AIRSERVICES AUSTRALIA

Review of the Radiocommunications Act (RCA) and the Role of the Australian Communications Authority

Submission by Airservices Australia

Airservices Australia is responsible for the provision of safe and environmentally sound air traffic services to aircraft in approximately 11% of the world's airspace. Australia's Flight Information Region includes not only Australia's sovereign airspace, but also significant international airspace over the Pacific and Indian Oceans.

The following submission is made by Airservices Australia from the perspective of its experience as a provider of air traffic services making use of the aeronautical spectrum. Airservices also actively participates in national and international consultative committees and forums on aviation spectrum issues.

The document provides Airservices' views on various issues raised in the Productivity Commission Issues paper.

Issues

Objectives of the Radiocommunications Act

Do the objectives of the RCA adequately describe the social, environmental and economic problems which radiocommunications legislation should address?

Airservices is concerned that the importance of radiofrequency spectrum to the aviation industry for safety-of-life functions is not well presented in the Radiocommunications Act.

The safety of air operations is vitally dependent on the availability and protection of reliable communications and navigation services. The high integrity and availability requirements associated with aeronautical safety systems demands special conditions to avoid harmful interference to these systems. Increasing demands from non-aviation services for spectrum in or near aviation bands not only increases the difficulties for spectrum acquisition as services expand and new technologies are developed, but also more seriously increases the potential for interference and threatens aviation safety. Safety is an absolute prerequisite for continued growth of the global air transport industry.

The ITU Member States recognise that the safety aspects of radionavigation and other safety services require special measures to ensure their freedom from harmful interference (ITU Article S4.10, refer Attachment 1/D). This special recognition of aviation as providing a "public service" within Australia is not reflected in Australia's radiocommunication legislation.

Airservices recommends that:

- Aviation safety services be specifically referred to and be given at least the same prominence as Defence, Police and Emergency services in terms of spectrum protection in the Act;

- Economic considerations alone should not be allowed to determine spectrum allocation for services which are dependent on the radiofrequency spectrum and have safety-of-life implications;

- In view of the safety-of-life implications associated with the aeronautical services and the need to ensure avoidance of interference to aeronautical services, management of aviation spectrum must be subject to firm and decisive control by Government and not left to industry self regulation or control by any commercial organisation;

- In finalising positions affecting aviation spectrum for World Radio Conferences (WRC) and other international fora, the Australian Communications Authority should consult with the Departments of Transport and Regional Services (also represented by Airservices Australia and Civil Aviation Safety Authority) and Defence.

Should the tradeoffs between competing economic and social uses of spectrum be more clearly articulated in the principles governing spectrum management?

Market based allocation of spectrum

Airservices is required, under the Civil Aviation Act and the ICAO Convention, to provide services to meet the demands of the aviation industry for safe and expeditious aircraft operations.

In recognition of the public benefit of radiofrequency spectrum use for aeronautical safety-of-life services, the Australian Aviation industry has been working with the ACA on developing guidelines which propose that spectrum requirements for these services should not be subject to market-based allocation processes.

Airservices is opposed to market-based allocation of radiofrequency spectrum for aeronautical safety-of-life services for the following reasons:

- the potential for costs to escalate substantially to the aviation industry without commensurate benefits to the public, noting the absence of a world price for aeronautical spectrum;
- the risk to the international competitiveness of the Australian aviation industry due to the need for aeronautical equipment standardisation and interoperability in global air transport operations;

- the risk of significant non-Australian ownership of this resource that is critical to international and domestic aviation;
- the need for additional national legislative and regulatory arrangements to protect national allocations;
- the possibility of jeopardising international agreements and coordination;
- risk of accepting short term financial returns on the use of spectrum at the expense of provision for the necessary long lead times for the introduction of aviation services.

Airservices recommends that the Radiocommunications Act be amended to indicate that radiofrequency spectrum use for aeronautical safety-of-life services be not subject to market-based allocation processes so as to ensure public and national interests are protected. It is proposed that a clause (similar to that provided for the ABA clause 36 (5)) be inserted with the intent that spectrum allocated by international agreement to aeronautical services not be designated for spectrum licensing.

The approach to allocating spectrum under the Radiocommunications Act

Does the current process of consultation with the ITU promote Australia's interests effectively?

The global nature of the aviation industry dictates that Australia must take into consideration international aviation plans to ensure maximum economic and social benefits to Australia.

An example of where Australia did not take a long term global economic view in support of the Aviation industry, was the conversion of the aeronautical mobile satellite services (AMS(R)S) 1.5 and 1.6 GHz bands[1] to generic mobile satellite services (MSS) use (refer also to Attachment 1/B). The potential for short term economic gain derived from spectrum converted to MSS should have been assessed against the increased aviation costs arising from buying back MSS spectrum taking into account the:

- consequent need for more stringent equipment standards to satisfy aviation standards; and
- restrictions to technological developments of aviation systems.

Airservices recommends that the ACA take careful consideration of the global nature of the aviation industry and its economic benefits to Australia in its consultation with the ITU.

[1] The AMS(R)S 1.5 and 1.6 GHz frequencies are used for voice and data pilot to Air Traffic Control satellite communications primarily in oceanic and continental low density airspace. The operational benefits of satellite communications contributes to substantial efficiency savings.

What is the potential for allowing entities other than the ACA to issue licences?
What would be the advantages and disadvantages of delegating this function to other government agencies or private sector entities?
Is the licensing system effective in managing frequency interference?

Licence fees are paid to the ACA as the regulatory authority to enable them to perform the national spectrum management activities. It is therefore the ACA's responsibility to ensure that the spectrum is operated in conformance with the Radiocommunications Act and Regulations. Moreover the ACA must take proactive steps by regular monitoring the spectrum to ensure that it is used correctly and unlawful operation is discouraged, nationally as well as internationally.

Airservices recommends that the ACA, as spectrum regulator continue to maintain this role and take proactive steps to control interference to radio services by regular monitoring of the radiofrequency spectrum, nationally and internationally.

Charging for the use of spectrum

Do auction processes ensure that spectrum is allocated to the uses that are of highest value to society?

