA.

To provide for the investigation of accidents in which aircraft are involved. This is a basic obligation in the Chicago Convention. The specifications in Annex 13 apply to accidents occurring in the territory of a Contracting State to aircraft registered in another Contracting State. Where the event has relevance to international operations it is necessary to apply the specifications in Annex 13 to accidents and incidents involving aircraft operating within airspace open to international civil aviation. Other accidents and incidents, occurring either inside or outside this environment, should be investigated to a depth and frequency compatible with the goals and objective set for those parts of the civil aviation system. This differentiation should be reflected in the Act. As at present, we consider that the Accident Investigation Branch should be separated from, and independent of, CASA. (See also Section 13.7.6.)

To be responsible for search and rescue operations in respect of any civil aircraft and the crew and passengers of any such aircraft. Annex 12 to the Convention is applicable to the establishment, maintenance and operation of search and rescue services in the territories of the Contracting State and over the high seas. This State function is at present coordinated such that other international obligations concerning safety of life at sea also are covered. A New Zealand Search and Rescue manual is published by the Civil Aviation Division of the Ministry of Transport. We feel that this arrangement works satisfactorily and propose that this State function, including marine coordination, be a function of CASA identified in the Act.

To advise the Minister and Government Departments on all matters affecting civil aviation. This function will still be valid for CASA.

To provide a national meteorological service. Annex 3 to the Convention prescribes that each Contracting State shall determine the meteorological service it will provide and shall also designate the authority to provide, or to arrange for provision of, the meteorological service. Part IV of the Act designates the New Zealand Meteorological Service as a branch of the Ministry of Transport. This branch provides meteorological services for the benefit of all sections of the community. Therefore some other State body, outside that branch, should be responsible for the determination of the amount and quality of meteorological services needed for the safety of civil aviation. This will be even more important in a "user pays" environment. We consider that CASA should cater for the determination and surveillance functions with respect to standards for meteorological services for civil aviation.

To carry out such functions and duties as may be conferred on it by this or any other enactment or as the Minister may from time to time direct. This kind of escape clause most probably needs to be there but, if the goals and objectives for the civil aviation system are set properly, and if CASA functions are well defined in the Act itself, the need for ministerial intervention is likely to be limited.

14.1.2 Other Functions

Besides the principal functions of the Ministry of Transport covered by Section 5 of the Act, there are some other functions spelt out in other sections.

Inquiries and Annual Report (Section 14 and 15). There should be provision, as we see it, for the Director of CASA to, from time to time, appoint external persons for the purpose of security the improvement, development and better regulation and administration of the civil aviation system. The reason for engagement of external persons could be a need for independent views.

CASA should be required to furnish a report of its activities during the preceding year. The report should include monitored trends in flight safety, supported by an analysis of any impact these trends have with respect to the basic goals and objectives expressed in the Act.

Airport Security (Part IV A of the Act). The Aviation Security Service is at present a branch of the Civil Aviation Division of the Ministry of Transport. Annex 17 to the Convention requires that the Contracting State shall designate an appropriate authority within its administration to be responsible for the development, implementation and maintenance of the national civil aviation security programme. This State function should rest with CASA. At operational level, a security programme should be established for each international airport. This programme should use approved security service organisations based on vested privileges and authorised persons. The State must ensure that duly authorised officers are readily available at international airports to assist in dealing with suspected or actual cases of unlawful interference with international civil aviation.

Airways Services (Part II A of the Act). This insert in the principal Act defines: aerodrome control service, area control service, approach control service, flight information service, aerodrome flight information service, and aerodrome rescue fire service. There are a number of Annexes to the Convention addressing this area. Annex 11 covers air traffic services, which include all airways services above, except the aerodrome rescue fire service. Annex 11 also contains standards and recommended practices for organisation of the airspace, which is a State function, and requirements for communication and alerting services. Annex 10 covers aeronautical telecommunication. Annex 4 covers aeronautical charts. Annex 5 covers units of measurement. Finally, Annex 15 covers aeronautical information services (not to be confused with the flight information service above). We believe the Act should be structured such that those State functions that cannot be vested in an approved organisation providing airways services, should be functions of CASA identified in the Act. The aerodrome rescue fire service is part of Annex 14, covering aerodromes, and should be moved into that area in the proposed new structure of the Act.

Charges and Dues (Sections 13, 13A, and 13B). *The question about how CASA should recover its costs, is not covered by this study.*

14.1.3 Delegation Of Power

Powers of Minister (Sections 11 and 12). These primarily address aerodromes, services and facilities in connection with the operation of any aerodrome, or with the operation of aircraft engaged in civil aviation. In the Chicago Convention, and its Annexes, there is a distinction between: (a) State functions that rest with the State, or may be performed by an authorised designated agent with the State still held responsible, and (b) functions that may be performed by an approved person or organisation, based on vested privileges monitored by the State.

Take the meteorological function as an example. The *determination* of the meteorological service to be provided is a State function, which must be undertaken by a designated authority. The *provision* of the meteorological service may be vested in an approved organisation. This distinction should be clarified in the Act.

Delegation by Director of Civil Aviation Division (Section 17). This section confers on the Director the power to delegate powers exercisable by him. The Director uses this power when he issues an Instrument of Delegation delegating powers to officers of the Department.

State functions are also, with the consent of the Minister, delegated to persons who are not officers of the Ministry. (In the Act, the interpretation of “persons” is unclear. By reading Section 17B it is clear that “person” includes “corporation”. Whether other organisations also are covered by the word “person” is not evident. Flight examiners comprise the largest group performing State functions based on delegated powers. Within this group are numerous persons who are also approved persons. These approvals are given with reference to the Civil Aviation

Regulations 1953. the approved persons have vested privileges and corresponding responsibilities similar to licensed persons. There is no distinction in the Act (or elsewhere, such as in the Regulations) between performing State functions and performing other functions within the civil aviation system, based on vested privileges. This fact creates an unclear distribution of responsibility.

With the consent of the Minister, the Director also delegates powers to the Airways Corporation of New Zealand Ltd by a letter dated 31st March 1987. These delegations concern State functions which, in our view, is the intention of this section of the Act. It is strange that these delegations are to an *organisation,* not to individual persons. *We propose that delegation of State functions be to individual persons only.* (See also section 12.1.5).

Section 29 subsection 4(ba) of the Act confers on the Director power to issue, "in such manner as may be prescribed in the regulations", instructions, orders or requirements prescribing "privileges relating to such licences, ratings, approvals, and certificates as may be specified in the regulations".

There are a number of "approvals" specified in the regulations. The term "approved" is defined in the regulations, and means approved in writing by the Director. Furthermore "approved firm" means a firm or person approved for the purpose of carrying out any functions required by these regulations in relation to the airworthiness of aircraft. Unfortunately, the word "approved" is used in all sorts of connections: approved documents, parts, equipment, courses, individual persons, training organisations (not involved in airworthiness), conditions modifications, repairs, erections, patterns, forms and means. There is not provision in the Act or in the Regulations defining what kind of privileges, with corresponding responsibilities, may be vested in individual persons or organisations. There is an obvious need for clarification in the new Act.

14.1.4 Recognition Of The Operator; Levels Of Penalty

Sections 23 and 24 of the Act address responsibility for damage and penalties for dangerous operation of aircraft. Both sections identify a person to whom the aircraft has been demised, let, or hired out. We feel that the *operator* should also be introduced as a defined subject in the Act, using the ICAO definition: "a person, organisation or enterprise engaged in or offering to engage in an aircraft operation". Nowadays there can be many steps of leasing *etc* between the legal owner and the operator. We feel that the operator, as defined above, should be held primarily responsible for any damage or penalty. *He* is the licensed individual person or approved organisation who has been let into the civil aviation system. The true owner of the aircraft, if not an operator, might not be part of the civil aviation system at all; he might not even live in New Zealand. To make this change, the aircraft register must include information about the *operator* if the owner (for a period exceeding 14 days) lets someone else take over the operational responsibility. For reasons further explained in Section 13.5, we propose that the new Act should make it illegal to operate an aircraft unless it has a valid certificate of registration and unless change of ownership or operator has been registered within 30 days of the change.

The aircraft register should also include a section listing aircraft registered on a foreign register but which are operated for a period exceeding 14 days by a New Zealand operator. This part of the aircraft register may, from a practical point of view, be limited to aircraft that are certificated with a passenger seating configuration, excluding pilot seats, of 10 seats or more, or a maximum certificated takeoff weight above 5700 kg. The rationale behind this requirement is that these aircraft are complex and will be engaged in public or private transport of considerable numbers of passengers. It is not reasonable that foreign registered aircraft are allowed to be operated in New Zealand for a prolonged period of time by a New Zealand operator, unless the New Zealand authority has satisfied itself that the foreign authority has practical means to exercise its surveillance responsibility with respect to the aircraft. Alternatively it may be agreed between the authorities that New Zealand takes over the responsibility.

It should be a requirement that no foreign registered aircraft be engaged in commercial operation in New Zealand, by a New Zealand operator, unless the type of aircraft is approved in this country; nor should New Zealand assume surveillance responsibility unless such is the case. With the proposed extension of the aircraft register New Zealand would achieve better control of foreign registered aircraft operating in the country[120]. With the rapidly increasing numbers of leasing arrangements in aircraft sales, this issue is gaining more and more importance. Ratification by New Zealand of Article 83 *bis* to the Convention is an important decision in this field, which remains to be taken. We recommend that this be done.

We also recommend that the penalty for dangerous operation of aircraft should be altered to cover all types of dangerous operations within the civil aviation system that cause severe danger to any persons or property or flora or fauna. The reason is that the aviation system today is so complex and integrated that the time is over when the dangerous operation can be limited to the pilot and the manoeuvring of the aircraft. Any holder of vested privileges, being an individual person or organisation must be held responsible for his performance. Careless, reckless or negligent exercise of vested privileges must be prosecuted. There must be provisions in the Act to impose a penalty, in severe cases, *even if the actual flight was accomplished without accidental outcome.*

On the other hand, trivial offences against the rules and regulations (that under the present regulations make the offender liable on summary conviction to a fine and imprisonment) should be subject to civil fines, similar to the civil penalties introduced in the road transport sector. In the first place, however, corrective actions should be taken by administrative means. (See Section 13.4.3 and next section).

14.1.5 Suspensions, Cancellations And Disqualifications

Sections 24A through 24G of the Act address situations where, by an order of a Court, a holder of a pilot licence is disqualified from holding or obtaining a licence.

[120] This does not imply that New Zealand should control foreign operators. The issue only concerns foreign registered aircraft operated by New Zealand operators.

Section 29 subsection 2(b) gives provisions for a prescribed Authority, Minister of the Crown or officer, to cancel or suspend any licence of ”persons performing prescribed functions in relation to the operation, maintenance, or airworthiness of aircraft or the provision of airways services”, being the holders of licences, certificates or ratings of prescribed kinds. For some reason, aerodromes are not mentioned. Aerodromes are covered by subsection 2(a), but this subsection has no explicit provision to cancel or suspend the aerodrome licence. It is also unclear if *persons* includes organisations or not. Finally, the way Sections 17B and 17C of the Act are written, the Airways Corporation does not require a licence for the services of the Corporation provides with reference to Section 17A. Consequently, *there is no licence to be suspended or cancelled.*

We regard the present situation as unsatisfactory. To make the logic understandable, some agreed definition of terms must be introduced. Today, key words such as “approved” and “authorised”, have different meanings in different parts of the regulations. We propose the following.

The words “licences” and “ratings” should relate to individual persons only. Certificates of Approval should be issued for organisations or enterprises. When a person holding an aircraft maintenance engineer licence wants to set up his own business, the principle of vesting of privileges in an approved maintenance organisation should be used; there is a need for workshop facilities, special tools, manuals, *etc.* A Certificate of Approval should be issued vesting privileges in that single person’s operation, recognising it as an approved organisation. His personal licence is used as evidence of documented knowledge, skill and experience only.

In the interest of safety, corrective actions are needed for all types of vested privileges in the event on non-compliance. We refer to the discussion in Section 13.4.3. The first step for CASA should be to try to bring about corrective action through a constructive dialogue. Should this fail then the Director should be able to suspend a Licence or a Certificate of Approval either totally or partially under the Director has decided, after due investigation, what action should be taken. The normal action with respect to organisations should be to require a programme from the operator for what has to be done to resume the operation. Once a programme is agreed to, that programme, with its time schedule, becomes the basis for removal of the suspension. If this action fails, the Director must take steps to cancel the vested privileges.

Cancellation should be by order of the Court. The present provision in the regulations, stating that “no person whose licence, rating or certificate has been cancelled should again be issued with any such licence, rating, or certificate during the next succeeding 12 months”, is not a good tool to promote flight safety. It constitutes a penalty rather than a corrective action. In normal circumstances the Licence or Certificate of Approval should be cancelled until such time as the conditions precedent for the vested privileges are re-established. *Cancellation* means that the holder has lost *all* his privileges and must pass a new Entry Control in order to get into the civil aviation system again. There must be provision in the Act for the holder of a Licence or Certificate of Approval to appeal against cancellation. Cancellation should not be considered as a disqualification, which is a separate issue. (See below).

Finally, an authorised person must have the power to take such actions as may be deemed appropriate to prevent the holder of a Licence or Certificate of Approval from exercising his privileges, or parts thereof, if this is likely that this lead to serious danger to any person, property, flora or fauna. The actions taken should immediately be reported to the Director. The Director should initiate action to suspend the Licence or Certificate of Approval pending further investigation. In these cases the potential for a penalty should be obvious, and steps in order to prosecute should be taken.

Certificates issues for products, parts, facilities, systems, or procedures are less sensitive to handle. The expertise necessary to determine whether a product, part, *etc* meets the minimum requirements is purely technical. There is no need to involve a Court order for cancellations. The power to decide such matters should be conferred directly on the Director. The Act should provide for the holder of a Certificate to appeal against suspension or cancellation.

Sections 24A to 24G of the Act address disqualifications. In the new Act there should be a clear distinction between suspensions and cancellations on one hand, and disqualifications on the other hand. Suspensions and cancellations should not be regarded as penalties. They should be regarded as tools to remove vested privileges when the conditions laid down for a particular operation are not met, or when the corresponding responsibilities are abused. They should not preclude re-establishment of operations when conditions are again met. Civil penalties may also be applicable, but should be applied separately. If the holder of a Licence or Certificate of Approval has been found guilty of a criminal offence against the Act, or has repeatedly been found to abuse his privileges, disqualification by order of a Court should be considered.

We can envisage situations when suspensions of certificates may not be appropriate but forceful reaction from CASA would still be required. *We propose that a concept of civil fines be developed for inclusion in the new aviation act.* We refer to the ideas put forward in Sections 11.4.5 and 13.4.3.

14.1.6 Sale Of Liquor, Special Provisions And Indemnity

Sections 25, 26, and 27 of the Act address these areas. The content has no relevance to this study other than stating the fact that aircraft used for the purposes of any of the Armed Forces of New Zealand are not included in the civil aviation system.

14.1.7 Application Of The Act To Cook Islands And Tokelau

The present Act is extended to, and is in force in, the Cook Islands and Tokelau. In a "user pays" environment the responsibilities and corresponding duties and functions imposed or conferred on CASA must be clearly defined and transparent. Special attention should be taken to ensure that State functions are separated from *provider* functions. One logical solution is to commission the Airways Corporation to provide the required services, and leave the State functions with

CASA. From a practical point of view, however, specified State functions (such as calibration of navigational and landing aids) should be further delegated by CASA to the providing agency. (See Chapter 13).

14.1.8 Provisions For Regulations

The present Section 29 of the Act contents a mixture of general provisions and very specific details. The new Act should itself address all provisions indispensable to safe operation of the civil aviation system. The Act should recognise New Zealand's sovereignty as a State and declare that the Act is applicable only to civil aircraft, not State aircraft.

The regulatory powers needed to undertake the obligations originating from being an ICAO member state can be divided into two groups:

- the technical and operational safety field, and
- provisions to promote and encourage orderly and economic development, including traffic rights, and tariffs.

(Section 29A to 29D) of the present Act).

The new Act should be limited to provisions to cater for the first group. Traffic rights, tariffs, and legislation needed to provide for the facilitations listed in Annex 9 of the Convention have a commercial trade, and foreign affairs impact. These provisions are better disposed in legislation closer to whatever government department will be responsible for such areas in the future.

With respect to regulations, the other provisions in Section 29 of the Act are more or less obsolete.

14.2 NEW CIVIL AVIATION ACT: Proposed Structure And Contents

To summarise, we propose that the future Civil Aviation Acc should have the following structure and main contents.

Section 1: Applicability of the Act

To define the Civil Aviation System, terms and interpretations to be used consistently in the Act, Regulations and Standards.

Section 2: The overall safety goal and the Minister's responsibility

To establish the basic goals for safety in the civil aviation system in New Zealand.

In Section 10.4 we proposed the following safety goal:

> "The overall safety goal is that the New Zealand civil aviation system takes all measures that improve safety at reasonable cost, subject to New Zealand meeting its minimum obligations under ICAO.

Reasonable cost shall be interpreted as meaning that the cost to the nation is exceeded by the benefit to the nation."

In implementing the goal the following provisions should be considered:

- recognition that different sectors of the civil aviation system will have different safety levels;
- a balance between safety goals and air services demanded by society; and
- the distribution of resources for safety improvements.

For further details refer to the proposal in Section 10.4.

The Minister's responsibility is linked to the application of the Act. The Minister should ensure that the general goal and provisions under this section of the Act are met.

Section 3: Principal State functions and regulatory powers needed.

This section defines and discharges the authority and responsibility undertaken by the Contracting State and any other function needed to meet the general goals and objectives.

Section 4: Provisions for the Civil Aviation Authority.

This section establishes the Civil Aviation Safety Authority (CASA), its mission, authority, and responsibility, and defines what authorities may be further delegated.

Section 5: Provisions for other State provided functions.

This section recognises the existing agencies:

- the Meteorological Services, and
- the Office of Air Accident Investigation.

As long as the State provides aerodrome services there will have to be provisions in the Act.

Section 6: Provisions for delegation of powers to authorised persons.

Section 7: Provisions for vesting of privileges and determining corresponding responsibilities.

To establish under what conditions privileges may be bested in licensed or individual persons and approved organisations.

To establish the distribution of responsibility for safety.

Section 8: General rulemaking procedures.

To establish provisions for the adoption of Regulations based on the provisions of the Annexes to the Convention when applicable, and adapted to fulfil the basic goals and objectives for the civil aviation system in New Zealand.

To establish provisions for civil aviation safety standards, consistent with the Regulations, to be promulgated by CASA as a basis for vesting privileges in individuals and organisations and for certification products, parts, facilities, systems or procedures.

To establish provisions for mandatory consultation with parties concerned (*before* regulations and standards are promulgated) and lead-time for publication of new standards (*prior* to them becoming effective).

To establish under what conditions CASA may issue emergency directives.

To establish a general requirement that all operations within the civil aviation system shall be in accordance with the Act, Regulations and any other conditions the State may consider applicable in the interest of safety and in accordance with appropriate treaties and agreements between the State and other States.

Section 9: Enforcement.

To establish provisions for enforcement of the legislation within the civil aviation system; rules for suspension and cancellation of vested privileges, rules for disqualification and provisions for civil penalties and criminal offences. All provisions for enforcement should appear in the Act, none in the Regulations.

Section 10: Right of appeal

Any person or organisation affected by a suspension, cancellation, or disqualification by an order of the Court, should have the right to appeal to the court for reconsideration of the decision.

Section 11: Charges and dues.

Section 12: Application of the Act to Cook Islands and Tokelau.

A more detailed description of the above sections of the Act, is found in Appendix VIII.

14.3 NEW CIVIL AVIATION REGULATIONS

CAD has had in progress for some time a complete review of the Civil Aviation Regulations and associated documents to bring them up to date with ICAO standards, new terminology and technology. Looking at the draft material available, we observe that much effort has been put into proposed changed at a detailed level. No fundamental restructuring has been attempted.

We consider total revision of Civil Aviation Regulations 1953 to be long overdue. Major change of the Regulations must start with major change of the Act. As outlined in Section 14.1 above, some of the content in the present Regulations is lacking the required legal power, and should be transferred into the Act.

In Appendix IX we propose a new structure for the Civil Aviation Regulations, consistent with the outline presented for the new Act.

