



Advisory Circular

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AERONAUTICAL TELECOMMUNICATION SERVICE AND RADIONAVIGATION SERVICE PROVIDERS

GUIDELINES FOR COMPLYING WITH CASR PART 171 REQUIREMENTS AND STANDARDS

CONTENTS

1. References	1
2. Purpose of this AC	1
3. Status of this AC	1
4. CASR Subpart 171.A — Introductory	2
5. CASR Subpart 171.C — Obligations and Privileges of Service Provider	6
6. CASR Subpart 171.D — Contents of Operations Manual	16
7. CASR Subpart 171.E — Administration	32
Appendix A - ATEL/ANAV Service Provider — Application	37
Appendix B - Extract from ICAO Annex 10 Vol 1	39
Appendix C - Operational Voice and Data Recording	45

1. REFERENCES

- CASR Part 171 – Aeronautical Telecommunication and Radionavigation Service Providers
- CASA Manual of Standards – MOS Part 171
- ICAO Annex 10 Volumes I to V
- ICAO Annex 11
- ICAO Annex 14
- ICAO Doc 8071

2. PURPOSE OF THIS AC

This AC provides explanation of CASA requirements and where necessary, methods acceptable to CASA for prospective and approved service providers to comply with the requirements of CASR Part 171 for the provision, operation and maintenance of aeronautical telecommunication and radionavigation (ATEL/ANAV) services that support air traffic services (ATS) or aircraft navigation.

In this AC, each reference to a CASR Part 171 regulation number, or a Chapter number of the CASA Manual of Standards for Part 171 (MOS-Part 171), is the cross-reference to the relevant Part 171 regulation or Chapter in the MOS Part 171.

3. STATUS OF THIS AC

This is the second issue of AC 171-01. It incorporates amendments following a Post-Implementation Review of CASR Part 171 undertaken in 2004.

Advisory Circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the Regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.

Where an AC is referred to in a 'Note' below the regulation, the AC remains as guidance material.

ACs should always be read in conjunction with the referenced regulations.

4. CASR SUBPART 171.A — INTRODUCTORY

Subpart A of CASR Part 171 contains an introductory section, Contents, Applicability, Interpretation (definition of terms), and, in 171.015, the basic regulatory requirement that restricts the provision of aeronautical telecommunication or radionavigation services to persons approved by CASA.

4.1 Regulation 171.005 — Applicability

4.1.1 Part 171 applies to any person (including a corporation) seeking approval as a provider of one or more ground-based aeronautical telecommunication or radionavigation services that support ATS or IFR flight. In determining what constitutes ‘*provision of an aeronautical telecommunication or radionavigation service*’ (ATEL/ANAV service), the Part 171 requirements relate to persons that undertake the *operation and maintenance of the facilities* that provide the defined services. Applicability does not extend to persons that manufacture, market and install ATEL/ANAV facilities and equipments, unless the manufacturers also intend to provide the in-service *operation and maintenance* of those facilities or equipment. The term ‘*operation and maintenance*’ in the context of Part 171 means:

- placing a *facility* into operational service; or
- removing a *facility* from operational service; or
- undertaking any functions which affect the operability of a *facility* while the *facility* remains in operational service; or
- undertaking periodic performance inspections, or any maintenance on a *facility* while the *facility* remains in operational service; or
- undertaking any flight tests on a *facility* for the purpose of compliance with Part 171.

4.1.2 Aeronautical Telecommunication Services. Those services that are designated to be aeronautical telecommunication services and radionavigation services, and thus whose provision (i.e., their *operation and maintenance*) are subject to Part 171, are defined in ICAO Annex 10 Volume II. They are also listed in Chapter 2 of the MOS Part 171. The services are as follows:

- (a) ***aeronautical telecommunication services:*** These are the ground-based stations of those services defined hereunder that support an Air Traffic Service provided under Part 172; airborne stations are not included:
 - (i) ***Aeronautical Broadcasting Service.*** A broadcasting service intended for the transmission of information relating to air navigation;
 - (ii) ***Aeronautical Fixed Service.*** A telecommunication service between specified fixed points provided primarily for the safety of air navigation and for the regular, efficient and economical operation of air services;
 - (iii) ***Aeronautical Fixed Telecommunication Network Service.*** A worldwide system of aeronautical fixed circuits provided, as part of the aeronautical fixed service, for the exchange of messages and/or digital data between aeronautical fixed stations having the same or compatible communication characteristics;

- (iv) ***Aeronautical Telecommunication Network Service.*** An inter-network that allows ground, air-ground and avionics data sub-networks to inter-operate by adopting common interface services and protocols based on the International Organisation for Standardization (ISO) Open Systems Interconnect (OSI) reference model;
 - (v) ***Aeronautical Mobile Service.*** A mobile service between aeronautical ground stations and aircraft stations, in which survival craft stations may participate; emergency position-indicating radio-beacon stations may also participate in this service on distress and emergency frequencies. This service does not include ground stations that are provided for other than ATS purposes;
 - (vi) ***Any telecommunication service*** which processes or displays air traffic control data for use by an ATS provider under CASR Part 172;
 - (vii) ***Electronic briefing and flight plan lodgement service*** used by pilots.
- (b) ***Radionavigation services*** are for the safe navigation of aircraft and include *radionavigation aids* for IFR flight, and *any primary or secondary radar service* supporting ATS functions.

4.1.3 ATEL/ANAV Facilities. The types of telecommunication and radionavigation *facilities* that, either solely or by their interconnection, provide the electronic capability for the delivery of the defined ATEL/ANAV services are listed at Chapter 2 of the MOS Part 171. *Facilities* may consist of one item of equipment, or several items of interconnected equipment. As the *facility* types specified in Chapter 2 of the MOS are components of ATEL/ANAV services, their operation and maintenance, including the procedures and the personnel involved in those functions, are subject to the Part 171 requirements.

4.1.4 Facilities not applicable. The following *services/facilities* have been determined by CASA to be outside the applicability of Part 171, in that they do not support ATS or aircraft radionavigation, and are, or will be, regulated under other Parts of the CASRs:

- UNICOM VHF broadcast stations at an aerodrome.
- Certified Air/Ground Radio VHF broadcast stations at an aerodrome that are provided in accordance with the standards of CASR Part 139 (see MOS Part 139 Chapter 14).
- Airline or other aviation industry company or aeroclub or aerodrome operated VHF ground stations.
- Automatic weather information broadcast stations (AWIB) at an aerodrome.
- Pilot Activated Lighting (PAL) VHF ground stations provided in accordance with the provisions of CASR Part 139.
- VHF ground stations operating as Aerodrome Frequency Response Units (AFRU) provided in accordance with the provisions of CASR Part 139 (see MOS Part 139 Chapter 14).

4.2 Regulation 171.010 — Interpretation

4.2.1 This section contains the definitions of terminology that have a specific meaning in relation to Part 171. Other generally used definitions in the CASR Parts can be found in the Dictionary to the Parts of CASR.

4.2.2 The definitions in Part 171 are generally consistent with those definitions used in Annex 10 to the Convention on International Civil Aviation.

4.2.3 It should be noted that the term ‘*facilities*’ is used to define the item or items of equipment that make up any of the defined services.

4.3 Regulation 171.015 — Person not to provide service without approval

4.3.1 This regulation disallows the provision of any service defined as an aeronautical telecommunication or radionavigation service if the person is not approved by CASA as a service provider in accordance with the requirements of Part 171. A penalty is associated with any violation of this legal requirement, because of the potential impact on aviation safety of uncontrolled transmissions on aeronautical frequencies or the *operation and maintenance* of services not in accordance with international and CASA standards.

4.4 CASR Subpart 171.B — Approval of Service Providers

Subpart B of CASR Part 171 establishes the administrative provisions in relation to application for approval as an ATEL/ANAV service provider.

Note: Subpart E also contains additional provisions in respect to the application process, and should also be referred to.

4.5 Regulations 171.020 and 171.025 — Application

4.5.1 Who may apply? The only bodies presently eligible to apply for approval as a provider of an ATEL and/or ANAV service are the Commonwealth, Airservices Australia, or any person who is to provide a service in cooperation with, or by arrangement with Airservices Australia under the provisions of paragraph 11(3)(b) or (c) of the *Air Services Act 1995*. The applicant must make a written application to CASA. Use of the Application Form at Appendix A to this AC will facilitate the processing of applications. Applications must include the following information:

- The applicant’s name and address. In the case that the applicant is a corporation, the applicant’s registered address, ACN, and the names and addresses of its officers is also required.
- A copy of the applicant’s operations manual, prepared as if the applicant were a service provider.
- A list of each of the aeronautical telecommunication and/or radionavigation services for which the application is made, with the intended location and/or coverage of each service. (Note: “*coverage*” means the volume of airspace in which a radiated service is nominally provided, or for non-radiated services, the location at, or the locations between which, the service is nominally to be provided). Applications may be made for a national network of services, for services covering a regional area, for services supporting an ATS facility such as an air traffic control tower, or for one or more nav aids at an aerodrome.

Standards. For each service for which application is made, the applicant must identify any of the SARPs (Standards and Recommended Practices) included in ICAO Annexes 10, 11 and 14, or any standard in the MOS Part 171, that would not be complied with by the service as proposed by the

applicant. For each of the non-compliances identified, the reasons for, and the consequences of, the non-compliance are to be described in detail.

Most of the standards pertaining to ATEL and ANAV service provision appear in *ICAO Annex 10, "Aeronautical Telecommunications"*. Annex 10 consists of five volumes containing operational standards and technical specifications for the ATEL/ANAV services and facilities. The titles of the volumes are:

- Volume 1: Radio Navigation Aids
- Volume 2: Communication Procedures including those with PANS status
- Volume 3: Communication Systems
- Volume 4: Surveillance Radar and Collision Avoidance Systems
- Volume 5: Aeronautical Radio Frequency Spectrum Utilization.

It is important that Part 171 providers acquaint themselves with all the SARPs in ICAO Annex 10, as relevant to the services proposed, and make sure that the services proposed are in compliance with the SARPs. As all differences in Australian practice have to be notified to ICAO, CASA will not normally accept any non-compliance with Annexes unless there are extenuating reasons and it can be unequivocally demonstrated that the safety and standardisation of air navigation will be minimally and insignificantly affected.

Annex 11 "Air Traffic Services" mainly specifies procedures used in the provision of ATS. It defines the requirements for the recording of ATS voice communications and data, which will affect Part 171 providers. (Refer to Appendix C to this AC for guidelines on recording of ATS voice and data.)

ICAO Annex 14 "Aerodromes". Most of the material in this Annex is not relevant to Part 171 providers, however, particular attention should be paid by Part 171 providers to the standards in Chapter 8.7 pertaining to the siting and construction of facilities and installations on operational areas of aerodromes. Similar requirements are also included in the CASA Manual of Standards (MOS) Part 139. Part 171 providers must comply with the site clearance requirements in these standards.

4.5.2 In making an application, it is recommended that the applicant should also provide the following information:

- (a) whether the proposed services, and the facilities to provide the services, are actually installed at the sites/locations;
- (b) whether all support facilities, including spares for the facilities and equipment, test equipment, have been provisioned and are on-site;
- (c) whether the key personnel, technicians and other staff members have been engaged; and
- (d) whether it is practically possible to demonstrate the proposed services.