The user that is capable of paying the most amount of money for spectrum may not be the one that provides the highest value to society. A distinction needs to be made between uses dictated by economic terms and uses that are highly valued by society for non-commercial reasons.

Airservices recommends that a clear distinction be drawn between the user that has the greatest financial resources to secure the spectrum and the user that provides the highest value to society. Regulatory process need to be effective to ensure that uses valued highest by society be given preferential access to spectrum particularly where safety-of-life is involved.

Class licensing of radiocommunications and navigation devices on Aircraft

Class licences for non-assigned frequencies were introduced in 2001 for radiocommunications and navigation devices on aircraft. It is accepted that there are benefits in the class licence concept to the ACA in improving compliance, and removing the excessive administrative costs for issuing the non-assigned apparatus licences that attracted a small annual licence fee. However in the context of licence fees based on spectrum denial, this poses a significant contradiction.

Aircraft, particularly large and medium sized commercial aircraft carry a range of RF emitters and traverse the continent. The resulting spectrum denial in terms of spectrum and area is significant. Thus there is good cause to introduce a fee structure that recognises the extent of spectrum denied by aircraft operation rather than retain the Class Licence category that provides no return to Government for the use of spectrum.

Airservices would not oppose a category of licence which would take account of the considerable spectrum denial caused by aircraft radiocommunication and navigation installations.

Licence tenure and band clearance

With the capacity for technology developments in the hands of a relatively few countries, and spectrum allocation being determined only by a World Radio Conference, Australia has little potential to directly influence spectrum use through technology.

Aviation systems due to their global and safety characteristics, are planned and implemented with a focus towards a long life cycle. Planning of the airborne and ground based radio systems in the national airspace infrastructure is based on the provisions of the prevailing ITU Radio Regulations. The time scales associated with this planning process far exceed the nominal two-year period of the ITU WRC cycle. Thus long term stability of the ITU radio regulatory provisions is essential to provide a stable basis for the development of air transport. An uncertain, changing regime of radio regulations seriously impedes the air transport industry's strategic planning and thereby its long term development to the detriment of the global and national economy.

Long term tenure of the bands for aeronautical systems is necessary to ensure the public obtains maximum economic return following the long development and adoption phases.

Airservices recommends that:

- for non-commercial services like aeronautical safety services, that have necessary long life cycles, long term tenure should be provided;
- compensation be paid where notice to vacate to a long term licensee is expected to result in high relocation costs and premature write-down of assets.

Non-commercial use of the spectrum

How should 'public or community services' be defined?

Refer to Airservices' comments under the heading of 'Objectives of the Radiocommunications Act'.

Airservices recommends that Aviation safety services be specifically referred to as a 'public or community service' and be given at least the same prominence as Defence, Police and Emergency services in terms of spectrum protection in the Act.

How should 'adequate provision of spectrum for public or community services be determined?

Adequate spectrum for aviation services must take into account the need:

- for guard bands in order to avoid potential harmful interference to aviation safety services due to incompatible non-aviation services in adjacent band;

- for spectrum availability to meet future demands, noting the long lead times involved in infrastructure planning and deployment;

- to ensure equipment standardisation and interoperability of aeronautical radio systems to facilitate global harmonisation of air transport operations.

Impact of the legislation on competition

In assessing competition issues, what effects on the environment, welfare and equity, occupational health and safety, economic and regional development, the competitiveness of business including small business, and efficient regulation, need to be taken into account? Why?

Airservices would support the continued regulation of aviation spectrum under the existing national and international regime. Aeronautical spectrum is allocated internationally by the ITU reflecting the global nature of the aviation industry. The international Standards and Recommended Practices (SARPS) that set the standards or performance and operation of aviation services are determined by the International Civil Aviation Organisation (ICAO). Any change from these arrangements would have significant negative safety, environmental and economic effect on Australia.

The effectiveness of the ACA

Do the key performance indicators in the ACA's Corporate Plan provide an appropriate basis for assessing its performance?

The objectives of the Radiocommunications Act should be used to assess the performance of the ACA. In particular assessing the extent to which Australia is able to influence international radiocommunication forums to ensure "adequate provision of the spectrum for the use by public or community services" such as aeronautical safety services. A key performance indicator measurement could be the number of significant international, public or community services issues that are adopted as Australian positions.

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Attachments:

1. Overview of the Radiofrequency Spectrum for Aeronautical Services in Australia which includes:
   . Attachment A – Extracts from the European Commission Results of the Public Consultation on the Green Paper – *Next Steps in Radio Spectrum Policy*
   . Attachment B – Recent instances where Australia has supported the Sharing of Aviation Spectrum with other services
   . Attachment C – Incidents of Interference in the Aviation Spectrum from External Sources
   . Attachment D – Relevant ITU Definitions and Regulations
   . Attachment E – Frequency bands for Aeronautical Safety Services

2. *RF spectrum used by aviation faces growing interference from non-aeronautical sources*, ICAO Journal, Volume 56, No. 1, 2001

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ATTACHMENT 1

OVERVIEW OF THE RADIOFREQUENCY SPECTRUM FOR AERONAUTICAL SERVICES IN AUSTRALIA

Arising from concerns that the future growth and safety of air transport could be affected by sharing difficulties associated with the radiofrequency spectrum, Federal Government and industry representatives have developed guidelines to be adopted with regard to the radiofrequency spectrum allocated for aeronautical services. The Department of Transport and Regional Services (DoTRS), the Department of Defence (DoD), Airservices Australia, the Civil Aviation Safety Authority (CASA), the Australian Maritime Safety Authority (AMSA)[1] Ansett, Qantas and the Regional Airlines Association of Australia (RAAA) have contributed to the development of these guidelines in consultation with the Australian Communications Authority (ACA).