14.4 REQUIREMENTS, ORDERS, ETC

Regulation 8A, promulgation of orders, causes unnecessary turbulence in the system. It is spelt out in section 29(4) of the Act, that "any regulations made under this section may confer on the Director of the Civil Aviation Division power to issue, in such manner as may be prescribed in the regulations, instructions, orders, or requirements for all or any of the following purposes … prescribing the requirements, standards, and privileges relating to such licences, ratings, approvals, and certificates as may be specified in the regulations." This is the only place in the Act where approvals are mentioned.

In Regulation 8A, the phrase from the Act "in such manner as may be prescribed in the regulations" is *re*phrased to read "wherever in these regulations the Director is empowered or required to issue any order, requirement, or instruction, or to prescribe any procedure or condition, or to exercise any act of authority having a like or general effect, the Director shall publish a document … in such of the publications referred to in subclause (4) of this regulation".

Subclause (4) identifies:

- Civil Aviation Safety Orders (CASOs)
- Notices to Airmen (NOTAMs)
- the New Zealand Aeronautical Information Publication (NZAIP)
- New Zealand Civil Airworthiness Requirements (NZCARs)
- Civil Aviation Information Circulars (CAICs)
- such other publications as may be authorised by these regulations (this option is presently not in use).

CASOs may be used for the purpose of promulgating "orders or procedures required or authorised to be published by these regulations" or in respect of "requirements for persons holding or applying for licences, certificates, ratings, or other authorities under these regulations".

NOTAMs may be used for the purpose of promulgating "orders … requirements … of a temporary character requiring the use of any means to ensure timely promulgation in the interest of safety and which cannot be made available with sufficient expedition by publication in either a CASO or the NZAIP".

NZAIPs may be used for the purpose of promulgating "orders … of lasting character".

NZCARs may be used for the purpose of promulgating "orders, requirements … authorised or required to be published by these regulations".

CAICs may be used for the purpose of promulgating "information or any other matter relating to civil aviation for the purposes of facilitating the exercise of the functions of the Director". The latter part of this sentence can be interpreted as permitted promulgation of orders of short term character.

Regulation 18, offences and penalties, states that "any person who contravenes or fails to comply with any provisions of these regulations … any condition of the issue of any licence, rating, or certificate … or any lawful direction or condition specified in any MOTAM, CASO or NZCAR, should be guilty of an offence against these regulations".

The conditions precedent for a "lawful direction or condition" seem to be:

- publication of the order, requirement, or instruction in NOTAM, CASO or NZCAR only; and

- that the order, requirement, or instruction is required or authorised to be published by the Regulations with reference to a specific regulation conferring that power to the Director.

There are only a limited number of regulations that meet the prerequisite for a *lawful direction or condition*, compared to the large number of regulations conferring power to the Director to approve different things. The outcome is that, to satisfy a need, some minimum requirements for approval are published in CAICs, Civil Aviation Pamphlets (CAPs) and other documents. The operators complain about this situation, and some even refuse to accept these "unlawful" directions and conditions. As illustrated above, *it is fairly complicated to tell who is right.*

According to Annex 15 Aeronautical Information Services, NOTAMs may be used to promulgate changes in legislation requiring immediate notification. We would interpret the intention of NOTAMs and AIPs to be means of *informing* airmen about orders and requirements. The present Regulation 8A gives the reader the impression that NZAIP may be used to promulgate orders of lasting character. Regulation 18 indicates, however, that any such order would be *unlawful*, which is to our minds correct.

The general impression we get, by looking at the total volume of documents in which minimum requirements are spelt out, is confusion. The poor quality of the regulatory structure in general, and the confusion created in particular, are the two areas of greatest concern to the aviation industry. The energy lost in efforts to "beat the system" is incredible. We therefore propose total restructuring and rewriting.

14.5 STANDARDS AND INFORMATION PROCEDURES: A PROPOSAL

In Section 13.2 we addressed the need for standards to be promulgated by CASA. We proposed that standards should not be part of the law but should represent conditions to be met by an applicant to be vested with certain privileges. We also proposed that standards should be developed in co-operation with industry. The structure of the standards should be client-oriented, and we propose the following structure be considered.

Aviation Safety Standards

Part 1 Definitions and abbreviations

Part 2 Personnel training and licensing standards

Part 3 Commercial air transport operations standards[121]

Part 4 General aviation – helicopter operations standards

Part 5 General aviation – aeroplane operations standards

Part 6 Aerodrome design and operation standards

Part 7 Air navigation and ATS standards

Part 8 Meteorological Services standards

Part 9 Airworthiness standards

Further, we propose that in the future a strict division should be maintained between standards and information publications. The latter should be strictly informative. They could contain *information* about regulations and standards, but only when these have been promulgated properly.

14.6 SOME DETAILED COMMENTS ON REGULATIONS, REQUIREMENTS, ORDERS, ETC

14.6.1 Airworthiness Requirements

Against the cited comments from industry, we have reviewed airworthiness requirements and submit the following comments on particular subjects.

- From a technical point of view, the majority of airworthiness requirements seem reasonably sound and do reflect the general state of the art of the industry. There are exceptions where contents are out of date.
- In some respects requirements go too deeply in detail when matters could be left to approved organisations and licensed personnel.
- There is a general tendency to be very detailed in the subdivision of authorisations, certifications and approvals. The necessity for some approvals should be questioned. In future, the distinction between designated persons performing State functions and persons with vested privileges must be crystal clear.

[121] Addressing scheduled aeroplane operations and all aeroplane operations with aircraft over 5700 kg or more than 10 passenger seats.

- Another tendency is to approve individual persons at the lower levels of approved organisations, where it can be argued that it is sufficient for CASA to approve people at management level only. (See Chapter 12).
- The concepts of maintenance release, certificate of compliance, annual inspection and review inspection need revision. There is room for clarification and simplification.
- Requirements concerning provisions for entry of approved firms are generally sound and should constitute a good basis for vesting more responsibilities in such firms. Necessary pre-requisites are recognition of firms as approved legal entities and terminating Certificates of Approval.

14.6.2 Flight Operations

In the operational area the industry should be divided into two major groups, aeroplane operators and helicopter operators. The major concerns arise in the helicopter area.

The 1953 Regulations are made for aeroplanes. Helicopter operations were slowly introduced into New Zealand in the early seventies. Instead of developing separate regulations for helicopter operations, CAD tried to amend the existing regulations to cater for helicopters also. This approach has failed completely. The industry has complained bitterly, and has participated in working groups to support CAD in development of new regulations. The last helicopter review committee stalled in 1981. *We strongly recommend that separate regulations are established for helicopter operations.*

In reading the working papers produced by the helicopter review committee during 1979-1981, we gain the impression that CAD and the industry were very close to implementing of some sensible rules. As in the other areas of regulation we stress the need to *define* the terms used; to introduce terms like “joy-riding” and “undeveloped area” without a solid definition will create difficulties later on.

It is often stated that the versatility of the helicopter must be available to the customer to the limits of safe operation. But the helicopter’s ability to do things no other aircraft can do leads it to being exposed to a higher risk level more frequently and for longer periods of time. it is also argued that this higher risk level is well known and accepted by the operator, pilot and user, and cannot be regulated except by denying the helicopter’s potential to the end user; we do not agree that this need be so. The higher risk level might be well known by an experienced operator and an experienced pilot, but not known by the newcomers in the business and, for sure, not perceived by all end-users.

Again the best party to handle this situation is the experienced approved operator, having resources to take care of pilots, and gradually introduce new pilots to more demanding tasks as their level of experience increases. Another way is to have different requirements based on the type of operation and passengers carried.

- Passengers involved in high risk operations should be limited to crew members, inspectors (*eg* electricity transmission line inspectors), venison crew, and search and rescue and ambulance crew – all specially trained to be part of the mission crew.

- A second risk level involves passengers or ground crew specifically trained by the operator (*eg* off-shore platform passengers, workers on construction sites, and other helpers on the ground).
- The third level involves regular passengers (including patients involved in non-emergency transportation).

The above concept makes it possible to compensate for higher operational risk levels by more training and survival equipment for the passenger.

Finally, we support the opinion that the privileges vested in a helicopter pilot licence should address only the basic flying skills (PPL, CPL, Night, and Instrument). If the intention is really to seek to improve helicopter safety, then all the other applied skills necessary to utilise the versatility of the helicopter should be developed under the responsibility of an experienced operations manager in an approved organisation.

The outcome of this approach is that any new organisation entering the commercial scene will be limited to operations covered by the documented knowledge, skill and experience of the management involved. In order to expand the business into new, more demanding areas, the necessary competence would first need to be obtained. The approved organisation would be held responsible for not introducing any new activity for remuneration or hire until the required level of competence is gained.

14.6.3 Personnel Licensing

Personal licences are used extensively to vest privileges in individual persons within the civil aviation system. Part XII of the Regulations contains provisions for licensing and approval of aircraft maintenance personnel. Part XIII of the Regulations contains provisions for flight crew and airways services personnel licences and ratings.

Licensed Aircraft Maintenance Engineers

A new system for Licensed Aircraft Maintenance Engineers (LAMEs), has recently been introduced. The system has been developed with industry participants, and the persons concerned have expressed satisfaction. We consider that the new system, with its categories and ratings, may still be too complicated. We recommend a follow-up review within three years to evaluate the efficiency of the system and to propose considerable simplification.

The value of a formal licence renewal is questionable. Its main function is to establish that the licence holder is still active. Provided our proposed changes to the Act (with respect to privileges, corresponding responsibilities and strong means for enforcement) are accepted, we propose that the LAME licence and ratings thereto should be made non-terminating. The licence holder should be held responsible for not exercising his privileges unless he meets the minimum requirements for recent experience. Privileges equivalent to inspection authorisation (FAR 65.95) should be exercised by holders of Certificates of Approval only, as explained in Section 14.4.5 below.

NZCAR F1 states that "maintenance shall be performed only by a firm approved for the purpose"; except that on unpressurised piston engine aircraft used solely on private operations, and not exceeding 2730 kg certified takeoff weight, minor maintenance may be performed by an licensed aircraft maintenance engineer holding privileges appropriate to the aircraft. This is a sensible approach.

We support the concept that all aircraft (with a Certificate of Airworthiness) that are not maintained by an approved organisation on a regular basis, pass through an approved maintenance organisation at least annually. The approved organisation should be required to complete the annual inspection by issuing a Certificate of Maintenance Review. This document should be sent to CASA, to be used as a tool in CASA's surveillance. This will make it possible to remove the requirement for the Maintenance Release, which serves the same purpose as the Annual Inspection report.

NZ Gliding Association Engineers

The present Regulation 206, maintenance approval, is the provision for approval of NZGA Engineers recommended by the Gliding Association Technical Committee. According to the principles proposed by us, the *approval* would constitute a personal licence. We consider it appropriate that the Committee be given full responsibility, however, to internally approve engineers for maintenance of gliders and powered gliders.

Based on established requirements (similar to the existing NZCAR, Section J4) the Technical Committee of the Gliding Association should be an approved organisation with privileges to establish and maintain an internal approval system for AGMEs[122]. The Association should also accept the responsibility for the corresponding internal supervision of the AGMEs' performance. The privileges must be exercised according to rules established by the Association. The enforcement available to the Association would be limited to suspension or cancellation of the privileges given by them. Being part of the civil aviation system, a technical manager must be appointed within the Association, responsible for the internal approval and supervision process. The manager should be acceptable to the authority and named in the approval. For the purpose of issuance of Certificates of Airworthiness for gliders, which is a State function, a limited number of the AGMEs should be authorised by the authority. These persons would be personally responsible and accountable to CASA.

The present Regulation 206 can then be revoked as these functions will be covered by other regulations. Under our proposal, vesting of privileges in individual persons, other than through licences, will not occur. Any approved person is a person exercising some function within an approved organisation.

[122] Approved Glider Maintenance Engineers.

Certificates of Competency

Today, the Director may require any person performing specialised processes affecting airworthiness to hold a Certificate of Competence. Examples of such processes are welding and non-destructive testing. Most of the processes in question cannot be performed without special equipment and special facilities. That means the individual person is unable to exercise his privileges unless he also has access to the necessary equipment and facilities. This leads to the conclusion that a Certificate of Approval covering the man-machine environment is more appropriate.

We propose that CASA continues on the path established in NZCAR Section D5, and additional makes approved firms responsible for maintaining an appropriate number of internally approved persons capable of performing special processes. To make this arrangement work, the industry must be encouraged to establish procedures for training and examination of persons performing special processes. Industry standards must be approved by CASA. The present Regulation 207 can be revoked and requirements for special processes incorporated into the provisions for approved firms.

Approval of Aircraft Maintenance Training

We consider there is no need for approved instructors in accordance with Regulation 211. We propose that any instructor should be internally approved according to procedures included in the manual established by the approved Training Organisation.

Flight Crew Licences and Ratings

A major change to Annex 1 is currently being finalised by ICAO. We are aware that CAD staff have been involved. The change will include simplifications in the personnel licensing field. We recommend that New Zealand takes full advantage of the imminent amendment of Annex 1. The basic principle should be to minimise the number of licences and ratings in use. Looking at the present New Zealand system, *we propose that the following be removed:*

- *Cadet and flight navigator licences.* Air New Zealand does not operate any route that require a navigator on board. The new aircraft introduced have no station on the flight deck for a navigator.

- *Agricultural rating, helicopter.* Our opinion, supported by the industry, is that this rating is superfluous.

- *Chemical rating.* This rating has to do with the handling of poisons, *etc.* Strictly, this privilege has nothing to do with the civil aviation system as such. Bearing in mind that the pilot must have a licence anyway, the most cost-effective way to administer this privilege may still be to attach it to the pilot licence.

- *Compass rating*. To swing a compass is a maintenance task. The person responsible for this task is a person holding an aircraft maintenance licence or a person internally approved for that task performed within the privileges of an approved firm. The pilot's role is to position the aircraft as directed by the maintenance engineer. No compass rating is needed for that function.

- *Approved test pilots (Regulation 47).* The knowledge, skill and experience needed for a test flight is related to the test to be performed. When testing prototype aircraft, the whole programme must be established with the pilot test function as an integral part. CASA involvement, if appropriate, must anyway cover all aspects (not only the test pilot). We propose that Regulation 47 be revoked. Any test pilot requirement is covered either by conditions when issuing a Special Flight Permit (Regulation 19(2)) or by conditions laid down in the operations manual of the approved organisation.

- *Flight operations officers.* For completeness, there is provision in Regulation 138(2) for issuing licences to flight operations officers. This provision seems superfluous today, especially as it addresses flight operations officers employed by foreign operators and stationed in New Zealand. Foreign operators are not New Zealand's responsibility.

Approval of Flight Training Organisations

Today, no person may act as a ground instructor at an approved school or training organisation unless he has been approved under Regulation 192 for that purpose. This requirement creates a massive workload on CAD. There is no standard in Annex 1 requiring a State to approve ground instructors on an individual basis. The basic ICAO standard stipulates that "approved training established by a Contracting State should provide a level of safety at least equal to that provided by the minimum experience requirements for personnel not receiving such approved training". This provision is there to make it possible to reduce the experience requirements for pilots who have satisfactorily completed a course of approved training. To make this work, the management responsible for the training organisation should be held responsible for the provision of qualified ground instructions. We propose that Regulation 192 be revoked.

Regarding type training performed within an approved training organisation of a commercial air transport operator, the need for instructors to hold flight instructor ratings must be questioned. The chief instructor should be entrusted with the responsibility to appoint persons (with the required knowledge, skill and experience) as instructors for type training. The criteria used for selection should be found in the manual system of the organisation.

More generally, CASA should review the need for having so many different instructor ratings. The privileges of an instructor could be regulated on the basis of documented experience, without the need to amend the rating.

14.6.4 Approved Organisations

Chapter 12 discusses the general principles for distribution of responsibility within the civil aviation system. It states that a Certificate of Approval is granted to organisations vested with specific privileges and corresponding responsibilities. It also states that an approved organisation may, subject to rules laid down during entry control, approve employed persons, licensed or not, to exercise functions within that organisation, including signing of specified releases or approvals on behalf of that organisation.

In the assessment of the existing rules and regulations concerning organisations the above principles will be applied. The same principles were used in Section 14.6.3 to single out any person today approved or licensed by CAD, but who is really exercising the functions of an approved organisation.

Commercial Air Transport Operations

The following discussion concentrates on the provisions in the Regulations, ignoring the fact that the definitions in the Air Services Licensing Act and Regulations 1953 are different.

We propose one set of comprehensive standards, covering all commercial air transport operations as defined below:

> *Commercial Air Transport Operations* includes: all scheduled air services; and all non-scheduled air services (including executive operations[123]) with aeroplanes having a maximum certificated takeoff weight above 5700 kg or a passenger seating configuration (excluding pilot seats) of 10 seats or more[124].
>
> This definition is formulated to cater for aeroplanes meeting FAR Part 25 or SFAR No41 Part 135 Appendix A, SFAR 23 the new commuter category within Part 23, or equivalent design standards. To gain full advantage from the higher safety level built into the designs of these more sophisticated aeroplanes they should be operated and along the lines of large aircraft.

The rationale behind the inclusion of *executive operations,* as defined above, is to seek a similar level of safety for the employed person (who is required by his employer to use this mode of transport) by applying the same requirements as for other passengers travelling in the same types of aeroplanes in commercial operations.

[123] *Executive* operations means all private operations in which an aeroplane as defined above is used for the transport of persons who are required, by an employer, so to travel.

[124] Because New Zealand accepts a passenger in the second pilot's seat during one-pilot operation, this can also be interpreted as meaning operations with more than 10 passengers.

General Aviation Operations

Having defined commercial air transport operations according to the previous section, we now propose that all operations which do not fall under the definition be classified as *General Aviation Operations.*

There will be a need for comprehensive standards covering all aspects of general aviation operations. The standards will need to be subdivided according to the different characteristics of the operations concerned. In principle, we see a need for three sets of general aviation standards, namely:

- helicopter operations (commercial and private)
- commercial operations, aeroplanes
- private operations, aeroplanes.

Approved Organisations, Airworthiness

Looking at the continued airworthiness of aircraft using a life cycle approach, many “provider functions” are involved. All must be covered by the Regulations. It is presumed above that each operator’s Certificate of Approval covers its own maintenance facilities; also, that all independent maintenance organisations have their own Certificate of Approval. The relationship today between the independent maintenance facilities and the operators they serve is not clear from a responsibility point of view.

In Regulation 136(4)(c) there is provision for a maintenance manual; management and the distribution of responsibilities are not covered by the Regulations. In CAP 36 an effort is made to overcome this. There it is stated that “one person on the operator’s staff must be designated as being responsible for overall control of maintenance”. The actual work can be contracted out, however, to an outside organisation. Only under his Certificate of Approval is the maintenance contractor responsible for the standard of the work he performs. He is not responsible for the availability of the aircraft for maintenance. This is an area of conflict.

Where maintenance is contracted out, to an outside facility, it is not enough to accept a maintenance coordinator who does not have the necessary authority. One acceptable solution would be to include the provision of the management function in the outside contract. An appropriate person employed by the contractor could then be recognised and accepted as the operator’s maintenance manager.

The maintenance manager should be responsible for updating the operator’s maintenance manual. This manual must be the reference for all work on that operator’s aircraft. This is also an area of conflict. Incorporated into his maintenance and workshop procedures, the contractor probably has another more standardised manual which may not take account of particular operating conditions. One acceptable solution would be to include the operator’s manual in the contract.

The important issue is to establish a relationship between the operator and the contracted maintenance facility that work sin practice – not only satisfies some formal regulations. A practical solution is to ensure that the person controlling the expertise and the maintenance resources also ahs the authority to accept, and be held responsible for, continued airworthiness.

Regulation 176 confers authority on the Director "to grant a certificate of approval to a firm or a person for the purpose of design, construction, maintenance, processing, or supply of aircraft and aircraft components". There is a need for more designs and construction support within the industry. CAD today performs a substantial amount of consultancy in this area. Under our proposal this will terminate. Future regulations must continue to include provision for approved design and engineering organisations.

There are minimal provisions for manufacturing in the existing Regulations. Regulation 161(2)(b) talks about "material and processes used in construction". Regulation 174(d) addresses aircraft components "constructed and inspected under approved conditions". It is significant to the state of the art that NZCAR E2 (manufacture of aircraft and aircraft components) is not issued pursuant to Regulation 176, despite the fact that this regulation is the provision for granting approval to manufacturing firms. This is so because Regulation 176 does not confer on the Director the power to issue detailed requirements for entry.

