Airborne Delivery Challenge and Robot Airborne Delivery Challenge

Mission, rules and judging criteria

Version: 1.3

Date: 5 September 2010

IMPORTANT NOTICE TO COMPETITORS

Spectrum compliance is an issue that the organisers of the UAV Challenge take very seriously.

It is the responsibility of each team to ensure their UAV operations are spectrum compliant for the UAV Challenge.

Details of frequency management at Kingaroy will be provided during competitor orientation and safety briefing.

Failure to comply with any of the rules in Section 8.5 may result in team disqualification or other appropriate penalties (at the judges discretion).

This document is subject to change by the Challenge organisers. The current rules document will be available from the challenge website. Registered participants will be notified of any changes.

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Major Revision Record

Changes from 2009

- New front page: IMPORTANT NOTICE TO COMPETITORS.
- Figure 1: changed some distances.
- Section 2.1.5: Only high-school students that are team members are allowed on to the field.
- Section 2.2.2: Added mission waypoints.
- Section 4: Change of dates in schedule.
- Section 5.1: Takeoff gross weight must be less than 7 kg.
- New Section 5.3: Radio Equipment Frequencies.
- Section 6.3.1 and 6.3.2: Changes to scoring.
- Section 7: Teams MUST drop package within 10m of Outback Joe in order to win the prize.

Changes from v1.0

- New Section 5.6.1 Alternate Flight Termination Systems.

Changes from v1.1

- Update of Section 2.2.2 Mission Waypoints and made mention of ne KMZ file.
- Updated Table 1.
- New Figure 2.
- Changed name of Section 5.1.
- Section 5.13 Sharing of Equipment between Teams: Added that records keeping requirements.
- Section 6.1 Technical Report and Video: Now mentions that CASA will be given all the technical reports and may check with teams at the event for compliance with their technical report.
- Numerous changes throughout replacing the term UAV with aircraft.

Changes from v1.2

- Section 4: Update of Schedule given in Table 2. Removed Adverse Weather Day 2. The last possible day of the competition will now be Thursday 30 September.

1 The UAV Outback Challenge

The goal of the UAV Outback Challenge is to demonstrate the utility of Unmanned Airborne Vehicles (UAVs) for civilian applications. The competitors will be required to develop a UAV that could save lives by quickly and cost effectively delivering medical supplies to critically ill patients in the Australian Outback.

The Challenge rules have been designed to address safety and maintain an acceptable level of aviation rigour, while attempting to maintain a high level of "fair play", accessibility, and enjoyment. There is an expectation that teams will enter into the Challenge with a desire to compete within the spirit of the challenge and not to exploit loopholes for an unfair advantage. The organisers and judges reserve the right to take action against any team or individual that conducts themselves in a manner judged contrary to the intent and spirit of the Challenge.

The Challenge will provide valuable experience to student and private entrants, in the design, construction and operation of UAVs. This experience will help create a future generation of aerospace professionals - all focused on the fastest growing component of the international aerospace industry.

The event comprises of 3 flying categories. These are the:

- Airborne Delivery Challenge (open to Australian high schools),
- Robot Airborne Delivery Challenge (open to Australian high schools), and
- Search and Rescue Challenge (open to all)

2 The Challenges

2.1 Airborne Delivery Challenge

This category is only open to Australian high school students.

2.1.1 The Mission

A supply package(s) will be provided to each team for delivery on the day of the competition. The supply package (a popular chocolate bar) will have the following specifications:

1. Size of 105x30x20 (mm)
2. Homogeneous mass distribution
3. Weight of 60 grams

Each team must develop an airborne delivery system that can drop the provided supply package as close as possible to Outback Joe.

The aircraft will be remotely controlled by a human operator, known as the *UAV Controller*. The supply package will be dropped remotely by the *Mission Manager*. The UAV Controller and the Mission Manager will act independently and without communication once the competition has begun.

The layout for the course is shown in **Figure 1** below.