BACKGROUND

Responsibility for determining Australia's position on the preservation and protection of radio frequency spectrum for civil air operations at the International Telecommunication Union (ITU) World Radiocommunication Conferences (WRCs) lies with the Minister for Communications, Information Technology and the Arts. However, the development of Australia's position at WRC for all spectrum interests is considered by a consultative committee of the ACA's International Radiocommunications Advisory Committee (IRAC). This committee is known as the IRAC WRC Preparatory Committee and is the forum for extensive consultation with all stakeholders, including the aviation community. It currently consists of over 50 members from a cross-section of industry, scientific and government departments. Representatives from DoTRS, DoD, Airservices Australia, AMSA, Qantas and Ansett participate on this committee. Recognising the importance of these ITU World Conferences to aviation, Airservices Australia and other aviation industry representatives have participated in past WRCs and it would be expected that these representatives will be on Australia's delegation to the next WRC in 2003.

The increased demand for spectrum, to meet mainly the needs of new telecommunications technologies, has resulted in the radiofrequency spectrum with its finite limits becoming a scarce resource. Spectrum shortage has increased its economic value and intensified commercial pressure to adopt new technology and measures such as spectrum sharing and, inter alia, the introduction of wide band low power devices. Aeronautical services which provide for safety of life and have previously been allocated spectrum bands on an exclusive basis to ensure interference free operations are now under intense scrutiny for spectrum sharing and/or reallocation. Aviation bands are particularly targetted for spectrum sharing, as their full utilisation is necessarily slow because of the prolonged implementation times required to establish the integrity and reliability of developing aviation systems.

The environment of spectrum uncertainty threatens global harmonisation of aviation

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[1] AMSA is responsible for Search and Rescue operations in Australia involving the use of aeronautical emergency frequencies.

operations, long term planning of aeronautical systems, equipment standards and system interoperability. It has therefore become necessary to protect the special needs of the aeronautical services in regard to the development and operation of spectrum dependent systems.

In July 2000, following extensive public consultation, the European Community (EC) adopted a *Proposal for a Regulatory Framework for Radio Spectrum Policy in the European Community* which includes recommendations to implement Community policies in the aviation sector. A summary of the issues identified specific to the aviation sector is at **Attachment A**.

An overview of the environment for the radiofrequency spectrum for aeronautical services in Australia is set out below.

Strategic Issues

Air transport is recognised as being of major economic and social importance to Australia. Air transport planning is a long term business. Planning of the airborne and ground based radio systems in the national airspace infrastructure is based on the provisions of the prevailing ITU Radio Regulations. The timescales associated with this planning process far exceed the nominal two year period of the ITU WRC cycle. Thus long term stability of the ITU radio regulatory provisions is essential to provide a stable basis for the development of air transport. An uncertain, changing regime of radio regulations seriously impedes the air transport industry's strategic planning and thereby its long term development to the detriment of the global and national economy.

In regard to the radiofrequency spectrum, the development of air transport must not be hindered by shortage of the spectrum and/or the potential for interference from other radio services. Recent instances where Australia has supported sharing of aviation spectrum with other services are at **Attachment B** and examples of interference in the aviation spectrum are at **Attachment C**.

In the context of the introduction of new radio technology and advances in aviation techniques, it should be recognised that the general aim is to replace older and less efficient operational systems. Such development is likely to lead to more efficient use of the radiofrequency spectrum and may also relinquish spectrum for other uses.

International Organisations

The International Telecommunication Union (ITU) is the recognised international body for the regulation and use of the radiofrequency spectrum. Through biennial World Radiocommunications Conferences (WRC), the ITU makes and amends spectrum allocations to all radio services which are then enshrined in the Radio Regulations and accorded treaty status by Australia as a signatory to the ITU Convention. The International Civil Aviation Organisation (ICAO) performs a coordinating function to ensure safe and efficient use of spectrum allocated to the aeronautical services; it also develops technical planning standards/requirements and approves operational standards and recommended practices for aeronautical radio systems. ICAO rules and procedures are also accorded treaty status by Contracting States to the Convention on International Civil Aviation (Chicago 1944) to which Australia is a signatory. Relevant ITU definitions and regulations are listed in **Attachment D**.

The Aeronautical Services

The associated frequency bands and the aeronautical services that provide for safety of life in aircraft operations which are the subject of this paper are given in **Attachment E**.

The Utilisation of Frequency Bands

The planning and utilisation of frequencies in the aeronautical services will normally be the responsibility of ICAO. ICAO in consultation with the ITU, as necessary, develops and publishes the Standards and Recommended Practices (SARPS) which detail how these frequencies are to be used at Annex 10 to the ICAO Convention.

Allocation of Frequency Bands to Aeronautical Services

Frequency bands for aeronautical services are allocated by the ITU. Allocations and changes to frequency allocations can only be made at a WRC. Allocations to aeronautical safety services have in the past been made on an exclusive basis to ensure protection from interference. With increasing demands from other existing as well as new services, successive WRCs are tasked with reviewing the use of spectrum exclusively allocated to the aeronautical services.

Management of the Aeronautical Frequency Bands

Airservices Australia is nominated by the ACA to approve all frequency assignments made in the aviation bands. In so doing it ensures the implementation of ICAO frequency assignment policies and plans.

Airservices Australia also takes a lead role in the consideration of issues relating to aviation spectrum in Australia. In this capacity Airservices Australia represents aviation spectrum interests at national and international radiofrequency spectrum meetings.

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EXTRACTS FROM THE
EUROPEAN COMMISSION RESULTS OF THE PUBLIC CONSULTATION ON THE GREEN PAPER
NEXT STEPS IN RADIO SPECTRUM POLICY

Brussels, 10 November 1999
COM(1999)538

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2.2 Summary of comments on the Green Paper

2.2.5 The institutional framework for radio spectrum coordination

There was general support for the current technical arrangements for radio spectrum management comprising the ITU/WRC at the global level, CEPT at the regional level, and national regulatory authorities. However, some players argued that these organisations privilege the interests of the communications sector and of some vested interests, and that therefore policy guidance is needed to ensure that the various interests are appropriately balanced. Whereas Member States and the communications sector preferred to improve the situation within the current arrangements, the broadcasting and transport communities believed that the scope for conflict between commercial and non-commercial uses of the radio spectrum is such that political decision-making is required.