A processing firm is usually a subcontractor to a manufacturer or to a firm performing major maintenance. A firm working solely under one contract might be covered by the Certificate of Approval of the Contractor. If the processing firm wants its own approval, the general rules for approved firms should apply.

We concur with the existing principle (as noted in Section 14.6.3, on Licensed Aircraft Maintenance Engineers) that all maintenance on commercial aircraft and on all sophisticated aeroplanes should be performed by an approved firm. Furthermore, we suggest that all commercial operators should either have their own maintenance organisation or, if that function is totally contracted out, the contractor should take the responsibility for continued airworthiness. This proposal will probably create some turbulence. This is good, because a contractor refusing to take on this responsibility might well point to an arrangement that is not working.

According to Regulation 176 the Director may grant a certificate of approval to a firm or person for the purpose of "supply of aircraft and aircraft components". Aircraft components includes everything used in construction, maintenance and operation of aircraft.

NZCAR D6 and E5 relate to provisions for approval of suppliers. The purpose for the Certificate of Approval is to grant the supplier the right to issue release notes. Release notes are not explicitly covered by the present Regulations. Regulation 174 addresses "components fitted to or intended for use in any such aircraft". That leads to the conclusion that a Certificate of Compliance is one sort of release note.

Some system of airworthiness approval document or tag is needed to carry information about the airworthiness status of the applicable component. Suppliers come into the picture when a supplier either imports a large batch of components and sells the parts one by one, or is performing a required inspection or test before the component can be release for sale. The argument the is that the supplier must be approved in order to issue a release note. This is also applicable to oil companies supplying fuel *etc.*

Today some 90 firms have some 130 different privileges to supply components as approved suppliers. The original release note is provided by the manufacturer. This document will follow the component all the way to the approved maintenance facility. That facility is responsible for not installing any component where the airworthiness status is not properly documented.

The split batch case is usually a question of standard parts (such as bolts and nuts) conforming to established industry specifications. They can be treated by a statement of the batch on the sales document. It is still the responsibility of the approved maintenance facility to ensure conformity.

Any necessary inspection or test is maintenance work leading to a change of status of the component. Then a Certificate of Compliance has to be issued. To do that takes an approved maintenance facility, not a supplier.

The oil companies provide products meeting industry approved specifications for fuel, oil, *etc.* It is “overkill” to require them to be approved suppliers.

Storage facilities for products that require special storage conditions is the remaining area of concern. There are a limited number of products, such as metal-to-metal and composite bonding resins or films, where closely controlled shipping and storage conditions are critical. The processes where these resins or films are used require approved special-process firms. Those approved firms should be held responsible to ensure source control, because *they* have the required expertise, not the intermediate supplier.

In summary we see no need to retain the present system of approved suppliers; that provision in the Regulation 176 can be revoked, together with all existing approvals of suppliers. There must still be provision in the regulations for setting standards with respect to handling, marking, storage and delivery of any fuels, lubricants or chemicals used during, or in connection with, the operation of aircraft.

14.6.5 Personal Authorisation

There are a number of areas where it is convenient and practical for CASA to delegate State functions.

The largest group, by numbers, is in the personnel licensing area. Flight examiners, medical examiners, simulator examiners, and other examiners in the ground training area have to be authorised in person by CASA.

There are about 500 flight examiners today. This, in our mind, is far too many. To keep a uniform standard of performance in such a large group of people is an impossible task. It would be desirable to reduce this number to between 50 and 100.

Since they are acting on behalf of CASA, all authorised persons should be properly trained for their duties. Their performance should be the same as if the task were executed by a CASA employee. There should be annual meetings at which the examiners, by category, are brought together for update and exchange of information. There should be some monitoring of the performance of authorised persons.

The question of remuneration for services provided by the designated person is important from the point of view of integrity. The designated person is acting on behalf of CASA, and it is proper that he be remunerated at an appropriate rate, decided by CASA and not left to the whims of individuals. It is preferable that the designated person be paid by CASA. It can be argued that it is more cost-effective for the designee to collect a sum of money direct from the applicant, and keep it as his remuneration for the examination. This is the way the system works today, without any fixed price. The final outcome may be influenced by the methodology adopted for "user pay".

14.6.6 Aerodromes And Aerodrome Services

The existing rules regarding design and operation of aerodromes in New Zealand are based on the Civil Aviation Act and the Civil Aviation Regulations.

Regarding aerodromes the Act describes the powers of the Minister in respect of aerodromes and facilities, and institutes the aviation security service.

The Regulations contain some general rules for licensing of aerodromes and authorise the Director of Civil Aviation to include conditions in the aerodrome licence. There is no provision in the Regulations for aerodrome standards. Thus the main document regulating aerodromes is the aerodrome licence and the provisions and conditions attached to it.

CAD has an Aerodrome Standards Manual, based on Annex 14. This manual, however, is an in-house document and does not have the status of a national standard for aerodromes other than those operated by CAD. With the recent developments in New Zealand (*ie* airport companies) there will be many different providers of aerodrome services. The need for design standards is obvious. This is not just a matter of building an aerodrome; it entails continuous monitoring of development of obstacles, lighting and marking requirements, *etc.*

As outlined in Chapter 12, we propose that the provider or operator should bear the main responsibility for ensuring that operations are carried out according to the defined performance standards. To make this possible, standards for operation of an aerodrome must be available to the operator, and have the status of conditions for the aerodrome Certificate of Approval.

A Standard for aerodrome operation should include some of the present regulations, some of the provisions in the present licences, and such new provisions as CASA finds fit to include, *eg* requirements regarding operation manuals, organisation, competence and training of personnel, internal quality assurance, reports, safety on the manoeuvring and tarmac areas, and interface with the local air traffic services. The present requirements for rescue fire services would have their proper place in this Standard, as would provisions for bird and wildlife control and emergency planning.

Security standard, when established, should also be included here.

Our proposal is that the requirements for aerodromes and aerodrome operations should be contained in:

- Civil Aviation Act
- Civil Aviation Regulations
- Aerodrome Design Standard
- Aerodrome Operations Standard

Provisions for the two Standards should be included in the Act and the Regulations, and be developed by CASA in co-ordination with the providers and the air operators.

These documents should be supplemented by a manual issued by the aerodrome operator to inform and instruct his personnel on how operations should be performed in order to achieve prescribed safety standards and other goals established by the operator.

14.6.7 Airways Services And The Borderline With Aerodrome Services

The present requirements within the area of airways service are to be found in the Civil Aviation Act, the Civil Aviation Regulations and operational manuals.

The Act defines the term "airways services" and prescribes that the Airways Corporation should be the sole provider of area control, approach control and flight information services. It does not explicitly spell out requirements for a licence or certificate for these services. To provide aerodrome control, aerodrome flight information and aerodrome rescue fire services, the provider must hold a licence or certificate as required by the Director of CAD.

The Regulations establish the basic rules of the air and air traffic control. It also regulates that no person should provide any airways service except under the authority of, and in accordance with, the provisions of an airways services certificate issued by the Director, who may include in the certificate such conditions considered necessary in the interest of safety. Any holder of such a certificate should provide operations manuals for the use and guidance of his operations personnel. The contents of manuals are outlined in the Regulations.

The Regulations further require that a holder of a certificate should provide a training and monitoring organisation and ensure that all its personnel are properly instructed. Basic rules are established for reporting and investigation of air safety incidents.

It can be seen from the above that there are contradictions between the Act and the Regulations. Whilst the Act does not require the Airways Corporation to have a licence or certificate issued by the Director, the Regulations state that “no person shall provide any airways service except under the authority of … an airways services certificate issued by the Director”.

Further, the definition of Airways Services in the Act is incomplete as it does not address some other areas (*eg* communications and navigation services, aeronautical information services and aeronautical charts) for which the Airways Corporation is now acting as the provider.

We propose that an overall re-definition of airways services takes place and that the borderline between airways services and aerodrome services be reconsidered.

Our proposal is that Annex 14 should be the basis for definition of aerodrome services. This would mean that runway markings, other visual aids, taxiway, runway and approach lighting systems, power supply and rescue fire services, would be defined as aerodrome services rather than airways services. This would provide for a more practical division of responsibilities between aerodrome providers and the Airways Corporation. We consider it reasonable that an aerodrome operator has full control over what is happening on the airport surface. The Airways Corporation, however, may still be contracted by the aerodrome operator to *perform* some or all of the aerodrome services.

Annexes 4, 5, 10, 11 and 15 would then be the basis for defining airways services.

In accordance with our basic philosophy, an operating organisation should be responsible for ensuring that operations are carried out according to defined performance standards. To make this possible, standards for airways services must be available to the providers.

With this background, our proposal is that the regulatory framework for regulating airways services should be:

- Civil Aviation Act
- Civil Aviation Regulations
- Airways Services Standards covering services and facilities in all areas of airways services, according to the new definition.

Provisions for Standards should be included in the Act and the Regulations. Standards should be developed by CASA in close cooperation with providers and air operators.

In areas where the Airways Corporation is the sole provider of services, the Standards could be of a framework character, giving reference to applicable ICAO documents where practicable. For contestable areas, the Standards should be detailed enough for providers who may not have deep specialist knowledge of technicalities. In all cases there will have to be requirements for internal quality assurance.

In order to achieve prescribed safety standards and other goals established by the operator, the requirements need to be supplemented by operational manuals issued by the operator to inform and instruct his personnel.

CHAPTER 15

THE INSTITUTIONAL STRUCTURE

15.1 CURRENT INSTITUTIONAL FRAMEWORK

15.1.1 Background Of Public Sector Reform In New Zealand

The recent switch in economic philosophy in New Zealand is based on the belief that giving people freedom to manage their own affairs is better than government intervention. This has lead to a two-pronged process of reform.

Firstly, the government has moved swiftly to remove itself from regulating markets in which government has no essential role. By freeing entry into markets and establishing market "contestability", deregulation is expected to lead to more efficient use of resources, higher productivity, higher economic growth, better matching of supply and demand, and (insofar as those who make the effort reap the benefits) equity.

In relation to this study we should note the distinction between *economic deregulation* and *safety deregulation*. Safety and the economy are not unrelated, but it does not follow that economic deregulation will liberalise safety standards. As a nation's income and wealth increases, renewed demand for higher levels of safety may result in a greater degree of safety-related rules and regulations.

Secondly, government departments operating as trading organisations and/or providers of commercial services have been "corporatised" as State-owned Enterprises (SOEs) and given management autonomy. The first round of public sector reform resulted in the State-owned Enterprises Act 1986 and the establishment of nine new SOEs controlling 12% of the nation's GDP. Key to the SOE Act were accountability provisions for managers. According to the Deputy Prime Minister, Rt Hon G W R Palmer[125], "the constitutional importance of the Act lies in the new and enhanced system of accountability for State-owned Enterprises that are provided for in the measure."

By pursuit of these objectives the New Zealand economy has changed from one of the most regulated and controlled in the OECD into a market-oriented economy. The main thrust of government priorities is now aimed at: providing a stable economic environment, reducing transaction costs, improving public and private sector incentives, and allowing free access to markets.

[125] Palmer, G W R, *Unbridled Power,* Oxford University Press, Second Edition (1987).

Creation of the SOEs was the most dramatic change in public administration for many years. The discussion and debate leading up to "corporatisation" highlighted some salient points. In part, they reflect the fact that government is a political process. More importantly, however, they address the decision making and organisational environment in which public servants work.

- The political process can be a difficult environment for making commercial decisions – for example, it is difficult to reverse an early political commitment to a project when later feasibility studies are negative.
- Ministers must recognise political factors as well as commercial and economic considerations, and managers of government departments can be caught in a conflict between political and commercial principles.
- State departments have had unnecessary or inappropriate bureaucratic controls, lack of managerial autonomy and proper accountability, unclear and conflicting objectives and, in some cases, organisational structures inappropriate for their functions and roles.

While these points were made in relation to State trading organisations, many apply to departments responsible for economic development, welfare, *etc.* Broad public sector reforms are now addressing the environment in which government departments have focused on inputs (rather than outputs or performance) and management efficiency at top levels; the latter is the motivation for the State Sector Act 1988 which has just been passed.

There are, in essence, three categories of government agencies[126]:

- government departments,
- State-owned enterprises, and
- quangos.

The broad characteristics of these instruments of government, as they might be relevant to a civil aviation safety authority, are set out below.

15.1.2 Government Departments

New Zealand Government departments can be grouped into four areas of activity[127]:

- economic development,
- law and order,
- welfare, and
- government.

The Ministry of Transport (including the Civil Aviation Division) falls into the economic development group.

[126] Two, namely government departments and State-owned enterprises, are part of the State Service.
[127] Palmer, G W R, *op cit.*

Government departments have a variety of different names, for example:

- Ministry (*eg* Ministry of Transport)
- Department (*eg* Department of Trade and Industry)
- Corporation (*eg* Housing Corporation)
- Office (*eg* Crown Law Office, Audit Office)
- Commission (*eg* State Services Commission).

From an institutional point of view, the name makes no difference; it is merely a matter of nomenclature. They are all government departments headed by a public servant called the *Permanent Head*. The Permanent Head is responsible to the Minister in charge of the department for the efficient and economical administration of the department. Government departments are staffed by public servants[128]. The principal duty of the public servant is to the Minister in charge of the department[129]. The Minister has executive power and has a specific area of the Public Service to control.

The Minister of Civil Aviation and Meteorological Services controls the Civil Aviation Division and Meteorological Services. The Director of Civil Aviation serves, first, the Minister. But the Civil Aviation Division is part of the Ministry of Transport. The Ministry of Transport is controlled by the Minister of Transport (who is also the Minister of Civil Aviation and Meteorological Services). The Secretary of Transport presumably serves, first, the Minister of Transport, as distinct from the Minister of Civil Aviation and Meteorological Services, but has some responsibility to the latter.

As long as the Minister of Transport and the Minister of Civil Aviation and Meteorological Services remains one and the same person, this arrangement will probably not generate too many problems for the Minister, his Permanent Head or the relevant departments.

The position regarding the Director of Civil Aviation and his responsibilities to the Minister of Transport do not seem as clear. It *is* clear that the Director of Civil Aviation has responsibilities and functions imposed on him by the Civil Aviation Act. None of these responsibilities and functions involve the Secretary of Transport. Also, the Director may have responsibilities and functions imposed on him by the Minister of Civil Aviation and Meteorological Services; these responsibilities need not involve the Secretary of Transport.

The present relationships and responsibilities between the Minster of Transport and his Permanent Head and the Director of Civil Aviation are not as transparent as they might be; they are not clear to those in the civil aviation system or to third parties affected by the system.

Under section 26 of the old State Services Act 1962 no appointment to the Public Service could be made from outside the Public Service unless the person appointed had *clearly more merit* than any officer from within the service; it was

[128] With exceptions, *eg* members of the Armed Services, Police, and some others.
[129] Probine, M C, *The Public Service and Minister,* (1983).

virtually impossible to satisfy this *clearly more merit* burden of proof. This did not apply to higher appointments, which were governed by section 29; nevertheless, appointments from outside the public service were extremely rare.

The State Services Act 1962 was recently repealed by the Stat Sector Act 1988 which effects important changes in the way in which top Public Sector appointments are made. For the purposes of this review we have accordingly assumed that there will be no limitations as to conditions and terms of employment for public servants.

15.1.3 State-Owned Enterprises

One of the prime objectives in establishing State enterprises[130] was to clearly separate the State's commercial (provide or trading) functions from its non-commercial (regulatory or social) functions; the SOE Act does this.

The principal objective of an SOE is to be a successful business and this is clearly stated in section 4 of the SOE Act. The key principles of the SOE Act involve accountability of the managers of SOEs; managers will be assessed on commercial criteria. The heart of the accountability provision is the statement of corporate intent. This statement sets out what the SOE plans to do in a number of operational and financial areas for the current financial year, and the two following years. There is provision for SOEs to undertake non-commercial activities if the government chooses to pay for them.

In all there are 14 SOEs. Two of these are organisations form a major part of the New Zealand civil aviation system: Air New Zealand Limited[131] and the Airways Corporation of New Zealand Limited.

15.1.4 Quangos

A quango is a *quasi-autonomous non-governmental organisation.* Quangos are *loosely* connected to government and, as the acronym suggests, are not government departments. There are many quangos in New Zealand, and the government has declared it will "clean out the quango cupboard".

As part of government, quangos can perform useful and in some cases essential tasks. Thus quangos are likely to continue to be a tool of government administration. As administrative instruments, quangos may be chosen for certain roles because they:

- relieve Ministers of responsibility for detailed or specialised tasks;
- avoid direct political control and provide a measure of independence from government;
- avoid bureaucratic control and procedures;
- bring people outside the Public Service into decision making; and
- allow interest groups to participate.

[130] *State* enterprise is the term used in the SOE Act for a State-owned enterprise.
[131] Safe Air Limited is a wholly owned subsidiary of Air New Zealand, Mount Cook Group is owned 77%, and Air New Zealand owns 90% of Cook Islands Airways Limited.

Quangos take various forms; for example:

- commissions (*eg* New Zealand Fire Service Commission);
- statutory corporations (*eg* Accident Compensation Corporation);
- companies (*eg* Air New Zealand Ltd);
- tribunals (*eg* Planning Tribunal);
- boards (*eg* Aviation Safety Board);
- authorities (*eg* Air Services Licensing Authority);
- committees (*eg* National Aviation Advisory Committee, National Facilitation Committee);
- incorporated societies with government funding (*eg* Rehabilitation League NZ).

Depending on the role and task for which they are established, quangos can have advantages and disadvantages.

- Quangos may, after a time, pursue different goals from those for which they were established.
- Quangos can appoint staff without concern for appeals (although this is less relevant under the State Sector Act 1988).
- Quangos have greater independence, than do government departments, from Treasury control and scrutiny.
- Quangos are probably less publicly accountable.
- Quangos are subject to less Ministerial intervention or supervision.
- Quangos may be susceptible to "capture" by those the quango is supposed to regulate.

Each one of these is capable of being an advantage or a disadvantage, depending on one's viewpoint and the actual performance of the quango concerned. Perhaps the most significant disadvantage (or maybe advantage) is the lesser public accountability made possible by a quango.

Quangos are not foreign to the civil aviation system in New Zealand.

15.1.5 Government Joint Ventures

The government has various joint ventures, mainly commercial. There are two types:

- as shareholders in a joint venture company (*eg* Auckland International Airport Limited); and
- as a joint venture partner (*eg* Tauranga Airport).

Government joint ventures have been a feature of airports facilities and services.

15.1.6 Civil Aviation Division

In New Zealand the civil aviation safety authority is a State Service and an instrument of the Crown. The civil aviation safety authority is part of the Public Service; more particularly it is a division of a government department. That government department is the Ministry of Transport, and the civil aviation safety authority is the Civil Aviation Division of the Ministry of Transport.

The civil aviation safety authority has always been part of the State Service. At least since the establishment of the Department of Civil Aviation, it has been part of the Public Service.

With the introduction of the SOE Act and the formation of the Airways Corporation, CAD has largely been stripped of its major "provider" function. In addition, the Airport Authorities Amendments Act 1986 is a step towards the government's withdrawal from provision of airport facilities.

The Minister of Civil Aviation and Meteorological Services is the Minister primarily concerned with the government's joint venture airports. Administrative input to the government's joint venture airports is provided by the Policy Division of the Ministry of Transport; for government-owned aerodromes it appears to be provided by both CAD and the Policy Division[132]. Concerning future provision of airports and airport facilities, the administrative and operational roles of CAD and Policy Division will diminish.

In 1976 an amendment to the Civil Aviation Act 1964 set up the Aviation Security Service as a branch of CAD. This service is a provider function within CAD. The Secretary of Transport (and *not*, in the first instance, the Director of Civil Aviation) is responsible for the administration of the Aviation Security Service.

So, apart from the Aviation Security Service, CAD has today been stripped of its major provider functions. Its operational involvement in airports is also, as a result of government policy, on the way out. Putting aside the Aviation Security Service and the *ad hoc* consultancy need CAD has tended to fulfil, this means that CAD is essentially a regulatory and safety authority today.

There is no competition or conflict between CAD and other modal divisions (marine and road) for Ministry of Transport resources. There is no influence of one division over another on safety matters. Administratively, and in a regulatory and safety sense, the Civil Aviation Division has unique requirements and a client base all its own[133]. CAD neither interferes with nor has any technical or operational interest in the other two modal divisions, and *vice versa.* The three modal divisions function as independent divisions.