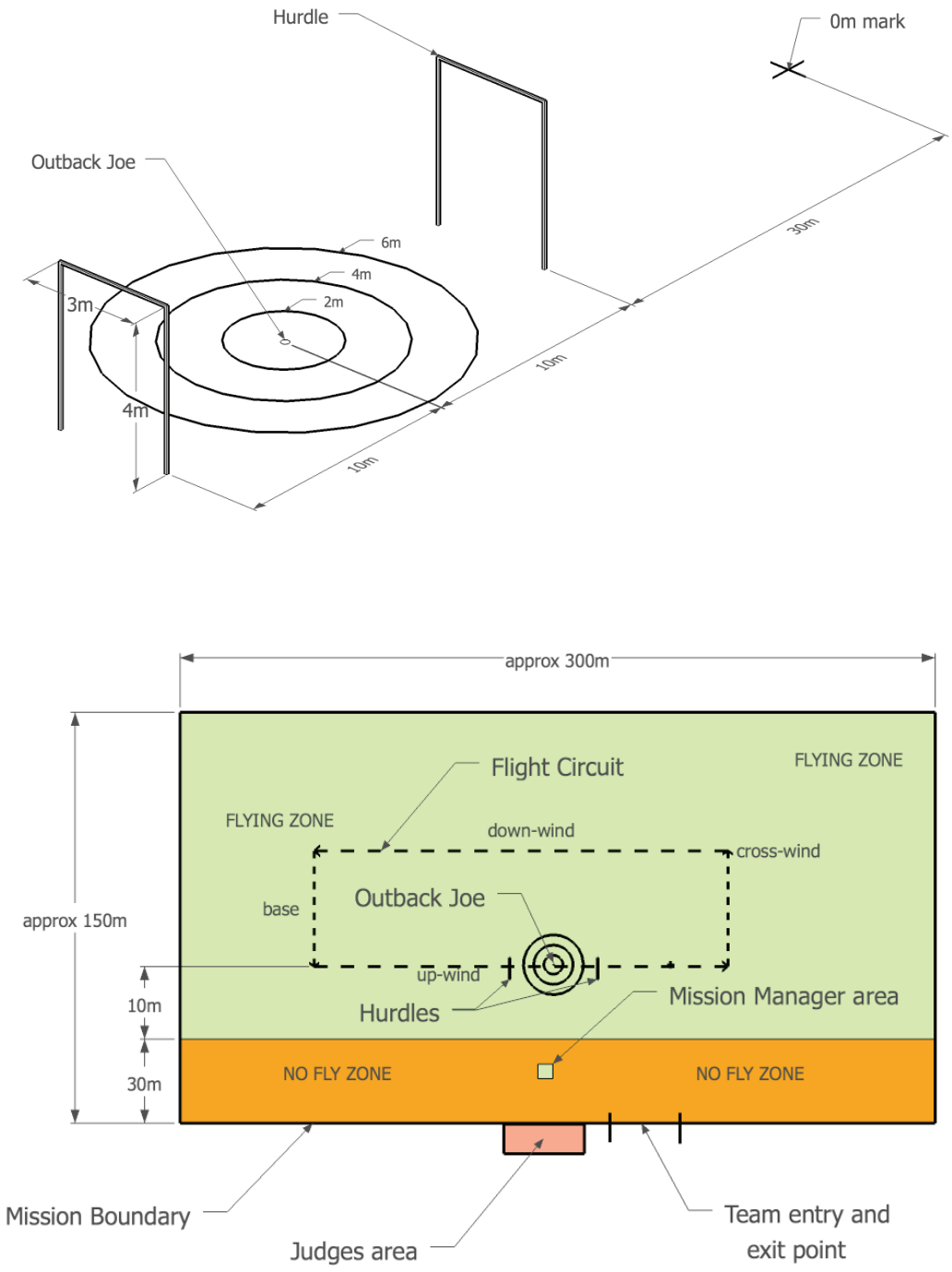

Figure 1. General Layout of the Airborne Delivery Challenge

2.1.2 Conduct of the UAV Controller

The UAV Controller is responsible for launching and recovering the aircraft and the safe piloting of the aircraft once it is airborne. At all times the aircraft must be remotely controlled.