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2.3 Individual sector interests

2.3.3 Transport sector

Respondents from the transport sector were most critical of the current arrangements for radio spectrum coordination and pointed to the privileged position of communications interests in CEPT and ITU/WRC.

The long-term strategic planning of the use of the radio spectrum was considered a key issue for the sector, as it calls for the long-term reservation of radio spectrum so as to allow for the gradual introduction of systems with long life cycles. This was considered fundamentally different from the requirements of the communications sector with relatively short time-to-market. Long-term strategic planning in the case of the transport sector would therefore require a lengthy process of establishing international agreement in order to deploy internationally compatible transport networks and to ensure critical communications.

Since transport networks are increasingly deployed at pan-European level (eg high-speed trains) and at global level (maritime and air transport), the harmonisation of radio spectrum allocation for such applications was considered essential. Respondents expressed the view that Community measures are required in order to ensure that the

Member States' commitments in the Community and international (eg International Civil Aviation Organisation - ICAO, International Maritime Organisation - IMO) context are appropriately implemented.

With regard to radio spectrum assignment and licensing, the transport sector was of the view that the pricing of radio spectrum is not appropriate in the case of services in the public interest. The aviation community pointed out that its international competitive position would be directly affected if individual countries charged air carriers for the use of the radio spectrum.

The sector expressed concern about the dominance of communications interests within the institutional framework for radio spectrum coordination. It saw a need for better policy directions to be given to the radio spectrum management bodies in which international or Community agreement is established. The responsibility of national regulatory authorities to ensure an appropriate representation of interests in these bodies was mentioned.

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3.2 Conclusions on the Green Paper consultation

The share of radio spectrum available for commercial (communications) applications is not sufficient to meet the growing needs of the sector. This has led to a situation where radio spectrum availability for public or non-commercial applications has come under increased pressure. Overall, the increased use of radio spectrum has a profound impact on the way society functions and on the competitiveness of industry.

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3.3 The public consultation in the context of Community policy objectives

– With regard to the objective ***to ensure an appropriate balancing of commercial and public interests***, the public consultation showed that there is a need for policy guidance when considering technical measures. A further integration of the radio spectrum management process within a policy context is therefore essential to ensure that radio spectrum use meets the requirements of society as a whole.

– Steps should be taken ***to ensure that the economic value of the radio spectrum is properly taken into account***. The introduction of market-based mechanisms in radio spectrum management, such as auctions, the administrative pricing of radio spectrum and secondary trading, can contribute to this objective, provided appropriate safeguards are in place to ensure continued availability of radio spectrum for non-commercial uses. Public interests objectives need to be clearly defined and appropriately taken into account in this context.

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RECENT INSTANCES WHERE AUSTRALIA HAS SUPPORTED THE SHARING OF AVIATION SPECTRUM WITH OTHER SERVICES

Background

To meet a growing demand for radiofrequency spectrum in the 1000 to 3000 megahertz (MHz) band by emerging technologies such as mobile telephones, the concept of using spectrum, allocated exclusively to a specific service, for generic use was one solution under serious consideration within the International Telecommunication Union (ITU) in the early nineties. For example, spectrum exclusively allocated for Aeronautical Mobile Satellite Service (AMS(R)S) use would be re-allocated for generic use as Mobile Satellite Service (MSS) spectrum. Other specific uses in the generic MSS category were the maritime mobile satellite and the land mobile satellite services. This was followed by attempts to share, or take over, spectrum allocated to airborne radio-altimeters, microwave landing systems (MLS), ground-based and airborne radar systems and the radionavigation satellite service, in response to the demand for spectrum by the mobile satellite service.

The Generic MSS Allocation

The concept of generic MSS allocation was strongly supported by Australia at the World Radio Conferences - WRC-92, WRC-95 and WRC-97. At WRC-97, the AMS(R)S bands at 1545-1555 MHz and 1646.5-1656.5 MHz were re-allocated to MSS. With pressure from the aviation community, Australia initially opposed this change but given its commitment to generic MSS, Australia changed its position at the Conference. To meet aviation concerns, the Conference adopted regulatory provisions (S5.357A) which were intended to give priority and protection to the aviation use of the band. As well, a Resolution (Res 218) was adopted to investigate techniques such as prioritisation, real time pre-emptive access and interoperability between MSS systems with the intention of ensuring spectrum provision and protection for aviation communications.

It wasn't long after WRC-97, that it became obvious there were no effective provisions in place requiring a MSS operator to carry aviation traffic in this once exclusive aviation band. It also was apparent that the focus for MSS operators was the very lucrative mobile radiocommunications market, and given the cost of meeting aviation requirements, together with the smallness of this market, there would be little or no provision for aviation services. Moreover, the demands from MSS operators for spectrum access compared to the comparatively slow take up of spectrum from aviation made it clear that most of the spectrum would be taken up in providing non-aviation communications long before aviation requirements could be realised. Aviation projections were for 10.8 MHz by the year 2010.

It was proposed by some stakeholders that it was a matter for resolution in the market place, that is aviation could elect to buy the spectrum it needed and thus determine how it should be used. It opposed change to any of the regulatory provisions ex WRC-97. It also opposed making 'must carry' (ie able to support aviation standards) provisions in the Radio Regulations on the grounds that this would be anti-competitive. The Australian International Radiocommunications Advisory Committee (IRAC) supported the aviation view that at least some change was needed to the regulatory provisions which would give aviation assurances of spectrum access in this band. These changes were embodied in a draft Resolution proposed by Australia and with some changes eventually was adopted at WRC-2000.

The Resolution adopted at WRC-2000 (Res 222) recognised the difficulties of spectrum access by aviation and set out the processes by which aviation would have access to spectrum as its needs increased and the band reached saturation. This included capacity planning through multi-lateral coordination, then intra-service and finally inter-service prioritisation and pre-emption. Techniques for prioritisation and pre-emption have yet to be studied and developed. The Resolution calls for results of these studies to be considered at WRC-05/6.