Currently a study of the total structure and functions of the Ministry of Transport is underway. This study includes proposals to reorganise the Ministry into a *structure which draws a clear distinction between a transport strategic issues unit and standards units undertaking regulatory activities*. It also suggests the

[132] The licensee of military aerodromes is the Secretary of Transport; presumably in the event of their use for civil aviation purposes.
[133] With the exception of seaplanes of which there are only a few on the New Zealand aircraft register.

separation of policy (regulatory) and operational (surveillance) functions between head office and the regions.

The suggestions and recommendations of the above study team may not be appropriate for a civil aviation safety authority for three reasons:

- it will not be possible to separate the so-called policy and operational functions of a civil aviation safety authority between head office and the regions (especially if regions are considered unnecessary for the civil aviation safety authority);
- the suggested role of the strategic issues and standards unit[134] appears to be of little or no value to a civil aviation safety authority exercising regulatory and administrative functions, a significant input to which originates from obligatory international standards bearing no relation to marine and road; and
- in a "user pays" environment there would be no competition for resources between the three modes.

15.2 ORGANISATIONAL AND INSTITUTIONAL CONSIDERATIONS

There are many factors to consider when deciding the most appropriate institutional set up for civil aviation safety authority:

- the role and functions of the safety authority;
- resources, management, and organisational arrangements of the safety authority;
- external relations, both foreign and domestic, of the safety authority;
- corporate identity (public image) and the organisation's transparency to users;
- institutional arrangements adopted in other countries with similar ambition levels in civil aviation safety; and
- historical arrangements for civil aviation in New Zealand.

These are discussed below.

15.2.1 Role And Functions Of The Safety Authority

The *role* of the safety authority is to seek to ensure public safety in civil aviation according to established goals and objectives;

In other words the role of the civil aviation safety authority is to administer national policy and international obligations relating to civil aviation safety. This is best handled by a State institution.

[134] The suggested role for the strategic issues unit (SIU) is to: recommend government policy, determine the Ministry's mission, negotiate Divisional objectives and targets, and perform audits of the Divisions. In a user pays environment consideration needs to be given to: whether SIUs are appropriate in this environment; whether the user ought to pay for them; and, if the user should, who *is* the user and how should he be charged.

The *functions* of the safety authority are to:

- develop and provide *standards* for the civil aviation system;
- perform *entry control* for new entrants wishing to join the system;
- perform *functional supervision* over all elements of the civil aviation system;
- perform *exit control* for all elements leaving (voluntarily or involuntarily) the civil aviation system; and to
- *analyse* the changing commercial, technical and social environment so as to maintain appropriate regulations, standards and procedures.

These functions are best performed by a State institution.

15.2.2 Resources, Management And Organisation

The current study of the total structure and functions of the Ministry of Transport recommends that "operating divisions would have sole responsibility for developing and requiring adherence to standards, and would be given control over the resources allocated to these programmes" and that " this study has determined that modal directors should have all the resources required to achieve their objectives".

The recommendation that support services be under the control of the modal directors is supported by our findings. Indeed, if the civil aviation safety authority lacks a dedicated administrative support group its effectiveness and efficiency suffers (as is the case today under the present organisational arrangement within the Ministry of Transport).

A basic issue is whether the civil aviation safety authority should be one of the modal divisions of the Ministry of Transport (or Ministry of Safety, perhaps) or whether the civil aviation safety authority should be an independent stand-alone organisation.

There is more to the answer to this question than the cost of an additional layer of management over the Director of the safety authority if it were part of a Ministry of Transport. Yet one of the objectives of public sector reform is government efficiency, and this must be a significant factor. The administrative arm of the civil aviation safety authority need not be large.

It might be argued that the advantage to a civil aviation safety authority in being part of a Ministry of Transport is access to a greater range of skills. On the other hand, it can be argued that skills in the other modes of transport (marine and road) would be available anyhow, but from a different department; or they could be purchased from the private sector. It might also be argued that skills in accounting economics, law and commerce might be more readily available if the civil aviation safety authority were part of a Ministry of Transport. On the other hand, in-house availability of such skills might at times stifle seeking better advice on special issues from *outside* government. And, if there were an ongoing need for these skills (and the benefit exceed the cost) they could be incorporated into the staffing of the safety authority. Thus we do not consider "a greater range of skills" to be a valid argument.

It might be argued that there are other advantages to locating a civil aviation safety authority within a Ministry of Transport or similar Ministry. These arguments essentially rest on statements such as the "need for coordinated transport policies and strategies at a national level", and "aviation, marine and road are alternative modes of transport and so it is appropriate to amalgamate the various modes into one Ministry structure. Amalgamation improves accountability for public resources devoted to transport; resource allocation is better, and modal objectives will not conflict".

Such arguments do not stand up to scrutiny if provider functions (such as airways services, airports and aviation security) are removed from CAD. There is no competition between the modes for resources. Airports, seaports, airways services, shipping companies, airlines, *etc* are already owned, operated or managed outside the Ministry of Transport. And, as the opening words of this chapter pointed out, government policy is to give enterprises the freedom to manage their own affairs. So the question must be asked, *what intermodal policies and strategies require coordination at a national level?* The only policy that might be co-ordinated is safety.

That aviation, marine and road are forms of transport is not a good enough reason, on its own, to amalgamate them into one Ministry[135]. And the argument that amalgamation improves accountability is difficult to substantiate. One of the corner-stones of public sector reform has been to improve accountability of managers in the State Service. The answer has been to establish State enterprises by divesting State departments of their provider or commercial functions. The point is that, in a move to improve accountability of these government departments, they have been broken up into smaller but logical, common operating functions (*eg* the Post Office). There is plenty of evidence that this strategy is working. So, on the contrary, amalgamation is more likely to undermine accountability.

From a management viewpoint, the advantages of a stand-alone civil aviation authority would be:

- clear authority (from the Minister and Parliament) and no diffusion of accountability; and
- greater transparency, making it easier to assess (and perhaps also to measure) the administrative and management performance of the civil aviation safety authority, making it more acceptable to its clients in a "user pays" environment.

Thus, from the considerations of resources, organisation and management, a stand-alone institutional set up is better than a safety authority that is part of a greater government department.

[135] If it were, then why not rail?

15.2.3 External Relations

In this section we address the civil aviation safety authority's relations with external bodies, both international and domestic. These considerations point to the civil aviation safety authority ideally being within the State Service.

New Zealand is part of the international community and as a member of the United Nations has a number of obligations. Our relations with other nations across a range of matters (diplomatic, trade, banking, taxation, communications, postage, customs, weather information and civil aviation) exert a strong international influence on New Zealand to conform – through obligatory international standards and internationally recognised recommended practices. Many such matters are regulated through international treaties and conventions having their own international secretariates[136]. The Chicago Convention and ICAO is one such international body exerting influence on New Zealand.

According to the Deputy Prime Minister, Rt Hon G W R Palmer, these obligations place a substantial restraint upon the freedom of action of the New Zealand Government[137]. It follows that a State institution is the most effective type of institution to deal with constraints placed on the New Zealand Government by its international obligations[138].

On the domestic scene a myriad of external forces exert influence and pressure on the civil aviation system. These were discussed in Chapter 5. The consequences of a civil aviation safety authority being "captured" by any organisation or group could be catastrophic. The institution best placed to withstand the commercial and third party pressure is probably one within the State Service. The State Service in New Zealand has an enviable record in terms of absence of corruption; and State servants are recognised as being politically neutral.

An institution within the State Service can best provide for the considerations encompassed by the term *external relations*.

15.2.4 Corporate Identity (Public Image)

The corporate identity (public image[139]) of the civil aviation safety authority is a small but nevertheless significant consideration. Corporate identity plays a large part in revealing to the outside world what an organisation is like and how it can be expected to behave. It also helps internal cohesion, a point which is often overlooked.

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[136] In 1947 ICAO became a specialised agency in relationship with the United Nations.
[137] Palmer, G W R, *op cit.*
[138] In any event, ICAO requires that a number of State functions, such as the issue of personnel licences, be fulfilled by the State. Naturally a State institution can do this, although a private institution could also do it if it had the necessary State authority.
[139] The popular word for corporate identity is *image*, but is avoided here because it can have connotations of an *artificial imitation* or an *artefact.*

A corporate identity helps to:

- make customers and clients recognise its services (or products) as being distinct from those of others;
- attract the best people to work for the organisation;
- persuade industry, society and government that the organisation is a “good neighbour”; and
- persuade financial institutions to offer money.

If an organisation does nothing about its corporate identity, then, by default, it takes on the same *appearance* as most other organisations doing similar things.

No doubt the corporate identity a civil aviation safety authority would like to project to its clients is that of:

- being knowledgeable about all civil aviation safety matters as they relate to regulations, standards and performance;
- being scrupulously straightforward and honest;
- having the power of legitimacy to enforce civil aviation regulations and standards; and
- being staffed by top class people with appropriate experience, qualifications and expertise in civil aviation.

The safety authority would like to be seen by its employees as being a good employer and as being effective in its role as a civil aviation safety authority.

To Society and the third power group, the civil aviation authority would like to be viewed as being all of the above.

To sum up, the key words are: civil aviation, competence, good employer and legitimacy. An institutional arrangement that can foster or enhance this type of corporate identity would help the safety authority not only in its dealings with the “outside world” but also to build internal cohesion.

It is plain from our discussion with organisations within the commercial power group, and from our knowledge of the third party powers, that the current institutional set up detracts from the public image and corporate identity of CAD. Most people employed by CAD believe it has a poor public image. They also consider that being part of the Ministry of Transport distorts the public’s perception of a civil aviation safety authority, *ie* that they are perceived as “aerial traffic police”.

From corporate identity considerations, the most attractive institutional form for a civil aviation safety authority is a stand-alone organisation within the State Service.

15.2.5 Foreign Safety Authorities

There are 157 signatories to the Chicago Convention. All have some form of civil aviation safety authority and, for all manner of reasons, a variety of different institutional arrangements are evident. Some reasons are economic (*eg* cost recovery), others follow constitutional practice, and others are simply an inheritance from a colonial past.

There is one common thread. As far as we are aware, all civil aviation safety authorities are State institutions. On an organisational level two types prevail: stand-alone safety authorities, and safety authorities that are part of a greater department of transport. A number of countries combine civil and military aviation.

Amongst countries which might have similar ambition levels in civil aviation safety to those of New Zealand, there is no definite preference for either type of institutional set up. European countries seem to prefer stand-alone organisations. Australia, on the other hand, has a civil aviation safety authority as part of a larger department of transport. In the US, although the FAA is part of the Department of Transportation, for all practical purposes the safety authority operates as a stand-alone organisation.

Overseas practice therefore suggests two practical institutional options for New Zealand:

- a stand-alone State institution, or
- an authority that is part of a larger State institution.

15.2.6 Historical Arrangements

Civil aviation (and meteorological services) has had a separate ministerial portfolio since 1955. Prior to that, civil aviation matters were handled by the Minister of Defence.

New Zealand's civil aviation safety authority has had three institutional forms. All have been State institutions:

1. Air Department, a joint civil and military State department;

2. Department of Civil Aviation, a stand-alone civil aviation regulatory authority; and now the

3. Civil Aviation Division of the Ministry of Transport.

The civil aviation safety authority was once a stand-alone institution but is now part of a larger State institution.

15.2.7 Summary

The role and functions of a civil aviation safety authority strongly suggest that these activities are best performed by a State institution.

The Director of the civil aviation authority needs to control and manage *all* resources (including administrative) required to fulfil the functions of the safety authority. In other words, the authority needs to be self-contained in terms of the resources to do its job. Such a self-contained organisation is consistent with a stand-alone institution.

A stand-alone civil aviation safety authority has significant advantages for the organisation's management and, thus, for its efficiency and effectiveness:

- clear authority (from the Minister),
- no diffusion in the accountability, and
- greater transparency.

From the point of view of resources, organisation and management, a stand-alone institution offers a number of advantages over an institution that is part of a larger organisation.

From time to time the civil aviation safety authority is required to deal with international obligations constraining the actions of the New Zealand Government. There are also State functions that have to be fulfilled to meet ICAO obligations. A State institution is naturally suited to handling these needs.

In terms of the civil aviation safety authority's external relations of a domestic or commercial kind, a State institution is also the best form of institution to deal with these considerations. Being part of the Ministry of Transport detracts from CAD's corporate identity and, to some extent, its internal cohesion. Considering corporate identity, the most attractive institutional set ups is a stand-alone organisation within the State Service.

New Zealand's civil aviation safety authority has always been part of the State Service, first as a stand-alone institution and now as part of the Ministry of Transport. The arguments for the civil aviation safety authority to be a State institution are compelling. Resource, organisational, management, public image and corporate identity considerations point to real advantages stemming from the safety authority being a stand-alone institution. The civil aviation safety authority should be an organisation within the State Service, and most probably a department of the Public Service[140].

[140] The Public Service in New Zealand is made up of a number of departments; the State Service includes the Public Service plus a number of branches of government outside the Public Service such as the police, armed forces, parliamentary counsel office, SOEs, etc.

The name of the civil aviation safety authority is important to its external relations and corporate identity. There are no constraints on the use of names; authority, administration, agency, office, commission, department, board, *etc* could be used for the civil aviation safety authority. We favour the name *Civil Aviation Safety Authority* because it simply and precisely defines the role and functions of the organisation.

15.3 PROPOSED INSTITUTION AND INSTITUTIONAL CONSEQUENCES

15.3.1 Recommended Institutional Framework

The institutional framework of a civil aviation safety authority should enable the organisation to perform the functions required of it to fulfil its role. Sections 15.1 and 15.2 considered matters relating to the safety authority's institutional framework and concluded that the best framework for the civil aviation safety authority is a stand alone State institution. Accordingly it is recommended that:

> The New Zealand civil aviation safety authority be a State institution and that the authority be a stand-along organisation reporting directly to the Minister of Civil Aviation and Meteorological Services.

This means that the civil aviation safety authority is an instrument of the Crown in respect of the Government of New Zealand.

There is no good reason for locating the civil aviation safety authority outside the Public Service[141]. It should stay within the Public Service but be taken out of the Ministry of Transport and established as a separate department. It is therefore recommended that:

> the safety authority be called the *Civil Aviation Safety Authority of New Zealand* and the permanent head[142] or chief executive[143] be called the *Director General*[144].

15.3.2 Institutional Consequences

In Chapter 16 we recommend that the role of the civil aviation safety authority be purely regulatory. This excludes all provider or operational functions. We also propose that the civil aviation safety authority be self-sufficient.

[141] The Public Service as defined in the State Services Act (1962) and the State Sector Bill.
[142] In terms used by the State Services Act 1962.
[143] In terms used by the State Sector Act 1988.
[144] The title should aim at external international relations. In the international civil aviation community *Director General* carries the appropriate recognition and status.

A civil aviation safety authority as a stand-alone organisation with no provider functions has consequences for the:

- Aviation Security Service;
- Air Services Policy Branch of the Policy Division of the Ministry of Transport; and
- Air Services Licensing Authority.

We have recommended that the functions of the Aviation Security Service be taken over by the individual airport authorities or companies concerned. Having a stand-alone civil aviation safety authority within the Public Service does not clash with shifting the responsibility for aviation security to the airport companies, so there are no adverse consequences to consider.

The Air Services Policy Branch is responsible for the development and implementation of civil aviation policies *outside the area of safety*. Specifically the Branch is responsible for helping promote an efficient and economical civil aviation industry, for advising on policies for the development of domestic and international air services and tariffs, and for airport development and financing[145]. Reference in the Act to the promotion and encouragement of the orderly and economic development of civil aviation is more properly a function of the Policy Division of the Ministry of Transport (referred to in the Act) rather than the Civil Aviation Division.

From the Ministry of Transport's review of its total structure and functions, to which we referred in Section 15.1.6, two areas of concern arise. *That* study envisaged the policy branches for each mode being parts of modal divisions in a restructured Ministry of Transport. This is at variance with our recommendation that the civil aviation safety authority should be purely a safety authority.

The two potential areas of concern are: what is to be done, in terms of organisation and management, with the

- air services and tariffs, and
- airport development and financing

functions of the present Air Services Policy Branch?

Air services and tariff functions concern two markets, international air transport services and domestic air transport services. They have nothing to do with civil aviation safety. They are more properly concerned with the commercial and air traffic rights of the civil aviation industry. Air services and tariff functions of the Air Policy Branch could be transferred to the Department of Trade and Industry (or the proposed Ministry of Commerce). Or, air services and tariff functions could first be split between international and domestic, and then shared between the Ministry of Foreign Affairs and the Department of Trade and Industry (or the

[145] Ministry of Transport, *Brief for Hon W P Jeffries,* August 1987.

proposed Ministry of External Affairs and the proposed Ministry of Commerce)[146].

Airport related functions currently handled by the Air Services Policy Branch[147] could also be transferred to the Department of Trade and Industry (or Ministry of Commerce). All administrative functions of government-owned airports, and the government's interests in joint venture airports, could be transferred or sold to Government Property Services Limited, Land Corporation Limited, or perhaps the Department of Lands.

The Air Services Licensing Authority (ASLA) is a quango established for the purpose of licensing all domestic air transport and aerial work services operated for hire or reward. The secretariat for the ASLA is located within the domestic air services policy section of the Air Services Policy Division of the Ministry of Transport. It follows, therefore, that the ASLA secretariat would move with the domestic air services policy section as described above.

As a consequence of the various recommendations in this review, and in the current climate of public sector reform, it would be most appropriate and timely to review the need for the ASLA[148].

In summary, there are no significant institutional consequences of creating a purely safety oriented civil aviation safety authority as a separate department of the Public Service. This reorganisation is in step with the general direction of public sector reform. Therefore potential problems, if any, in the area of institutional consequences are unlikely to be great.

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[146] In relocating the functions of the Air Services Policy Division, splitting the division between international and domestic air services policy should not be made without careful thought. Whilst a good argument can be made for transferring the international section to the proposed Ministry of External Affairs, there are good arguments for keeping the two areas of air services policy together in the proposed Ministry of Commerce.

[147] Airport development, financing and administration of the government's involvement in joint venture airports and, to some extent, the administration of government aerodromes, are all handled by the domestic air services policy section within the Air Policy Branch. The process of airport corporation is also currently being handled by the Air Policy Branch.

[148] In Section 5.1.1 we noted that the ASL Act merely doubles up on provisions elsewhere. We are unable to perceive any useful function to be served by the ASLA in the future regulation of civil aviation. The ASLA has no mandate over commercial matters, and safety matters do not require it.

CHAPTER 16

PROPOSED ORGANISATION OF THE NEW CIVIL AVIATION SAFETY AUTHORITY

16.1 FUNCTIONS TO BE COVERED

We concluded earlier that the new Civil Aviation Safety Authority of New Zealand (CASA) should be a stand-alone organisation implementing aviation *safety* policy only. In this chapter we consider the organisational structure and the resources needed by CASA to carry out its functions.

16.1.1 Principal Functions

Chapter 13 analysed the functions of the civil aviation safety authority, which were to:

- provide standards
- exercise entry control
- perform functional supervision
- exercise exit control
- undertake analysis of change

covering the various participants in the civil aviation system, namely:

- approved training organisations
- individual licence holders
- air transport operators
- aerial work operators
- maintenance facilities
- design and manufacturing facilities
- aircraft owners/operators
- private operators
- aerodrome and airport providers
- providers of air navigation and air traffic services
- sports and recreation activities

Section 16.2 considers CASA's organisational structure. Section 16.3 concludes there is no need for regional offices. Section 16.4 describes the functions of CASA in sufficient detail to assess staff requirements. The remainder of this section prepares the way by dealing with two particular topics, training of airline inspectors and the merit of retaining CAD's flying unit.

16.1.2 Airline Inspectors' Licences

A special issue is keeping flight inspectors "current" on particular aircraft. CASA need not have pilots who are current on *all* aircraft types operated by major carriers. Airlines should have designated and authorised check-pilots for carrying out flight tests and pilot checks[149]. CASA could exercise surveillance by using airline inspectors with broad backgrounds who are not current on the particular aircraft type. For instance, an ex-airline captain could well serve as an inspector for five years or more without actually flying. Periodic simulator training would "keep his hands in".

