



Advisory Circular

AC 101-1(0)

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UNMANNED AIRCRAFT AND ROCKETS UNMANNED AERIAL VEHICLE (UAV) OPERATIONS, DESIGN SPECIFICATION, MAINTENANCE AND TRAINING OF HUMAN RESOURCES

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Advisory Circulars are intended to provide recommendations 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 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. BACKGROUND

4.1 Flight by unmanned aerial vehicles (UAVs) in controlled airspace and over populous areas presents problems to the regulator in terms of ensuring the safety of other users of airspace and persons on the ground. In the past, safety assurance would normally have been in the form of a prohibition of such activities, however, improvements in the technology associated with UAVs means that the potential exists for the operators of UAVs to comply with any safety imposition imposed by the regulator, which will ensure an adequate level of safety. The penalties for the operator may be increased complexity, increased weight, reduced payload and increased cost. In most cases, these factors will render commercial operations non-viable, however, as costs reduce and miniaturization continues, builders of UAVs may soon be able to develop cost effective solutions to current constraints.

4.2 The UAV comprises not just the aircraft, it also consists of the UAV ground control system, communications/datalink system, the maintenance system and the operating personnel. Thus, when considering requests for UAV operating approval, the regulator will assess the UAV system as a whole. The guidance contained in this advisory circular should be considered during development of a UAV system.

5. OPERATION OF UAVS IN CONTROLLED AIRSPACE

5.1 General

5.1.1 In general, when operating in controlled airspace, UAVs should be operated in accordance with the rules governing the flights of manned aircraft as specified by the appropriate ATS authority. UAVs should be able to comply with ATC regulations and equipment requirements applicable to the class of airspace within which they intend to operate.

5.2 Procedures and Authorisations

5.2.1 The procedures and authorisations in this Section apply specifically to UAV operations within controlled airspace and include procedures and authorisations required to govern UAV take off, climb, descent, and landing. These are required to provide for the pre co-ordination and procedures necessary to safely recover a UAV through controlled airspace should UAV system failure preclude the ability to remain outside controlled airspace.

5.2.2 These procedures apply specifically to those UAVs that can be monitored and controlled in real-time from a UAV control station. Nothing contained in this document is meant to preclude operation of a UAV in an “autonomous” or programmed flight mode, provided that UAV performance and designated ATC communication circuits are continuously monitored by the UAV operating crew, and that the UAV system and crew are capable of immediately taking active control of the UAV.

5.3 Flight Manual

5.3.1 UAV flights in controlled airspace should only be conducted if an approved UAV Flight Manual is immediately available to the UAV controller within the UAV control station.

5.3.2 CASA may approve flights in controlled airspace by non-certificated UAVs. In this case, CASA may require availability to the controller of reference material appropriate to the UAV being operated.

5.4 Flight Testing

5.4.1 UAV flight testing and certification flights should normally be conducted outside controlled airspace, however, flights within line of sight of the controller may be carried out in an approved operating area in accordance with an approval issued by CASA subject to ATC clearance.

5.5 Rules of Operations

5.5.1 All flights outside visual sight of the controller should be conducted:

- (a) in accordance with conditions specified in an approval issued by CASA;
- (b) in an approved operating area; or
- (c) in a known traffic environment — in accordance with regulations governing the flight of a manned aircraft.

5.6 Flight Notification

5.6.1 Where a UAV flight is to be conducted in airspace shared with manned aircraft, flight notification may be in the form of a NOTAM or may be filed in accordance with the normal procedures for IFR flight. The flight plan should indicate that the aircraft is unmanned and provide as much detail as possible concerning the nature of the flight.

5.6.2 The UAV may not enter controlled airspace without approval of the controlling authority; this would normally be in the form of an airways clearance. UAV flight procedures when operating within controlled airspace are as directed by the controlling authority.

5.6.3 When the operation of a UAV does not involve flight higher than 400 ft AGL or within close proximity to an aerodrome, the operator may exercise discretion in lodging flight notification. Where there is doubt, the operator should seek guidance from CASA.

5.7 Collision Avoidance

5.7.1 Unless the controller of a UAV is provided with sufficient visual cues to enable the acquisition and avoidance of other air traffic, UAV flights in controlled airspace will be treated as IFR flights, subject to ATC control.

5.7.2 CASA may require a large UAV to be equipped with an SSR transponder, a collision avoidance system or forward looking television as appropriate for the type of operation.

5.8 Noise Abatement

5.8.1 UAVs should follow applicable local noise abatement procedures at their launch and recovery sites such as operating hours, directed flight paths/altitudes, etc., consistent with safe operation of the UAV.

5.9 Take off and Landing

5.9.1 When a UAV is operated at an aerodrome normally used by manned aircraft, take off and landing should be in accordance with normal procedures and the UAV should follow ATC instructions unless otherwise authorized.

5.9.2 For UAVs, which are manually controlled for, take off by the launch controller, VFR procedures, local airfield pattern regulation, and VFR weather minimums for the class of airspace will apply. After take off, the launch controller should manoeuvre the UAV as required to maintain visual contact. During take off and evolution from direct to autonomous control, the UAV system must be monitored by the UAV supervising controller to verify UAV system status and compliance with navigational and flight path clearances. The supervising controller is responsible during this phase for collision avoidance but should allow the launch controller to manoeuvre the UAV as directed by ATC under IFR procedures.

5.9.3 For UAVs, which are manually controlled for landing by the launch controller, VFR procedures, local airfields pattern regulations, and VFR weather minimums for the class of airspace, will apply. The UAV should be flown according to ATC instruction with traffic separation provided by ATC, to a pre-designated recovery point, entering a holding pattern until visual sight of the UAV is acquired by the supervising controller. At this point, the supervising controller assumes responsibility for traffic separation and collision avoidance. The supervising controller should monitor the recovery evolution to manual control to verify UAV performance and compliance with navigational and flight path clearances.

5.9.4 For UAVs equipped with automatic take off and landing systems, the supervising controller should monitor UAV system status and compliance with ATC clearances, making flight path corrections as required and/or directed by ATC.

5.10 Emergency Procedures

5.10.1 The UAV flight plan should include information and procedures regarding pre-planned emergency flight profiles in the event positive data link control of the UAV is lost. Dependent on system capabilities, these profiles could include:

- (a) UAV autonomous transit to a pre-designated recovery area followed by an autonomous recovery;
- (b) UAV autonomous transit to a pre-designated recovery area followed by activation of a flight termination system (FTS).

5.10.2 *Abort Procedures.* Specific abort and flight termination procedures should be developed by the supervising UAV controller, and should be briefed to ATC as required. At a minimum, information regarding pre-programmed loss-of-link flight profile (including termination actions should the control link not be re-established), flight termination capabilities, and UAV performance under termination conditions should be briefed.