The UAV Controller must manoeuvre the aircraft such that it remains in the flying zone as shown in Figure 1. Spotters on the course will determine if the aircraft flies outside the flying zone.

Airspace incursion procedures:

- *Flying into the No-Fly Zone:* If the aircraft is deemed to have flown into the no-fly zone then the Range Safety Officer will direct the UAV Controller to land the aircraft without delay. The Range Safety Officer is responsible for the safe operations of the event. Upon landing the aircraft the team will be declared as disqualified due to safety reasons. The no-fly zone is designed to protect the general public who are watching the event.
- *Exiting the Flying Zone*: If the aircraft is deemed to have flown outside the flying zone (excluding the no-fly zone) then the Range Safety Officer will direct the UAV Controller to land the aircraft without delay. Upon landing the aircraft the Range Safety Officer will give a verbal warning to the UAV Controller. The clock will remain running throughout this process. The UAV Controller is allowed two warnings. If the flying zone is breached a third time, the Range Safety Officer will direct the UAV Controller to land the aircraft and to vacate the field. The team will then be declared as disqualified due to safety reasons.

The UAV Controller must adhere to the flight circuit procedures that will be provided at the competition.

2.1.3 UAV Controller Proficiency

The UAV Controller must be MAAA Bronze-wing standard or equivalent. Proof of this will be required prior to entering the competition.

2.1.4 UAV Controller Equipment

Only radio transmitters that are compliant with Australian radio spectrum requirements may be used during the event. Fail safe must be set such that setting the transmitter off will close the engine throttle. Demonstration of this will be required prior to entering the competition.

Normal Drop Procedures:

Before the drop, the aircraft must fly down the upwind leg of the course and the aircraft must be manoeuvred such that it will pass directly overhead of the two hurdles that are laid out onto the course. The two hurdles have the following specifications:

1. Height of 4m
2. Width of 3 m
3. Open hurdles

The UAV Controller must fly the aircraft such that it passes over the hurdles, but must not fly higher than 200 feet (within *CASR101* guidelines).

The UAV Controller can perform as many additional circuits as desired before landing the aircraft, so long as it is within the time limit for the competition and the aircraft remains within the flying zone (each package delivery must occur within 3 circuits). The UAV Controller can launch and recover the aircraft as many times as desired within these constraints also. The UAV Controller can move around the course as required in order to fly the aircraft in a safe manner.

The delivery of the payload will be controlled by a human operator, known as the *Mission Manager*. The Mission Manager's zone will be marked on the test day and will be a 2m x 2m square. The Mission Manager and associated equipment must be located within this square at all times during the mission. The Mission Manager's area will be enclosed with a barricade around the edges towards the flying area and covered from the top for safety. The Mission Manager will NOT be able to see the Outback Joe or the aircraft during the flying element of the competition and will NOT be able to communicate with the UAV Controller during the drop sequence.

The Mission Manager must control the delivery mechanism independently of the UAV Controller.

The objective is for the *Mission Manager* to deploy the supply package such that it comes to a rest as close as possible to Outback Joe. It is important to note that it is the final resting place of the package that will be used for judging criteria.

The aircraft must comply with the specifications in Section 5.1. Whilst flying between the hurdles, the aircraft must maintain an average minimum forward velocity of 3m/s. This will be verified by the judges.

2.1.5 Scoring Criteria for Flying Component of Assessment

Points will be awarded based on the time required to complete the mission and the proximity to Outback Joe (Section 6.3). A maximum of three drops are allowed. There is no limit to the number of passes over Joe within the allocated time. **The best result will be used for the final score.**

A total allowable time of 20 minutes will be provided for each team in the Airborne Delivery Challenge and 30 minutes for teams in the Robot Airborne Delivery Challenge. This includes walking onto the field, set-up, launch, the mission, landing, recovery, pack-up and exiting the field. The judges will indicate when the timer starts and team can then enter the mission area.