For those inspectors who have to be current on specific aircraft types, CASA must find effective ways of achieving this. In some countries inspectors periodically perform active flight duty in the normal operation of airlines. For this to be feasible the following conditions have to be fulfilled:

- the inspector must meet the airline's standard;
- when flying for the airline the inspector reports to the airline's flight operations manager, not to the safety authority;
- the inspector must perform enough flight duty to be acceptable to the flight operations manager[150]; and
- when flying for the airline the inspector is paid by the authority *but he exercises no inspecting functions.*

In New Zealand similar arrangements have been considered in the past, but the Airline Pilots' Association seems to have objected. We have not had time to discuss the issue with ALPA, but propose that such an arrangement once more be discussed between the parties concerned. It is in everyone's interest for CASA inspectors to be qualified beyond criticism.

CASA should avoid appointing airline inspectors who are only marginally qualified on an aircraft type. Surveillance by such inspectors will not be respected by either airlines or pilots.

When making our assessments of staffing and costs we have assumed that such an arrangement for flight training can be achieved, at least for inspectors working with scheduled operators. We have allowed adequate financial resources for their periodic flight checks and/or simulator training. We have also allowed for flight training of those inspectors for whom active airline operation is not practicable.

[149] On medium and small size airlines, however, designated check-pilots may not be practicable.
[150] This may amount to 3 to 4 days a month.

16.1.3 The Flying Unit

CAD has nine aircraft based at Ardmore, Paraparaumu and Christchurch airports. The aircraft are maintained at Paraparaumu airport, where CAD has a very good hangar facilities adjoining the operational base. Major maintenance is contracted out. The whole operation is run professionally.

One Fokker F27 aircraft earns revenue on calibration work in New Zealand and the South Pacific. As opportunities arise, the second F27 is chartered out, currently to Mt Cook Airlines. The two F27s are also used to give continuation training (flying time) for CAD's airline inspectors, usually combined with a "productive" flight. There is some VIP flying with the non-calibration F27. The other aircraft are also used to provide continuation training for inspectors, usually combined with another requirement such as transport of other CAD personnel to airports and areas not readily accessible by public transport services.

In summary, the aircraft are used for:

- calibration flights (in New Zealand and Pacific Islands);
- chartering out to other airlines and organisations;
- providing airline inspectors and general aviation inspectors with continuation training for maintenance of their licences;
- providing transport for inspectors, surveyors and other CAD personnel; and
- assisting in monitoring operations.

CAD is responsible for ensuring navigation and landing aids are correctly calibrated at prescribed intervals, checking aids after being out of service and carrying out acceptance checks on new equipment. The present arrangement is that CAD operates the aircraft and the calibration function is carried out in conjunction with Airways Corporation staff using equipment owned by CAD or Airways Corporation.

Under "user pays", the Airways Corporation will probably be charged all CAD costs associated with the calibration. Although CAD is responsible, the task of calibration could be delegated to another party, namely the Airways Corporation, to carry out on behalf of CAD (see Section 13.7.5).

The costs of the flying unit are set out in Table 16.1 below.

Table 16.1: Flying Unit Operating Costs – Current Level
(from 1988/89 budget)

Fuel and contract maintenance		
F27 Aircraft (2)	1,478,000	
Other Aircraft (7)	602,700	
		2,080,700
Other operating costs		
Operation	896,198	
Maintenance	388,439	
		1,284,637
Interest & depreciation		896,000
Total cost		4,261,337
Less estimated revenue[1]		2,600,000
Annual Net Cost		$1,661,337

The need to own, maintain and operate nine aircraft must be questioned. Consider their uses.

- *Calibration.* In the short term the present arrangement should continue. In three to five years, when new calibration equipment is purchased, the entire operation will have to be reassessed, including the aircraft type. The customer (*ie* Airways Corporation) should have considerable influence. Under "user pays", the Airways Corporation is entitled to have the most economic operation.

- *Outside charters.* CASA should not be involved in chartering aircraft to the airline industry.

- *Inspector's continuation training.* Inspectors should obtain their flying hours with operators whenever practicable. For other flight training, aircraft can be hired.

- *Transport.* Public transport services should be used. When operators or airports inaccessible to public transport services require inspection, aircraft can be hired.

- *Monitoring.* Hire aircraft and helicopters as required.

Table 16.2 presents the revised costs of the flying unit, after selling all aircraft other than the calibration F27.

Table 16.2: Flying Unit Operating Costs – Calibration F27 Only

Fuel and contract maintenance

Fuel and contract maintenance		870,000
Other operating costs		
Operation	410,000	
Maintenance	185,000	
		595,000
Interest & depreciation (20% of market vale)		300,000
Total Cost		1,765,000
Less estimated revenue[1] (at present rate of earnings)		1,600,000
Annual Net Cost		$165,000
Plus hire of aircraft[2]		303,000
Total Annual Cost		$468,000
Representing a saving of $1.,2 million per annum		

Notes:

1. from Airways Corporation
2. Aircraft hired for inspector checks, transport, training and monitoring activities.

Instead of owning a fleet of nine aircraft CASA can achieve its objectives at less cost by airline inspectors doing continuation training with airlines and by CASA hiring aircraft as required. This saves over a million dollars a year.

We therefore recommend that CAD sells all aircraft other than the F27 calibration aircraft. We also recommend that CAD quits Paraparaumu airport as soon as practicable and transfers the F27 operation to an Air New Zealand maintenance base[151].

16.2 ORGANISATIONAL STRUCTURE

16.2.1 General Requirements

Several organisational structures can be envisaged for CASA, each option having its advantages and disadvantages. No single option is best from every point of view. We must seek an organisational structure which provides the best balance and is suited to implementing our recommended changes in the regulatory system.

[151] This would be the most economic course of action from an operational view, but the timing would depend on how long the Airways Corporation is willing to pay the additional cost associated with the Paraparaumu airport operation.

Our assessment of CAD found major improvements needed in the following areas:

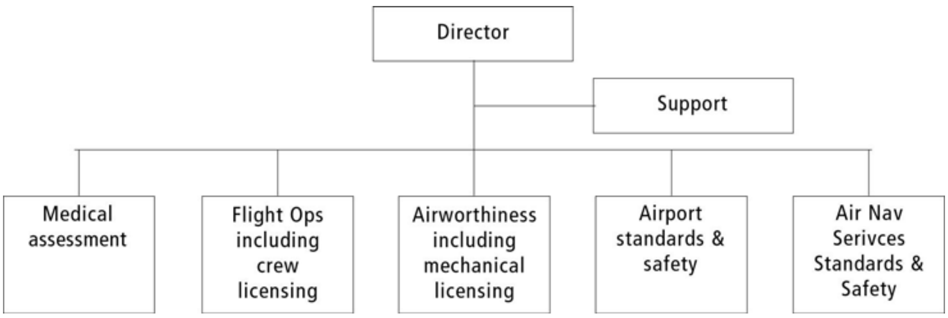
- there should be fewer management levels, and more people reporting to each manager;
- management personnel should be selected for their management, rather than specialist capabilities;
- importance should be placed on recruiting and personnel development;
- internal communication should be greatly improved;
- client relations should be simpler, and clients should be clear as to whom in CAD is responsible;
- the organisation should be adaptable and responsive to external change;
- organisational structure should reflect the relative importance of various functions;
- standards development should be balanced against surveillance duties; and
- internal and external accountability should be enhanced, and levels of authority better defined;
- the organisation should be such as to require minimum resources to discharge its functions.

Among the organisational options for CASA, three generic types require examination.

16.2.2 Option 1: Competence-Oriented Structure

This is the traditional structure that has governed many civil aviation authorities in the past. There are two variants. The first is presented in Figure 16.1.

Figure 16.1 - Option 1a – Traditional Competence-oriented Structure

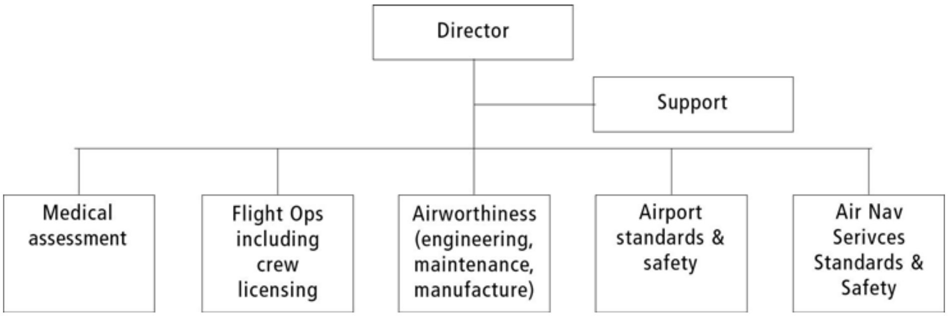


The advantages of this structure are that: all competence of a specific kind is concentrated in one unit; there is little call for duplication of resources; and there is a high level of internal professional support within each unit.

The disadvantages are that: there is no incentive for interdisciplinary co-ordination; there is no clear relationship between the organisation and the client; the organisation does not structure its output in a client-related way; all units are responsible for both development *and* application of standards; coordination of priorities for standards development can be problematical.

In some countries, safety authorities identify personnel licensing[152] as an area of specific competence, having the largest number of external clients, and establish separate units for this. The organisational structure then looks like Figure 16.2.

Figure 16.2 - Option 1b – Competence-oriented Structure with a Separate Personnel Training Unit



As to the choice between options 1a and 1b, we make the following assessment.

Personnel licensing in CAD is currently split between head office and the three regional offices. Within head office it is split between Flight Operations Branch (flight crew) and Airworthiness Branch (licensed engineers). Within Flight Operations, three functions related to licensing report directly to the Manager (one of which has two sub-units). Within Airworthiness, the chief examiner for licensed engineers is two levels below Manager Airworthiness and in some aspects reports to Controller Personnel Licensing in Flight Operations Branch. Medical certification of flight crew is handled regionally in the main, but sometimes by head office. It is fair to say that the licensing process is extremely complicated and difficult for clients to understand. This complexity is a major obstacle to CAD's efforts to develop personnel licensing.

The aviation community views flight crew and licensed engineer availability as a key issue for civil aviation development in this country. Modernising the licensing system is a major task for CASA, requiring an integrated approach to: training objectives, curriculum development, means of instruction and training, and means of examination and testing. CASA will need professional competence in education, not just the traditional specialist competence in flight operations, airworthiness and air traffic control. The end result should be that advanced training organisations can be authorised to examine on behalf of CASA.

CAD already has some very ambitious development programmes, which should be supported. All resources should be combined into one main head office unit responsible for personnel training and licensing.

Regardless of whether CASA has regional offices, all licensing administration (including medical) should be centralised in head office. The number of licences is insufficient to warrant a regional split and with the new approach to licensing proposed in Chapter 11 the overall workload will decrease considerably.

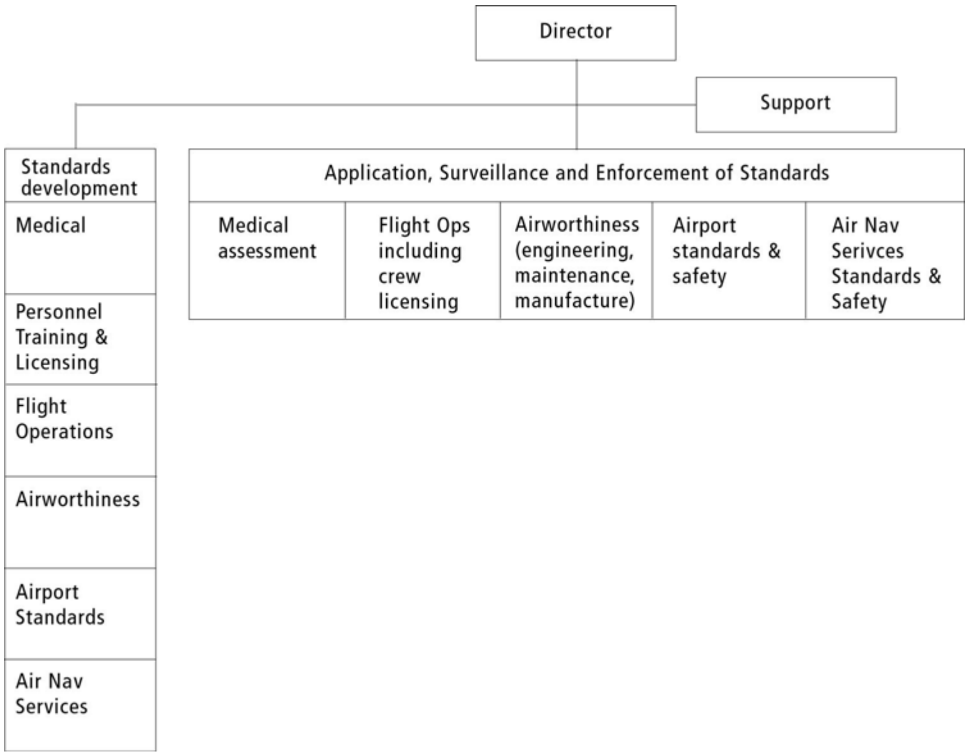
[152] With associated training systems and examination functions.

On the basis of the need for better administration and organisation in the personnel licensing area, we limit further evaluation to Option 1b. In options yet to be discussed we will adhere to the same principles regarding personnel licensing.

16.2.3 Option 2: Development Of Standards Separate From Application Of Standards

Another generic organisational type separates the task of standard setting from administering standards. Consider such a structure, as set out in Figure 16.3.

Figure 16.3 - Option 2 – Standards Development Separate from Standards Application



Based on the policy of separation of the two main organisational blocks, the main advantage is that, because resources are allocated exclusively for development of standards, standards development will not languish.

Disadvantages are that:

- duplication of scarce specialists is inevitable;
- through lack of eye-to-eye feedback from the industry, those involved exclusively with standards development lose touch with the practical impact of their work; and

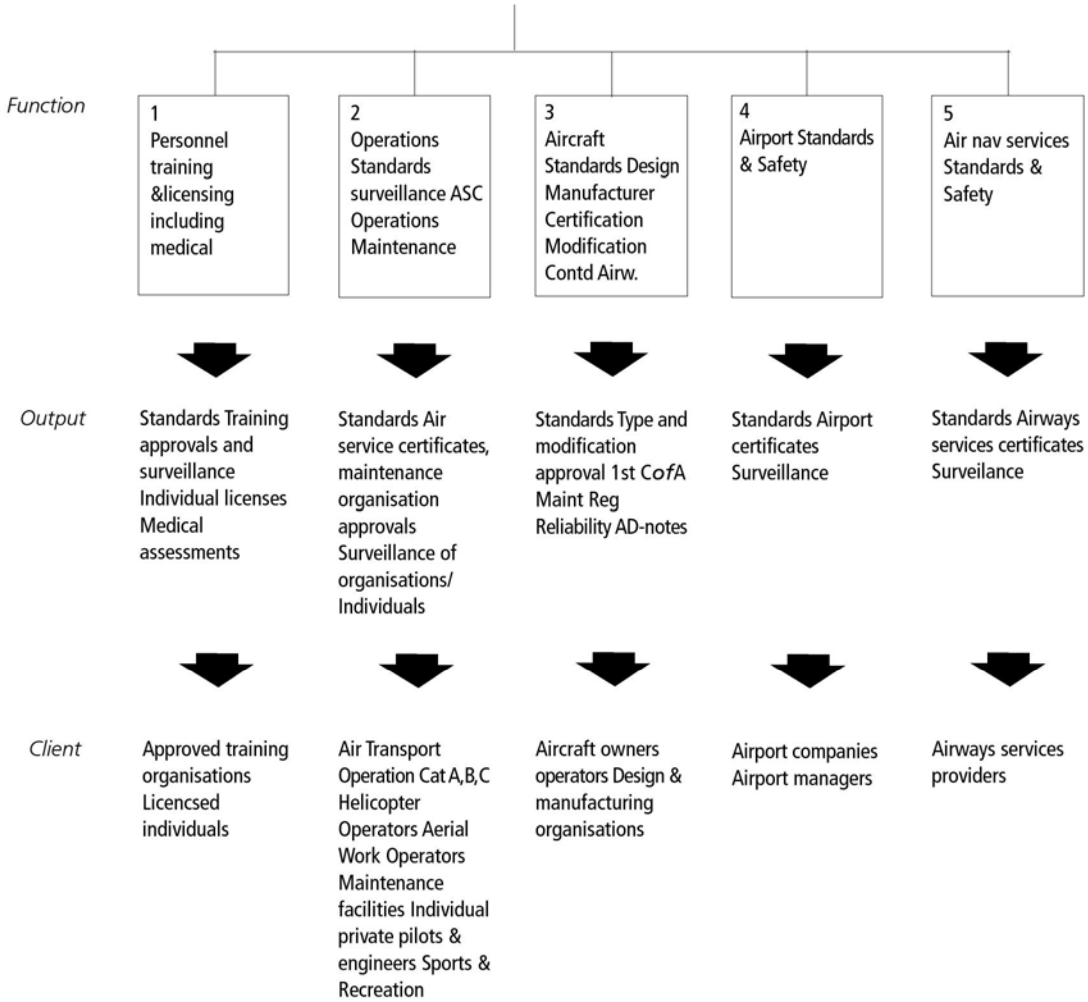
- the organisation does not easily adapt to changes in emphasis in work load[153].

We conclude that, particularly for an aviation system the size of New Zealand's, the disadvantages of this structure are such as to make it impossible to comply with the requirement that CASA be as lean and efficient as possible. We will later show there are other means to achieve the advantages this option could offer. Option 2 will therefore receive no further consideration.

16.2.4 Option 3: Client –Oriented Output

An organisational structure aligned to CASA's main client groups would make CASA transparent to the industry, with easily understood allocations of authority and responsibility. In some respects Option 1b could be said to be one such structure, but we have in mind the structure of Figure 16.4.

Figure 16.4 - Option 3 – Client-oriented Output



[153] It is not necessary always to have the same capacity allocated to a certain area. For example, a major revision of airworthiness standards may require intensive input for a period of time but, once completed, airworthiness standards may require only minor attention for some years.

Consider in turn each of Figure 16.4's five client groups.

1. The first client group is approved training organisations and licensed individuals, for whom CASA's outputs are:

   - standards for personnel training and licensing;
   - approvals for training organisations, training programmes, special training aids such as simulators, and special courses;
   - individual licences; and
   - medical assessments.

   In terms of the blocks shown in Figure 16.2 (*ie* for Option 1b), personnel training and licensing is aggregated with medical assessment in this CASA structure.

2. The second client group comprises all the various categories of aircraft operators. It is in this area that the client-related organisational structure could have its major impact. Theoretically an organisational unit could be formed for each category of operators (air carriers, commuter, airlines, small air transport operators, helicopter operators, fixed wing aerial work, private aviation, sports and recreation). In practice there is a limit to how far CASA can be split and remain efficient. In any event, for each operator-oriented organisational block, there would be the following outputs:

   - operational standards (maintenance as well as flight operations);
   - air service certificates;
   - maintenance organisation approvals;
   - surveillance of organisations;
   - surveillance of private operations; and
   - surveillance of sports and recreational activities.

   CASA's policy on authority involvement in surveying private operations, sports activities and recreational activities will have to be reflected in the organisational structure.

   CASA's functions are presently fulfilled by parts of the existing Flight Operations Branch and the Survey section within the Airworthiness Branch of head office, as well as regional functions in flight operations and airworthiness.

3. The third client group is aircraft operators seeking type approval, and design and manufacturing organisations, who have a common interest in the aircraft as a technical product. CASA outputs for this group are:

   - standards for aircraft designs, manufacturing certification, modification and continued airworthiness;
   - type and modification approvals;
   - type related maintenance requirements;
   - approval of Master Minimum Equipment Lists;
   - special flight permits;

- first certificate of airworthiness;
- reliability monitoring; and
- airworthiness directives.

CASA functions to be grouped together to provide this output are parts of the present Airworthiness Branch, mainly the aircraft engineering and reliability sections.

4. The fourth group of clients comprises aerodrome providers (airport companies, airport managers). The related CASA outputs are:

- aerodrome standards;
- aerodrome certificates of approval;
- aerodrome surveillance; and
- security standards, approvals and surveillance.

5. A fifth group of clients (at present only one) is providers of airways services. Related CASA outputs are:

- standards for airways services;
- certificates of approval for airways services; and
- surveillance of airways services.

CASA functions related to these third and fourth groups of clients and outputs are today largely found in the Airways Services Branch of the CAD.