In the meantime there is no guarantee that this spectrum will not be saturated by non-aviation MSS. The problem is exacerbated by the closed shop policies adopted by MSS operators who gather on a regular basis at multi-lateral planning meetings (MPMs) to establish their spectrum requirements and to agree on spectrum sharing. Aviation operators have expressed concerns that they are not permitted to participate in these meetings. The Japanese administration has submitted a draft Resolution to the ITU calling for this process to be brought under ITU control and to have it conducted more transparently.

Ultimately of course, once spectrum saturation is reached, awkward decisions as to which non-aviation service provider will have to upgrade its service to permit aviation communications will have to be taken. Considering that MSS operators will have been entrenched in the band for some time and the infrastructure costs they would have incurred, it is doubtful that any administration will have the desire to enforce these decisions.

MSS Allocation in the GNSS Band

At WRC-97, against aviation advice, Australia supported and proposed the allocation of a sub-band 1559-1567 MHz in the band 1559-1610 MHz allocated to the Radionavigation Satellite Service (GPS and GLONASS, identified as GNSS in the aeronautical band) to the MSS. Australia was following the Europeans represented by the CEPT which as a group, formed from telecommunications service providers and operators, was committed to supporting mobile telecommunications services. The justification appeared to come from a limited study undertaken by INMARSAT which claimed to show that interference levels expected from MSS transmissions were well below the levels that might cause harmful interference to GNSS receivers.

With the intervention from the USA, the Conference decided against making an allocation to MSS in this band preferring that this matter be first studied before any decisions were taken. In the detailed and comprehensive studies that followed, it was proven that the interference levels to protect GNSS receivers in precision approaches to airports were substantially lower than that assumed by MSS proponents, and that expected interference from MSS transmitters would have serious repercussions for GNSS aeronautical operations. These results were reviewed at WRC-2000 which almost unanimously decided against making any allocation to MSS in this band. The Conference further ruled that this band would not be subject to any further examination for possible MSS allocation in the continuing search for MSS spectrum.

Future MSS Allocation in the ARNS Bands

The band allocated to the Aeronautical Radionavigation Service at 5091-5150 MHz for MLS use is under consideration for extended co-primary use by satellite feeder links in support of the MSS. The results of studies currently in progress to permit sharing of this band will be considered at WRC-03. Australia has supported the allocation to be made to permit the MSS/FSS operation to continue, taking into account ITU-R sharing studies. The benefit of global harmonisation of spectrum use for equipment standardisation to the aviation industry is a significant issue here.

The band 2700-2900 MHz allocated to Aeronautical Radionavigation (ARNS) and Radiolocation in which Australia operates Airport Primary Surveillance Radars are under consideration for use by fourth generation mobile satellite services (IMT 2000). Australia supported the consideration of this band as a candidate band among a number of other frequency bands for IMT 2000.

Recommendation

That a national aviation spectrum policy/guidelines be implemented to ensure availability and to protect aviation spectrum that impacts on safety of life.

INCIDENTS OF INTERFERENCE IN THE AVIATION SPECTRUM FROM EXTERNAL SOURCES

The following incidents were reported to the Australian Transport Safety Bureau (ATSB). In many cases, the reason for the incident could not be determined; however, external electronic interference was believed to be the cause.

Aircraft Type	Location	Summary of Incident
767	Taipei	Automatic Direction Finder (ADF) needles wavered and then began to drift right
737	Tabletop Radar (PSR) Site	128.85 MHz at Townsville unusable due to severe external interference (several incidents)
767	Perth	GPWS (Radar Alt) alert (4.2 - 4.4 GHz)
Grumman	Archerfield	Music crosstalk on 123.6 MHz
737	Sydney	Autopilot disengaged. No source of EMI on board aircraft
Many	Melbourne	Control frequency 135.3 MHz breakthrough. interference from Diathermy Generator
BAE	Sydney	DME (967-1213 MHz) interference from external source
747	Hong Kong	Interference on 119.1 MHz & 121.3 MHz from telecomms equip in China (several times)
747	Hong Kong	Interference on 129.3 MHz from telecomms equip in China (several times)
767	Hong Kong	Interference on 123.7 MHz
767	Hong Kong	Interference on 124.05 MHz
767	Hong Kong	Interference on 121.3 MHz & 128.2 MHz
747	Hong Kong	Interference on 118.7 MHz
767	Shanghai	Interference 119.75 MHz, 128.35 MHz &128.3 MHZ
767	Bali	Interference on 123.9 MHz
767	Coolangatta	Interference on 130.4 MHz from local paging system transmitter
Learjet	Brisbane	Interference on 127.1 MHz from local radio station antenna problem
ATS	Adelaide	Interference on a number of control freqs: 118.2 MHz, 130.45 MHz, 128.6 MHz, 127.05 MHz & 125.3 MHz

RELEVANT ITU DEFINITIONS AND REGULATIONS

telecommunication: Any transmission, emission or reception of signs, signals, writings, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems.

radiocommunication: Telecommunication by means of radio waves.

allocation (of a frequency band): Entry into the Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radiocommunication services or the radio astronomy service under specified conditions.

radiocommunication service: A service as defined in the ITU Radio Regulations involving the transmission , emission or reception of radio waves for specific telecommunication purposes.

safety (of life) service: Any radiocommunication service used permanently or temporarily for the safeguarding of human life and property.

interference: The effect of unwanted energy due to one or a combination of emissions, radiations or inductions upon reception in a radiocommunications system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy.

harmful interference: Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with the ITU Radio Regulations.

S4.10: Member States recognize that the safety aspects of radionavigation and other safety services require special measures to ensure their freedom from harmful interference; it is necessary therefore to take this factor into account in the assignment and use of frequencies.

FREQUENCY BANDS FOR AERONAUTICAL SAFETY SERVICES

This annex lists aeronautical frequency bands that have been identified as being used for safety services. The ITU distinguishes between aeronautical mobile services provided for safety and regularity (route (R) services) of flight and those for other purposes (off-route (OR) services).