5.10.3 The data link should be continuously and automatically checked and a real time warning should be displayed to the UAV crew in case of failure. In case of loss of data link other than intermittent loss of signal or during programmed periods of outage, SSR 7700 code should be squawked both automatically and manually by the UAV controller and emergency recovery procedures should be executed. The parameters, which determine acceptable intermittent loss of signal and total loss, will be set by the manufacturer. A UAV, which has lost total control data link and is conducting an autonomous

pre-programmed flight profile to termination or recovery will be handled by ATC as an emergency aircraft.

5.10.4 In the event of communications failure between the supervising UAV controller and ATC, the UAV should squawk SSR code 7600 (mode 3A) and attempt to establish alternate communications. Pending reestablishment of communications with ATC, the UAV will be controlled in accordance with last acknowledged instruction or should be commanded to orbit in its current position. If communications with ATC are not re-established, the UAV sortie should be aborted.

5.11 Meteorological Conditions

5.11.1 Weather minimums for UAV flight should be determined by the equipment and capabilities of each specific UAV system, the qualifications of the supervising controller and the class of airspace in which the flight is conducted.

5.11.2 *Icing Conditions.* UAVs should not be flown in conditions where icing may form without proper anti-ice/de-icing equipment.

5.11.3 *Visibility.* For UAVs operating under VFR procedures for launch and recovery, visibility requirements are as defined for the type of airspace, but in no case less than 5 km and 1000 foot ceiling. For UAV systems equipped with an internal automatic precision landing aid such as those based on the Global Positioning Systems (GPS), weather minimums should be sufficient for an external observer to visually verify the UAV flight path and alert the UAV controllers of unsatisfactory landing approach in sufficient time to execute a missed approach; as such, minimum visibility is dependent on UAV approach speed, size, and performance capabilities.

5.12 Co-ordination/Authorisation with CASA

5.12.1 Subject to review, CASA may approve UAV systems for operations within published guidelines. The review will include but not be limited to UAV certification, controller qualification, flight planning, weather minima, installed equipment and maintenance procedures. Operations outside published guidelines will require special approval on a case-by-case basis.

5.12.2 *Local Operations.* Prior to the commencement of UAV operations, UAV operating personnel should establish Local Operating Procedures for UAV operations with the appropriate ATS authority. Specific procedures should be established for ground UAV operations, flight plan filing procedures, integration of UAVs into local traffic pattern, UAV take off and landing procedures, local airspace restrictions, noise abatement procedures, right-of-way rules, communications requirements, and UAV emergency procedures. Designated “safe areas” will be established for emergency UAV holding and flight termination.

5.13 Interfacing with Air Traffic Services

5.13.1 UAVs operating within radar controlled airspace should be equipped with a SSR transponder capable of operating in modes 3 A and C. The supervising UAV controller should have the capability to change the SSR code and squawk identification when required.

5.13.2 *Flight Deviations.* All requests for flight deviations should be made by established procedures to the appropriate ATS authorities.

5.13.3 Communications. The supervising UAV controller should initiate and maintain two way communications with the appropriate ATC authorities for the duration of any flight.

5.13.4 Position Reporting. UAVs operating in controlled airspace should be continuously monitored for adherence to the approved flight plan by the supervising UAV controller. The supervising UAV controller should make all position and other required reports to the appropriate ATC unit. Automatic Dependent Surveillance systems (ADS) may be suitable for this purpose.

5.13.5 Tracking. Where radar coverage is provided, ATC will continuously monitor the flight path of the UAV. Outside of radar coverage, CASA may require the fitment of additional equipment to facilitate tracking of the UAV and separation from other aircraft. ADS or similar equipment may be suitable for this purpose.

5.13.6 UAV Identification. Each UAV flight should have some means of informing ATC that the flight is unmanned. Therefore, all UAV call signs should include the word 'UNMANNED'.

5.14 Line-of-Sight Operations

5.14.1 For purposes of UAV operations within controlled airspace, 'line-of sight' refers to visual versus radio data link line-of-sight. Accordingly, the only applicability to operations as discussed in this document is to the take off and landing phase.

- (a) *Mission Briefing.* The following information should be included in any flight authorisation requests and flight plans when applicable. When UAV take off and landing is to be accomplished by a launch controller under visual conditions, the supervising UAV controller should ensure appropriate airport/ATC personnel are briefed on the specific evolution of control to be conducted and are aware of the specific UAV operating procedures required. In addition to the information required for the flight plan, procedures for UAV taxi, take off, separation, local traffic pattern restrictions, controller hand-over, departure, abort to recovery, and flight termination should be briefed.
- (b) *Communication Requirements.* Communication requirements for UAV line-of-sight operations are as required for the class of airspace in which the flight will occur. When the flight controller is not co-located with the launch controller, the launch and recovery control station as well as the primary UAV control station must have established communications with ATC authorities responsible for the area of flight prior to commencement of flight.

5.15 Operations Beyond Line-of-Sight

5.15.1 Mission Briefing. The following information should be included in any flight authorization requests and flight plans when applicable.

5.15.2 Performance Requirements. Any performance requirements or limitations unique to the UAV should be provided to the ATC unit as appropriate prior to the flight. The pilot in command should not request any clearance (i.e. SID, precision approach, altitude, holding pattern) that the UAV is not capable of executing within its approved flight envelope.

5.15.3 Abort Procedures. Specific abort and flight termination procedures should be developed by the supervising UAV controller, and should be provided to ATC as required.

At a minimum, information regarding pre-programmed loss-of-link flight profile (including terminal actions should the control link not be re-established), flight termination capabilities, and UAV performance under termination conditions should be briefed.

5.15.4 *Direct Communications Required.* Communications between the supervising UAV controller and the controlling ATC authority should be as required for the class of airspace in which operations occur. The UAV control station should utilize a communications architecture, which interfaces with existing ATC communications equipment and procedures, so that the fact that the supervising UAV controller is on the ground is transparent to ATC personnel. Upon check-in with ATC personnel, the supervising controller should request a direct telephone number for ATC for contingency use should radio communications fail.

5.15.5 *Chase Plane Requirements.* Chase planes are not required for UAVs operating in controlled airspace when on approved IFR flight plans and in accordance with the procedures outlined in this AC. During flights or portions of flights under IFR procedures if a chase plane is utilized, the chase plane must be incorporated into the IFR flight plan. In such a case, the flight will be classified as a formation flight, and will have the same right-of-way status as aircraft engaged in towing. A chase plane should not be utilized in conjunction with UAV IFR flight operations when VFR conditions applicable for the class of airspace cannot be maintained.

5.15.6 *Qualification of the Supervising UAV Controller.* At a minimum, the supervising UAV controller should have completed the ground training applicable to the issue of an instrument rating in order to operate UAVs in controlled airspace under an IFR clearance.