4.5.3 If CASA approves an applicant as a Part 171 provider a certificate will be issued to the applicant by CASA. Certificates will normally be issued for a five-year period of validity, but CASA may suspend or cancel an approval at any time, if there are grounds for that action.

Note: See also section 5 of this AC for further information on the administration of applications and approvals.

5. CASR SUBPART 171.C — OBLIGATIONS AND PRIVILEGES OF SERVICE PROVIDER

Subpart C of Part 171 sets out the technical requirements and standards in relation to the services and the personnel of approved ATEL/ANAV service providers.

5.1 Regulation 171.030 — Service by provider

5.1.1 This regulation requires an approved service provider to provide its ATEL/ANAV services in accordance with the provider's approved operations manual and any conditions included in its certificate issued by CASA. Exceptions are made for test transmissions that are necessary to test a service or facility (providing that any transmission has been the subject of prior notification or a NOTAM), or for services provided as a contingency in an emergency where the continued safety of air navigation is paramount.

5.1.2 Assigned frequencies. Those services that radiate electromagnetic signals-in-space must operate on an assigned aeronautical frequency in the relevant aeronautical frequency band. Frequencies are to be assigned by the Australian Communications Authority or Airservices Australia or another frequency assigner authorised by the ACA. (There is a monetary cost for the frequency assignment and licensing service.)

5.1.3 Identification codes and call-signs to be allocated by the AIS. Aeronautical communication and radionavigation services have specific identification codes or call-signs. Approved providers of services/facilities that transmit identification codes or call-signs as part of the radiated signal-in-space must apply to, and use, the identification codes or call-signs allocated by the Australian Aeronautical Information Service (AIS, Airservices Australia). It is the responsibility of approved providers to arrange for their frequency and identification/call-sign allocations before making any transmissions.

5.2 Regulations 171.035 and 171.040 — Changes by service provider to services.

5.2.1 Regulation 171.035 applies if a service provider proposes to introduce a new ATEL/ANAV service, or make a change to an existing service the effect of which would be that the service would no longer be in accordance with the certificate issued to the service provider under regulation 171.250 or is a change that requires prior notification to CASA because of a requirement to do so in the service provider's safety management system (SMS).

5.2.2 Service providers may make changes to their facilities or to the procedures for the provision of services if such changes do not change the service for which they have received approval in the certificate issued by CASA under Regulation 171.250; and the change or modification is undertaken in accordance with the relevant change procedure in the provider's operations manual established in accordance with regulation 171.115 (1)(d).

5.2.3 Proposed changes to an approved service that require prior CASA approval will be processed by CASA as a variation to the certificate issued to a service provider. Should approval be given, it will be authorised by re-issue of the schedule to the certificate with the amended or additional entries covering the change to the service or the new service. It may be necessary in such cases for the service provider to enclose any supporting documentation (i.e. supporting safety case, see paragraph 4.8 relating to SMS) with the proposed amendment.

5.2.4 Proposed changes and modifications that do not change the approved services delivered to users and do not require any amendment to the schedule to the certificate, for example replacement of, or modifications to, hardware or software to improve reliability or to provide improved functionality, frequency changes, or changes of call-signs, etc. may be implemented without reference to CASA, provided that the service provider's operations manual is amended to reflect the change, and CASA is provided with a copy of the amendment within a reasonable time. (Note that radio frequency and call-sign changes require prior notification to the AIS for NOTAM advice.)

5.3 Reserved

5.4 Regulation 171.050 — Technicians

5.4.1 Regulation 171.050, together with the standards in the MOS Part 171, establish the personnel qualifications and the specialised training required for technicians engaged by a service provider to operate and/or carry out the maintenance of facilities providing aeronautical telecommunication or radionavigation services.

5.4.2 *Technician* is a defined term under Part 171. It means a person who is engaged by a service provider to *operate* or *maintain* any facility, or to conduct measurements of the performance of, and/or calibration of, a facility during a flight inspection. It does not include a trainee technician, or a technician undertaking on-the-job training under the direct supervision of a supervising technician – see regulation 171.050(2).

5.4.3 Technician Qualifications. The basic minimum qualifications required for technicians are prescribed in the MOS Part 171. The minimum academic qualification for technicians performing operation and maintenance functions associated with ATEL/ANAV is a diploma of technology in one of the following:

- (a) Radio engineering;
- (b) Communications engineering;
- (c) Electrical engineering;
- (d) Electronic engineering;
- (e) Computer science;
- (f) Information technology; or
- (g) Qualifications equivalent to the above qualifications.

For those technicians that carry out or supervise electrical, mechanical, or lines work only, the minimum qualification is an electrical or mechanical or lines trade qualification, as relevant.

Where a service provider considers, and CASA agrees, that the operation and maintenance of a particular type of facility is not technically complex, lesser qualifications may be acceptable for those technicians who operate and maintain that type of facility.

5.4.4 Technician Certification. It is important that service providers have a system in place for assessing the competency of its technicians, whether they are employed by the service provider or they are contract technicians. Service providers must have an internal certification scheme for its technicians that establish the technical authorisations granted to each technician. The certification must be in the form of a controlled document provided to each technician that identifies the technician and the types of ATEL/ANAV facilities for which the technician has been granted authorisation, the operation and maintenance functions authorised in relation to each facility, the date on which each authorisation was granted, and the date on which the authorisation expires or the date on which revalidation or reassessment is due.

5.4.5 Workplace Assessors. The qualification standards for Workplace Competency Assessors undertaking competency assessments for technician certification are set out in the MOS 171 at Chapter 5.2.1.2. The primary requirements are that the assessor (or assessors where one or more persons work together) has been trained and accredited to ANTA Certificate IV, and holds formal recognition of competency in the unit being assessed. The latter requirement to hold formal recognition of competency will normally be satisfied if the assessor holds internal certification for the particular facility/equipment of the service provider's technician certification scheme. However, in the particular situation where a new ATEL/ANAV facility/equipment is to be commissioned by a service provider, there may not be any persons within the service provider that hold such technical certification. In such cases, the requirement to hold formal recognition of competency would be satisfied if the assessor has successfully completed a competency based course of instruction on the facility/equipment that is provided by the equipment manufacturer, or a course that has been developed in-house by the service provider.

5.4.6 Technician Training. Technicians who carry out functions associated with the operation and maintenance of facilities must be given appropriate, specialised training on the facility type, followed up by an on-the-job evaluation of their competence.

5.4.7 Ongoing Competency Checks. It is also necessary to have a procedure for on-going competency checking, recency checking and refresher training to ensure retention of competence. As a guide, where technicians have not been involved in particular maintenance work on a particular facility for periods in excess of 2 years, refresher training is to be provided and re-authorisation of the technician's personal certification is to be undertaken. The competency assessments must be carried out by a person holding the qualifications for assessors prescribed in the MOS Part 171, and the assessment process must ensure that each technician:

- (a) has received a course of training or instruction in the operation and maintenance of each facility for which he/she has responsibility; and
- (b) has been assessed as competent to operate and maintain those facilities without supervision.

5.4.8 Contract Technicians. Where a service provider engages a third party organisation to provide technicians to *operate or maintain a facility* covered by the certificate, the certificate holder remains responsible for compliance with the requirements of Part 171, including the requirements in relation to technician qualifications and certification.

5.4.9 Functions which can only be carried out by Technicians holding a personal certification. In amplification of the above requirements relating to the certification of technicians, the term "operate or maintain a facility" in the context of Part 171 means any actions undertaken on the facility which can affect its operability and/or performance *while it is in operational service*. This includes:

- (a) placing a facility into operational service; including the associated parameter checks and measurements of the performance of the facility taken immediately prior to its placement into service, to ensure its accuracy and integrity;
- (b) removing a facility from operational service;
- (c) monitoring the performance of a facility and undertaking executive or operational functions on the facility, including reconfiguration of the facility, while the facility remains in operational service, (this does not necessarily include basic go/no-go monitoring of the status of the facility derived from built-in test equipment or supervisory systems);
- (d) undertaking periodic performance inspections and measurements and adjustments in accordance with the Maintenance Plan while the facility is in operational service;
- (e) undertaking periodic maintenance while the facility remains in service;
- (f) undertaking flight testing, measurement or flight calibration functions; and
- (g) direct supervision of trainee technicians undergoing training on operational facilities;

but does not include:

- (h) basic go/no-go monitoring or over-sighting the on-going operational performance of any facility, while it is on-line;
- (i) testing, engineering trials, maintenance, modification, or repair of any facility that has been taken out of operational service;
- (j) maintenance on a facility that has been taken out of service;
- (k) engineering trials on a facility that has been taken out of service; and
- (l) repair of modules or components of a facility at a remote agency.

5.4.10 Although not a regulatory requirement, functions (h) to (l) above should be undertaken by persons holding qualifications equivalent to that required for technicians, but not necessarily holding a personal certificate of authorisation relevant to the operation and maintenance of the particular facility. Those functions at (h) to (l) may also be undertaken by technicians employed by other organisations not holding a Part 171 approval.

5.4.11 Guidelines on technician training courses. ICAO has issued guidelines on technician training in the ICAO Training Manual (ICAO Doc 7192). The guidelines are based on the International Federation of Air Traffic Safety Electronic Association's (IFATSEA) Training Manual for Air Traffic Safety Electronic Personnel. This material provides general guidance material on training courses for technical staff operating in Part 171 service providers.

5.5 Regulation 171.055 — Test Transmissions

5.5.1 This regulation is self-explanatory. The provisions of this regulation are to enable approved providers to undertake engineering and operational trials on facilities or equipment prior to or after commissioning, or to prove equipment after maintenance, modification, etc. Service providers may radiate transmissions on aeronautical band frequencies if such is necessary for the testing of services or facilities or equipment. This permission is subject to prior notice having been provided by an appropriate identifying electromagnetic transmission or voice announcement on that frequency, and/or passed to the AIS for the issuing of NOTAM advice, or otherwise if the transmission includes clear information that it is a test transmission not to be used for operational purposes, or radiates on an unused frequency, etc. If a provider is in doubt as to whether a test transmission meets this requirement, CASA should be contacted before the transmission is made.

5.6 Reserved

5.7 Regulation 171.065 — Interruption to Service

5.7.1 This regulation is self-explanatory. It requires service providers to advise AIS (for the purpose of issue of a NOTAM) and other users (e.g. ATS) of planned or unplanned interruptions to any service. For services not published in AIP ERSA, advice to the AIS will not be necessary. At least 24 hours notice to AIS is necessary before any planned withdrawal of service.

5.8 Regulation 171.070 — Test Equipment

5.8.1 Service providers must have available the necessary test and measuring equipment for the operation, performance inspection, and maintenance, of all of its facilities. The facility operation and maintenance plan (and/or the operating and maintenance instructions for each facility) should specify the test equipment requirements for all levels of operation and maintenance undertaken by the service provider.

5.8.2 Many types of ground navigation aids used for safe air navigation are analogue equipment that must be set to defined performance parameters and tolerances for each particular location. The validity of these settings, and therefore the accuracy and the integrity of the nav aids, depends on the calibration and accuracy of the test equipment, including the flight test equipment, used for facility calibration and maintenance.