Frequency band	Brief description of safety use
160-285 kHz 315-405 kHz	Non-Directional Beacons
2.1-28 MHz (various bands)	Aeronautical Mobile (R) and (OR) Service
74.8-75.2 MHz	Instrument Landing System Marker Beacon
108-118 MHz	Radionavigation Aids - VHF Omnidirectional Range, Instrument Landing System Localizer, Terrestrial Augmentation for RNSS
118-137 MHz	Aeronautical Safety Communications
121.45-121.55 MHz	Aeronautical Emergency Location
242.95-243.05 MHz	Aeronautical Emergency Location
328.6-335.4 MHz	Instrument Landing System Glide Slope
960-1 215 MHz	Aeronautical Radionavigation Aids - Distance Measuring Equipment, Tactical Air Navigation, Radar Beacons, Secondary Surveillance Radar, Airborne Collision Avoidance System, Radionavigation Satellite Systems
1 215-1 400 MHz	Aeronautical Radar
1 215-1 260 MHz	Radionavigation Satellite Systems
1 545-1 555 MHz (s-E)	Aeronautical Mobile Satellite Communications
1 559-1 610 MHz	Radionavigation Satellite Systems, Terrestrial and Satellite-Based Augmentations for Satellite Navigation Systems
1 646.5-1 656.5 MHz (E-s)	Aeronautical Mobile Satellite Communications
2 700-2 900 MHz	Radar (Aeronautical Radionavigation)
4 200-4 400 MHz	Airborne Radio Altimeter
5 000-5 250 MHz	Microwave Landing System, Radionavigation Satellite Systems
5 350-5 470 MHz	Airborne Weather Radar
8 750-8 850 MHz	Airborne Doppler Radar
9000-9500 MHz	Precision Approach Radar
13.25-13.4 GHz	Airborne Doppler Radar
15.4-16.6 GHz	Airport Surface Detection Equipment, Weather Radar, Aircraft Landing System, Radar Sensing and Measurement System
24.25-24.65 GHz	Airport Surface Detection Equipment
31.8-33.4 GHz	Airport Surface Detection Equipment

RF spectrum used by aviation faces growing interference from non-aeronautical sources

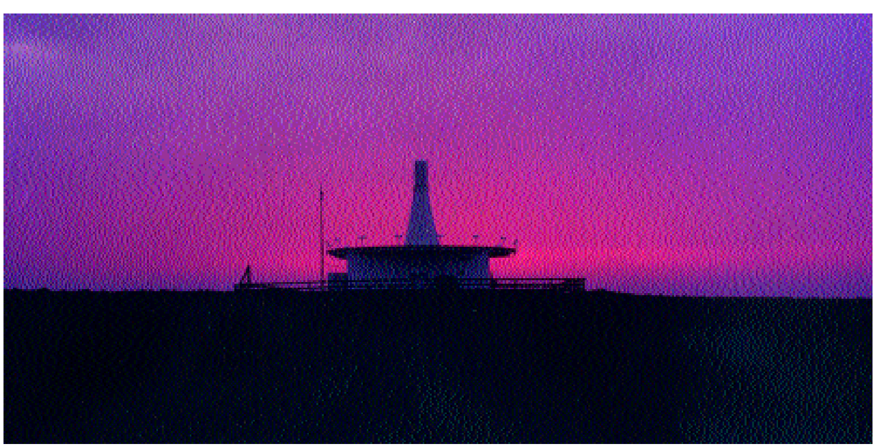
With increased pressure on RF spectrum utilization from all radio sources, special measures will have to be taken to preserve the interference-free operation of essential aeronautical radiocommunication and radio navigation services.

ROBERT WITZEN
ICAO SECRETARIAT

FOR many years ICAO has addressed the problems of electromagnetic interference with essential aeronautical radiocommunication and radio navigation services. In the late 1970s and early 1980s various worldwide meetings held by ICAO reviewed the problems related to the effects of harmful interference from non-aeronautical sources, and developed a number of recommendations for further action.

The International Telecommunication Union (ITU) has also taken action, having developed several reports and recommendations concerned with protecting aeronautical services. A recommendation now under development by an ITU study group, on the "protection of safety services from unwanted emissions," includes a number of important aspects to be considered when addressing the protection of safety services.

Since the 1970s the level of interference from non-aeronautical sources has risen dramatically. Twenty years ago, exclusive bands were available for aviation use, and the relatively low utilization of the radio frequency (RF) spectrum by all radio services meant that relatively few interference cases were documented. During the last two decades, however, the increased sharing of the aeronautical spectrum with non-aeronautical services has introduced a number of new potential sources of harmful interference. In addition, the generally increased use of spectrum by all radio services and the explosive growth in the telecommunications industry (e.g. mobile telephones) means that interference from systems operating outside the aeronautical bands is more likely. Yet a third factor is the introduction of new aeronautical systems that make use of the RF spectrum for communications and navigation. This requires that special measures be taken by aviation to avoid mutual interference between aeronautical systems on board an aircraft.



Since the 1970s the level of interference from non-aeronautical sources has risen dramatically. Use of the band 100-108 MHz by the FM broadcasting service, for example, may cause interference to an ILS or VOR system operating just above 108 MHz.

Sources of interference

The most common source of interference is the RF energy from unwanted emissions from an interfering transmitter falling on the operating frequency (or within the RF bandwidth) of aeronautical receivers. Normally, the level of these emissions decreases as the frequency separation between the interfering signal and the "victim" receiver increases. A special case however, is for spurious emissions on harmonics of the RF carrier frequency, which can exhibit relatively high signal levels at a great distance from the carrier frequency. As an example, the fourth harmonic of 27 megahertz (MHz) can cause interference at 108 MHz (ILS localizer) and the fifth at 135 MHz, which is used in air-ground voice safety communications.

Another source of interference comes from increased frequency sharing. Since the early 1990s, aviation has been forced in a significant number of cases to share spectrum with non-aeronautical services. This situation arose as a result of modifications to the table of frequency allocations established by the ITU at world radiocommunication conferences. Normally, compatibility between the aeronautical and non-aeronautical services is maintained through the development of appropriate ITU-R recommendations or by special provisions or footnotes to the frequency table of the radio regulations. These provisions place certain constraints on the incumbent or the incoming service, or both. An example is the use of the bands between 1164-1350 MHz by the radionavigation satellite service. These bands are used by aviation for distance measuring equipment (DME) and radar systems, which need priority in protection over the radionavigation satellite service. In principle, any form of sharing increases the interference level and restricts full use of the spectrum by aviation.

