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Monash UAV Operations Manual

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MONASH
UNIVERSITY

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This document sets out the procedures adopted by the Monash UAV Group and is a supporting document for current insurance provisions permitting fully autonomous flight. It may be of interest to others conducting research in this area.

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1 Aims of this Operations Manual

The aim of this document is risk minimisation.

This manual lays down a set of policies and procedures to be followed by the Monash University Unmanned Air Vehicle (UAV) Group. These policies and procedures are designed to keep the risks and hazards posed by the Monash University UAV Group (MU UAV Group) well below the risk level currently prevailing at model aircraft flying sites around Australia.

The hierarchy of compliance is

- Commonwealth Civil Aviation Safety Regulations.
- State government regulations.
- Local government regulations.
- Model Aeronautical Association of Australia guidelines.
- Monash University Regulations and guidelines.

These regulations are summarised below with comments. Pointers to the full regulations are given where the documents are electronically accessible.

This document is a 'work in progress' and additional detail will be added as the document evolves and field experience dictates.

2 Commonwealth aviation regulations.

2.1 Civil Aviation Safety Regulation CASR-101

All Monash UAV Group aircraft shall be flown in strict accordance with CASR-101. The allowable aircraft characteristics are summarized in section 6.2.4.

2.1.1 Other commonwealth restrictions.

National parks, wildlife reserves and heritage areas may have aviation restrictions placed on them designed to protect local wildlife or the amenity of an area. The Monash UAV group shall obey any such restrictions at all times.

2.1.2 RAMSAR and environmental protection issues.

No flying is permitted by the Monash UAV Group within designated RAMSAR sites during bird occupancy. <http://www.deh.gov.au/water/wetlands/publications/>

No noise or other environmental challenges to sensitive areas. Turkey farms are particularly sensitive to low level over-flights.

3 State and Local Government Regulations.

In general, aviation activities are commonwealth matters however state and local governments may impose restrictions on where "model aircraft" can be flown or impose special noise or hazard restrictions near wildlife reserves or sensitive sites. The Monash UAV Group shall obey all such restrictions at all times.

4 Model Aeronautical Association of Australia regulations.

The MAAA operates under delegation from CASA and sets operational standards for local RC model aircraft clubs. All flying members of the Monash UAV Group are required to be paid up members of an MAAA affiliated club and to comply with MAAA regulations at MAAA sites. In addition to CASR-101 weight limits, the MAAA only allows amateur built aircraft up to 7 kg to be flown without a permit and requires an MAAA 'heavy model' inspection certificate for aircraft from 7 kg to 25 kg. The Monash UAV Group shall require a heavy model inspection certificate for all aircraft between 7 and 25 kg MAUW.

5 Monash University Regulations.

5.1 Occupational Health and Safety

The primary source for this section is the Monash OHS website. In the event of any conflict between this manual and the OHS information, the OHS words take precedence.

<http://www.adm.monash.edu.au/ohse/documents/Docum.htm> (master index page).

All flying activities are classed as Field Trips, i.e. Off-campus activities, either urban or country/remote. The OHS requirements for these activities can be found at the following URLs.

[Guidelines for health and safety during off-campus activities undertaken in urban areas](#)

[Guidelines for health and safety during field activities in country and remote areas](#)

Overall Risk Control guidelines may be found at [Risk Control Program](#).

In the event of an injury or observed hazard, the following form is to be used

[Hazard and Incident Report Form](#)

These source documents are appended to this Manual for general information but please check the current on-line versions for the latest specific details.

6 Monash UAV Group Safety requirements

UAV operations have specific risks and hazards which may not be generally covered in the Monash OH&S documents. The following issues are self imposed by the UAV Group.

6.1 Public Safety

Public safety is paramount and the Safety Officer shall immediately cease all flying should any member of the public be deemed to be in any danger from MU UAV aircraft operations. Flying shall not recommence until that hazard has been removed.

6.2 Monash University staff and student safety

The University has a duty of care to all staff and students and the Safety Officer shall immediately cease all flying should any member of the field crew be deemed to be in any danger from MU UAV aircraft operations. The Safety Officer has the power to send off the field any MU UAV Group member for breaching safety standards. Flying shall not be allowed if any identified hazard is present.

6.2.1 Safety Officer.

A Safety Officer will be designated for all flying trips. That person shall be responsible for ensuring the minimum equipment items specified below are on site, in a serviceable condition and readily accessible. First aid qualifications are highly desirable for this position.

6.2.1.1 A suitable first aid kit is on site and readily accessible.

6.2.1.2 Suitable fire extinguisher(s) are located within 5 metres of the refueling and battery charging points and within 20 metres of the launch point.

6.2.1.3 A mobile telephone is on site where mobile coverage is available. The Safety Officer shall also make themselves aware of the nearest available telephone if cell phones are inoperable.

6.2.1.4 A flight radiotelephone (air band transceiver) is on site whenever flight operations above 400 feet AGL or within controlled airspace is contemplated.

The Safety Officer shall also be responsible for ensuring the following procedures are complied with.