5.8.3 The standards for the control, calibration and maintenance of test equipment are in Chapter 6 of the MOS Part 171, and are repeated below:

- A service provider has available the necessary test facilities for use in the operation and maintenance of services and facilities.
- Service providers use documented procedures to control, calibrate and maintain test equipment.
- Calibrated test equipment is used in the maintenance of a service or facility.
- Calibration is carried out at prescribed intervals for each type of test equipment and the calibration is traceable to national measurement standards.
- Records of the calibration status of each item of test equipment are retained.
- Each item of test equipment carries a visual identification of its calibration status, the date that the equipment was last calibrated, and the prescribed calibration periodicity.
- The validity of previous results is assessed when any item of test equipment is found to be out of calibration.

The calibration of test equipment is in most cases a highly specialised function that should be undertaken by specialist agencies that are certified as meeting the general requirements for the competence of testing and calibration laboratories under AS ISO/IEC 17025:1999.

5.9 Regulation 171.075 — Documents to be maintained

5.9.1 Service providers must hold and keep amended those documents that are necessary as basic references for their services and functions. As a minimum, the documentation that will be required is:

- (a) the service provider's operations manual, and all documents referenced within the manual. This will include:
 - (i) the functional and technical specifications of services and facilities;
 - (ii) the configuration of services and facilities;
 - (iii) facility operation and maintenance plans;
 - (iv) interface agreements with other organisations;
 - (v) local instructions and technical procedures;
 - (vi) Safety Cases produced in relation to services/facilities.
- (b) ICAO Annex 10 Volumes I to V, (those volumes actually held will depend upon the services provided);
- (c) ICAO Annex 11 (if the services are in support of ATS);
- (d) ICAO Doc 8071 (if the services are radionavigation services);
- (e) CASR Part 171 and MOS Part 171;
- (f) manufacturer's equipment handbooks, in particular those volumes that contain the Operation and Maintenance Instructions, the logistics support and spare parts listings, as relevant to each facility, and for each associated item of test equipment used for maintenance.

5.9.2 These documents must be available to technicians at their workplace.

5.9.3 A process for the authorisation and amendment of documents is required and should be in accordance with ISO 9000 quality system standards. All initial issues and subsequent amendments of documents generated by the service provider are to be authorised by one of the service provider's key personnel (see section 4.2.2) or an appropriate delegate. Where the amendment involves a change to the design of a facility, the amendment must be authorised by a person who is qualified and competent to do so (i.e. the *design authority* for the facility or equipment; see section 4.6.1(b)). The mandatory requirements in the MOS Part 171, and include:

- (a) document and data control processes to control the authorisation, publication, distribution, and amendment of all documentation issued, or required by, the service provider;
- (b) the currency of the documentation can be readily determined;
- (c) documents are available at locations where needed by staff;
- (d) only current versions of documents are available;
- (e) a master copy of all documentation is securely held;
- (d) the processes ensure that all documents, which are referenced in the operations manual, are included in an index to the operations manual.

5.9.4 All documentation may be held as computer based records provided that there is a system of control in place that will ensure any paper copies of computer based documents are subject to the controls required under this regulation.

5.10 Regulation 171.080 — Records

5.10.1 Adequate and accurate records are a necessary element of a safety management system. Under this regulation, a service provider is required to have a records system to identify, collect, index, store and maintain records necessary to provide a traceable history over the complete life cycle of services and facilities. Records kept are to include at least the following:

- (a) records of design, manufacturing, procurement, installation, testing, commissioning, maintenance, routine operation, modification, and decommissioning;
- (b) records of the designated authorities for the design, operation and maintenance for each system;
- (c) records of hazard analysis and risk assessments;
- (d) records of facility performance and facility maintenance history including performance parameter values, test facilities utilised, identity of authorised technicians conducting operation and maintenance, changes to maintenance procedures;
- (e) records of facility failures and faults; and
- (f) records of defect reports and associated defect investigations;
- (g) records of each technician's competencies, including details of the technician's qualifications, experience, specialised training, competency assessments and facility authorisations.

5.10.2 Records should be under the control of the relevant key personnel or their delegates. Access to the records system needs to be controlled to retain appropriate security. CASA will require applicants and approved providers to give it access to the records system for the purpose of entry certification or for safety audits.

5.10.3 Site Logs. Site logs are to be kept for all facilities used to provide an aeronautical telecommunication service or a radionavigation service. The site log must have entries to record all occurrences and actions relating to the operation, maintenance, modification, failure, faults, removal from, and restoration to, service. Entries in site logs include the date/time of the entry and the occurrence and are to be signed by the technician or other person making the entry. Site log records are to be retained for at least five years.

5.11 Regulation 171.085 — Security Program

5.11.1 The security program established by a service provider should be based on a risk assessment of the possibility of intrusion by unauthorised persons and animals, or damage by natural events.

5.11.2 Service providers must establish appropriate physical security measures for all facilities that provide an aeronautical telecommunication or radionavigation service. The level of security afforded to each facility will be to minimize the risk of destruction, unauthorised access, entry by animals, and malicious damage or tampering, to each facility. It will generally be necessary to have, as a minimum, a system of personnel control that positively limits access to facilities to personnel approved by the service provider.

5.11.3 The physical security measures adopted for site security should:

- (a) control entry access at all times to all entry points;
- (b) protect personnel on duty;
- (c) establish procedures in respect to bomb or other threats; and
- (d) establish monitoring facilities that detect unauthorised access to critical radionavigation or radiocommunication facilities.

5.11.4 Other than for facilities located airside on an aerodrome having perimeter fencing, security fences around any facility will be necessary. OHS requirements should also be taken into account in establishing security fencing, particularly for high power transmitters.

5.11.5 The required site clearances to limit interference or distortion of radiated signals around various types of airways facilities on aerodromes are in the Manual of Standards, MOS Part 139.

5.12 Regulation 171.086 — Safety Management System

5.12.1 The requirement for an SMS is a CASA standard applicable to service providers in the aviation industry. An SMS adopted by a Part 171 service provider must comply with the standards in Chapter 3 of the MOS Part 171. These standards permit a service provider to establish an SMS that is best suited to its business practices while providing for safety assurance. Depending upon the service(s) provided, not all elements of the SMS may be applicable to all service providers.

5.12.2 An SMS defines the policies, procedures and practices for managing the safety of the provision of services, and for managing any changes to their provision. To be

effective, the SMS should be integrated within the operating procedures and practices of a service provider, rather than being stand-alone.

5.12.3 The necessary features of an SMS for a Part 171 service provider are:

- The service provider's safety policy and objectives;
- The organisational and staff responsibilities for safety matters;
- The establishment of the levels of safety that apply to the services; and the monitoring of the levels of safety achieved;
- The process for internal safety reviews;
- The process for the internal reporting and management of safety concerns and incidents;
- The process for the identification, assessment, control and mitigation, of existing and potential safety hazards in service provision;
- The definition of the interface arrangements for safety management and the relative associated responsibilities and procedures with internal functional groups and with aerodrome operators and support service providers; and
- The processes for the management of changes to existing services (including the de-commissioning of a service).

5.12.4 Requirement for Safety Cases. The Safety Case is essentially a method for safety risk management. Safety Cases provide documented evidence and argument that a service or facility, or a proposed change to the design of a service or facility, meet safety objectives or levels for the service or facility.

5.12.5 Risk management is an iterative process consisting of defined, sequential steps that support better decision-making by contributing to a greater insight into risks and their impacts. It incorporates several elements, from the initial identification of safety hazards and the analysis of their risk, to the evaluation of its tolerability and the determination of possible risk reduction options, through to the selection, implementation and monitoring of appropriate control and reduction measures.

5.12.6 Reference for risk management: Australia/New Zealand Standard 4360:1999 'Risk Management'.

5.12.7 Reference for the preparation of Safety Cases: Guidelines for the preparation of safety cases have been published by CASA in AC 171-2(0).

5.12.8 Safety cases submitted to CASA: Safety cases should be submitted to CASA to support new services, and any changes to existing services that would result in a change to the certificate issued to a service provider under Regulation 171.250, or otherwise requires prior notification to CASA in accordance with an arrangement or change definition that is set out in the service provider's SMS. Changes which should be covered under the provision relevant to SMS inclusions are those which are significant reductions in service coverage, navaid types and locations, introduction of new nav aids, changes in frequency spacing allocations, etc.

5.12.9 Interface arrangements with ATS providers. The ATS provider interface arrangements identify staff responsibilities and arrangements in relation to normal service provision and abnormal contingency provisions.

5.12.10 Interface Arrangements with Organisations Providing Support Services.

These are interface arrangements with other organisations providing (sub-contracting) a support service, facility, or data, which interconnects or interfaces with an aeronautical telecommunication or radionavigation service. Support services include terrestrial or satellite bearers carrying voice or data communications, radar data provided by another organisation's radar surveillance systems, and other electronic data sources of operational information. The interface arrangements should include:

- (a) a functional specification for the support service; and
- (b) the values or characteristics of availability, reliability, accuracy, integrity, and recovery time, as relevant, of the support service; and
- (c) the monitoring and reporting of the operational status of the support service, facility, or data, provided by the other organisation; and
- (d) interface arrangements and management processes which will support the services provided.

Support service interface arrangements are not required if the service provider can demonstrate or provide evidence that it has suitable interruption recovery contingency arrangements in place, which will provide continued safe operation of a service during any interruption to, or failure of, any support service.

5.12.11 Aerodrome Operator Interface Arrangements. The Aerodrome Operator interface arrangements set out the respective responsibilities of the aerodrome operator and the service provider for aerodrome infrastructure and aerodrome works that are associated with, or may affect, any Part 171 service. In this regard, the interface arrangements should cover, as relevant:

- (a) provision of mains and stand-by electrical power;
- (b) the management of aerodrome cabling that connects with Part 171 services;
- (c) interfaces between airport and obstacle lighting, beacons and other vis aids, with the aerodrome control tower;
- (d) fault reporting of outages; and
- (e) staff access, and physical security of facilities.

6. CASR SUBPART 171.D — CONTENTS OF OPERATIONS MANUAL

Subpart D of CASR Part 171 establishes the requirements in relation to a service provider's operations manual. Prospective providers are required to prepare a draft operations manual to support an application to CASA for approval as a Part 171 provider. As the operations manual establishes the standards and procedures under which a service provider's services will be delivered, CASA considers the content of the operations manual to be of primary importance in the approval process. Approval of prospective providers will not be granted by CASA unless the applicant's operations manual complies with the requirements of Subpart D of Part 171.

6.1 Regulation 171.090 — Operations manual to contain or refer to information

6.1.1 The operations manual should be a definitive statement of the applicant's proposed services and the standards, procedures and practices under which the applicant intends to deliver those services and to carry out its on-going *operation and maintenance* functions. Regulation 171.075 requires the operations manual to be a controlled document (see section 3.9), the contents and all amendments to be issued by an appropriate authority, and that it is available to those persons who need to refer to it (*key personnel* and *technicians*).

6.1.2 It should be noted that a requirement to include specified information in the operations manual may be satisfied by referring, in the manual, to that information in another document held by the applicant. If desired, the operations manual may be prepared and submitted in electronic form, and the documents referred to may also be in electronic form. Any separate documents are to be indexed and cross-referenced in the operations manual, and are subject to the documentation control processes specified by regulation 171.075, (see section 3.9).