The third source of interference is the effect of the utilization of frequency bands, adjacent to aeronautical bands, where radio systems are in operation using relatively high-power signals. An example is the use of the band 100-108 MHz by the FM broadcasting service, which may cause interference to an instrument landing system (ILS) or very high frequency omnidirectional radio range (VOR) operating just above 108 MHz. Measures to protect ILS and VOR were one of the main topics discussed at the ITU regional broadcasting conference in the early 1980s. Given the technical complexity of the problem, it was not until 1995 that an ITU recommendation on this matter could be approved.

The work of ITU world radiocommunication conferences and meetings of ITU radiocommunication sector study groups is extremely important in setting the conditions for a safe and efficient use of the spectrum. Recent meetings focused on protection for the following systems:

- the microwave landing system (MLS) from satellite feeder links;
- radar systems on-board aircraft at 15 gigahertz (GHz) from satellite feeder links;
- airport surveillance radar at 15 GHz from satellite feeder links;
- global navigation satellite system (GNSS) from the mobile satellite service;
- DME from radionavigation satellite systems;
- primary radar from radionavigation satellite systems; and
- MLS from radionavigation satellite systems.

Studies now under way at ITU are looking at several of these issues, with the scope to be expanded.

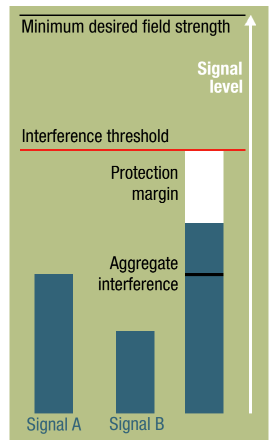
The potential sources of interference identified above are from radio systems that are intended to radiate electromagnetic energy to provide radio services (e.g. cellular phones or broadcasting transmitters). There are also systems in operation that make use of RF signals but which are not intended to radiate electromagnetic energy, such as microwave ovens, TV cable distribution systems and certain medical equipment. These systems can also interfere with the reception of radiocommunication and radionavigation signals through unintended leakage of RF energy. In the ITU radio regulations, provisions have been made for these systems to operate in certain frequency bands allocated to the category "industrial, scientific and medical (ISM) equipment".

Radiation limits from ISM equipment were developed by the International Special Committee on Radio Interference (CISPR) and are described in International Electrotechnical Commission (IEC) standard CISPR 11 and 28. These limits do not always comply with ICAO's position on the need to protect safety services. Furthermore, the limits apply for measurements that take place at ground level while most interference measured above ground level is stronger. This occurs because the attenuation of RF energy through the roof of a building is generally less than that through the walls. Also, aircraft experience the cumulative effect of RF interference from various sources, something that is very difficult to measure on the ground and is not considered in the radiation limits set by CISPR.

A relatively new source of interference includes the various personal electronic devices that passengers bring on board an aircraft. These include electronic equipment such as computer games, portable computers and radio. Cell phones are a major problem because these transmitting devices could seriously interfere with on-board navigation and communications equipment. Assessment of the adverse impact of this type of interference is under way, and ICAO is considering the need for further action.

Protection margin

In general, interference is acceptable, but only up to the level where it becomes harmful. The ITU radio regulations describe interference as "the effect of unwanted energy due to one or a combination of emissions, radiations or inductions upon reception in a radiocommunication system, manifested by any performance degradation misinterpretation or loss of information which could be extracted in the absence of such unwanted energy." Furthermore, harmful interference is defined by the regulations as a condition "that endangers the functioning of a radio navigation service or other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service operating in accordance with these regulations."



Calculating the impact of multiple interfering signals

When studying the effect of interference, due consideration must be given to the cumulative effect that may be present at the receiver input. In assessing models for predicting interference, it is therefore necessary to consider the protection margin that a specific interfering signal leaves in conjunction with other interfering signals. In order to secure the safe operation of aeronautical systems, the summation of all interfering signals must not exceed the interference threshold level (see figure). When the protection margin is zero, there is no adequate protection of the safety service. Interference threshold levels are determined by ICAO or by aviation industry organization such as ARINC, RTCA or the European Organization for Civil Aviation Equipment (EUROCAE).

This principle has been supported by many ITU recommendations. An aeronautical safety margin, varying from six to 10 decibels (dB), has been used in recommendations that establish a model for assessing the protection for various aeronautical safety-of-life systems.

Interference models

ICAO provisions describe the effect of interference in the form of a desired to undesired (D/U) signal protection ratio. The desired signal strength considered is the minimum signal level required of a given aeronautical system throughout its coverage area. The undesired or interfering signal is the maximum signal level that can be expected from the interfering system which in most cases is a system with the same characteristics; an example of this would be a desired non-directional radio beacon (NDB) signal encountering interference from another NDB operating on the same frequency but geographically positioned in such a way that no harmful interference is caused.

The signal protection requirements which are used during the frequency assignment planning process for aeronautical systems cannot, directly, be applied to external interfering sources. The signal protection ratio required to ensure, for instance, the safe operation of an ILS in the presence of an FM broadcasting signal is different from that required in the presence of another ILS operating on the same or adjacent channel.

Normally in the case of systems that provide continuous wave (CW) signals, such as NDB, ILS or VOR, the protection from interference from external sources can be expressed in the form of a D/U signal ratio. The actual value of the protection ratio, as described above, depends upon the particular characteristics of the interfering signals. In cases where the transmissions of the radiocommunication or radionavigation systems are not continuous, such as in voice communications or DME, the interference in many cases may not exceed the sensitivity threshold or the particular interference threshold of the relevant receiver.

The specific geometry of the interference situation may also have a significant effect on the permissible level of interference. Normally, for aeronautical systems that are used during the en-route phase of flight, the minimum separation distance between an external interfering signal and an aircraft can be set at about 300 feet (100 metres). For systems used during the final approach and landing phase of a flight, however, this minimum separation distance is normally 100 feet, and is related to the obstacle clearance surface.