5.16 Operation of Equipment

5.16.1 *Equipment Requirements.* The following equipment should be fitted and operable prior to a flight under IFR procedures:

- (a) *Position Lights.* These lights should normally be turned on at all times the UAV is in motion including taxi, takeoff, flight, and landing, unless otherwise approved by CASA.
- (b) *Anti-Collision Lights.* These lights should normally be turned on at all times the UAV is in flight unless otherwise directed by CASA.
- (c) *Transponder.* The supervising controller should have the capability to turn the transponder on and off, manually select codes, and squawk and identification as directed, while the UAV is airborne.
- (d) *Radios.* UAV communication architecture should allow the supervising UAV controller to communicate with the ATC facilities controlling the UAV regardless of its location.
- (e) *Acquisition light.* The light should be operable on command as an aid to identification of the UAV.

5.16.2 *UAV System and Attitude Displays.* The UAV system should be capable of displaying to the supervising controller all aircraft system and attitude information necessary for safe operation, control, and navigation.

5.16.3 *Flight and Voice Recorder.* Where recording systems are required by CASA to record UAV systems and navigational status, and radio and intercom voice communications, such systems should be operable for the duration of the flight. This system will normally be installed within the UAV control station.

5.16.4 Flight Termination. UAVs should not operate within controlled airspace without an operable flight termination system or a system which provides autonomous recovery to a predetermined recovery area following failure to maintain safe flight control or operation within parameters agreed by the operators and CASA.

6. OPERATION OF UAVS OVER POPULOUS AREAS

6.1 General

6.1.1 The paramount factor to be addressed when considering flight by UAVs over populous areas is the safety of people and property on the ground. The risk of injury or damage resulting from the crash of a UAV is dependent upon a variety of factors:

- (a) mass of the UAV;
- (b) composition of the UAV;
- (c) velocity of the UAV at impact.

6.1.2 The potential of the UAV to crash is also dependent upon a variety of factors:

- (a) integrity of the airframe;
- (b) reliability of the engine;
- (c) reliability of control systems;
- (d) reliability of the control communications system;
- (e) ability of the controller.

6.1.3 CASA is charged with the responsibility of ensuring the safety of flying operations, the following guidance in this section has been developed for that purpose.

6.2 Procedures and Authorisation

6.2.1 The procedures and authorisations in this Section apply specifically to UAV operations over populous areas and are additional to any requirements specified in Section 5 where populous areas and controlled airspace are coincident.

6.2.2 These procedures apply specifically to those UAVs that can be monitored and controlled in real-time from a UAV control station or which are operated by line of sight control. Nothing herein is meant to preclude operation of a UAV in an 'autonomous' or programmed flight mode, provided that UAV navigation performance can be continuously monitored by the UAV controllers, and that the UAV system and crew are capable of immediately taking active control of the UAV.

6.3 Flight Manual

6.3.1 UAV flights over populous areas should be conducted only if an approved UAV Flight Manual is immediately available to the supervising UAV controller within the UAV control station. (See paragraph 5.3).

6.4 Flight Testing

6.4.1 UAV flight testing and certification may not be carried out over populous areas.

6.5 Rules of Operations

6.5.1 UAV flights over populous areas may not be conducted except:

- (a) by a UAV certificated for such flight; and
- (b) in accordance with conditions specified in an approval issued by CASA; or

- (c) at an altitude which would allow the UAV to clear the area in the event of engine failure.

6.5.2 Generally, the requirement for certification will limit flights over populous areas to large UAVs, however, the designer of a small UAV may apply for a type certificate subject to the requirements of CAR 1998 Part 21 and accompanying advisory material. Provided that the aircraft meets CASA's requirements, the UAV may be eligible for certification.

6.6 Noise Abatement

6.6.1 UAVs should follow the principles of noise abatement procedures during flight over populous areas consistent with safe operation of the UAV.

6.7 Emergency Procedures

6.7.1 The UAV flight plan should include procedures to be followed in the event of:

- (a) engine failure;
- (b) loss of data link;
- (c) loss of control;
- (d) failure of navigation;
- (e) airframe damage.

6.7.2 Emergency procedures may include the use of recovery devices, such as parachutes, where a failure subjects persons or property to immediate danger or, where the immediate risk of hazard from failure is minimal:

- (a) UAV autonomous transit to a pre-designated recovery area followed by an autonomous recovery;
- (b) UAV autonomous transit to a pre-designated recovery area followed by activation of a flight termination system.

7. UAV OPERATION OVER UNPOPULATED AREAS

7.1 Small UAVs

7.1.1 Provided that a small UAV is operated not above 400ft AGL and remains clear of designated airspace, aerodromes and populous areas, there are no restrictions imposed upon the operation of a small UAV. The operator is responsible for ensuring that the UAV is operated safely and remains clear of potential low level traffic, structures, powerlines etc, except where operation in close proximity is part of an operation authorised on the operator's operating certificate. The operator should consider the benefit of a thorough reconnaissance of the proposed route beforehand.

7.1.2 Where a person wishes to operate a small UAV above 400ft AGL, that person must do so in accordance with conditions imposed by CASA. Such conditions may specify:

- (a) maximum altitudes;
- (b) communication requirements;
- (c) operating times;
- (d) operating area limitations;
- (e) UAV equipment etc.

7.2 Large UAVs

7.2.1 A person wishing to operate a large UAV may only do so if it has been issued with Certificate of Registration and either an Experimental certificate or a certificate of airworthiness in the Restricted category and is operated in accordance with an approval issued by CASA.

8. DESIGN SPECIFICATION FOR UAV SYSTEMS

8.1 General

8.1.1 A UAV system comprises both airborne and ground based equipment and should be designed to minimize the potential for a failure of any component to prevent continued safe flight and recovery of the UAV. Because of the wide range of airborne vehicles and ground stations which potentially form part of a UAV system and the wide diversity of possible operations, some design criteria may apply to all UAV systems and some may be unique to a type or class of UAV. Thus, the potential developer of a UAV system is encouraged to consult with CASA prior to commencement of a project. The following design criteria are for general guidance only.

8.1.2 The guidance pertains to the design of seven critical UAV subsystems for operations outside of an approved operating area:

- (a) flight control;
- (b) electrical;
- (c) communications/data link;
- (d) navigation;
- (e) propulsion;
- (f) UAV control station;
- (g) flight termination.

8.2 Design Criteria

8.2.1 Flight control design should facilitate control of the UAV by the controller and provide unambiguous operations and clear indications of UAV flight status. Design criteria should minimise the potential for human error. All flight indications and warnings necessary to ensure safe control of the UAV flight path should be provided. In particular, the supervising controller should be informed of any degraded mode of operations due to any failure, including cases in which there is an automatic switching to an alternate or degraded mode of operation. The control station should include a diagnostic and monitoring capability for the status of the vehicle. Real time, direct communications/surveillance, and continuous data transmission capability should be provided.