6.2 Regulation 171.095 — Organisation and management of service provider

6.2.1 The operations manual must include a chart of the service provider's structure which clearly depicts the lines of management, technical authority, and functional responsibility, across all functional areas of the service provider that are associated wholly or partially with the aeronautical telecommunication and radionavigation service delivery. The chart should include the names, relevant qualifications, relevant experience, and positions of the chief executive of the service provider, and of the *key personnel*. The responsibilities of these persons should also be included or appended.

6.2.2 Management Structure. The chief executive is the person who is nominated as having overall responsibility for the proposed services, and the *key personnel* are those persons (or person) who have the responsibility within the service provider for the management of the *operation, maintenance, and the safe provision*, of its services. These persons plus any other persons at management level that represent the management structure of the service provider should be suitably qualified and/or experienced for the position held.

6.2.3 Depending upon the size and complexity of the service provider's organisation, the extent of the services it proposes to provide, and whether it intends to undertake system engineering, installation and commissioning functions, the following are the activities and functions for which these key management personnel should be responsible, and capable of managing:

- (a) the establishment of internal standards, practices and procedures that comply with the Part 171 requirements and standards;
- (b) system engineering, specification, procurement, installation and commissioning of facilities;
- (c) establishment and review of the internal safety management system and its review;
- (d) establishment, review and on-going responsibility for the facility maintenance regime, including logistics support of facilities and the procedures required under Part 171 in relation to the maintenance functions;
- (e) the resourcing of qualified, competent technicians in sufficient numbers, at appropriate locations, to carry out the operation and maintenance functions of the service provider; and
- (f) Where a service provider has a number of manned bases, it is expected that an appropriate supervisory structure will be established at each base such that there is a senior officer in charge, plus sufficient supervisory personnel to oversight the technical functions.

6.2.4 In assessing applications, CASA will give close attention to the management structure, and the capabilities of the managers of the applicant. Where CASA considers that the proposed management structure does not satisfactorily support the proposed services, approval will not be granted.

6.2.5 The applicant needs to have sufficient personnel to undertake all its proposed functions. The number of personnel required will depend on many factors, but mainly the types and extent of the facilities, their geographic locations, and the geographic locations of the maintenance bases. Only personnel associated with those operations and maintenance functions undertaken by the service provider itself should be included in the organisation chart. For example, where the facility operation and maintenance plan specifies that the repair of modules or equipment components of facilities will be carried out externally by a contract agency such as the facility manufacturer or an authorised repair agency, the organisation chart need not include details of that part of the maintenance function. Again, in assessing applications, CASA will give close attention to the proposed structure and the disposition of the key personnel, supervisors and technicians; if it is considered that the structure does not satisfactorily support the proposed functions, approval will be withheld.

6.3 Regulation 171.100 — Way in which standards are met

6.3.1 Under this regulation, the operations manual must contain a listing of the technical standards relating to design, installation, commissioning and testing, and operation and maintenance, that are applicable to each service, and to each facility, which makes up each service. In the context of this regulation, the term *standards* means a relevant ICAO standard or recommend practice, any requirement in the Manual of Standards Part 171, or any other relevant international or domestic standard or requirement which has been called up anywhere in the service provider's operations manual, or in documentation referenced in that manual, as applying to the service or facility. It also includes any standards specified by the facility manufacturer in equipment specifications or handbooks. For each of the standards listed or referenced, the operations manual must include a statement as to whether and how compliance with the standards has been achieved. Where compliance with a relevant standard is not achieved, this is to be clearly indicated, and a statement of the reason for non-compliance and its impact on the service provided in terms of the performance of the service, and aviation safety, is to be included.

6.3.2 Where the standards applicable to services and facilities are those established by the equipment manufacturer and are included in the manuals, handbooks, or specifications, provided by the manufacturer it remains the responsibility of the applicant to satisfy CASA that those standards have actually been achieved in each particular facility installation. This will normally require site acceptance testing.

6.4 Regulation 171.105 — Functional specification and performance values of services

6.4.1 This regulation requires the inclusion in the operations manual of a statement of the basic performance descriptors (functional specification) for each of the aeronautical telecommunication or radionavigation services. Such information is to enable CASA to assess the performance of the services in terms of their suitability for aviation use.

6.4.2 Functional specification. The *functional specification* (synonymous with the operational requirement) of the service is essentially a brief statement of its operational function from the perspective of those for whom the service is intended (air traffic control or pilots). For example, the functional specification for an Instrument Landing System might be:

“Precision approach to landing navigation aid providing pilots with electronic data for glide path and vertical and horizontal guidance to ICAO Category 1 in accordance with the standards of ICAO Annex 10 Vol I.”

or, for an aeronautical mobile service used for the purpose of ATC air/ground control at an aerodrome:

“VHF air/ground service in accordance with ICAO Annex 10 Vol II used for local aerodrome control”

6.4.3 Availability and Reliability. Values for each of the following basic parameters, as relevant to each service type, are to be included for each service:

- (a) **Availability.** All aeronautical telecommunication and radionavigation services must provide high levels of operational availability. In many cases, achievement of the necessary availability levels will require the use of design features such as redundancy and/or duplication of facilities, automatic changeover from main to standby facility in the event of a fault, remote monitoring and maintenance capability including remote reconfiguration, remotely actuated equipment recycling capability, dial-up monitoring, etc. Availability is a measure of the operational availability of the system to users over the total time period that it is required by users. It is normally quoted over the period of an average year or longer, and takes into account the time the service will be unavailable as a result of both unscheduled failures and scheduled or unscheduled maintenance.

$A_o = T_a / T_t$ where A_o = Operational Availability, T_a is the total time that the service is available when required by users, and T_t is the total time period that the service is required to be available.

Where a service comprises a completely new design, and operational experience is not available, A_o may not be available for the system as there is no in-service knowledge of its actual performance. In this case, the Inherent Availability A_i should be stated in lieu of A_o . (Manufacturer's technical specifications or equipment manuals often include A_i .)

$A_i = (T_t - T_d) / T_t$ where T_t is total time, T_d is down time due to failure.

Where a service has duplicated or redundant facilities (including standby power supply) with automatic changeover or automatic or remote reconfiguration, or main/standby capability, an additional parameter termed 'continuity' should also be quoted in the operations manual for the applicable services. 'Continuity' is a measure of the time that the service takes to changeover from the main to the standby facility, or to reconfigure itself following a fault, including a power supply fault or failure. Services for which continuity is an applicable parameter include precision nav aids, radar display services for ATC, A/G communication channels for ATC, point-to-point data and communication links.

A major factor in achieving required levels of A_o is the provision of standby power systems. Standby power systems may take the form of Diesel No-Break Generating Sets, Diesel Standby Generating Sets, floating battery supply across a mains charger, or Uninterruptible Power Supplies with battery backup to mains supply. For remotely located facilities having relatively low power requirements, solar power supplies used in conjunction with floating batteries may be a satisfactory solution.

The provision of standby power is necessary for many ATEL/ANAV services and facilities where continuity of service is a critical requirement. ICAO Annexes 10 and 14 provide guidance in regard to the requirements for standby power for particular facility types. Critical ATEL/ANAV facilities that should have *no-break standby power supply systems* to ensure continuity are those in the following classes:

- (i) all control tower facilities;
 - (ii) all terminal area radar surveillance systems;
 - (iii) all terminal area precision and non precision approach nav aids;
 - (iv) all terminal area air/ground VHF communication systems;
 - (v) all radio bearers/networks and stations servicing any CNS system(s) used for terminal area control;
 - (vi) all enroute communication systems; including all satellite communication ground stations used for ATS voice and data; and
 - (vii) all enroute radar facilities.
- (b) **Reliability.** This is measured in terms of long-term mean time between failure (MTBF) of the complete service, taking account of all possible failure modes.

MTBF = total time period/number of failures during time period

- (c) **Accuracy.** This is a measure of the degree to which the actually displayed or presented value complies with the true value of any parameter provided by the system to operational users. The measure is mainly applicable to radionavigation services, including radar data and display services. It is not applicable to communication or broadcast services. Accuracy figures should take account of all sources of error of the provided service other than user interpretation errors. Since accuracy is a statistical measure of performance, in the case of a radionavigation system, the statement of the accuracy is not meaningful unless it is qualified by the probability that the accuracy is achieved, or the uncertainty in position which applies.
- (d) **Integrity.** This is a measure of the ability of the service to provide a warning to users when the service should not be used, or when an error has occurred in data transfer or computation. *Integrity* may be computed and presented in a variety of ways, e.g., as a Go/NoGo warning based on internally measured parameters that utilise built-in test equipment or self-monitoring systems. *Integrity* values for radionavigation services are often stated as a probability of the loss of integrity over a number of events.

6.4.4 For newly procured facilities, the above parameters will normally be included in the technical specifications and/or will be specified by the facility manufacturers. For existing facilities, providers will have to calculate overall values for complete services based on the configuration of the facilities (including power supply systems and support services provided by telcos) that comprise or support each service, and knowledge of the history of the performance of the facilities.

6.4.5 ICAO Guidance Material. ICAO Attachment F to Annex 10 Volume 1 provides guidance material concerning the levels of reliability and availability for

radiocommunication services and radionavigation aids, which should be considered by service providers as minimum standards. The ICAO information is shown in Appendix B to this AC.

6.4.6 The following table provides, for guideline purposes only, values of the performance parameters for a number of service types. These values do not necessarily represent those that CASA would require or approve for any specific service; such requirements will depend upon each individual service and its specific application.

Service	Ao	MTBF (hours)	Accuracy	Integrity	Continuity (changeover and standby power)
Aeronautical broadcasting service	>.99	>1000 hours	N/A	N/A	15 seconds
Aeronautical mobile service (ATC A/G comms)	>.9999	>10000 hours	N/A	Direct, rapid, continuous, static free	Immediate
Radar Data Display for ATC	>.9999	>10000 hours	TBA	Not specified	Immediate
ILS Localiser and Glide Path	>.999	>1000 hours	ICAO Annex 10 Vol 1 Ch 3 and Table C2 Attachment C	ICAO Annex 10 Vol 1 Ch3 and Table C2 Attachment C	Immediate
DME	>.99	>1000 hours	ICAO Annex 10 Vol 1 Ch 3 section 3.5.3.13	Not specified	Immediate
VOR	>.99	>1000 hours	Not specified	Not specified	Immediate
NDB	>.99	>1000 hours	N/A	ICAO Annex 10 Vol 1 Ch3 section 3.4.8.1	Immediate

6.5 Regulation 171.110 — Technical Description

6.5.1 Under this regulation, the following information concerning the specification and interconnection of facilities must be included for each service:

- (a) the kind and the location of each facility making up the service;
- (b) the technical specification of each type of facility;
- (c) the interconnection of each facility making up the service, or to any other service to be provided under the operations manual; and
- (d) the monitoring system relevant to each facility.

6.5.2 Kind and location of facilities. The type of facility should be described from the listing at Chapter 2 of the MOS Part 171. The location of the facility is the geographic name of the place at which the facility is installed.