Jim Jorgenson

Various electronic devices that passengers bring on board an aircraft may cause interference with communications and navigation equipment. Cell phones are a major concern.

Specific cases of interference

FM broadcasting stations. This type of interference can occur at any point within the service volume of an ILS or VOR, and manifests itself around a broadcasting station. The volume of the area affected can be large, with an irregular shape.

The interference model for FM compatibility is described in detail in an ITU recommendation (ITU-R Recommendation IS. 1009). The provisions of this recommendation are generally used in order to assess compatibility between FM broadcasting stations and aeronautical systems operating between 108-137 MHz. The work that took place in the Limited European Group on Broadcasting and Aeronautical Compatibility (LEGBAC) provides the basic interference assessment method and is used by many administrations in Europe.

Television cable carrier systems. Cable carrier systems originally operated in the frequency band below 108 MHz. The introduction of the use of frequencies in the band 108-137 MHz by these cable carrier systems is of concern because of the potential of co-frequency interference to essential aeronautical services.

Normally, properly installed and maintained cable carrier systems do not radiate much electromagnetic energy. However, malfunctioning of the system may result in a significant amount of electromagnetic energy being radiated. Such cases are also not always quickly dealt with and the result may be interference in the aeronautical systems, notably ILS or VOR, for a particularly long period of time.

The best solution would be to prohibit the use by cable systems of frequencies falling within the aeronautical safety allocations, but this might not be practicable in all cases. ICAO would support the establishment of practices and enforcement procedures that would provide a high degree of assurance that excessive levels of electromagnetic energy would not be radiated from the cable distribution systems.

Signaling systems for power line distribution systems. Where these systems

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Electromagnetic interference

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operate in the frequency range of operational NDBs, interference to NDB reception is experienced. The problem can be solved through coordination between the various authorities involved.

ISM equipment. Special frequency bands have been designated by the ITU for use by industrial, scientific and medical systems. Of concern to the protection of aeronautical services is the level of spurious or unwanted emissions that is allowed for this equipment.

Conclusion. As a result of the increasing use of the radio frequency spectrum by all radio services, interference from non-aeronautical sources is expected to grow. Special measures, both at ICAO and ITU, will be necessary to enable expanded use of the RF spectrum by all radio services while preserving interference-free operation of essential aeronautical navigation and communication services. □

Weight and balance verification

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the site and soil conditions. Although the cost may be considered substantial, the ability to avoid just one accident could well be worth the investment.

An AAWBVS can be acquired by aeronautical authorities under a number of arrangements. It can be purchased outright and installed by others under Emery Winslow's supervision, or purchased outright on a turnkey basis.

To assist in those instances where the outright purchase of an AAWBVS would be difficult or infeasible, an innovative alternative provides for the weighing system to be installed and certified at an airport at no cost to the aeronautical authority. Under this arrangement, the system is operated in return for fees paid by air cargo carriers. In addition to installing, calibrating and certifying the AAWBVS, training is provided for the maintenance and operating personnel on a continuous basis at the manufacturer's expense. In return for these services, the aeronautical authority must agree to establish a regulation requiring that all cargo carrying aircraft pass over the AAWBVS prior to take-off, and must also agree to establish a fee programme for each AAWBVS transaction. The amount of the fee and the collection method would be mutually determined by the aeronautical authority and Emery Winslow.

Conclusion. As concern for overall aircraft safety grows, the challenge will be to embrace newer and better safety measures, especially when the safety measure is available at an affordable price.

The newly developed automatic aircraft weight and balance verification system provides an opportunity to improve safety for cargo aircraft in a way not previously thought practical.

The benefit to cargo aircraft is the elimination of the unstabilizing and dangerous effects of an out-of-tolerance CG, an overloading or any irregularity in cargo distribution.

The value of eliminating the ever lurking danger of unsafe aircraft weight and balance is difficult to express in dollars or even adequately explain with words. Safety simply should not be compromised. As a means to further enhance cargo aircraft safety, pretake-off weight and balance verification is worthy of careful consideration.

Although improved safety is the issue, there are also residual benefits that accrue to users of AAWBVS. For example, the information provided by the AAWBVS can be a useful tool for air cargo executives in achieving operational improvements. It can be used to improve the quality of the cargo handling and loading process. And there are also the beneficial effects of an improved weight and balance on aircraft operating efficiency and aircraft maintenance. □

SEMINAR IN NAIROBI

ICAO conducted a seminar on the aeronautical telecommunication network (ATN) and global navigation satellite system (GNSS) at its regional office in Nairobi from 24 to 27 October 2000. Lecturers came from ICAO, Eurocontrol, the U.S. Federal Aviation Administration (FAA) and SITA.

PANS-OPS amendment

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briefings, establishing that the operator must implement flight and cabin crew briefings for specific phases of operations. In addition to actual conditions and circumstances, briefings need to address special aspects of operations. For flight crew, briefings shall be conducted for at least pre-flight, departure and arrival operations. Cabin crew briefings must be conducted prior to the first departure of the day, and must also be conducted following changes of aircraft type or crew, and before flights involving a stop of more than two hours.

The PANS-OPS establishes that preflight briefings must include both flight and cabin crews. Combined flight and cabin crew preflight briefings should focus on crew coordination as well as aircraft operational issues. This would include any unserviceable equipment or abnormalities that may affect operational or passenger safety requirements as well as essential communications, emergency and safety procedures, and weather conditions.

Flight crew departure briefings should prioritize all conditions relevant to the take-off and climb phase. The conditions that need to be covered include the runway in use, aircraft configuration and take-off speeds; departure procedure and departure route; navigation and communications equipment set-up; aerodrome, terrain and performance restrictions, including noise abatement procedures; take-off alternate; items included in the minimum equipment list; review of applicable emergency procedures; and applicable call-outs.

Flight crew arrival briefings prioritize all conditions relevant to the descent, approach and landing. The conditions covered for these phases of flight include terrain restrictions and minimum safe altitudes during descent; the arrival route; instrument