8.2.2 A UAV system should incorporate a fail-safe flight termination system (FTS) or autonomous recovery system (ARS), which provides recovery to a predetermined recovery area. This system should operate on demand or automatically following failure to maintain safe flight control or operation within parameters agreed by the operators and CASA. The need for this feature will be given greater emphasis where operations are planned over or close to populous areas or where they will be within or close to controlled airspace. Less emphasis on a FTS/ARS will be accorded for those UAVs operating in remote areas.

8.3 Safety Standards

8.3.1 UAV operations should be as safe as manned aircraft insofar as they should not present or create a hazard to persons or property in the air or on the ground greater than that created by manned aircraft of equivalent class or category.

8.4 Registration

8.4.1 CASA requires the operator of a large UAV to hold a certificate of registration for the aircraft and to maintain the information required for compilation of UAV reliability and failure rates.

8.4.2 Although a small UAV is exempt from the requirement for registration, each UAV should have affixed to it a durable identification plate inscribed with appropriate marks to identify ownership and identity of the particular aircraft.

8.5 Technical Issues and Related Criteria

8.5.1 Proven fail-safe principles will govern the design of UAV systems. System independence and adequate redundancy and back-up features should provide for safe functioning of the UAV in the event of a system failure. Redundancy of system management functions also should be built into the system. A description of what constitutes 'fail-safe' design appears at Appendix 2.

8.5.2 UAV system design should provide for a failure detection apparatus (pre-flight and in-flight built-in-test) that will immediately notify the supervising controller of a system failure. Adequate provision for the safe operation of the UAV following a system failure should be provided. Potential human UAV controller errors should be considered by UAV designers and adequate provisions should be taken to minimize the effects of such errors. Additionally, an engineering analysis of any UAV design should be submitted to CASA to assist in the further review of UAV design criteria. The following are considered critical system design criteria for UAVs.

8.5.3 *Software.* All UAV system software should be verified and validated in accordance with RTCA document DO-178B or equivalent. Safety critical software may be subject to additional verification by CASA.

8.5.4 *Flight Management System.* The flight management system includes UAV controller controls, sensors, computers and actuation parts necessary to control the UAV. Any single failure of the flight control system should not affect the ability to control UAV recovery. Provisions for possible reversion to degraded modes of operation also should be incorporated into flight management system design. Provision for continued control of the UAV should be made in the event of a propulsion or power generation system failure.

8.5.5 *Electrical System.* The electrical system should provide sufficient power and endurance to ensure safe operations and recovery throughout all phases of flight even in the event of an emergency. Consideration should be given to the ability to shed non-essential load in the event of a power generation failure. Similar considerations apply to the ground control station.

8.5.6 *Communications System/Data Link.* Approval for all frequencies used in UAV operations must be obtained from national authorities. Data link signal strength should be continuously monitored and appropriate maximum data link range cues should be provided to the supervising controller. Any single failure of the communications system (uplink or downlink) should not affect normal control of the UAV. Uplinks/downlinks are sensitive

to electromagnetic interference (EMI) and should be adequately protected from this hazard. Provisions for direct communications between the supervising controller and the appropriate ATC via two way radio should be incorporated in the system design.

8.5.7 Navigation System. The UAV navigation system should meet the required navigation performance standards of the flight rules and the specific requirements for the airspace in which the operations are to be conducted. Only navigation systems meeting the requirements for 'sole means navigation' will normally be considered for flights under IFR and in controlled airspace.

8.5.8 Propulsion System. All essential elements of the propulsion system should meet required reliability standards as approved by CASA.

8.5.9 UAV Control Station. In its simplest form, the UAV control station may consist of a hand held transmitter incorporating basic flight controls and rudimentary displays similar to those of a model aircraft. Control stations for UAV operations beyond line of sight should include controls and displays for aircraft attitude and performance, propulsion, navigation, aircraft systems and sensor operation as well as flight system and voice recording equipment. CASA will assess the control station against the requirement to assure the safety of air navigation of the UAV.

8.5.10 UAV Structure. UAV aircraft structure should be designed to withstand the maximum expected operational loads as determined by the intended operational flight envelope of the UAV. Structural design of small UAVs should meet the standards applicable to the construction of model aircraft of the same weight category, which may be obtained from the Model Aircraft Association of Australia (MAAA). Large UAVs should comply with the appropriate design requirements advised by letter in accordance with CAR 1998 Part 21.

8.5.11 Flight Termination System. A UAV system should incorporate a fail-safe flight termination system (FTS) or autonomous recovery system (ARS), which provides recovery to a predetermined recovery area. This system should operate on demand or automatically following failure to maintain safe flight control or operation within parameters agreed by the operators and CASA. The need for this feature will be given greater emphasis where operations are planned over or close to populous areas or where they will be within or close to controlled airspace. Less emphasis on a FTS/ARS will be accorded for those UAVs operating in remote areas.

8.6 Equipment requirements

8.6.1 The following equipment and instrument capabilities should be installed on the UAV and/or be available to the supervising controller in order to comply with the requirements for safe flight under IFR procedures:

- (a) *Position Lights.* UAVs should have position lights installed as required. The UAV supervising controller may be given the capability to turn these lights on and off while the UAV is airborne, however they will normally be turned on at all times the UAV is in motion including taxi, takeoff, flight, and landing, unless otherwise directed by CASA.
- (b) *Anti-Collision Lights.* UAVs should have strobe lights installed as required. The UAV supervising controller may be given the capability to turn these lights on and off while the UAV is airborne, however they will normally be turned on at all times the UAV is in flight unless otherwise directed by CASA.

- (c) *Transponder.* For operation in controlled airspace, and where otherwise required by CASA, UAVs should have an operable SSR transponder installed. The supervising controller should have the capability to turn the transponder on and off, manually select codes, and squawk and identification as directed, while the UAV is airborne. CASA may approve operation without in-flight resettable SSR codes and identification capability on a case by-case basis.
- (d) *Radios.* The supervising controller should have full and immediate access to two way radios within the UAV control station as required to maintain communications. UAV communication architecture will be designed to allow the supervising controller to communicate with the ATC facilities and UAV ground crews controlling the UAV regardless of their location.
- (e) *Navigation Systems.* Navigational information should be available to the supervising controller in a format required for reporting in accordance with ATC requirements.
- (f) *UAV System and Attitude Displays.* The UAV system should display to the supervising controller all aircraft system and attitude information required for safe operation, control, and navigation.
- (g) *Flight and Voice Recorder.* CASA may require the UAV system to have a recorder to record UAV systems and navigational status, and radio and intercom voice communications. This recorder will normally be installed within the UAV control station.
- (h) *Built-in Test.* Some aircraft may require procedures designed to exercise critical components and systems and provide an indication of their state of health together with an appropriate display. This information may be available to the ground station during flight. A set of diagnostic procedures should also be included to aid fault location. For in-flight use this should include remaining emergency power reserve.