6.5.3 Technical specification of each kind of facility. The technical specification of a facility should include, in technical terms, all inputs and outputs to the facility, and the specifications and standards to which the facility has been designed. The technical

specification must cover both the hardware and software of the facility. This information is normally provided by the equipment designer/manufacturer. (If that is the case, reference to the relevant content in the manufacturer's documentation is all that is necessary in the operations manual.)

6.5.4 Facility interconnection. This should be in the form of a block diagram, each facility representing one of the blocks should be identified and the major signal or data inputs and outputs between facilities or to or from other services shown.

6.5.5 Facility monitoring. The monitoring system for each facility, or group of facilities, should also be included in block diagram form, conveying the method of monitoring, parameters monitored, monitoring outputs and the location at which the outputs are presented. The monitoring requirements for nav aids are presented in the following paragraph.

6.5.6 Navaid status monitoring and reporting. ICAO Annex 10, Volume 1, paragraph 2.8.1 '*Provision of information on the operational status of radionavigation aids*' states:

'Aerodrome control towers and units providing approach control service shall be provided without delay with information on the operational status of radionavigation aids essential for approach, landing and takeoff at the aerodrome(s) with which they are concerned.'

Based on this requirement the following standards have been adopted by CASA for the monitoring of navigation aids used for civil aviation within Australian airspace:

6.5.7 Terminology.

- *immediate reporting*: The serviceability of the navigation aid is monitored continuously and the status is provided to the associated, responsible ATS unit. Any change in the status of the navigation aid will be provided within 10 seconds.
- *standard reporting*: The facility status is reported to the Part 171 provider within 5 minutes of a change in serviceability.
- *pilot reporting*: the status of a navigation aid is observed by a pilot on an opportunity basis and if the aid is found to be unserviceable, the pilot reports the status of the aid to ATS within a reasonable time. Reporting may also be undertaken by a ground handling agent or aerodrome operator, in the situation where local status reporting is provided. In such cases the agent or aerodrome operator shall notify ATS or the Part 171 provider.

6.5.8 Remote Status Indication: Monitoring of navaid performance is carried out by electronic monitoring systems installed as part of the equipment. The monitor circuits will take executive action if the performance of the facility is outside specified tolerances. The monitor system will shutdown the equipment, or, in the case of a duplicated equipment, changeover to the standby equipment. The monitoring system will also provide a status output at the equipment site. The requirements for the operational reporting of this status is categorised as follows:

- **Approach Aids:** Any navaid used for a precision or non-precision approach that has a published approach/letdown procedure in AIP must have *immediate reporting* to the aerodrome control tower or ATS unit providing approach control service. When approach control is not provided or the unit providing it is closed, ATS reporting is not required. *Standard reporting* shall be provided in all cases to the relevant Part 171 provider.
- **ATS Required Aids:** These aids are used by ATS for traffic management and are usually gateway aids in and out of major airports. These aids shall have *standard reporting* to the responsible ATS Unit and *standard reporting* to the relevant Part 171 provider.
- **Enroute Aids:** these are aids for which there are no published approach/letdown procedures or are not *ATS Required Aids*. These aids shall have *standard reporting* unless CASA has given approval for the use of *pilot reporting*. The use of *pilot reporting* may be authorised by CASA in situations where it is technically impracticable and/or costly to provide *standard reporting*.

6.6 Regulation 171.115 — Safe Operation

6.6.1 This regulation requires the service provider to document in its operations manual the in-house technical and operational procedures under which the service provider intends to carry out its service provision functions. The procedures required are:

- (a) **Configuration recording and control process:** Part 171 providers are required to establish and apply configuration management processes to all ATEL/ANAV facilities, throughout the life cycle of the facilities. The life cycle commences from the time operational requirements are determined, to technical specification, through the project acquisition phase where baselines are established and the system is commissioned, through normal operation and maintenance, to decommissioning. Configuration management is a discipline applying technical and administrative direction and surveillance to a facility or equipment. The component elements of configuration management are:
 - *Baseline identification*, which is the process for defining and documenting the characteristics of the items that make up a Part 171 service. This is normally undertaken by the unique identification and description of each circuit component, module, sub-assembly and equipment.
 - *Configuration control*, which is the process by which proposed changes to the baseline are evaluated, designed, co-ordinated, approved or disapproved and, if approved, implemented in a controlled manner.

- *Status accounting*, which is the process for recording changes made to the system, and amending the *baseline identification* to reflect the changes.
- *System audits*, which is the process by which the systems are reviewed to ensure that they meet stated needs and performance specifications.

These processes are to ensure that the current physical configuration of hardware, software and operational processes relevant to each service/facility are recorded and kept under control. A person or persons should be established by the service provider as the '*configuration control authority*' to define and carry out in-house configuration control processes and maintain the associated records.

- (b) **Design control.** This is the process for the control of the design of new services or facilities or the modification of services or facilities. The process should cover design and development planning, organisational and technical interfaces between different groups including the user groups, design input and output requirements, design review processes, design verification and validation processes and major modification processes. This need not be included if a service provider does not intend to undertake in-house design and development of new systems or the major modification of existing systems.

The procedure should establish the *system design authority* for the design, changes to the design, and/or the modification, of services or facilities, and its procedures, equipments, software and components. The *system design authority* is a person (or group of persons), not necessarily within the service provider, qualified, competent and knowledgeable, in the technology of a service/facility. Unless a service provider retains in-house engineering expertise, the *design authority* will normally be the equipment manufacturer or agent and in that case any design changes should be subject to its design approval. In undertaking design authorisation, the *design authority* should ensure that the system design meets its functional and technical specifications.

- (c) **Commissioning of new services or facilities.** This is the procedure under which the commissioning of any new service or facility is undertaken. The commissioning procedure must ensure that system performance has been validated by engineering tests and flight tests as necessary, and that the appropriate *design, operation and maintenance authorities* have accepted that the service operates in accordance with its operational requirements, safety objectives and requirements, and applicable ICAO and MOS standards. For services, which support ATS, the relevant Part 172 service provider for which the service is intended should be included as a signatory in the commissioning authorisation process. For major systems, commissioning should also be subject to the production of a safety case that establishes that all predicted aviation safety hazards have been considered and the risks have been managed within safety objectives. (Guidelines for the preparation of safety cases covering airways systems are published in AC 171-2(0).)

- (d) **Performance Analysis and Recording.** This is a procedure that maintains a record of the operational performance of each service over its life cycle. The procedure should establish a history of service/facility failures and fault occurrences, and the corresponding system or facility downtimes. It should also support analytical summaries to establish the achieved values of Ao, MTBF, and system recovery times. These actually achieved values can then be compared with the engineering and operational specifications for services and facilities as a means of monitoring their on-going performance.
- (e) **Fault Reporting.** This is a procedure by which the service provider internally communicates the reporting of service and facility failures and faults to responsible supervisors and technicians for the management of their rectification. The procedure should establish the objectives for service recovery times and cover the reporting and technician call-out processes necessary to return services to operation within the defined recovery times. The procedure must cover failure/fault occurrences outside normal working hours as well as those during working hours.
- (f) **Defect Reporting.** A defect reporting system by which the service provider identifies, reports, investigates and rectifies any facility design deficiencies which are beyond the scope of the normal maintenance activity to manage and correct, or any procedural weaknesses, or any configuration/documentation errors. The defect reporting system should at least cover:
- (i) continual inability of services and facilities to perform within specification or standard operating parameters;
 - (ii) continual faults on equipment or software, including software bugs;
 - (iii) unavailability or unsuitability of spares and test equipment;
 - (iv) incorrect configuration identification, drawings, or operation and maintenance procedures; and
 - (v) poor VHF coverage or interference.
- (g) **Modification Procedure.** A facility modification process must be established unless a service provider intends to use external engineering expertise for this purpose rather than undertaking modifications in-house. In that case, such a statement should be included in this section of the operations manual. This procedure should cover:
- (i) the process for software changes, including the processes to test for latent faults in software following the change; and
 - (ii) the process for design changes. (See also Design Control above; a similar process for the nomination of a *design authority*, etc, should apply here.)

6.7 Regulation 171.120 — Facility Operation and Maintenance plan

6.7.1 The *operation and maintenance* of *facilities* used in service provision must be undertaken in accordance with a pre-established plan that is included or referenced in the operations manual. The facility operation and maintenance plan, (also known as a Logistics Support Plan (LSP)) for a *facility* may be derived from the facility manufacturer's documentation, or may be developed or varied by the provider based on its knowledge of the performance and maintenance requirements of each *facility*. What is included in the Plan must have a sound basis in logistics support. In considering this section of an operations manual, CASA will pay close attention to the adequacy of the Plan to support the ongoing performance, and the availability and recoverability specifications, of a service.

6.7.2 Many existing facilities, in particular existing radiocommunication facilities, nav aids, and radar systems, incorporate analogue circuitry that has to be subject to periodic inspection to ensure that it is operating within its performance specification. Other than for facilities incorporating RCMS, the periodic inspection is carried out on-site at specified time intervals. The inspection procedures and the test and measurements taken or checked are to be designed to confirm that each facility meets the established performance specifications, and also that the facility is likely to continue to do so until least the time of the next performance inspection.

6.7.3 Flight inspections. For nav aids systems in particular, periodic inspections not only entail ground tests on site but also flight inspections at defined time intervals. The time intervals, procedures, standards and equipment used for flight inspections are to provide the final assurance that the signal-in-space accuracy, integrity, and coverage of the facilities are within tolerances defined in the operational specifications.

6.7.4 The facility operation and maintenance plan for each service/facility should include:

- (a) the procedures for scheduled and unscheduled maintenance; including reporting and call-out processes, removal and return to service of operational facilities, recording of the maintenance activities to provide a traceable history of events, etc.;
- (b) a description of the maintenance scheduling system. The scheduling system should specify and record the scheduled maintenance intervals, the maintenance standards that apply to the facility, a record of the last maintenance activities and the next scheduled maintenance;
- (c) the interval of time between scheduled maintenance and/or routine performance inspections, and the basis of the establishment of that time interval;
- (d) the operation and maintenance instructions for each facility;
- (e) a workload analysis of the technicians involved in facility operation and maintenance. The objective of this requirement is to show that the service provider has, or will have, sufficient numbers of technicians to carry out the operation and maintenance plan;

- (f) details of planned facility flight inspections. This must include details of the standards and procedures to be used for flight inspections, the time interval between flight inspections, and the identity of the flight inspection organisation that will be contracted to carry out the flight inspections;
- (g) the disposition of support spares and test equipment; and
- (h) the plan for repair of facility modules and equipment components. External repair specialist agencies may be used, in which case the identification of the repair agency should be included in the plan.

6.7.5 Necessity for Flight Inspections. The necessity for a flight inspection of a radionavigation aid will arise in the following situations:

- (a) at the time of installation, as part of the pre-commissioning tests;
- (b) for routine confirmation of facility performance and integrity at predetermined intervals. These intervals are to be based on the ICAO guidelines in Doc 8071;
- (c) where investigation of the performance of a navaid is necessary resulting from pilot reports, incident/accident investigations, or engineering developments; and
- (d) in addition, the necessity for flight-testing is to be assessed following non-scheduled maintenance or modification. A flight-test will be required unless it can be absolutely determined from ground based performance inspection that the radiated signal has not been affected. If it cannot be absolutely ascertained that no unsafe variation in performance has resulted from maintenance or modification action, the aid is to be removed from service pending a flight inspection.