The main advantage of this organisational structure is that it gives priority to a client-oriented approach by CASA. The holder of an air service certificate needs to relate to only one unit within the authority – the unit responsible for that particular type of operation. For the introduction of a new aircraft type (which is a major issue for an operator) the aircraft engineering unit will have to be involved only if the aircraft is the first of its type in the country. For setting up type training for a new rating, the operator will have to approach the personnel training and licensing unit, but for recurrent training and periodic flight checks the operations unit would have surveillance responsibility. Another advantage of this type of organisation is co-ordination between operations and maintenance responsibilities of CASA. Lack of such coordination is a major weakness in CAD today.

The disadvantage of this structure is that similar types of competencies have to be divided between several units. There are already similar major splits in CAD, however, and it is possible to achieve more efficient groupings than exist today.

16.2.5 Preferred Organisational Structure: Special Considerations

Considering the pros and cons of the options analysed above in the New Zealand setting, we conclude that *CASA should be modelled on Option 3, the "client-oriented output" organisational structure.* This is the structure most suited to bring about recommended changes and, in the most efficient way, address the current and potential problems of the aviation industry.

Some particular aspects require further explanation. To follow the development of the remainder of this section it will be helpful to refer to Figure 16.5 from time-to-time.

Standards Development Function

Given the demands for day-to-day certification and surveillance, largely governed by operators' immediate needs, development of safety standards can take a back seat.

To safeguard against this eventuality a standards development unit should be instituted, cutting across all the main, client-oriented functions. This unit needs few permanent staff since standards development will be undertaken by specialist staff seconded from the main technical units for specific projects. The standards development unit needs permanent staff for co-ordinating, editing and project management only[154]. The main units will need sufficient staff to provide personnel on secondment. When seconded, these personnel must give top priority to the project manager's standards and development assignment.

This arrangement makes it possible to assign resources and priorities to standards development as and when required. The technical specialists involved have necessary eye-to-eye feedback from industry through their normal work. The overall resources devoted to standards development is minimised and the organisation has maximum flexibility.

It is appropriate for other interdisciplinary functions (such as analysis, safety information, ICAO coordination, *etc*) also to be placed in the standards development unit.

Client Oriented Operations Units

We now turn to the question of how many client-oriented operations units CASA should have:

- There should be a Commercial Air Transport Unit with flight operations and maintenance competence covering:

  - all scheduled aeroplane services,
  - operations of aeroplanes with a maximum takeoff weight over 5700 kg or having more than 10 passenger seats[155], and
  - maintenance organisations serving these operators

[154] No personnel should work exclusively on the technical side of standards development. (The project manager may be full time, but in his management role).
[155] Including the right-hand front seat.

- There should be a General Aviation Unit with flight operations and maintenance competence covering all operations not included above, namely:

    - air taxi and charter operations,
    - all helicopter operations,
    - fixed-wing aerial work (flying schools excluded),
    - private operations (to a limited extent), and
    - maintenance organisations serving these operators.

It is impractical and inefficient to have a separate unit covering helicopter operations. Many operators have both fixed wing aircraft and helicopters. Maintenance facilities serve both. To break up the organisation into too many pieces impairs CASA's efficiency. For these reasons it is undesirable to divide client-oriented operations functions into more than two units.

Where a maintenance organisation serves both groups of operators a pragmatic decision has to be taken as to which unit shall assume survey responsibility for the particular maintenance facility.

With this split of responsibilities, all scheduled operators and all operators of complex aeroplanes, together with their maintenance organisations, will be handled by CASA personnel with airline competence. Full coordination will be possible between flight operations and maintenance.

Private Aviation

Under the above split, private operations of complex aircraft (usually corporate or executive aircraft) come under the Commercial Air Transport Unit. Private operation of small aircraft will, in principle, come under the survey of the General Aviation Unit, although the major attention of this unit should be addressed to commercial operations.

CASA's major responsibility to private aviation is to provide safety information. The resources for this should be located in the interdisciplinary standards development unit. Notwithstanding this, CASA personnel should provide information and advice (but not consultation) as and when required.

Sports and Recreation

With respect to sports and recreational aviation CASA should follow present CAD policy and limit its direct involvement as far as possible. The sports and recreation organisations involved should be approved and authorised to carry out their own safety regulation as far as their competence allows. We gather from our enquiries that competence is adequate except for engineering capability, which is insufficient to perform type assessments – of gliders, powered gliders and microlights, for example. CASA needs to allocate engineering resources for such type assessments, to the extent that cost-benefit analysis demonstrates a net benefit from doing so.

We propose a coordinator be placed in the Standards Development Unit to maintain an overview of sports and recreation organisations, monitor the process of approvals and authorisations and provide the necessary exchange of information. Except for engineering resources for type assessments, no other CASA personnel need be allocated to sports and recreational activities.

If a sports or recreational activity develops a serious safety problem justifying CASA intervention, an *ad hoc* campaign should be mounted to rectify the deficiency, undertaken as a temporary project.

Support Services

Since CASA is to be stand-alone organisation it must be self-contained as to its administrative support services. As well as services for the common benefit of all units, which should be assembled in a Support Services Unit, each main unit should have control over its own support services[156]. Apart from enhancing accountability it motivates secretarial and clerical personnel who can identify with their unit and share in the responsibility for its output.

The Support Services Unit contains: legal and investigative expertise, personnel administration, staff training coordination, finance, library, general office administration and some secretarial and typing capacity to cover staff absences and peaks in other units.

CASA must have ready access to qualified legal expertise to advise on rule-making and enforcement activities, noting that our proposals place less emphasis on recourse to legal remedies and more emphasis on corrective actions by flight operations and airworthiness inspectors.

Quality Assurance

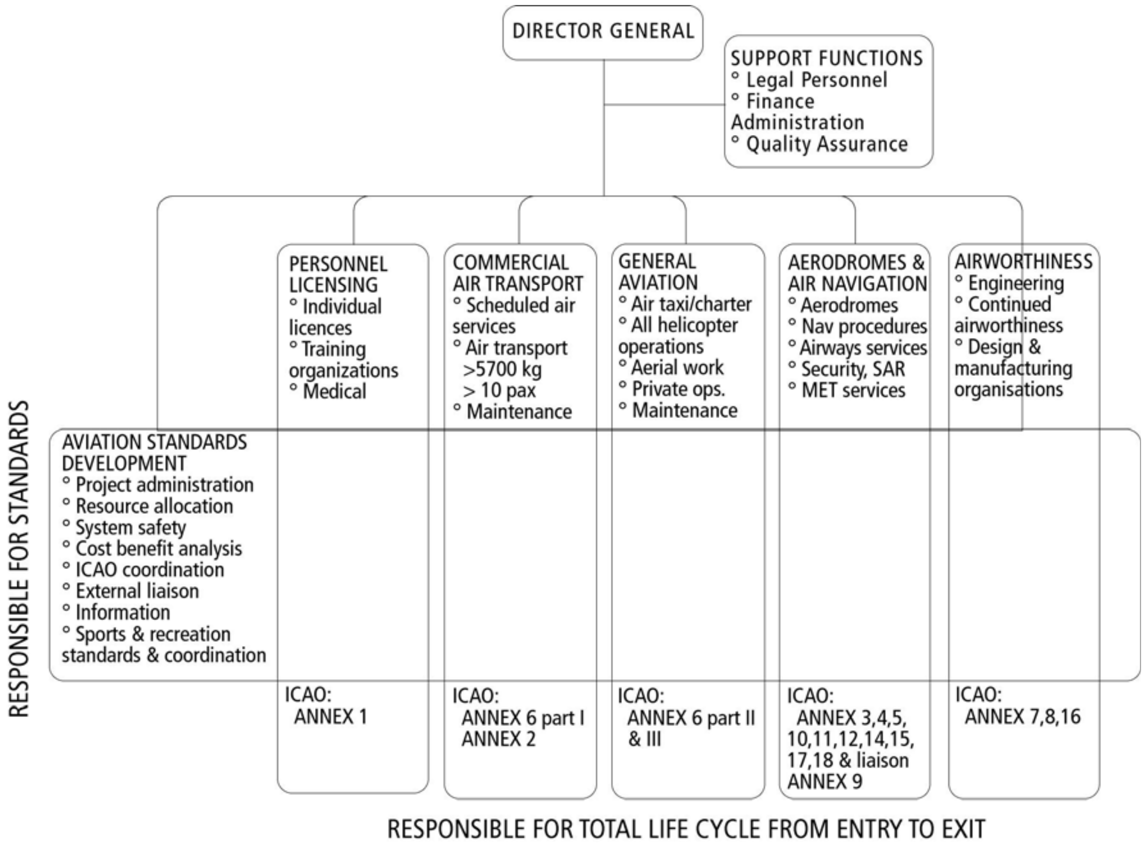
CASA will require many of its clients to maintain quality assurance to ensure consistency of goals, objectives and standards, and actual performance. Of course CASA should "practice what it preaches" by keeping a constant watch on its own effectiveness and efficiency, checking that it meets the cost benefit criterion enunciated in Section 10.4. If it fails on any count, corrective action must be taken. We therefore propose that CASA appoints a quality assurance manager, reporting directly to the Director General.

Conclusions

Based on the foregoing analysis we conclude that CASA should have a financial organisation as shown Figure 16.5. We will return to the detailed organisation and staffing after reviewing the need for regional and local units.

[156] This is intended to apply to resources needed on a continuous basis. The Support Services Unit would be the source of temporary assistance for peaks or intermittent special needs.

Figure 16.5 - Recommended Functional Organisation



16.3 THE NEED FOR REGIONAL OFFICES

Other review of the Ministry of Transport and its regional functions have recommended that development of national policies and standards should be head office tasks, whereas "operational" activities should be regional tasks. We disagree with these recommendations insofar as CASA is concerned.

The implications for CASA would be, say, four organisations (head office and three regions) duplicating expertise in all the areas of competence. Apart from the cost of duplication for such a small activity as civil aviation, a major obstacle is the nation-wide scarcity of personnel in several expert areas. In this section we discuss fully the pros and cons of regional offices.

16.3.1 Inadequacies Of Present And Past Regional Arrangements

Industry has spoken very favourably about CAD's regional staff. Good working relationships have developed due to ready availability of the regional personnel. Involved, as it is, in the affairs of operators and maintenance facilities at a rather detailed level, CAD has found regional offices very useful.

Industry has taken less kindly to interventions by CAD head office. Head office has sometimes taken different directions to those favoured by regional staff, the reasons for which have been poorly understood.

In discussion with regional personnel we have observed much frustration about relationships between head office and regions. Regions do not feel they have defined bounds of authority. Their decisions are sometimes overruled by head office personnel who may not even tell the region about their intervention and the reason for it. This creates hard feelings and undermines the region's authority with its clients.

Today's regional organisation is a mixture between a truly regional set up and a detachment of head office functions. The CAD regional manager has been left with little or no technical powers. The regional airworthiness superintendent reports directly to the manager of the Airworthiness Branch, but any head office matters concerning airworthiness surveys are handled by the chief surveyor. The regional superintendent of flight operations reports to the manager of Flight Operations Branch. Airline inspectors, however, do not report to the regional superintendent but to the controller of airline standards within the Flight Operations Branch. The lack of consequence and principle in this organisation makes it very difficult to comprehend, and it is bound to produce conflicts, the more so as regional superintendents do not feel supported by the head office managers to whom they report.

In earlier regional organisations, responsibilities and authorities were quite different. There was then a CAD regional director of flight standards who had authority in defined areas to decide on behalf of the Director. The regional director reported to the regional secretary of transport. Regional superintendents reported to the regional director and not to head office managers. This was no doubt a cleaner organisation, but it had other disadvantages. We have been told that there were mainly two problem areas. One was that regional directors were usually appointed either from the airworthiness side or from the flight operations side. They tended to remain interested mainly in the side from which they had come. The other side was left to itself without proper guidance, and there was less coordination between the two sides than the organisation chart lead one to expect.

Another problem area is said to have been that the formal organisational structure was misused by regions. Head office attempts to influence regions, in the interests of nation uniformity in technical and operational matters, could be frustrated by requests to pass instructions *via* the Director, Secretary of Transport, Regional Secretary of Transport and Regional Director. This arrangement looks almost as awkward as the present one, but it had the advantage that regional staff were supported by their regional director. He was sufficiently senior to have access to the Director and could sort out problems.

The greater independence and status of the regions in the previous organisation is said, however, to have created different interpretations of requirements and differing regional policies. Industry confirmed this to us by citing examples of how aircraft move around the country to gain the most favourable interpretations.

This suggests that the confusion of regulations, requirements, orders, *etc* (addressed in Chapter 14) may explain some of the difficulties between regions and head office. There are simply too many possible interpretations for consistency to be achieved, however hard people try.

Elsewhere in this report we recommended a total overhaul of the entire legislation and standards controlling the civil aviation system. In determining the regional issue we assume that regulatory problems will be sorted out and will not stand in the way of an optimum solution.

16.3.2 Consequences Of The General Principles

The main advantage of a regional organisation is proximity to clients. Clients have easy access to CASA personnel for sorting out problems and obtaining approvals and certifications in day-to-day operations[157].

Under the general principle enunciated in Chapter 12 we propose that CASA takes a step back and not be so closely involved in clients' day-to-day operations and decision making. Easy access to safety authority personnel leads clients to regard them as part of their own workforce. It has been confirmed to us that much of the work of regional units can be classified as consultancy. We have stated that consultancy work should not be undertaken by the safety authority. As we see it, the remaining tasks of regional units will be further decreased by implementation of the working methods and principals proposed in this report.

At the regional office level, new working principles will mean less frequent involvement with detailed approvals and certifications. This suggests the possibility of one central office, *ie* no regional offices. One central office has overwhelming benefits, as listed below.

- Reduced overheads and better staff utilisation will improve efficiency.
- Efficiency would also be improved by eliminating: battles between regions and head office; severe problems of communications, co-ordination and control; and the ensuing frustration felt by staff and the confusion felt by industry.
- With less involvement in detailed day-to-day matters, CASA need not be at the beck and call of its clients. Client visits can be co-ordinated in an orderly programme of work.
- Better work programming leads to better supervision of staff than could be the case in a regional set up – one boss, one standard, one report.
- Centralisation makes possible a close-knit team applying standards uniformly and consistently, with resultant benefits to industry.
- By rotating personnel to gain a better spread of work they can more competently (and consistently) evaluate against their wider backgrounds of experience.
- Rotating personnel reduces the risk of "client capture".
- CASA's leaner organisation will have insufficient technical specialists to disperse around the country.

[157] To take an example, an airworthiness office at Hamilton was considered practical in the days when Pacific Aerospace had a production line of Fletcher aircraft and needed frequent authority certification of output.

Judged in the context of CASA's "hands off" relationship with its clients, few disadvantages can be claimed for a centralised organisation. One might expect an onerous amount of travel away from home, but we estimate out-of-town travel to be no more than two days a week, and much less for many. The cost of travel is no great burden; the centralised organisation shows substantial cost savings overall.

The advantages of centralising is very strong. We are in doubt whatsoever that *regional units should be amalgamated into one centralised organisation*[158].

The natural cycle of *re*organisation is such that the question of regional offices will eventually be revived. The temptation to re-establish head office outposts must be resisted. That there is sufficient work in any one area to occupy someone full-time is inadequate reason to post someone even semi-permanently. To avoid the temptation to do so we recommend that CASA maintains *no* remote offices. Professionals are quite capable of working from hotel or motel rooms when required; and with laptop computers fitted with modems, the roving inspector can at all times be in touch with head office *via* telephone link.

16.3.3 Office Location

Aviation activity in New Zealand is fairly well spread, as shown in Chapter 5. As office locations, there is not much to differentiate Auckland, Wellington and Christchurch. Each has frequent and direct air links with the other two. Wellington wins out for having the best air links with the minor centres. Wellington is the hub of New Zealand domestic aviation services, and is thus to be preferred as the location for CASA's office.

16.3.4 Conclusions

Examining the arguments for and against regional (and local) units we conclude that the most efficient option for New Zealand is to assemble all CASA's personnel in one central office located in Wellington. Section 16.4's staff and cost assessment will assume this to be so.

We stress very strongly that our conclusions about regional units must in no way be interpreted as veiled criticism of regional personnel, or their work. On the contrary we have observed their dedication and high level of competence and heard much appreciative comment from industry. The role served by regional and local staff will not disappear. Rather, CASA will emphasise field work at the expense of some of CAD's current head office functions.

[158] Judged in terms of international comparisons New Zealand is not large enough to warrant regional units. In some countries with regional organisations the regions are much bigger than the entire New Zealand organisations.

16.4 DETAILED ORGANISATION AND STAFFING

In Section 16.2.5 we concluded that CASA should have the organisational structure of Figure 16.5. We now develop the organisation in detail. In reading the following analysis it will be helpful to refer to Figure 16.6 from time-to-time.

Reporting to the Director General will be the heads of seven main units plus the quality assurance manager. In a stand-alone civil aviation safety authority, we suggest the main units be designated “Divisions”, each headed by a “Director”.

The seven main divisions are:

- Aviation Standards Development Division
- Personnel Licensing Division
- Commercial Air Transport Division
- General Aviation Division
- Aerodromes and Air Navigation Division
- Airworthiness Division
- Support Services Division

To establish whether there is a need for sub-units under the divisions we first need to: define the tasks, identify the clients and assess the related volume of output; estimate the staff numbers and qualifications to do the job; and, on this basis, assess the need for sub-units.

16.4.1 Task Definitions And Staff Required

We will assess CASA’s tasks and the organisation and staff it requires *assuming the regulatory changes and changes in working methods have been carried out* according to our recommendations. (We estimate that this process of change will take three years, during which extra staff will be required, as addressed in Chapter 17).

Aviation Standards Development Division

Task Definitions

- coordinate activities related to ICAO; focal point for ICAO correspondence
- coordinate editing of aviation standards
- project management for standards development
- typing and editing of standards
- coordination with sports and recreational organisations and follow up delegated authorities
- provide selective safety information services
- system safety analysis; monitor safety trends
- cost-benefit analysis to support decision making on safety standards
- process and maintain aviation statistics
- maintain computer system

Staff Requirements

1 Director
1 Secretary
1 ICAO coordinator (broad aviation system knowledge)
1 Chief editor (Aviation Standard) and project manager (broad aviation background, good writer, good manager)
1 Project manager, standards development
1 Safety officer, sports and recreation coordinator (good general aviation background and familiarity with sports and recreation activities)
1 Secretary (word processing)
1 Safety information editor
1 Safety information officer
1 System safety analyst (graduate)
1 Economist (cost-benefit analyst)
2 Technical clerks, statistics processing
1 Computer systems officer
1 Computer programmer
15 Aviation Standards Development Division

Personnel Licensing Division

Task Definitions

- develop and maintain personnel training and licensing standards
- develop and maintain curriculum, theoretical and practical licensing examinations
- review and approve training methods and training sequence including technical aids (simulators and computer aids)
- perform entry control and functional supervision on approved training organisations
- administer theoretical examinations
- carry out flight tests for issue or upgrading of licences
- carry out practical examinations for LAME
- designate, instruct and monitor authorised examiners (flight and technical)
- issue medical certificates for first issues of flight crew licences, including upgrading to higher status
- perform computer-aided review of renewals issued by Designated Medical Examiners
- maintain computerised medical register
- designate, instruct and monitor authorised medical examiners
- issue, amend, renew, limit or suspend personnel licences
- maintain computerised licence register
- support clients with information and advice

Clients

91 Approved training organisations
11300 Licensed individuals

Staff Requirements

Having reviewed the tasks and estimated the number of staff required we have concluded that this division should be split into two sections:

- Training Systems Section carrying out the technical work involved, and
- Licensing Administration Section carrying out the administrative work in connection with personnel licensing and theoretical examinations.

Management and medical functions lie outside these two sections. The Principal Medical Officer reports to the director of the division, but does not have a separate section. 1.5 secretaries are allocated to the Principal Medical Officer. The Licensing Administration Section will also provide services to the Principal Medical Officer.