9. UNMANNED AERIAL VEHICLE CERTIFICATION

9.1 General

9.1.1 UAVs may be certificated in the Experimental or the Restricted category under CAR 1998 Part 21. An experimental certificate would allow a builder to conduct research and development, demonstrate compliance, train controllers, and exhibit and demonstrate a UAV. The Restricted certificated would be required for any other use. Each application for certification will be assessed on its merits. Applicants are advised to make contact with CASA as early as possible in the design stage so that a standard (which will be advised in writing) can be agreed.

9.1.2 UAV control stations may be approved as a discrete element of a UAV system where such stations are capable of adaptation to different UAV types.

9.1.3 Because of the wide range of types of aircraft and methods of construction potentially forming part of a UAV system and the wide diversity of possible operations, there will be some variety in the requirements pertaining to the certification of individual UAVs. Thus, the potential developer of a UAV system is encouraged to consult with CASA prior to commencement of a project.

10. UNMANNED AERIAL VEHICLE SYSTEM MAINTENANCE

10.1 General

10.1.1 A large UAV is a Class B aircraft and must be maintained in accordance with the relevant provision of CAR 1988 Part 4A. UAVs other than large UAVs should be maintained in accordance with standard procedures applicable to model aircraft.

10.1.2 For purposes of UAV airworthiness, the UAV and all support equipment (e.g., UAV control station) should be considered as components of a UAV system. Each manufacturer of a large UAV should develop, prepare and provide a set of maintenance and inspection manuals for operational use of their UAV. These manuals should include guidelines for appropriate skill levels to perform required inspection, maintenance and repair tasks. The manufacturer of UAVs should provide vehicle specific training as required.

10.2 Maintenance and Repair

10.2.1 Subregulation 21.50 (2) of CAR 1998 requires the holder of design approval for an aircraft to furnish at least one set of instructions for continuing airworthiness in accordance with applicable airworthiness standards to the owner of each aircraft. Thus, the mechanism is in place for CASA to determine and impose maintenance requirements on a large UAV.

10.2.1 Maintenance practices vary greatly with the design and construction of each type of UAV. Standard aircraft maintenance practices should be followed to the maximum extent possible. Considerable valuable information can be obtained from the manufacturer of the vehicle and can be used as a basis to establish inspection and repair information.

10.2.2 Maintenance and repair of UAVs should follow manufacturer's guidance. Personnel performing maintenance and repair should be appropriately trained and qualified.

10.2.3 Maintenance of the ground control equipment should be governed by manufacturers recommended period of inspection and overhaul as applicable.

10.3 Manufacturer's Guidance

10.3.1 For each model of UAV produced, the manufacturer should provide a set of procedures for the following:

- (a) *Inspections*. Pre-and post flight inspections including frequency, equipment and skill levels required to perform the inspections.
- (b) *Maintenance*. Diagnostic procedures, repair and replacement of components, including equipment and skill level required to perform.
- (c) *Repair Station*. Recommendations on minimum and preferred equipment for field and base facilities.
- (d) *In-flight Diagnostics*. Mission abort thresholds and recommended actions for in-flight systems shutdown and return to base.
- (e) *Flight Termination System (FTS)*. FTS components should be verified to be within calibration tolerance at intervals established by the manufacturer. Satisfactory status of the FTS should be verified by the supervising controller prior to each flight.
- (f) *Collision Avoidance System*. The Collision Avoidance System, if installed, should be exercised prior to each flight in accordance with manufacturers recommended procedures.

- (g) *Checklist*. The manufacturer should provide a set of check list procedures to be followed prior to and during any flight.
- (h) *Data Collection*: Each autonomous element of a UAV system (e.g. aircraft, control station, recovery system) should have a unique identification number. Critical components within each element are also to be assigned unique identification numbers. Details of hours flown, hours run, cycles undertaken and maintenance/inspections carried out on each component/element are to be recorded.

11. TRAINING REQUIREMENTS FOR CONTROLLERS OF UNMANNED AIR VEHICLES

11.1 General

11.1.1 Training requirements are essential to the establishment of effective UAV operations. A defined set of training requirements must continue to be refined on the basis of continued experience from ongoing UAV operations. Adoption of these requirements by the segments of aerospace industry involved in UAV training and operation will ensure that appropriate safety levels are maintained and public trust in UAV operations is gained.

11.2 Training and Operations Criteria

11.2.1 Some of the difficulties currently encountered in establishing a set of acceptable UAV training and operations criteria result from the wide variety of UAV sizes and UAV types with widely differing technology architecture envisioned for production and from diversity of UAV operation. Some UAV training criteria may apply to all UAVs and some may be unique to certain types and classes of vehicles.

11.2.2 Future UAV training and operational provisions will eventually accommodate virtually all classes of UAVs and all types of UAV use. The data collected and experience gained in future civil UAV operations will also provide CASA and the aerospace industry with the expertise necessary to adequately determine the best method of controlling and integrating UAV operations with existing procedures.

11.3 Medical Standards

11.3.1 Working in a relatively benign environment, the medical requirements for UAV controllers may not need to be as stringent as for conventional aircrew. However, as a rule, UAV controllers involved in command and control of UAV operations should be assessed as medically fit and should abstain from the use of stimulants, drugs or alcohol in the same manner as the driver of a motor vehicle.

11.4 Ground Training

11.4.1 UAV controllers should have completed thorough ground instruction equivalent to that undertaken by aircrew of comparable aircraft. The depth of knowledge required will depend on the operating environment. The following topics, which are not exhaustive, should be covered:

- (a) aerodynamics, including effects of controls;
- (b) aircraft systems;
- (c) performance;
- (d) navigation;
- (e) meteorology;

- (f) airspace;
- (g) rules of the air;
- (h) radio telephony procedures; and
- (i) emergency procedures management.

11.4.2 Ground instruction should be delivered by personnel with appropriate experience and/or qualifications in the relevant topic.

11.5 Flight Training

11.5.1 UAV controllers should have undertaken thorough practical training in the control of a UAV in flight, which may consist of a proportion of simulated flight training. The training should enable the controller to demonstrate that he/she can control a specific UAV throughout its design parameters and potential operating conditions, including dealing correctly with emergencies and system malfunction.

11.5.2 All instruction should be conducted by personnel who are acceptable to CASA as being qualified to conduct UAV flight training.

11.6 Proficiency/Currency Requirements

11.6.1 The currency/proficiency of UAV controllers should be maintained by regular practice, which may be computer based. Additionally, all UAV controllers should be subject to periodic theoretical and practical examination. These requirements should be addressed in the operations manual.