6.7.6 Maintenance activities not requiring a confirming flight check. Some examples of the typical maintenance activities that can be performed without necessitating a confirmation flight check/inspection are:

- **NDB including locator beacons:** All maintenance can be carried out without necessity for a flight inspection, provided the antenna current is restored to the value at the last flight inspection. The antenna may be replaced, on the same earth mat, with one which is an identical type, provided the antenna current is restored to the value at the last test flight. Change of operating frequency by less than 20% is permissible (NOTAM action applies).
- **DME and VOR:** All maintenance procedures and modifications can be carried out on the transmitting and monitoring equipment circuitry provided that the aerial system conditions, as determined by field measurement or monitor indications, can be restored to the condition that existed at commissioning or during the last flight inspection. Maintenance of fixed field detectors may be undertaken providing no change is made to the physical location of the monitor aerials.
- **ILS Localiser and Glide Path:** All maintenance procedures and modifications may be undertaken on duplicated transmission assemblies. Maintenance on monitor modules may be undertaken. Maintenance on unduplicated circuits that are not phase or amplitude sensitive may be carried out. Maintenance on surface finishes and obstacle warning systems may be undertaken provided there is no physical damage or displacement of antenna assembly.

- **ILS Marker Beacon:** All maintenance procedures and modifications may be carried out provided that power output and modulation percentages are returned to at least the Low Performance Level and no adjustments that affect the phase relationship of the currents in the various antenna elements are made and the antenna position remains unchanged.

6.7.7 Maintenance activities requiring routine confirming flight check: Typical maintenance functions that require the performance of a confirming flight inspection within a 6 months period (usually conducted when the flight inspection aircraft is in the vicinity) are as follows:

- **NDB:** Following any change in antenna current, antenna height, or earthmat changes, for the purpose of increasing the published coverage. Note that any increase in coverage should be confirmed by flight inspection before being advised by NOTAM.
- **DME:** Antenna replacement with an antenna of identical type mounted at the same height. The power delivered to the antenna must be of the nominal value for the beacon and VSWR must not exceed the low performance level.

6.7.8 Maintenance activities and environmental changes requiring confirming flight check before returning to service. Typical maintenance functions that require the performance of a confirming flight check before the facility is returned to service are:

- **NDB:** Following any change in antenna current, for the purpose of decreasing the published coverage. Note that any decrease in coverage must be published in NOTAM after the extent of the decrease is confirmed by flight inspection.
- **VOR:** Following replacement of the antenna; after repositioning of the monitor antenna; after replacement of transmission lines of critical length; following a change in operating frequency.
- **DME:** Following any change to the height or type of antenna.
- **ILS Localiser and Glide Path:** Following the replacement or repositioning of any fixed field detector directly associated with course/path position, sensitivity or clearance monitoring. Whenever corrective maintenance of a major nature is carried out on any transmission line of critical length, antenna array or parts of the antenna system contributing to the field pattern, such as absorber or reflection screens and parasitic elements. For the ILS Glide Path only; after adjustment of the carrier phasing and width controls if the monitor indications are outside tolerance when SOC are set. In the case of the carrier phasor, a variation of + 20 degrees is allowed in its setting to obtain maximum DDM at the width monitor.
- **ILS Marker Beacons:** A flight check will be required following adjustments to transmission lines and antenna array, which may affect the phasing and thereby distort the radiated field pattern.
- **Environmental changes:** Any significant environmental changes, e.g. buildings, earthworks, fences, roadwork's, power lines, vegetation, that are outside the tolerances specified in the CASA Manual of Standards Part 139, or cause changes in standard operating conditions as determined by ground inspections.

6.7.9 Standards for the Maintenance of Nav aids. The standard for the routine maintenance of nav aids is ICAO Doc 8071 Volume 1 Manual on Testing of Radio Navigation Aids. The maintenance periodicities specified in ICAO Doc 8071 Vol 1 for Ground Test Requirements and Flight Test requirements should be adopted by service providers for the ground maintenance and flight-inspection/testing of navigation aids. The periodicities specified in ICAO Doc 8071 are repeated in the table below and these must not be extended unless other periodicities *have been specifically approved by CASA by an entry in the service provider's operations manual*. Where actual operational data provides a firm knowledge of the long-term performance stability and integrity of any particular type of navigation aid, approved service providers may make submissions to CASA for approval for variation to the periodicities. Such requests are to include supporting data.

Note: The periodicities specified relate to the most frequently recurring maintenance item of the specified ground or flight inspection schedule. Not all scheduled maintenance items are required to be undertaken at every ground or flight inspection. Refer to ICAO Doc 8071 for details.

Navaid facility type	Maintenance standard	Maximum Periodicity - Ground Performance Inspections	Maximum Periodicity – Flight Inspections
NDB	ICAO Doc8071 Vol 1	6 months	12 months
DME	ICAO Doc8071 Vol 1	6 months	12 months
CVOR	ICAO Doc8071 Vol 1	12 months	12 months
DVOR	ICAO Doc8071 Vol 1	12 months	3 years
ILS	ICAO Doc8071 Vol 1	Localiser: 3 months Glide path: 3 months Markers: 3 months	Localiser: 6 months Glide path: 6 months Markers: 6 months

6.8 Regulation 171.125 — Safety Management System

6.8.1 This regulation simply requires that the operations manual of the service provider includes information about the safety management system that is set out in regulation 171.086 (see section 3.12 above).

6.9 Reserved

6.10 Reserved

6.11 Regulation 171.140 — Test equipment

6.11.1 The operations manual must describe the standards and procedures for the calibration and maintenance of test equipment used for the maintenance of any ATEL/ANAV facilities – see section 3.8 of this AC concerning the standards in this regard.

6.11.2 Regulation 171.145 — Interruption to service

6.11.3 The operations manual must include the following requirements, which are amplified in the following paragraphs:

- (a) the procedure to be used if an ATEL/ANAV service is interrupted;
- (b) a specification of the acceptable recovery time for each service;
- (c) the procedure to be used if the acceptable recovery time of a service is exceeded; and
- (d) a description of any method to provide an alternative service if an ATEL/ANAV service is interrupted (unless the alternative service is to be provided by another approved service provider, e.g. another Part 171 or Part 172 provider, in which case that should be stated in the operations manual).

6.11.4 Procedure to be used if an ATEL/ANAV service is interrupted. CASA takes the term *interrupted* in the context of this regulation to mean that, during its scheduled hours of operation, an ATEL/ANAV service:

- (a) has failed and is not available to users; or
- (b) has been withdrawn from service for the purpose of either scheduled or unscheduled maintenance at a time that the service is required by users; or
- (c) is operating outside its performance parameters (i.e., a fault has occurred which affects its technical performance or integrity such that the service has to be withdrawn at a time that the service is required by users;
- (d) but, does not include facility faults that have not resulted in the ATEL/ANAV service being inoperable or unusable. Examples are a fault that results in a changeover to a standby or duplicated facility, or a fault in a redundant element, where the service continues to be delivered in accordance with specification. While such faults obviously need to be attended to, they may not require the same level of response as a complete service failure, and are not classified as interruptions.

6.11.5 The objective of the procedure for responding to a complete failure of service should be to re-establish the service as quickly as is possible, consistent with properly restoring its operability. Factors important in attaining this objective are:

- (a) quick response by maintenance technicians;
- (b) the location of the technicians in relation to the location of the facilities;
- (c) equipment designs that provide good maintainability;
- (d) efficient logistics support, particularly the availability of spares and test equipment; and
- (d) the establishment of contingency plans for the provision of replacement or alternate services, facilities, equipment, and/or procedures by the users.

6.11.6 Specification of *recovery time*. The regulation requires service providers to determine a time period, termed the *recovery time*, which will define the planned level of response for the restoration of each service. While the *recovery time* will be the primary factor establishing the logistics support plan for a service, it should be based essentially on the operational requirement for the service, not on the capability of the logistics support system. In specifying *recovery times* that will satisfy aviation safety dictates and be acceptable to CASA, service providers should consider the following:

- (a) the requirements of the service users;
- (b) the type of service. As a guide, all facilities for terminal communications and radar surveillance, and all terminal precision and non-precision approach aids are to be allocated the shortest possible response times. (Recovery times for these services should be in the order of 30 to 60 minutes maximum);
- (c) if the service is used by ATS, are there alternate back-up services available to ATS and/or are there fall back contingency procedures, until the service can be restored; and
- (d) the availability of alternate services.

6.11.7 Procedure if the acceptable recovery time of a service is exceeded. The provider is required to establish and document a contingency plan that defines the planned actions to be taken by the provider in the event that the specified recovery time is not achieved in practice. The contingency plan may take various forms depending on each particular situation. In many instances it will not be feasible to provide alternate or backup ATEL/ANAV services, in which case the most appropriate contingency response will have to be based on particular operational procedures such as reversion to procedural control, or reduction of aircraft movements, etc. For this reason, the plan should be established in conjunction with the associated ATS provider, and may take into account the following aspects:

- (a) the likely outage time. Extended periods of outages resulting from major failures and facility breakdowns should be taken into account;
- (b) the type of service involved and the feasibility of providing a reduced service, or the availability of alternate or backup services;
- (c) the possibility of diversion of aircraft to other aerodromes, the handover of ATS functions to another sector/unit, or the reduction of aircraft movement rates to a predetermined level, etc.; and
- (d) the possibility of a service being remotely provided by, or rerouted through, another Part 171 provider.

6.12 Regulation 171.150 — Document control

6.12.1 The operations manual must describe the service provider's document control processes – see sections 3.9 and 3.10 of this AC concerning the requirements in this regard.

6.13 Regulation 171.155 — Security program

6.13.1 The operations manual must describe the service provider's security program – see section 3.11 of this AC concerning the requirements for a security program.

6.13.2 Regulation 171.160 — Changes to procedures

6.13.3 The operations manual must include the means by which changes are to be made to the procedures established under the facility operation and maintenance Plan. The change procedures should establish an appropriate authority within the service provider (e.g. the *key person(s)* responsible for operation and maintenance functions) to assess and authorise any changes to operation and maintenance procedures; the procedures for removal and return of facilities to operational service; the logistics support of services; and the amendment of relevant documentation including the operations manual.

6.13.4 Major changes to any service should always be supported by a safety case that assesses the safety risks of the change.

7. CASR SUBPART 171.E — ADMINISTRATION

Subpart E of CASR Part 171 specifies the approval process and the administrative requirements for both prospective and approved providers.

7.1 Regulation 171.165 — Joint applications not permitted

7.1.1 Any person or corporation that has the necessary capabilities, qualified personnel and facilities, may apply for approval as a Part 171 provider.

7.1.2 An application made by a partnership, or by 2 or more persons jointly, is not a valid application.

7.2 Regulation 171.170 — CASA may ask for demonstration of service

7.2.1 When considering an application for approval, CASA may, in writing, request the applicant to demonstrate its ATEL or ANAV service.

7.2.2 It will be the normal procedure for CASA to request such a demonstration before an approval is finally given. An exception will be considered where the actual facilities for service delivery are not in existence at the time of application, and the applicant does not wish to procure and install the necessary facilities unless and until an approval to operate is granted. In this situation, a condition of the approval will be that the service is satisfactorily demonstrated at commencement.