Teams must complete their mission and leave the field within the 20/30 minutes time period. A points penalty will be applied for time over the 20/30 minutes.

2.1.6 Adverse Weather

Postponement of the competitions due to adverse weather conditions will be at the judges' discretion. Flying will be delayed if the 10-minute average wind speed exceed 15kts. An adverse weather day has been built into the schedule (Section 4).

In the event that all teams do not have the opportunity to fly due to adverse weather the winners will be determined by the points from the team's technical report and oral presentation.

2.1.7 Additional Deliverables

In addition to the points awarded for the mission, entrants will also be graded on a technical report and video (Section 6.1). The report will outlines their design, methodology for package deployment and operational and safety procedures. An oral presentation must also be given at the competition (Section 6.2).

2.1.8 The Prize

The winning high school in this category will receive a prize of $5,000. In the event of a tie on points the prize will be equally shared by all parties.

2.2 Robot Airborne Delivery Challenge

2.2.1 The Mission

The Robot Airborne Delivery Challenge is the same as the Airborne Delivery Challenge with the following exceptions:

1. Once the aircraft is airborne and established in the circuit, the UAV Controller will switch to autonomous mode.
2. In autonomous mode, the aircraft will be able to fly through the designated circuit waypoints without intervention from the UAV Controller.
3. The UAV Controller is able to resume manual control at any time during the autonomous operations through a switch on the transmitter.

2.2.2 Mission Waypoints

The following table list the waypoints of the designated circuit for the Robot Airborne Delivery Challenge:

Table 1: Robot Challenge waypoints.

Boundary Point	**South** **(WGS 84 Degrees:Minutes:Seconds)**	**East** **(WGS 84 Degrees:Minutes:Seconds)**
Mission Waypoints		
WP-1	26° 34' 29.3"	151° 50' 23.2"
WP-2	26° 34' 27.3"	151° 50' 20.1"
WP-3	26° 34' 27.8"	151° 50' 17.7"
WP-4	26° 34' 30.7"	151° 50' 15.4"
WP-5	26° 34' 35.2"	151° 50' 16.5"
WP-6	26° 34' 37.3"	151° 50' 19.7"
WP-7	26° 34' 36.8"	151° 50' 22.3"
WP-8	26° 34' 33.8"	151° 50' 24.2"
Outback Joe Location		
Drop	26° 34' 31.7"	151° 50' 23.8"
30m Safety Boundary		
SB-1	26° 34' 26.5"	151° 50' 24.4"
SB-2	26° 34' 36.1"	151° 50' 26.6"