11.7 Controller Qualification

11.7.1 Since UAV systems vary so widely and missions envisioned so diverse, co-ordination between the UAV manufacturer and CASA to build a consensus as to the appropriate level of training should be exercised. UAV systems which operate in an IFR environment will require a high level of training or experience, while operation and use of the UAV system in remote areas and G airspace, determined by CASA as posing no threat to public safety or property, may require only a minimal level of training.

11.8 Initial Certification

11.8.1 UAV controllers should be required to demonstrate satisfactory knowledge of ground and flight operations via oral/written examinations and initial flight check.

11.9 Maintenance Personnel

11.9.1 The training required of maintenance personnel will vary according to the complexity of the UAV system. CASA will require that a person intending to operate a UAV system ensures that persons required to perform maintenance on a large UAV system are trained to the standard shown in CAR 1988 Part 4A.

12. GETTING APPROVAL

12.1 Who Needs Approval

12.1.1 A person considering the use of a UAV for a particular task should first consider whether the operation will need approval from CASA before it can commence. A small UAV will not require approval if its operation remains clear designated airspace, aerodromes and populous areas and remains below 400ft AGL. The operator is responsible

for ensuring that the UAV is operated safely and remains clear of potential low level traffic, structures, powerlines etc, except where operation in close proximity is part of an operation authorised on the operator's Operating Certificate (OC). All other operations will require approval from CASA. This approval is not to be confused with an Operator Certificate, which is required for all commercial UAV operations.

12.2 Types of Approval

12.2.1 Operating Area Approval. An operating area approval may be for a temporary area approved for a single UAV operation, a semi-permanent area established for a regular UAV activity or a permanent area established for a special purpose. A permanent or semi-permanent area may be established in order to alert other users of airspace to the possible presence of UAVs in the area. CASA will negotiate with the UAV operator, Airservices Australia and the Regional Airspace Users and Advisory Committee (RAPAC) prior to requesting the declaration of a particular area as a 'Danger Area'.

12.2.2 Operator Approval. An operator certificate (OC) is required for all commercial use of UAVs. CASA may issue an OC if it is satisfied that the person can conduct the operation safely and will thus need to be satisfied that the operator fulfils the minimum requirements for issue of an OC and any other requirements necessary according to the type of operation and the location of the intended operation. The OC will have appropriate conditions imposed on it and may contain approval for unrestricted operations of a type described in the operations manual.

12.2.3 Aircraft Approval. Approval for a particular UAV to fly in Australian airspace is in the form of a certificate of airworthiness (CofA). A CofA is not necessary for a small UAV, which is not normally permitted to fly over populous areas or in controlled airspace. However, if a small UAV is constructed in accordance with certain design standards, it may qualify for the issue of a CofA in the same manner as a large UAV. Approval to operate in particular airspace or over certain areas will then be dependant upon conditions imposed on its CofA.

12.2.4 Operating Approval — Small UAVs. A small UAV, which is to be operated above 400ft AGL will need CASA approval. The approval will be in written form covering:

- (a) who may operate the UAV;
- (b) operating area;
- (c) operating altitudes;
- (d) operating times;
- (e) notification requirements:
 - (i) AIC;
 - (ii) NOTAM;
- (f) communication requirements:
 - (i) broadcast;
 - (ii) telephone, etc;
- (g) limitations and restrictions; and
- (h) safety requirements.

12.2.5 Before granting this approval, CASA will consider the nature of the proposed operation and other traffic using the airspace and may require compromises in order for the UAV operation to fit in with other traffic.

12.2.6 Operating Approval — Large UAVs. Operating approval is required for all large UAVs. Approval for operation outside controlled airspace will be given in the same manner as for small UAVs. For operation over populous areas or in controlled airspace, approval will be given in accordance with limitations in both the CofA and the operations manual of the operator.

12.3 Who May Give Approval

12.3.1 The CASA office responsible for the area in which the UAV operation is to take place may approve the operation subject to any conditions, which are considered necessary in the interest of safety. Such conditions should be based upon but not limited to consideration of:

- (a) UAV characteristics;
- (b) population density;
- (c) airspace requirements;
- (d) nature of other air traffic;
- (e) timing and duration of the activity.

12.4 Submission of Requests for Approval

12.4.1 The advance notice required for the granting of an approval to operate a UAV depends upon the degree to which arrangements are already in place and the complexity of the operation. For instance, if an OC has already been issued and the operation is confined to a remote area, the notice required may be only a number of days. However, for initial issue of an OC and approval of a complex operation, the notice required may be a number of months. Operators are urged to give the maximum notice possible and not leave requests for approval to the last minute.

12.5 Considerations

12.5.1 When considering a request for approval to conduct a particular operation with a UAV, CASA must ensure that the operation of the UAV will pose no greater threat to the safety of air navigation than that posed by a similar operation involving a manned aircraft. This characteristic may be termed ‘acceptable’. CASA will consider either in combination or in isolation the benefits of systems which:

- (a) allow the controller to detect and/or avoid other aircraft;
- (b) reduce the hazards resulting from engine or component failure to an acceptable level;
- (c) demonstrate an acceptable level of reliability;
- (d) can be shown to pose no significant risk to persons or property.

12.6 Limitations

12.6.1 When issuing approval, CASA may impose limitations on the operation of a UAV in order to ensure that the UAV will pose no greater threat to the safety of air navigation than that posed by a similar operation involving a manned aircraft. Such limitations may include:

- (a) altitude restrictions;
- (b) geographical restrictions;
- (c) operational restrictions;

- (d) broadcast requirements;
- (e) provision of observers;
- (f) restricted timing of operations.

12.7 Legal Obligations

12.7.1 Any approval which may be granted by CASA would not confer on an operator of a UAV any rights as against the owner or occupier of any land on or over which the operations are conducted, or prejudice in any way the rights and remedies which a person may have in respect of any injury to persons or damage to property caused directly or indirectly by the UAV. Furthermore, such approval would not absolve the operator/controller from compliance with any other regulatory requirements, which may exist under Federal, State or local law.

13. OPERATOR CERTIFICATION

13.1 General

13.1.1 An operator intending to conduct commercial operations utilising UAVs must be the holder of an operating certificate (OC) issued under CASR Part 101. Guidelines for the issue of OCs are shown at Appendix 3.

14. INSURANCE

14.1 General

14.1.1 While CASA does not require the operator of a UAV to hold insurance cover, CASA would strongly recommend that the operator discusses with an insurance analyst the liability that he or she might incur for any damage to third parties resulting from the operation of the UAV and any procedures for reducing that liability.

Bill McIntyre
Executive Manager
Aviation Safety Standards

APPENDIX 1**DEFINITIONS**

UAV Control Station: A flight deck on the ground without external flight environment clues, i.e., no direct visual contact with the UAV, used for control of a UAV.