7.3 Regulation 171.175 — CASA may ask applicant to provide more information

7.3.1 If CASA considers that it reasonably needs more information than has been provided in an application to complete assessment of the application, including any further information to be included in the operations manual before it can be approved, the applicant will be requested to provide the additional information or further documentation. In this situation, CASA will advise the applicant accordingly in writing, clearly stating the information that is required.

7.4 Regulation 171.180 — Matters that CASA may or must take into account

7.4.1 In assessing and making a decision on any application, CASA may take into account:

- (a) anything in the application and the applicant's operations manual;
- (b) anything in any other document submitted or referenced by the applicant;
- (c) the results of any demonstration of a service; and
- (d) anything that CASA has in its records about the applicant.

7.4.2 However, before taking into account anything that CASA has in its records about an applicant, CASA must inform the applicant in writing of the substance of the information, and invite the applicant to make a written submission about such matter, within a specified, reasonable, time. CASA must take into account any such submissions.

7.5 Regulation 171.185 — When CASA must grant an approval

7.5.1 If a person has applied for a certificate as an ATEL/ANAV service provider, and the applicant has demonstrated compliance with the requirements for the grant of the approval, CASA will grant an approval if CASA considers that the approval would not be likely to have an adverse effect on the safety of air navigation. This consideration would normally only be made where an ATEL or ANAV service that has previously been approved by CASA is already operating in the same airspace, and is providing the same service as that service which the applicant proposes to provide. An example of this possibility is the provision of two similar navigation aids providing the same service in the same or overlapping airspace, where mutual interference may be a problem.

7.5.2 CASA does not intend to provide certification to applicants who cannot establish a valid reason to provide a service. This will be the case if the application is purported to be for the provision of a Part 171 service to support an ATS provided by a Part 172 provider, but there is no statement of an agreement with that Part 172 provider included in the application.

7.6 Regulation 171.190 — When decision must be made; and 171.195 — Decision making period may be extended

7.6.1 CASA must make a decision about an application within 90 days after receiving it. If a decision is not taken in 90 days, regulation 171.190 provides that CASA is taken to have refused the application.

7.6.2 It should be noted that the 90 day assessment period may be extended if CASA has made a request under 171.175 for the applicant to provide further information or has invited submissions under 171.180(2)(b). The time between when CASA makes the request or invitation and when the applicant responds does not count in the 90 day period.

7.6.3 Should CASA complete its assessment of the application before the 90 days has expired, it will inform the applicant of the result in writing at that time.

7.7 Regulation 171.205 — Approvals; and 171.215 — CASA's power to vary condition of approval

7.7.1 Regulation 171.215 provides that CASA may approve an application only if it approves the applicant's draft operations manual. Approval of the operations manual will be contingent on its content satisfactorily addressing all the requirements set out in Part 171 and the MOS Part 171.

7.7.2 In approving an application, CASA may impose conditions that restrict the kind of service to be provided, the way in which a service is provided, the coverage of the service, the time during which a service is provided, the requirement to satisfactorily demonstrate a service prior to commissioning, etc.

7.7.3 At the time of issuing an approval, or subsequently, CASA may, if necessary in the interests of safety, impose further conditions or vary a condition. In this situation, CASA is required to give the service provider written notice of the proposed imposition or variation, and must specify a reasonable period within which the approval holder may make a submission in relation to the imposition or variation of the condition. A condition will not be finally imposed before any submission is considered by CASA.

7.7.4 Certificates issued under regulation 171.250 will have an expiry date included. In addition, a date for the review of the conditions placed on the certificate may be included on the certificate. That date will be dependant on the type and extent of the conditions that are initially placed on the certificate, but will not normally be in excess of three years after the date of original issue of the certificate.

7.7.5 If it is necessary to vary anything on a certificate, a replacement certificate will be issued. This will be the case where:

- (a) there is a change in the service(s) provided by an approved provider, and CASA has approved the change; and
- (b) it is necessary to change or add to any of the conditions on a certificate.

7.8 Regulation 171.220 — Suspension and cancellation of approvals; and 171.225 — Notice to approval holder to show cause

7.8.1 Before taking action to cancel an approval, CASA may give an approval holder a show cause notice to inform the approval holder of facts and circumstances that justify the cancellation of the approval, and invite the provider to state why its approval should not be cancelled. A show cause notice will provide at least seven days for the approval holder to respond.

7.9 Regulation 171.230 — Grounds for cancellation of approval

7.9.1 The grounds for CASA to cancel an approval are that the approved provider has:

- (a) breached a condition of approval;
- (b) contravened the *Civil Aviation Act 1988* or any regulations made under that Act; or
- (c) has been guilty of conduct that renders the service provider's continued holding of an approval likely to adversely affect safety.

7.10 Regulation 171.235 — Cancellation of approval after show cause notice

7.10.1 This regulation sets out the provisions and procedural requirements under which CASA may cancel an approval. CASA may only cancel an approval if:

- (a) there exist facts or circumstances that amount to grounds for cancellation; and
- (b) CASA has given the holder a show cause notice; and
- (c) CASA has taken into account any written representations made by or on behalf of the holder, within the period of time stated in the show cause notice; and
- (d) not cancelling the approval would be likely to have an adverse impact on the safety of air navigation.

Sub-paragraph (a) above does not apply if CASA is obliged to cancel an approval – see regulations 171.237 and 171.240.

7.11 Regulation 171.240 — Cancellation at request of service provider

7.11.1 This regulation provides that service providers have the right to request the cancellation of an approval at any time. CASA must accept such a request and will immediately action such requests, consistent with its obligation to inform users of the impending cessation of the relevant services.

7.12 Regulation 171.250 — Certificate

7.12.1 This regulation provides that CASA will issue a certificate to ATEL/ANAV service providers.

7.12.2 An ATEL/ANAV certificate issued to a service provider will include the following content:

- (a) the identity of the service provider (name and address);
- (b) a list of those ATEL/ANAV services approved under the certificate, together with details of their location and coverage, and basic facility type identification;
- (c) the date the Certificate comes into effect, and the date it will end; and
- (d) any conditions on the Certificate.

CASA will issue a replacement certificate if anything set out on the certificate is no longer correct.

7.13 Regulation 171.255 — Return of certificate if approval ceases

7.13.1 This regulation provides that an service provider must return its Certificate of Approval if CASA's approval ceases.

7.14 Safety Inspections and Audits

7.14.1 The *Civil Aviation Act 1988* provides for authorised CASA officers to have access to any place necessary for the purpose of carrying out CASA's functions. This access is required for carrying out safety inspections and audits of approved providers.

7.14.2 A safety audit program will normally be established by agreement between CASA and the provider at the time of initial issue of the certificate. Non-scheduled inspections may also be carried out by CASA as necessary or if there are grounds to believe that the approval holder is not complying with Part 171.

Patrick Murray
Group General Manager
Air Transport Operations Group

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APPENDIX A



ATEL/ANAV Service Provider — Application

Reference: CASR Part 171

SECTION A: APPLICANT DETAILS

Person/Company Name	Registered Address	CAN
Principal(s)	Postal Address	Telephone No.

SECTION B: OPERATIONAL DETAILS TO BE PROVIDED TO CASA WITH APPLICATION

Location of proposed Part 171 operation:
ATEL and/or ANAV Service(s) to be provided: Location and coverage of each service provided:
Proposed Commencement Date:
Daily Hours of Service:
Organisation Chart: Provided yes / no
Operations manual Provided yes / no
Are facilities installed and operative? yes/no
<i>Documentary evidence in support of all matters in this application may be requested</i>

SECTION C: LIST OF NON-COMPLIANCES WITH MOS PART 171 and ICAO ANNEX 10

MOS or Annex 10 reference	Details and reason for non-compliance
Attach list if insufficient space	

SECTION D: DECLARATION

On behalf of _____, I hereby apply for CASA Certification as an ATEL and/or ANAV Service Provider.

Signed: _____

My authority to act on behalf of the applicant is: _____

Name of person making the declaration: _____

Date: _____ / _____ / _____

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APPENDIX B

Extract from ICAO Annex 10 Vol 1

ATTACHMENT F. GUIDANCE MATERIAL CONCERNING
RELIABILITY AND AVAILABILITY OF RADIOCOMMUNICATIONS
AND NAVIGATION AIDS1. Introduction and
fundamental concepts

This Attachment is intended to provide guidance material which Member States may find helpful in providing the degree of facility reliability and availability consistent with their operational requirement.

The material in this Attachment is intended for guidance and clarification purposes, and is not to be considered as part of the Standards and Recommended Practices contained in this Annex.

1.1 Definitions

Facility availability. The ratio of actual operating time to specified operating time.

Facility failure. Any unanticipated occurrence which gives rise to an operationally significant period during which a facility does not provide service within the specified tolerances.

Facility reliability. The probability that the ground installation operates within the specified tolerances.

Note.— This definition refers to the probability that the facility will operate for a specified period of time.

Mean time between failures (MTBF). The actual operating time of a facility divided by the total number of failures of the facility during that period of time.

Note.— The operating time is in general chosen so as to include at least five, and preferably more, facility failures in order to give a reasonable measure of confidence in the figure derived.

Signal reliability. The probability that a signal-in-space of specified characteristics is available to the aircraft.

Note.— This definition refers to the probability that the signal is present for a specified period of time.

1.2 Facility reliability

1.2.1 Reliability is achieved by a combination of factors. These factors are variable and may be individually adjusted for an integrated approach that is optimum for, and consistent with, the needs and conditions of a particular environment. For example, one may compensate to some extent for low reliability by providing increased maintenance staffing and/or equipment redundancy. Similarly, low levels of skill among maintenance personnel may be offset by providing equipment of high reliability.

1.2.2 The following formula expresses facility reliability as a percentage:

$$R = 100 e^{-t/m}$$

where:

- R = reliability (probability that the facility will be operative within the specified tolerances for a time t , also referred to as probability of survival, P_s);
- e = base of natural logarithms;
- t = time period of interest;
- m = mean time between facility failures.

It may be seen that reliability increases as mean time between failures (MTBF) increases. For a high degree of reliability, and for operationally significant values of t , we must have a large MTBF; thus, MTBF is another more convenient way of expressing reliability.

1.2.3 Experimental evidence indicates that the above formula is true for the majority of electronic equipments where the failures follow a Poisson distribution. It will not be applicable during the early life of an equipment when there is a relatively large number of premature failures of individual components; neither will it be true when the equipment is nearing the end of its useful life.

1.2.4 At many facility types utilizing conventional equipment, MTBF values of 1 000 hours or more have been consistently achieved. To indicate the significance of a 1 000-hour MTBF, the corresponding 24-hour reliability is approximately 97.5 per cent (i.e. the likelihood of facility failure during a 24-hour period is about 2.5 per cent).

1.2.5 Figure F-1 shows the probability of facility survival, P_s , after a time period, t , for various values of MTBF.

Note.— It is significant that the probability of surviving a period of time equal to the MTBF is only 0.37 (37 per cent); thus, it is not assumed that the MTBF is a failure-free period.