1	Director
1	Principal Medical Officer
0.5	Medical Officer
2.5	Secretaries
5	*Sub-total, Management and Medical*

Training Systems Section

1	Manager (high level flight operations training background)
2	Educational and training systems experts
5	Flight testing and training organisation inspectors (current pilots)
2	Flight crew theory, examination development and marking (pilot/navigator/flight operations officer background)
2	Theoretical and practical LAME examiners (technical background)
1	Technical training inspector (graduate technical background)
13	*Sub-total, Training Systems Section*

Licensing Administration Section

1	Manager (good knowledge of licensing requirements, service-oriented)
4	Licensing staff
1	Theoretical examination administration
2	Clerical support
8	*Sub-total, Licensing Administration Section*

26 Total, Personnel Licensing Division

Commercial Air Transport Division

Task Definitions

For all scheduled aeroplane operations and all operations with aircraft with MTOW above 5700 kg or having more than 10 passenger seats, for maintenance organisations serving the above operations, and for the aircraft concerned:

- develop and maintain flight operations and maintenance organisation standards
- entry control for new commercial operators and maintenance facilities; issue certificates of approval
- entry control for major changes to existing certificates of approval; issue amendments
- review and approve systems, procedures and methods requiring CASA approval (*eg* MEL systems)
- surveillance (major audits, route, base and facility inspections, routine meetings and *ad hoc* visits)
- monitor and survey aircraft airworthiness; issue, renew, suspend or cancel certificates of airworthiness
- approve minor modifications to aircraft and aeronautical products
- approve operator-derived maintenance programme
- participate in incident investigations; on request, provide expertise for accident investigation
- periodic flight checks with flight ops managers where designated check pilots are not available
- inspect aerodrome facilities and service at request of Aerodromes and Air Navigation Division, or in connection with other duties
- support clients with information and advice
- initiate corrective actions and enforcement
- designate, instruct and monitor authorised persons

Clients

34 operators with 231 aircraft and their maintenance organisations
(8 Category A, 20 Category B and 6 private/corporate operators, some 30 maintenance facilities)

Staff Requirements

This division should be divided into two sections:
- Air Transport Operations Section, and
- Air Transport Maintenance Section

staffed as follows:

1 Director
2 Secretaries
3 Sub-total, Management and Administration

Air Transport Operations Section

1 Manager, air transport flight operations (high level air carrier flight ops background; non-flying)
8 Flight operations inspectors
4 Major air carrier pilot background (all current pilots, except that one could be simulator flying only)
4 Commuter airline pilot background (at least 3 current pilots; the fourth could be non-flying)

9 Sub-total, Air Transport Operations Section

Air Transport Maintenance Section

1 Manager, air transport maintenance (graduate technical background)
6 Airworthiness inspectors (2 with engineering background)
7 Sub-total, Air Transport Maintenance Section

19 Total, Air Transport Division

General Aviation Division

Task Definitions

For all commercial helicopter operations, and all commercial aeroplane operations not allocated to the Commercial Air Transport Division, for private operations (other than sports and recreation), for maintenance organisation serving above operators, and for the aircraft concerned:

- develop and maintain flight operations and maintenance organisation standards
- entry control for new commercial operators and maintenance facilities; issue certificates of approval
- entry control for major changes to existing certificates of approval; issue amendments
- review and approve systems, procedures and methods requiring CASA approval
- surveillance (major audits, route, base and facility inspections, routine meetings and *ad hoc* visits)
- monitor and survey aircraft airworthiness; issue, renew, suspend or cancel certificates of airworthiness
- approve minor modifications of aircraft and aeronautical products
- approve operator-derived maintenance programmes
- spot checks on private operations
- support clients with information and advice
- periodic flight checks with flight ops managers and commercial pilots/owners where designated check pilots are not available
- participate in incident investigations and, on request, provide expertise for accident investigation
- inspect aerodrome facilities and services at request of Aerodromes and Air Navigation Division, or in connection with other duty
- initiate corrective actions and enforcement
- designate, instruct and monitor authorised persons

Clients

253 operators with aerial work licences and 1003 aircraft
152 Category B and C air transport operators with 683 aircraft

Approximate total due to dual air service licences:

300 operators and 1200 aircraft commercially operated
800 aircraft privately operated (excluding gliders, powered gliders and microlights)

Some 30 maintenance facilities and some 35 limited maintenance approvals.

Staff Requirements

This division should be divided into two sections:

- General Aviation Operations Section, and
- General Aviation Maintenance Section

staffed as follows:

1 Director
2 Secretaries
3 Sub-total, Management and Administration

General Aviation Operations Section

1 Manager, Flight ops commercial general aviation (pilot background, non-flying)
5 Flight inspectors, helicopter operations (current commercial helicopter pilots)
5 Flight inspectors, fixed wing operations (current commercial aeroplane pilots)
11 Sub-total, General Aviation Operations Section

General Aviation Maintenance Section

1 Manager, maintenance/engineering background
9 Airworthiness inspectors (3 with some engineering background)
1 Technical clerk, airworthiness monitoring and survey planning
11 Sub-total, General Aviation Maintenance Section

25 Total, General Aviation Division

Aerodromes and Air Navigation Division

Task Definitions

- develop and maintain standards on design and operation of aerodromes and related ground aids, on airways services, aeronautical information services, navigation and communications procedures and facilities, meteorological services, security, search and rescue, rescue fire services
- implement, or cause to be implemented, ICAO annexes 3-5, 10-12, 14-18 and related procedural manuals

- provide coordination to the Airways Corporation for the production of the AIP
- entry control of new providers of aerodrome, security and airways services, issue certificates of approval
- entry control on systems, procedures, facilities and equipment and issue approvals
- perform, or cause to be performed, flight calibration and flight inspection
- surveillance (major audits, inspections, routine meetings and *ad hoc* visits)
- investigate, or cause to be investigated, air safety incidents categories A and B
- review malfunction and occurrence reports and statistics
- analyse providers' quality assurance and audit reports and accident, incident and other reports
- coordinate community planning, protection zoning, noise and bird control
- coordinate with the Meteorological Services and search and rescue organisations
- designate, instruct and monitor authorised persons
- supports clients with information and advice
- initiate corrective actions and enforcement

Clients

Airways Corporation of New Zealand Ltd
Airports and aerodromes
Potential new providers of airways services

Staff Requirements

This division should be divided into four sections:

- Aerodromes Section, and
- Security & Search and Rescue section,
- Air Navigation Services section, and
- Flight Calibration section

with the following staffing:

1 Director
2 Secretaries
3 Sub-total, Management and Administration

Aerodromes Section

1 Manager, aerodrome standards background
1 Aerodrome, navigation and charts officer, pilot background
1 Navigation procedures designer
2 Aerodrome and ground aids experts (including dangerous goods handling)
1 Aerodrome expert, community planning coordinator
1 Rescue fire expert
7 Sub-total, Aerodrome Section

Security & Search and Rescue Section

1 Manager, experienced senior police officer background
2 Security inspectors
3 Sub-total, Security & Search and Rescue Section

Air Navigation Services Section

1 Manager, ATCO background
2 Airways services inspectors, ATCO background
1 Airways services and meteorological services inspector, airline pilot background
2 Communications and navigation aids technical experts, high level competence
1 Communications procedures officer
1 Aeronautical Information Publication coordinator
8 Sub-total, Air Navigation Services Section

Flight Calibration Section

1 Manager and chief pilot, active pilot (captain)
3 Calibration pilots (1 captain, 2 first officers)
1 Chief engineer, LAME
1 Licensed engineer
1 Handyman
7 Sub-total, Flight Calibration Section

28 Total Aerodrome and Air Navigation Division

Airworthiness Division

Task Definitions[159]

- develop and maintain airworthiness standards
- perform type investigations and issue certificates of type approval
- issue airworthiness certificates for first-of-type aircraft
- review and approve major modifications
- review and approve aircraft flight manuals and other type-related documents such as MMEL and maintenance requirements
- perform noise and engine emission certification
- investigate, or cause to be investigated, major technical malfunctions
- on request, provide expertise for accident investigations
- perform entry control for design and manufacturing organisations; issue certificates of approval
- surveillance of approved organisations (major audits, inspections, routine meetings and *ad hoc* visits)
- monitor reliability and malfunction reports and provide information feedback to aircraft owners

[159] Note that this definition differs from today's conception of airworthiness tasks.

- monitor continuing airworthiness information from manufacturing States; evaluate and issue airworthiness directives for aircraft on the New Zealand register
- perform aircraft registration and maintain computerised aircraft register
- support clients with information and advice
- initiate corrective actions and enforcement

Clients

Owners/operators of some 3000 aircraft

Staff Requirements

This division should be divided into two sections:

- Aircraft Engineering Section, and
- Continued Airworthiness Section

with the following staffing:

1 Director
2 Secretaries
3 Sub-total, Management and Administration

Aircraft Engineering Section

1 Manager, graduate aeronautical engineer, design generalist
1 Graduate engineer, transport category aircraft generalist
1 Structures specialist, graduate
1 Small aircraft design generalist
1 Helicopter design specialist (including mechanical and hydraulic systems)
1 Engine, noise and pollution specialist
1 Performance & AFM specialist
2 Electrical systems and avionics specialists
9 Sub-total, Aircraft Engineering Section

Continued Airworthiness Section

1 Manager, graduate aeronautical engineer
1 Maintenance and reliability specialist, air transport
1 Airworthiness engineer
1.5 Clerks, aircraft/registry
0.5 Clerk airworthiness
5 Sub-total, Continued Airworthiness Section

17 Total Airworthiness Division

Support Services Division

Task Definitions

Provide overall support for the efficient functioning of all divisions, in particular:

- legal advice on rulemaking and standards development
- legal advice and investigative support on corrective actions and enforcement
- personnel administration, including industrial matters
- co-ordination and administrative support for staff training
- budget and finance administration
- record keeping, technical library service, stores and purchasing, switchboard and reception, typing support for staff absences and to cover peaks.

Staff Requirements

Although different functions can be recognised in the Support Services Division, we do not propose any sub-units. Staff required are:

1 Director
1 Secretary (to Director General)
1 Secretary (to support services)
1 Senior staff lawyer
1 Staff lawyer/investigator
2 Personnel administrators
1 Staff training coordinator
1 Accountant
1 Senior clerk, finance
3 Clerks, finance
1 Librarian
1 Clerk (library)
1 Stores and purchasing clerk
2 Clerks (record keeping)
2 Switchboard operators
1 Typist
1 Advisory officer (graduate cadet)
22 Total, Support Services Division

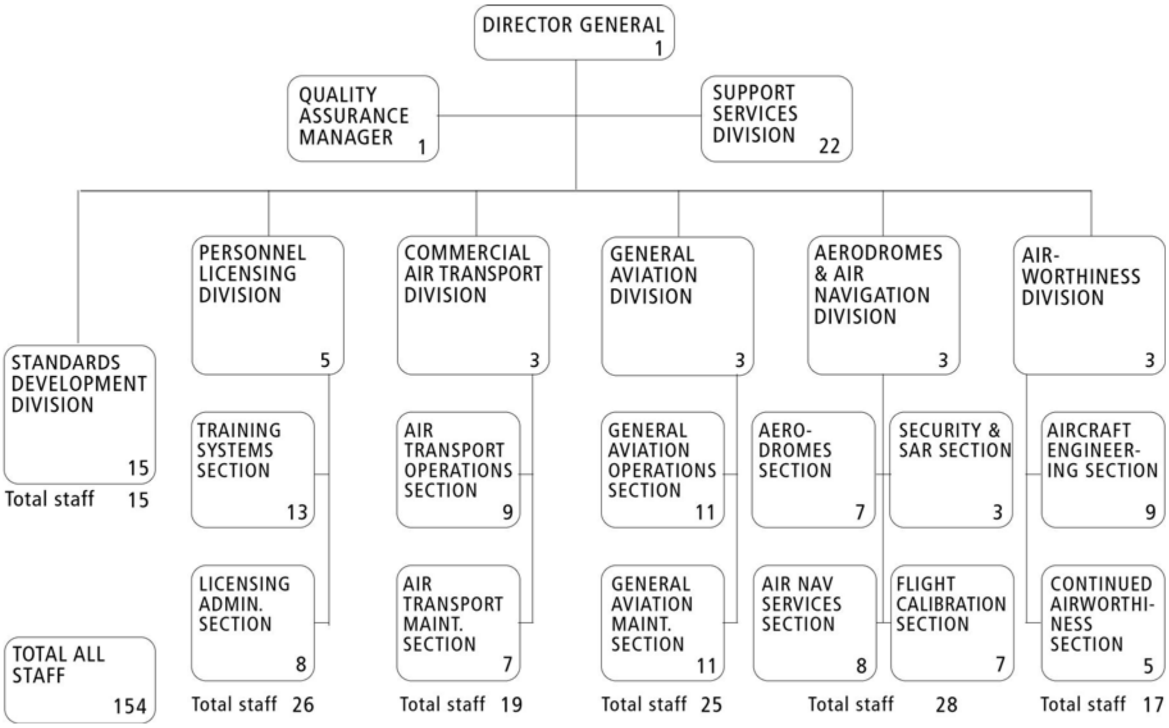
Top Management

The top management will consist of the Director General with duties and powers to be defined in the Civil Aviation Act. Directly reporting to the Director General will be a Quality Assurance Manager to monitor that CASA is effective and efficient and checking that it meets the cost-benefit criterion enunciated in Section 10.4.

16.4.2 Summary

The organisation resulting from the above analysis is illustrated in Figure 16.6.

Figure 16.6 - Civil Aviation Authority of New Zealand (CASA)



CASA's overall staff requirements will be *154*, distributed as follows:

Director General	1
Quality Assurance	1
Aviation Standards Development	15
Personnel Licensing	26
Commercial Air Transport	19
General Aviation	25
Aerodromes and Air Navigation	28
Airworthiness	17
Support Services	22
	154

This is a major reduction compared with CAD staffing. In the next section we compare CASA with some other safety authorities to verify that our estimates of staff are realistic.

16.4.3 Comparisons With Other Civil Aviation Safety Authorities

A number of aviation safety authorities in Europe have helpfully responded to our requests for information as to how they are staff and we are accordingly able to compare New Zealand with Denmark, Finland, Federal Republic of Germany, France, the Netherlands, Norway and Sweden.

Table 16.3: International Comparison of Technical Capabilities

		Number of Aircraft					
	Population (millions)	Total	Transport & Powered[1]	Transport >5700kg	No. of LAMEs	No. of Maintenance Facilities	Transport Aircraft Manufacture
New Zealand	3.2	3017	2218	73	1300	96	No
Denmark	5.0	1603	1042	87	1000	35	No
Finland	4.9	1202	622	45	1119	26	No
FRG	60.0	20330	7344	330	2827	-	Yes
France	60.0	11346	7213	436	n/a[2]	1003	Yes
Netherlands	14.0	1317	637	134	656	42	Yes
Norway	4.1	1259	1147	147	935	20	No
Sweden	8.3	2181	1603	120	1059	63	Yes

Table 16.4: International Comparison of Operational Capabilities

	Total	Major Carriers	Commuters	Taxi/ IFR	Charter VFR	Aerial Work	Flying Schools
New Zealand	433	7	14		159	162	91
Denmark	112	8	0	21	7	51	25
Finalnd	132	2	2	28	43	7	56
FRG	160+	33			127		
France	>100	10					
Netherlands	72	4	2	24	22	1	19
Norway	61	3	11	15	18		14
Sweden	188	6	18	25	47	15	77

Great care is needed when making comparisons. In some countries, for example, the presence of major manufacturing industries has a very big effect on the engineering and surveillance resources needed by the safety authority. The nature and size of operators also has to be considered; New Zealand stands out as being extreme in terms of the number of small operators.

With caution about interpretation we submit the following comparative figures. Apart from New Zealand we do not identify particular countries. Countries are referred to as A, B, C, *etc*, but the designation differs between tables. New Zealand is considered twice; firstly the current situation designated "CAD" and secondly the proposed situation designated "CASA".

Table 16.5: International Comparison of Airworthiness Staff Numbers

	Total Aircraft / Total Airworthiness Personnel	Trnspt+Normal A/C / Total Airworthiness Personnel	Transpt+Normal A/C / Maintenance Personnel	Maintce Facilities / Surveillance Personnel
A	70	64	90	1.4
B	74	47	116	1.6
C	175	63	>140	
D	76	30	65	2.2
E	86	44	89	3.7
F	68	50	87	3.1
G	34	16	49	3.2
NZ CAD	50	37	50	2.2
NZ CASA	86	63	103	5.3

Table 16.6: International Comparison of Staff Needed to Maintain the Register

	Aircraft Per Person
A	1454
B	1202
C	
D	659
E	2904
F	2269
G	3017
NZ CAD	2011
NZ CASA	

The following table shows the relations between numbers of licensed operators (flying schools excluded) and authority personnel in flight operations units carrying out certification and surveillance of operators, including related standards development work.

Table 16.7: International Comparison of Staff Needed for Flight Operations

	Total Operators	Major Carriers	Commuters	Taxi/ Charter	Aerial Work
A	8.2	0.4	1.4	5.3	1.1
B	5.9	0.5	0.2	5.1	0.1
C	16.4	0.4	0.4	14.2	1.4
D					
E	3.6	0.2	0.9	2.5	0.0
F					
G	12.4	1.1	0.0	4.0	7.3
NZ CAD	6.6	0.1	0.3	3.1	3.1
NZ CASA	14.3	0.3	0.6	6.6	6.8

Note:

1. Excluding flying schools

We list the following rates to compare the numbers of authority personnel involved in: training approvals and licensing; flight testing and technical examination; and standard setting.

Table 16.8: International Comparison of Licensing Personnel

	Flying Schools Per Authority Licensing Person	Professional Flight Crew Licenses Per Authority Licensing Person	LAMEs Per Authority Licensing Person
A		306	565
B			
C	2.8	140	468
D	3.2	329	
E	6.7	217	424
F	18.7	306	1119
G	4.6	273	500
NZ CAD	5.1	141	130
NZ CASA	7.0	195	433

Table 16.9: International Comparison of Administration and Medical Licensing Staff

	Licensing Administration Personnel	Medical Personnel
A	2809	5500
B	2634	2040
C	1891	1146
D	1354	
E		6146
F		7563
G	1910	4400
NZ CAD	593	2265
NZ CASA	1617	3775

Conclusions from the International Comparisons

Airworthiness Personnel. Present New Zealand figures indicate a rather low productivity, but not the lowest among countries compared. The proposed staffing for CASA will mean high productivity, but not above the productivity some other countries have achieved.

Staff to Maintain Aircraft Register. Present New Zealand figures indicate under-staffing which is confirmed by the status of the register. Proposed staffing for CASA improves this situation, but maintains a reasonably high productivity

Flight Operations Staff. Present New Zealand figures indicate about average staffing. Proposed staffing seems to indicate high productivity, near the highest of the comparison countries. There are many small operators in New Zealand, however, who are more or less “sleeping clients”. In a “user pays” system, when CASA starts to charge for surveillance, it may be that a number of these operators will not see it as worthwhile to maintain their licences. Against this background the resulting workload is reasonable.

Personnel Licensing Staff. Present New Zealand figures indicate low productivity. This is due to the New Zealand licensing system probably being the most complicated amongst the comparison countries (due to multitudes of categories, ratings and related examinations and safety authority checks). We have recommended a considerable simplification of the licensing system, *which is a pre-requisite for the proposed staffing and resulting productivity figures.* Productivity will still be a little on the low side because we have not assumed that all the possible simplifications will be carried out within the three year implementation period. In the long run further savings should be possible.

Licensing Administrative Staff. Present figures indicate very low productivity, and this is largely due to the split of operations between head office and regions and the complexity of the licensing system. The proposed staffing leads to a considerable increase in productivity, but more could still be gained when the licensing system is completely revised.

Medical Staff. Present figures indicate a productivity below average; our proposal means an improvement to above average. More is to be gained when “licensing for life” has been introduced.

Summary. Although our proposals means a drastic reduction in staffing, comparisons with other aviation safety authorities show that the resulting productivity demands are reasonable.

16.4.4 Some Explanations Of How Staff Requirements Were Estimated

The following assumptions were used to establish the staffing for the client-oriented output units.

Personnel Licensing Division

We assume that authority flight test inspectors will carry out flight tests for issuing:

- 140 commercial pilot licences pa,
- 10% of private licence issues, 60 pa,
- licence upgrades to ATPL for medium – and small-size airlines, 50 pa,
- new type-ratings for medium-sized airlines,
- instructor ratings, and
- instrument ratings[160].

We further assume that personnel licensing staff will perform *ad hoc* surveillance of approved training organisations at the same time as visits for flight testing. We also assume that once every two years audit inspections will be carried out on flying club schools (one day on-site), and once every year for professional schools (general aviation, two days on-site).

For major airlines with approved training organisations we assume:

- monthly visits to Air New Zealand and Ansett,
- quarterly visits to other Category A operators,
- six-monthly visits to other operators,
- one or two major audits a year on Air New Zealand and Ansett
- one audit a year on other operators, and
- flexibility for *ad hoc* inspections.