- 6.2.1.5 If flying from private property, the local owner or controller of the flying field is aware of the UAV Group presence and has approved the operation.
- 6.2.1.6 There will be no flying on total fire ban days.
- 6.2.1.7 Sunscreen, appropriate clothing and foot ware are to be worn at all times.
- 6.2.1.8 Drinking water is available.
- 6.2.1.9 Alcohol consumption within 8 hours before or during flying operations is prohibited.
- 6.2.1.10 All rubbish is removed at end of every flying day.
- 6.2.1.11 The Safety Officer will formally report, with suggestions for improvement, on any safety breaches, injuries or procedural problems experienced.

6.2.2 Duty Pilots.

A Duty Pilot shall be appointed whether operating at an MAAA affiliated site or not. Pilots wishing to fly for research purposes shall submit to the duty pilot a list of the flights they intend to complete on that day.

The Duty Pilot shall be responsible for spectrum management on the field and the operation of an agreed system to prevent radio interference amongst the MU UAV Group.

The Duty Pilot shall control the sequence of flying to maximize safety and facilitate the research outcomes for the day. The Duty pilot is responsible for ensuring adequate record keeping, safety and discipline on the field for that day. No flight may commence without Duty Pilot authorization.

The Duty Pilot, or the Timekeeping delegate, will record the takeoff and landing times of all aircraft, the total number of flights for the day and the total time flown.

Each researcher will submit to the Duty pilot within 7 days, a report of their own research outcomes for that day.

The Duty Pilot may delegate as he sees fit but remains the responsible person.

Required record keeping.

- Names of all personnel on the site each day.
- Radio frequencies used for each aircraft flown.
- Weather conditions through the day.
- Brief description of all aircraft flown
- Purpose, duration and outcome of each flight.
- Total number of flights and total duration for the day.
- Description of any incidents, injuries or safety breaches.
- Improvement suggestions.

6.2.3 Range Safety – Flight Termination Systems.

All aircraft flown by the Monash UAV Group shall be fitted with a Flight Termination System (FTS) at least the equal of commercial model aircraft radio control “failsafe” systems. Any aircraft attempting to follow a flight plan controlled by an onboard GPS receiver (i.e. autonomous navigation) shall carry an additional independent FTS which can be manually triggered from the ground or automatically triggered should the aircraft drift away from the designated flying site. The FTS shall minimize kinetic energy and bring the aircraft promptly to the surface.

6.2.4 Monash UAV Group aircraft limitations.

Flying at sites away from MAAA control allows the use of GPS navigation and fully autonomous flight under CASR-101 regulations plus the other self imposed limitations required for OHS, Insurance or prudential reasons.

All Monash UAV Group affiliated aircraft flown at non-MAAA sites will conform to the following requirements:-

- 6.2.4.1 Must weigh less than 7 kg including fuel OR have MAAA 'heavy model' certification. Aircraft above 25 kg require an additional CASA 'giant model' certification.
- 6.2.4.2 Must remain below 400 feet AGL if flown autonomously under GPS control. Autonomous flight above 400 feet AGL requires explicit CASA approval for that class of aircraft flown at that specific site nominated in the CASA written approval. Flights above 400 feet AGL are permitted without specific CASA approval provided the aircraft operation conforms to Subpart G of CASR-101.
- 6.2.4.3 Must not be flown within gliding distance, in the prevailing weather, of a populous area.
- 6.2.4.4 Must remain within visual range at all times. If being flown manually above 400 feet at least one observer who is not flying at the time must keep lookout for other aircraft.
- 6.2.4.5 When flying autonomously under GPS navigation, the aircraft must have dual independent failsafe systems to prevent a runaway aircraft. System 1 may be the normal RC failsafe but system 2 must be completely independent, on a second frequency with its own receiver, power supply, servos and other mechanisms capable of limiting flight if the primary systems fail. Beacon mode is preferred where the ground based Range Safety Transmitter is active and the onboard Flight Termination System is triggered either by an explicit command from the ground or the aircraft drifting out of range of the Range Safety Transmitter.
- 6.2.4.6 Must not be rocket, jet or turbine powered unless specifically authorized in writing by the Monash UAV Group Team leader, currently Professor Greg Egan.
- 6.2.4.7 If any autonomous flying is under way, regardless of intended altitude, a continuous radio watch on the area frequency will be maintained and any nearby aircraft heard are to be immediately notified that autonomous aircraft operations are taking place. Immediately before launch and every 15 minutes during autonomous flight, a general broadcasts will be made by a licensed operator on the area frequency.

7 Autonomous Navigation Pre-Flight Procedures.

Before any autonomous navigation flight is permitted within the Monash University UAV Group, the researcher must give a formal presentation and obtain a peer group endorsement for the system controlling the proposed flight(s). The designer or researcher presentation shall present evidence of a satisfactory 'walk around' test where the system was physically demonstrated to correctly follow the nominated flight path on the surface.

Other sections required.

This manual will be expanded as experience develops

8 Specific site details.

Things you need to know about the site that are not immediately obvious such as circuits should always one way in certain wind directions due to local turbulence, radio interference or to avoid particular noise or environmentally sensitive sites, etc. How to get there, who holds the keys, access restrictions, where to park, no go areas, GPS coordinates of the boundaries, etc.

8.1.1 Important contacts.

Land owner, Fire brigade, Hospital, Police, CASA, RAAF, etc.

8.1.2 Site activation.

What must be done before flying at this site.

How to activate the site via NOTAM if required.

Timetable and checklist for activation.