1.2.6 It may be seen that adjustment of MTBF will produce the desired degree of reliability. Factors which affect MTBF and hence facility reliability are:

- a) inherent equipment reliability;
- b) degree and type of redundancy;
- c) reliability of the serving utilities such as power and telephone or control lines;
- d) degree and quality of maintenance;
- e) environmental factors such as temperature and humidity.

1.3 Facility availability

1.3.1 Availability, as a percentage, may be expressed in terms of the ratio of actual operating time divided by specified operating time taken over a long period. Symbolically,

$$A = \frac{\text{Actual operating time (100)}}{\text{Specified operating time}}$$

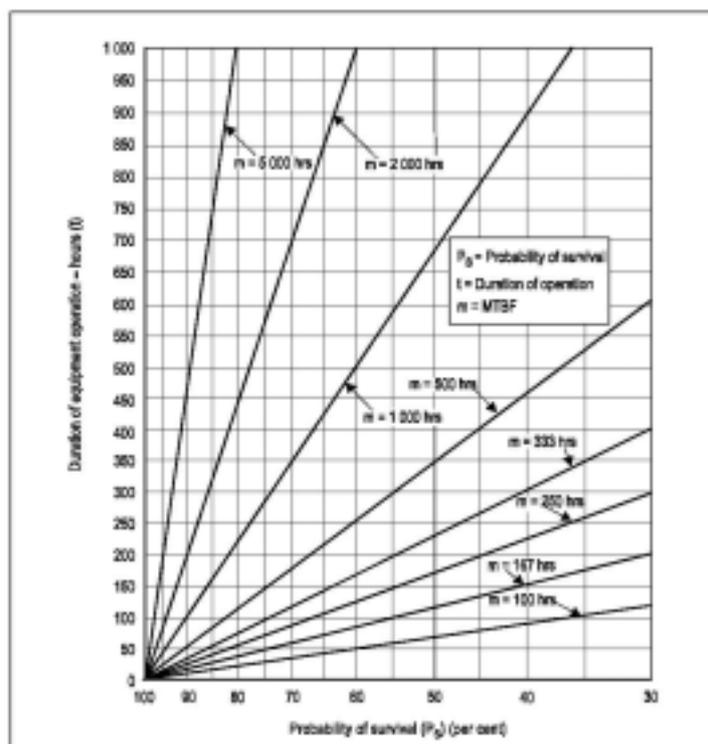


Figure F-1. Plot of $P_s = 100 e^{-t/m}$

For example, if a facility was operating normally for a total of 700 hours during a 720-hour month, the availability for that month would be 97.2 per cent.

1.3.2 Factors important in providing a high degree of facility availability are:

- a) facility reliability;
- b) quick response of maintenance personnel to failures;
- c) adequate training of maintenance personnel;
- d) equipment designs providing good component accessibility and maintainability;
- e) efficient logistic support;
- f) provision of adequate test equipment;
- g) standby equipment and/or utilities.

2. Practical aspects of reliability and availability

2.1 Measurement of reliability and availability

2.1.1 *Reliability*. The value that is obtained for MTBF in practice must of necessity be an estimate since the measurement will have to be made over a finite period of time. Measurement of MTBF over finite periods of time will enable Administrations to determine variations in the reliability of their facilities.

2.1.2 *Availability*. This is also important in that it provides an indication of the degree to which a facility (or group of facilities) is available to the users. Availability is directly related to the efficiency achieved in restoring facilities to normal service.

2.1.3 The basic quantities and manner of their measurement are indicated in Figure F-2. This figure is not intended to represent a typical situation which would normally involve a larger number of inoperative periods during the specified operating time. It should also be recognized that to obtain the most meaningful values for reliability and availability the specified operating time over which measurements are made should be as long as practicable.

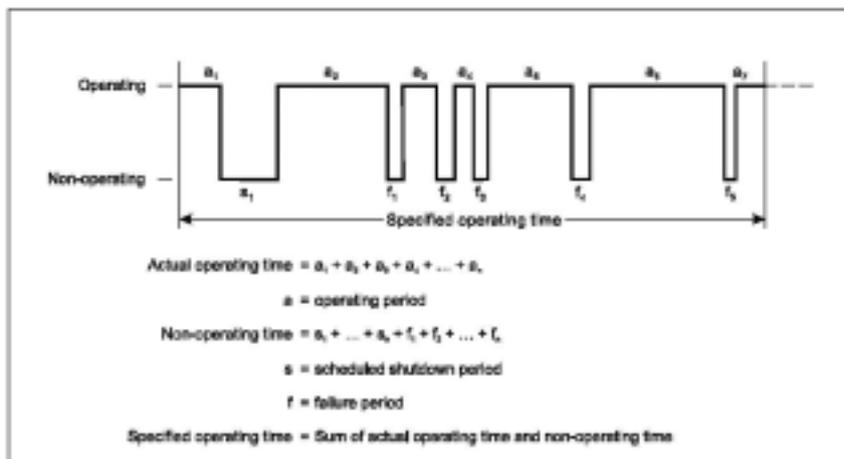


Figure F-2. Evaluation of facility availability and reliability

2.1.4 Using the quantities illustrated in Figure F-2, which includes one scheduled shutdown period and five failure periods, one may calculate mean time between failures (MTBF) and availability (A) as follows:

Let:

$$\begin{aligned}
 a_1 + a_2 + a_3 + a_4 + a_5 + a_6 + a_7 &= 5\,540 \text{ hours} \\
 a_1 &= 20 \text{ hours} \\
 f_1 &= 2\frac{1}{2} \text{ hours} \\
 f_2 &= 6\frac{1}{2} \text{ hours} \\
 f_3 &= 3\frac{1}{2} \text{ hours} \\
 f_4 &= 5 \text{ hours} \\
 f_5 &= 2\frac{1}{2} \text{ hours} \\
 \text{Specified operating time} &= 5\,580 \text{ hours}
 \end{aligned}$$

$$\text{MTBF} = \frac{\text{Actual operating time}}{\text{Number of failures}}$$

$$= \frac{\sum_{i=1}^7 a_i}{5}$$

$$= \frac{5\,540}{5} = 1\,108 \text{ hours}$$

$$\begin{aligned}
 A &= \frac{\text{Actual operating time} \times 100}{\text{Specified operating time}} \\
 &= \frac{\sum_{i=1}^7 a_i \times 100}{\sum_{i=1}^7 a_i + s_1 + \sum_{i=1}^3 f_i} \\
 &= \frac{5\,540}{5\,580} \times 100 = 99.3 \text{ per cent}
 \end{aligned}$$

APPENDIX C**OPERATIONAL VOICE AND DATA RECORDING****1. Introduction**

1.1 ATEL/ANAV services provided for ATS purposes may require the Part 171 provider to establish, operate and maintain facilities for the automatic recording of electronic information.

1.2 ICAO Annex 11 standards require the recording of all ATS operational communications and surveillance data. The primary purpose of such recordings is to provide information for SAR and for accident or incident investigation. The recordings may also be used for the purpose of legal evidence. Consequently, the availability, integrity, legibility and security of the recording procedures, recording facilities, and recording media management practice, must be assured.

1.3 This Appendix contains guidance on the standards pertaining to the management of recorded information by a Part 171 provider. The term 'tapes' is used generically in this Appendix and should be interpreted to also include other electronic storage media.

2. Programs to be recorded

2.1 The programmes to be recorded will be subject to agreement with the Part 172 ATS service provider, and will normally include:

- operational voice communications on all ATS channels;
- radar video programmes at all radar display positions;
- flight data (AFTN and ADS);
- Controller Pilot Data Link (CPDLC) data;
- equipment status records.

3. Responsibilities

3.1 At ATS units, the responsibility for providing the electronic recording of the above programs rests with the Part 171 staff. However, in some instances, particularly at those ATS units where Part 171 technicians are not resident, the routine management of tapes (i.e. the loading, changing, labelling and storage of the tapes) used for recording voice and data programs is undertaken by ATS staff. However, the usual situation is that that the Part 172 provider will request the Part 171 provider to provide the complete voice and data recording service, including the recording media management.

3.2 Whether the ATS staff or the Part 171 technicians undertake the tape management functions, the responsibilities and procedures of all the staff involved in voice and data recording functions should be formally agreed between the Part 171 and 172 providers.

4. Technician training

4.1 Part 171 technicians should receive training in the recording management functions they are responsible for. The technician's personal authorisation certificate is to identify those recording functions each technician is authorised to undertake.

5. Recording Procedures and Management of Recording Media

5.1 Part 171 providers should provide recording services in accordance with the following standards:

- **Recording of each operational position.** Voice recording and radar data recording facilities shall provide a chronological record of all voice communications and the radar program for each operational position of an ATS service.
- **Time injection.** All recordings shall incorporate time injection or stamping which will provide for the re-establishment of the actual time of events.
- **Status monitoring of recording facilities.** Status monitoring of all recording facilities shall be undertaken at all times that the ATS unit is operative.
- **Failure notification to operational positions.** For voice recording, a priority indication of a failure of the recording facility shall be presented to the relevant ATS operational position so that a manual record of communications can be kept by ATS.
- **Labelling of recording media.** All recording media (tapes) shall be clearly labelled or indexed unambiguously in accordance with documented procedures. Labels to include start and end times and the subject recording(s)/position(s).
- **Period of retention.** Recordings shall be retained in storage for at least 30 days. When the recording is pertinent to accident or incident investigations they shall be retained for longer periods until the service provider is advised that they will no longer be required.
- **Storage and security of recording media.** All recording media shall be stored in a manner that will ensure its safekeeping, in a locked, cabinet that is located in a secure area with controlled access.
- **Tape site holdings.** The quantity of removable recording media applicable to the equipment to be held on site shall be sufficient to cover the rotation period before tapes are re-used, with contingency provided for a loss of tapes through quarantining for investigations or unforeseen tape damage arising from equipment fault or normal wear.
- **Erasement of tapes.** Recording media that is designated for disposal shall be erased before disposal, or otherwise treated as classified waste. Magnetic storage media is to be bulk erased before disposal.
- **In the event of accident or incident.** On receipt of notice of an accident or incident from the ATSB or the Part 172 ATS provider, recorded media possibly pertinent to any possible investigation shall immediately be removed from the recording facilities, regardless of the available recording time remaining, and placed in a quarantine area. The removal of the media shall ensure that there is no loss of recording during the process. All such media shall be clearly labelled and held in the media quarantine storage area.

- **Designated release authority.** Recording media may only be released to a designated release authority that is a nominated official of the ATSB, CASA, or the Part 172 provider. The release authorities in the ATSB and the Part 172 provider are to be established under prior agreement with those bodies.
- **Retention of accident and incident tapes.** All tapes involved in an accident are to be permanently retained in the quarantine area until handed over to one of the designated release authorities. All tapes placed in the quarantine area must remain there until a formal release request is received from the designated release authority of the ATSB, CASA or the Part 172 provider. The actual release of the tapes must be by means of person-to-person handover. If no formal release request is received, the tapes shall continue to be held in quarantine until such time that one of the designated release authorities formally advises that the tape is not required.
- **On site review of accident or incident recordings.** A Part 171 provider may provide an on-site review of an accident or incident recording to the one of the designated release authorities of the ATSB or CASA or the associated Part 172 provider.

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