[160] It has not been possible to obtain numbers of ratings normally issued.

For LAME licensing we assume that further simplifications are made to the licensing system. On a total population of 1300 licences, the estimated annual output is currently:

- 1600 technical examinations
- 200 issues of basic licences,
- 600 issues of additional categories,
- 400 issues of ratings, and
- 300 issues of maintenance approvals.

This indicates a very complicated system. It has recently been revised and agreed with industry but still needs further simplification. In our staffing estimates we assume that considerable simplification will take place within three years.

Commercial Air Transport Division

We assume there will be frequent high-level contacts between CASA and the major airlines, for exchange of information on: airline development plans; safety and reliability trends; incidents and accidents; and results of airline quality assurance and authority surveillance. We estimate the following.

- For Air New Zealand and Ansett, monthly meetings with representatives of flight operations, maintenance and personnel licensing jointly. The seniority of the participants should be: for CASA, Divisional Directors and heads of sections; and for the airline, the equivalent management levels in flight operations, maintenance and training. Once every quarter the Director General should participate, as well as the airline's general manager of airline operations.
- Quarterly meetings with other Category A airlines.
- Six-monthly meetings with other operators.
- Two major audits per year of Category A airlines.
- One major audit per year of other operators. Audits involve both operational and technical personnel.
- one major route-inspection on each aircraft type in each airline per year; more if problems are indicated. This should include overseas line stations, and both technical and operational personnel should be involved.
- Some 20 periodic flight tests on flight operations managers/chief pilots when designated check pilots are not available.
- Entry control activities as and when required.
- About 25 airport inspections per year at the request of the Aerodrome and Air Navigation Division.

General Aviation Division

For the 300 commercial operators, 65 maintenance facilities and 2000 aircraft concerned we assume the following annual activities:

- 300 operator inspections and audits taking one day, including maintenance and flight operations personnel,
- 400 periodic flight tests with flight operations managers/owner operators,
- 100 route checks,
- 40 aerodrome inspections (one every four years),
- meetings, information and advice,
- 30 maintenance facility audits,
- 35 maintenance facility visits,
- 500 aircraft survey inspections[161],
- 1500 reviews of annual aircraft inspection reports, and
- entry control activities as and when required.

Aerodromes and Air Navigation Division

In addition to in-house activities, we estimate the following external activities will place:

- 3 major airports inspected twice a year by 2 men for 2 days,
- 25 other airports inspected once a year by 1 man for 2 days,
- 20 rescue fire services inspected once a year by 1 man for 2 days,
- 3 security services inspected monthly by 1 man for 1 day plus additional *ad hoc* inspections,
- continuous monitoring of Airways Corporation quality assurance output,
- for each area control centre, audit inspection twice yearly, 2 men for 3 days,
- 10 small ATS units on average visited once a year, and
- direct involvement in 10 incident investigations per year.

Airworthiness Division

Airworthiness Division staffing is based mainly on the competencies needed for CASAA to discharge its responsibilities. Internal work dominates over field work, and it has been anticipated that today's heavy involvement in "consultancy" with respect to aircraft modifications will disappear. `

16.5 CASA'S PROJECTED BUDGET FOR 1991/92

This section translates our recommendations into a budget. Many assumptions have been used and every endeavour has been made to record them (refer Appendix XII). The heading "1991/92 Budget" is intended to emphasise the three-year implementation period.

Section 6.6 showed CAD's budget for 1988/89 was $22.13 million. The purpose of establishing this figure was to enable comparison of existing costs with those of

[161] Each aircraft is inspected one every four years.

our proposals. Our 1991/92 budget for CASA is expressed in 1988 dollars to allow direct comparisons to be made. Table 16.10 is based on a CAD staff complement of 340 and a CASA staff complement of 154.

Table 16.10: Comparison of CAD and CASA Annual Budgets

		CAD's 1989/90 $M		**CASA's 1991/92 $M**
Salaries & wages[1]	14.75		7.91	
Travel, transport, communications	1.70		1.99	
Maintce & operations, rents	4.69		1.61	
Materials, supplies & servicing	1.41		0.99	
Other operating expenditure	2.18		1.65	
		24.73		14.15
Less Revenue (Flying Unit)		2.60		1.60
		$22.13M		$12.55M

Note:

1. CAD figure includes an allocation of $3.41 million for Corporate Services

The bulk of the $9.58 million saving reflects a reduction of staff. Some of this reduction is illusory because:

- 45 staff members have, in effect, been transferred to airport authorities as a consequence of the recommendation that airports take over the operational functions of aviation security[162];
- the *actual* existing staff strength of CAD is 260 compared with the 1988/89 budget figure of 292 we have used[163]; and
- based on the amount charged by Corporate Services to CAD we estimated the equivalent staff number to be 458 whereas in our assessment of CASA we have allowed for fewer people to perform the same tasks.

The 1988/89 budget for regions is $3.0 million; although extra travel costs are incurred by CASA, there are substantial savings nevertheless.

Disposal of all aircraft except one F27, and eventual transfer of the operation out of Paraparaumu, accounts for $1.0 million. The $3.4 million allocated to CAD from Corporate Services will not all be required by the safety authority and it is likely the savings here would be about $1.0 million.

Under "user pays", charges would be reduced by 30% to 50%, depending on the user. If "user pays" is introduced before these economies are effected the charges should be based on CASA's costs as presented above, not on CAD's costs[164].

[162] Airports advise they would require 45 extra staff. We assume that airports will wish to hire staff which is already fully trained and will prefer existing CAD staff.
[163] Refer Section 6.6.

In Table 16.11 we list CAD's proposed safety-related capital expenditure that may not be required by CASA[165]. It shows a once-only capital cost benefit of $4.6 million.

Table 16.11: CAD Safety-related Capital Not Needed by CASA (1988 dollars)

Future Capital Expenditures			**$M**
Information Services – Regions	(Computer, faxes)	0.033	
Administration – Auckland	(Airport building)	1.900	
Security – Regions	(Various equipment)	0.145	
			2.078
Sale of Assets			
Surplus aircraft			3.180
Less extra computer resources needed by CASA			(0.649)
Total Surplus Funds			4.609M

[164] Apart from encouraging efficiency in the organisation, this would undoubtedly improve the acceptability of the charges.
[165] We do not list proposed capital expenditures that are *not* safety-related, since they do not reflect essential differences between CAD and CASA.

CHAPTER 17

IMPLEMENTATION

17.1 PRINICPAL DECISIONS REQUIRED

Government Approval in Principle

Give the broad changes it recommends, release of this report will create unrest within CAD and the civil aviation industry. The government should decide as soon as it can what steps it proposes to take pursuant to the report. It is very important that action is seen to be taken to gain the confidence of the industry and staff.

Director General's Appointment

The Director General will be responsible for the implementation of the programme. His involvement and commitment will be a critical element. We therefore recommend that the Director General be appointed as soon as the government gives its approval in principle to actions to be taken in consequence of the report. Soon after the Director General's appointment other key people should, for similar reasons, also be appointed.

Goals and Objectives for the Civil Aviation System

It is the responsibility of the Minister, assisted by the Director General, to establish goals and objectives for the civil aviation system.

Outline Implementation Plan

At the outset, an implementation plan should be prepared for approval by the Minister. Although detail is not required, attention would be given to the nature of tasks, the timing and the resources required for implementation. Resources outside CASA may be needed to assist in the phase.

17.2 PERSONNEL SELECTION

Because we propose a considerable reduction in personnel (for CASA, as compared with CAD) and closing of regional offices, all CAD personnel will be placed in apposition of utmost uncertainty. It is in the interest of CASA, as well as current CAD personnel, for prompt decisions to be made as to who will have a place in CASA. Although it is crucial for the new authority to recruit *some* new people with recent industry background and management experience, it is also crucial not to lose key people currently within CAD.

We therefore propose that early decisions be taken to make appointments at management levels – and, thereafter, for the rest of the staff. At the same time, decisions should be taken on which staff could be given temporary assignments during the implementation period.

17.3 DETAILED IMPLEMENTATION PROGRAMME

The next stage will be to establish a critical path for implementation of the government's approved plan. Some tasks, such as changes to the Act and Regulations, will be time consuming. Where significant recommendations require amendment to the Regulations, such amendments should be given a "fast track" approach.

CASA's staffing levels in Section 16.4 relate to the situation that will obtain after all recommended changes have been implemented. For an interim period additional resources will be needed for implementation projects, especially the total review of regulations and standards. The following lists CASA staffing requirements for these implementation projects[166].

Table 16.12: Implementation – Staffing for CASA Special Projects

	Project Managers	Specialist Staff
Technical Basis for New Regulations	1	4
Personnel Licensing Standards	1	2
Commercial Air Transport Standards	1	2
General Aviation		
- Helicopter Standards	1	2
- Aeroplane Standards		2
Aerodrome Design and Operation Standards	1	2
Air Navigation and ATS Standards	1	2
Security Services Standards	1	1
Meteorological Services Standards	1	1
Airworthiness SDtandards		
- engineering and manufacture	1	1
- continued airworthiness		1
Internal Working Procedures	1	3
Internal Training and External Information		2
	11	27

[166] On top of this we assume addition resources will be provided by industry participation.

Persons on management levels in CASA should be appointed as the project managers.

Not all 38 staff in Table 16.12 are additional to CASA's long-term requirement. The new structure for CASA allows for 24 people needed as an *average* requirement for standards development and project management. Thus a net increase of 14 extra staff is required during the implementation phase[167].

It should be borne in mind that some existing procedures cannot be changed until (at least provisional) new regulations and standards are established. The additional interim resource requirements to bridge this period will have to be gauged by CASA.

We expect CASA to be fully operational at the end of three years, and recommend that this be the target date for completion of the programme of change. Most of the changes should be capable of implementation within eighteen months. At that stage the staffing would be down to 154 plus 14 additional people needed for the following eighteen months.

17.4 STAFF TRAINING REQUIREMENTS

Under our proposals CASA's role will be different from CAD's role at the present time. The difficult part will be changing the attitudes and behaviour of the people involved; this applies to both the industry and the safety authority. Many factors influence an individual's receptiveness to change: past experience, pre-conceived ideas, disillusionment, job insecurity, personal attributes, and many more.

To effect the changeover extensive staff training is required. Training seminars will be required for all staff to: explain the new safety philosophy, teach new technical and personal skills, and demonstrate how to relate with the industry. All this will take time and good management. Allocating three years for the total implementation programme should not be looked upon as generous, or permitting tardy progress. Training must start as soon as practicable if existing staff levels are to be reduced to the target level (plus the additional 14) by the end of the first eighteen months.

Beyond the changeover phase staff training will remain an ongoing process. A pilot or engineer recruited by CASA does not automatically become a good inspector. He needs training for his new role. CASA needs permanent resources to co-ordinate training programmes.

[167] Not all extra staff are necessarily needed for the entire three year implementation period.

CHAPTER 18

SUMMARY OF RECOMMENDATIONS

Throughout Part III of the report recommendations have appeared as the arguments have developed and conclusions reached. The main recommendations thus made are summarised below. In parenthesis are the section numbers where the recommendations can be found.

> The aviation safety goal is: *that the civil aviation system takes all measures that would improve safety at reasonable cost, subject to the State meeting its minimum obligations under ICAO.* Reasonable cost is interpreted as meaning that the cost to the nation is exceed by the benefit to the nation. (10.4)
>
> The aviation safety regulatory body should stop striving for improvement in safety at the point when the value of the next increment of safety is outweighed by the cost of achieving it. (11.5)
>
> Cost-benefit analysis should, whenever practicable, be a mandatory tool in the rulemaking process for discretionary areas. (13.2)
>
> The Airways Corporation and the airport companies must have explicit guidance as to their public safety obligations. They should have incentives to take a cost-benefit viewpoint, and to regard cost-benefit analysis as a natural method of evaluation. (11.3.2)
>
> The safety regulatory body should not have dominion over the private decisions of individuals. If an individual wishes to fly, and will not endanger the lives and property of others, he should be free to do so. (11.3.3)
>
> Flight crew licences should be non-terminating with medical certificates renewed by designated medical examiners (DMEs). (11.4.2)
>
> Medical examinations by "SuperDMEs" (medical personnel who have passed the post-graduate diploma in aviation medicine) should not be imposed on commercial pilots. (11.4.3)
>
> For professional pilots over 40 years the issue of medical checks as frequently as six monthly should be raised with ICAO. (11.4.3)
>
> As aviation's occupational health expert the Principal Medical Officer should decide whether air crew are medically fit to fly. If he deems it desirable he may seek aid (but not direction) from specialist medical advice from whomsoever he considers most appropriate in any given circumstance. (11.4.3)
>
> For grievances regarding medical fitness the appeal authority should be the Director of Civil Aviation (or his equivalent under a new regime) who should be

free to seek advice from any quarter, including the Aircrew Licensing Board. (11.4.3)

At Auckland, Wellington and Christchurch, operational tasks of aviation security should be transferred to the airport company. (11.4.5)

Standards should be established for airport security and significant financial penalties be imposed if standards are not met. (11.4.5)

The regulations should reflect and balance the powers applied to civil aviation (12.1)

The legislation should:

- establish a framework for the total civil aviation system;
- provide for Civil Aviation Authority itself;
- express the flight safety requirements needed to transform Society's expectations into operational principles; and
- institute improved enforcement procedures with adequate penalties. (12.1)

The legislation should provide for:

- the discharge of responsibilities undertaken by New Zealand as Contracting State to ICAO and designate appropriate authorities;
- the basic goals and objectives for the civil aviation system in New Zealand;
- a civil aviation safety authority, its objectives, powers and responsibilities, and define what tasks that may be further delegated;
- the minimum requirements for entry into the civil aviation system;
- continued operations within the civil aviation system by persons and organisations;
- administrative and legal enforcement of requirements and conditions including limitation, supervision or cancellation of vested privileges and procedures for appeal; and
- procedures to facilitate change to regulations and requirements. (12.1.4)

The role of a civil aviation authority in New Zealand should be limited to safety related issues. (12.1.6)

A clear-cut division of responsibilities for safety between the state authority and the participants in the system should be established in legislation. (12.2.1)

The legislation should make it clear that the individual is expected to carry out his privileges according to prescribed standards and to observe an limitations and conditions imposed on the licence. Failure to do so should have defined consequences. (12.2.2)

"Provider" functions should not be undertaken by the safety authority. (12.2.3)

The responsibility for meeting defined performance standards should rest with approved organisations. (12.2.3)

An approved organisation should maintain internal quality assurance. (12.2.3)

The manuals are the responsibility of the approved firm. (12.2.3)

For a new entrant into the system, manuals form the basis for issuing certificates of approval. (12.2.3)

The approved organisation must assume full responsibility for any manual amendments. (12.2.3)

No operation should be allowed by the operator unless covered by the manual. (12.2.3)

The safety authority should limit its involvement to the organisational structure and senior levels of personnel of approved firms. (12.2.4)

There should be some basic organisational principles as a basis for acceptability of air service operators. (12.2.4)

The Airways Corporation must be treated on the same basis as other approved organisations. (12.2.4)

The safety authority must define standards for organisation and competence levels as conditions for issuing certificates of approval to the Airways Corporation. (12.2.4)

The main authority functions for a civil aviation safety authority are to:

- provide standards for the different sectors of the civil aviation system;
- perform entry control by means of licensing, approving or certificating new entrants into the system;
- perform functional supervision by means of surveillance, support and corrective actions;
- perform exit control in terms of limitations, suspension or cancellation of licences, approvals or certificates; and
- perform analyses of changes in order to amend regulations, standards and working methods to respond to changing environment and technology and to experience gained in the system. (13.1)

All major principles and provisions that affect individuals and organisations in a legal sense should be covered by the Civil Aviation Act and the Civil Aviation Regulations. (13.2)

The overall regulatory framework should be overhauled, starting with the Civil Aviation Act and the Civil Aviation Regulations. (13.2)

Provisions for a consultative process, and for defined lead times before new standards become effective, should be contained in the Civil Aviation Act. (13.2)

Regulations should be updated every two years in order not to accumulate inadequacies that could create problems for industry. (13.2)

No Certificate of Approval for an organisation should be non-terminating. (13.3)

Licensed individuals and approved organisations shall carry the primary responsibility for their own performance. (13.4)

No consulting services should be provided by the safety authority. (13.4.2)

The holder of the Certificate of Approval shall be held responsible. (13.4.3)

A certificate of an approved aerodrome, training organisation, flying school, design, construction, maintenance, processing, and supply organisations shall not be transferred without the written consent of the Director. (13.5)

The aircraft register should include information about the operator, if not the same as the owner. (13.5)

The Civil Aviation Act should make it illegal to operate an aircraft unless it has a valid certificate of registration and unless change of ownership or operator has been registered by the safety authority within 30 days. (13.5)

A damaged aircraft requiring major repairs automatically has its Certificate of Airworthiness cancelled. (13.5)

The safety authority should provide all statistics and basic analyses needed for assessment of aviation safety in New Zealand. (13.6)

There must be a clear-cut definition of responsibilities between the safety authority and the aerodromes and airways organisations. (13.7.1)

Standards for airports and airways services should be developed in accordance with the Act and the Regulations. (13.7.2)

The safety authority must certify and approve new systems, procedures, facilities and equipment, of providers of airways and aerodrome services wishing to enter the system. (13.7.3)

A provider of aerodrome and airway services must have an internal quality assurance programme. (13.7.4)

Clear principles should be developed on what level of incidents are required to be reported to the safety authority. (13.7.4)

There should be an assessment of the importance and implications of each ATS incident and the safety authority should ensure that incident investigations are carried out at an appropriate level. (13.7.6)

The following principles should be applied for Category *A* ATS incidents.

- They should be immediately reported to the safety authority.
- As at present, the Airways Corporation should immediately secure all possible relevant facts, including recorded information and make its assessment of the severity of the incident.
- A designated officer of the safety authority should receive incident information and coordinate resulting activities.
- The safety authority should assess, on the basis of preliminary information, the severity of the incident and decide on the proper form of investigation. (13.7.6)

The Chief Inspector of Air Accident should be kept informed about incidents and the safety authority decisions. Critical cases should be informally coordinated at the time of decision. (13.7.6)

The safety authority has the right to request that the Chief Inspector of Air Accidents undertakes an investigation. (13.7.6)

Special arrangements should be made for job rotation between the safety authority and the Airways Corporation. (13.7.10)

The safety authority should decide the minimum level of meteorological services required for various categories of operation and define the minimum standards for these services and for meteorological instruments used at aerodromes. (13.8)

The safety authority requires flight operational expertise to establish operational requirements and standards for meteorological services. (13.8)

It is recommended that the name of the new authority be the *Civil Aviation Safety Authority* (CASA). (16.2.8)

Administrative support functions should be under the control of the safety authority. (15.2.3)

The safety authority should be a state institution and an independent organisation reporting directly to the Minister of Civil Aviation and Meteorological Services. (15.3.1)

The role of the Air Services Licensing Authority should be reviewed. (15.3.2)

Extensive staff training and indoctrination programmes should be undertaken to implement the proposed principles. (16.1.2)

The authority should avoid appointing airline inspectors with marginal qualifications. (17.1.2)

Agreements should be set up with airline to enable inspectors perform active flight duty with airlines. (16.1.2)

All aircraft, except the calibration F278, should be sold; the calibration F27 should be situated at an Air New Zealand base as soon as practicable and agreeable to the Airways Corporation. (16.1.2)

Paraparaumu airport is not required by the safety authority. (16.1.2)

The organisational structure for the civil aviation safety authority should be client-oriented and output-oriented. (16.2.5)

Regional offices should be closed. (16.3.4)

The major function of the safety authority, for private aviation, should be the provision of relevant safety information. (16.2.5)

The safety authority should limit its direct involvement in sport and recreational activities to approving and authorising these bodies to carry out their own safety measures up to the level of their technical expertise. (16.2.5)

The safety authority should appoint a quality assurance manager. (16.2.5)

All the resources of the safety authority should be located in one office, and Wellington is the most suitable location. (16.3.2)

The overall staffing to support the proposed role and objectives of the safety authority is 154. (16.4.3)

A total of 38 people should be involved in the implementation phase; 14 of whom are additional to the 154 and 24 are seconded from permanent staff. (16.6)

There are numerous recommendations relating to the new Act and Regulations found in Chapter 14.