Autonomous Operation: A pre-programmed, automated flight profile that does not require human intervention for normal operation.

Built In Test: A set of aircraft internal software procedures to determine the level of functionality of predetermined critical systems or components.

Controlled Airspace: An airspace of defined dimension within which air traffic control service is provided to flights in accordance with the airspace classification.

Evolution: The process of transferring control of the UAV from manual control to autonomous control or vice versa.

Fail-safe: A provision built in to an equipment so that the equipment does not cause disastrous consequences even if it, or part of it, fails to perform its designed function.

Launch Controller: The person who will input command to the UAV or to the UAV system during the landing and takeoff phases of operation when the UAV is being controlled manually by line of sight.

Flight Controller: The person who will input commands to the UAV or to the UAV system once the UAV is transferred from line-of-sight control to autonomous control.

Supervising Controller: The designated person within the controlling UAV control station tasked with overall responsibility for operation and safety of the UAV in flight.

Pre-Flight Inspection: Set of manufacturer recommended systems and components functional tests to be performed prior to any launch.

Unmanned Aerial Vehicle (UAV): Means a powered, unmanned aerial vehicle, other than a model aircraft used for sport and recreation, which may be operated autonomously beyond line of sight of the controller but, in all cases, would be subject to remote control by the controller.

APPENDIX 2

THE FAIL-SAFE DESIGN CONCEPT

The fail-safe design concept considers the effects of failure and combinations of failures in defining a safe design.

1. FUNDAMENTALS

1.1 The following fundamental objectives apply:

1.1.1 In any system or subsystem, the failure of any single element, component, or connection during any one flight should be assumed, regardless of the probability. Such single failures should not prevent continued safe flight and recovery.

1.1.2 Subsequent failures during the same flight, whether detected or latent, and combinations thereof, should also be assumed, unless their joint probability with the first failure is shown to be negligible.

2. CONCEPT

2.1 The fail-safe design concept uses the following design principles or techniques to ensure a safe design. The use of only one of these principles or techniques is seldom adequate. A combination of two or more is usually needed to provide a fail-safe design; i.e. to ensure that marginal and critical failure conditions are remote or improbable and that catastrophic failure conditions are incredible:

2.1.1 Design integrity and quality, including life limits, to ensure intended function and minimize the occurrence and/or the effects of failures.

2.1.2 Redundancy or a back-up system to enable continued function after any single (or other defined number of) failure(s); e.g. two or more engines, hydraulic systems, flight control system, etc.

2.1.3 Isolation (especially physical or spatial separation) and independence of systems, components, and elements so that the failure of one does not cause the failure of another.

2.1.4 Proven reliability so that multiple, independent failures are unlikely to occur during the same flight.

2.1.5 Failure warning or indication to provide detection.

2.1.6 Flight controller(s) procedures for use after failure detection, to enable continued safe flight and landing by specifying flight controller(s) corrective action.

2.1.7 The capability to check a component's condition.

2.1.8 Failure containment to limit the safety impact of a failure.

2.1.9 Design failure path to control and direct the effects of a failure in a way that limits the safety impact.

2.1.10 Error tolerance that considers adverse effects of foreseeable error during UAV design, test, manufacture, operation, and maintenance.

2.1.11 Margins or factors of safety to account for foreseeable but uncertain or undefined adverse conditions.

APPENDIX 3

GUIDELINES FOR UAV OPERATOR CERTIFICATION

1. GENERAL

1.1 This appendix lists the general requirements for issue of an Operator Certificate (OC). CASA may relax the requirements according to the type of operation for which the operator certificate is sought according to the potential impact of the operation on the safety of air navigation or the safety of persons generally. Similarly, where concerns exist for the safety of other aircraft or persons generally, CASA may require more stringent conditions to be satisfied before issuing an OC.

2. UAV OPERATOR CERTIFICATION

2.1 No operator, or controller, may conduct commercial operation unless the operator of the UAV holds a valid OC, issued by CASA under Part 101.

2.2 An applicant for an OC or variation of an OC should allow the Authority to examine all safety aspects of the proposed operation.

2.3 An applicant for an OC must satisfy the Authority that he is able to conduct safe operations.

2.4 An operator should grant the Authority access to his organization and aircraft and should ensure that access is granted to their associated maintenance organization for the purpose of determining continued compliance with these Regulations and, where appropriate, continued airworthiness of aircraft.

2.5 An OC will be varied, suspended or revoked if the Authority is no longer satisfied that the operator can maintain safe operations.

2.6 The operator must have a management organization capable of exercising operational control and supervision over any flight operated under the terms of its OC.

2.7 The operator must have nominated an accountable manager acceptable to the Authority who has corporate authority for ensuring that all operations and maintenance activities can be financed and carried out to the standard required by the Authority.

2.8 The operator must nominate post holder(s), acceptable to the Authority, who is (are) responsible for:

- (a) flight operations;
- (b) the maintenance system;
- (c) crew training; and
- (d) ground operations.

2.9 The operator must ensure that every flight is conducted in accordance with the provisions of the Operations Manual.

2.10 The operator must ensure that its aircraft are equipped and its controllers are qualified, as required for the type of operation.

2.11 The operator must comply with such maintenance requirements as are prescribed and contained in the operations manual, for all aircraft operated under the terms of its OC.

2.12 The operator must provide the Authority with a copy of the Operations Manual and all amendments or revisions to it.

2.13 The operator must maintain operational support facilities, appropriate for the type of operation.

3. ISSUING OPERATING CERTIFICATES

3.1 An application for an Operating Certificate must be in a form acceptable to CASA.

3.2 CASA must issue an Operating Certificate if satisfied about the following matters:

- (a) that the operator has produced and will keep up to date an operations manual, acceptable to CASA, specifying procedures to be followed by controllers and other relevant persons to ensure the safety of the operator's operations;
- (b) where an operator establishes a maintenance system, details of that system will be kept up to date and published in the operations manual;
- (c) the operator has complied with paragraph 5.

4. OPERATING CERTIFICATE CONTENT

4.1 An Operating Certificate must contain at least the following particulars:

- (a) name and location (main place of business) of the operator;
- (b) date of issue and period of validity;
- (c) description of the type of operations authorised;
- (d) type(s) of UAV(s) authorised for use;
- (e) where appropriate, registration markings of the authorised UAV(s) except that operators may obtain approval for a system to inform the Authority about the registration markings for UAVs operated under its OC;
- (f) special limitations (e.g. VFR only, day only, not over populous areas etc.).

5. CHIEF CONTROLLER AND MAINTENANCE CONTROLLER OR SCHEDULER

5.1 An operator must:

- (a) establish a position of chief controller in the organisation with the functions and duties mentioned in paragraph 6;
- (b) ensure that, at all times, persons approved by CASA and appointed as chief controllers or maintenance controllers or schedulers are occupying or acting in the positions.

5.2 An operator must not, without CASA's permission, appoint a person to the position of chief controller on a part-time basis, except in a single UAV operation.

5.3 Any person or organization appointed to be responsible for the maintenance of the operator's aircraft must be acceptable to CASA.

5.4 An operator of large UAVs must appoint a person or organization, acceptable to CASA, to be responsible for the maintenance of the operator's UAVs.

6. FUNCTIONS AND DUTIES OF THE CHIEF CONTROLLER

6.1 The Chief Controller for an operator is to have control of all controller training and operational matters affecting the safety of the flying operations of the operator.

6.2 The responsibilities of a Chief Controller must, unless the Authority otherwise specifies in writing, include the following responsibilities:

- (a) ensuring that the operator's air operations are conducted in compliance with the Act and the Regulations;
- (b) maintaining a record of qualifications held by each controller;
- (c) monitoring operational standards, and supervising the training of controllers of the operator;
- (d) maintaining a complete and up-to-date reference library of operational documents as required by the Authority for the class of operations conducted.

7. QUALIFICATIONS OF CHIEF CONTROLLER

7.1 A Chief Controller must satisfy the Authority that he or she holds appropriate experience and certificates to permit him or her to act as controller of all operations authorized by the operator's certificate.

7.2 The chief controller of an organization engaged in the operation of large UAVs must be the holder of a UAV controller certificate, however, CASA may exempt the chief controller of an organization operating small UAVs from the requirement to hold a controller's certificate

8. ACCEPTANCE OF CHIEF CONTROLLER BY THE AUTHORITY

8.1 A person will not be accepted as a Chief controller unless:

- (a) he or she can satisfy CASA that they are able to maintain a satisfactory standard in the conduct or management of flying operations; and
- (b) before being approved as a Chief Controller, the person has:
 - (i) been assessed by a flying operations inspector as suitable to carry out the responsibilities of a Chief controller; and
 - (ii) passed an oral examination conducted by such an inspector covering the regulatory requirements for the safe conduct of operations.

8.2 In addition to the requirements specified in paragraph 8.1, a person proposed for appointment as Chief Controller may be required to demonstrate to a flying operations inspector his or her controlling proficiency.

8.3 The Authority must give written notice of an approval, or rejection of an approval, for a person to be appointed as, or to act as, a Chief Controller to the operator and to the person and must, where a proposed appointment is rejected, include in the notice the reasons for the rejection.

8.4 An approval remains in force subject only to the approved person maintaining a satisfactory level of performance.

8.5 An approval relates only to the operator specified in the notice of approval.

9. CANCELLATION OR SUSPENSION OF APPROVAL

9.1 An approval may be cancelled or suspended at any time if, in the opinion of the Authority, the performance of the Chief Controller is no longer of an acceptable standard.

9.2 Where the Authority cancels or suspends a person's appointment as a Chief Controller, the Authority must:

- (a) notify the person and the operator in writing of the cancellation or suspension; and
- (b) provide the person and the operator with reasons.

10. ISSUE, VARIATION AND CONTINUED VALIDITY OF AN OC

10.1 An operator will not be granted an OC, or a variation to an OC, and that OC will not remain valid unless he has satisfied the Authority that he has the ability to:

- (a) establish and maintain an adequate organisation;
- (b) comply with such maintenance requirements as are prescribed;
- (c) comply with the relevant provisions of paragraph 2.

10.2 Notwithstanding the provisions of 11.6, the operator must notify the Authority as soon as practicable of any changes to the information submitted in accordance with this paragraph.

11. ADMINISTRATIVE REQUIREMENTS

11.1 An operator should ensure that the following information is included in the initial application for an OC and, when applicable, any variation or renewal:

- (a) the official name and business name, address and mailing address of the applicant;
- (b) a description of the proposed operation;
- (c) a description of the management organisation;
- (d) the name of the accountable manager;
- (e) the names of major post holders together with their qualifications and experience; and
- (f) the Operations Manual.

11.2 When appropriate, in respect of the operator's maintenance system only, the following information must be included in the initial application for an OC and, when applicable, any variation or renewal, and for each UAV system type to be operated:

- (a) the maintenance management exposition;
- (b) the operator's UAV maintenance program(s);
- (c) the UAV technical log;
- (d) the number of aircraft.

11.3 The application for an initial issue of an OC must be submitted at least 90 days before the date of intended operation. Assessment of an application will not commence until CASA is in receipt of all required documentation.

11.4 The application for the variation of an OC must be submitted at least 30 days, or as otherwise agreed, before the date of intended operation.

11.5 The application for the renewal of an OC must be submitted at least 30 days, or as otherwise agreed, before the end of the existing period of validity.

11.6 Other than in exceptional circumstances, the Authority must be given at least 10 days prior notice of a proposed change of a nominated post holder.

12. THE MANAGEMENT AND ORGANISATION OF AN OC HOLDER

12.1 General

12.1.1 An operator must have a sound and effective management structure in order to ensure the safe conduct of air operations. Nominated post holders must have proven competency in performance of their role.

12.1.2 In the context of this Appendix, ‘competency’ means that an individual must have a technical qualification and managerial experience acceptable to the Authority, as appropriate.

12.2 Nominated Post Holders

12.2.1 A description of the functions and the responsibilities of the nominated post holders, including their names, must be contained in the Operations Manual and the Authority must be given notice in writing of any intended or actual change in appointments or functions.

12.2.2 The operator must make arrangements to ensure continuity of supervision in the absence of nominated post holders.

12.2.3 The operator must satisfy the Authority that the management organization is suitable and properly matched to the operating network and scale of operation.

12.2.4 A person nominated as a post holder by the holder of an OC must not hold a post under any other OC, unless acceptable to the Authority.

12.2.5 More than one of the nominated posts may be filled by one person if acceptable to the Authority.

12.3 Adequacy and Supervision of Staff

12.3.1 Crew members. The operator must employ sufficient staff dependent upon the nature and the scale of operations who have a thorough understanding of their responsibilities within the organization.

12.3.2 Supervisors. The number of supervisors to be appointed is dependent upon the structure of the operator and the number of staff employed. The duties and responsibilities of these supervisors must be defined, and any flying commitments arranged so that they can discharge their supervisory responsibilities.

12.3.3 The supervision of all staff must be exercised by individuals possessing experience and personal qualities sufficient to ensure the attainment of the standards specified in the operations manual.

12.4 Facilities

12.4.1 An operator must ensure that facilities available at each operating location are sufficient for the safety of flight operations.

12.4.2 Administrative arrangements must be adequate for timely distribution of operational instructions and other information to all concerned.

12.5 Documentation

12.5.1 The operator must make arrangements for the production of manuals, amendments and other documentation.

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