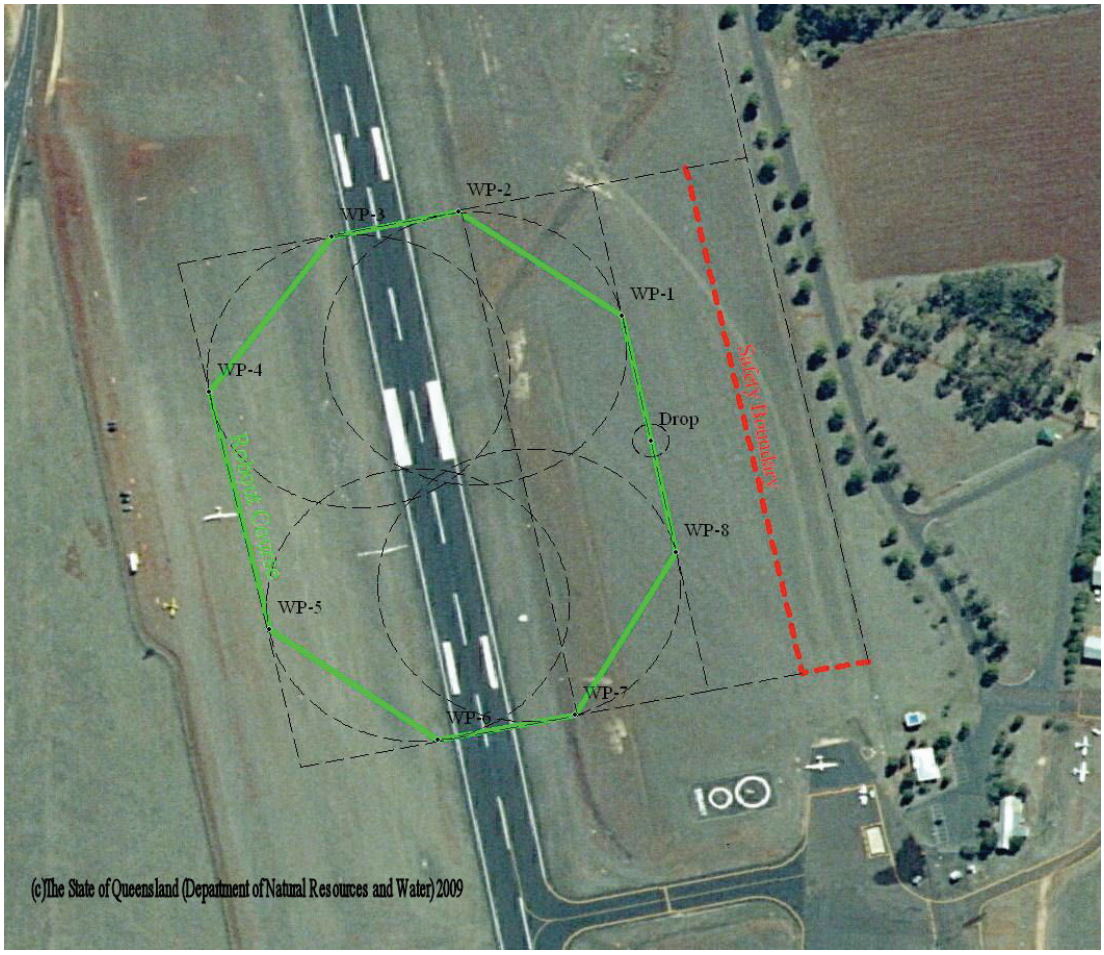

Figure 2. Waypoint locations on the Robot Airborne Delivery Challenge course.

Outback Joe will be located at the waypoint designated "Drop" and the hurdles placed 10m either side of this waypoint along the line WP-8 – WP-1, as per the Airborne Delivery Challenge. No aircraft is to fly closer than 30m to the fence line. This 30m Safety Boundary is defined by a line passing through SB-1 and SB-1, the

red line in Figure 2. During the event markers will indicate this line. Any aircraft that crosses this line will be disqualified, as per "Flying into the No-Fly Zone". While a "Flying Zone" has not been defined, the aircraft will be monitored for controllability and course following and the range safety officer, marshals or the judges may request mission termination as per "Exiting the Flying Zone". A "Flying Zone" may be defined during the event and details will be passed to the competitors. The "Flying Zone" maybe defined by a series of markers.

Note that these waypoints are available in a KMZ (Keyhole Markup Language) file 2010RobotLayout.kmz. Please see Challenge website for this file.

2.2.3 Changing competition level

In the event of technical difficulties, teams entering the Robot Airborne Delivery Challenge can downgrade to enter the Airborne Delivery Challenge. This declaration must be made to the organising committee at least 24 hours prior to the event.

2.2.4 The Prize

The winning high-school in this category will receive a prize of $10,000. In the event of a tie on points, the prize will be equally shared by all parties.

3 Challenge Safety

Safety is a priority for the UAV Outback Challenge, and the rules (Section 5) contained in the document have been put in place with safety in mind. The safety mechanisms that have been put in place include: ensuring compliance with CASR101 (where applicable); air vehicle safety inspections and structural verification; UAV Controller override capability; flight termination mode; and a proven history of safe flight operations.

Entrants are reminded that during their research and development phase, all test flying must comply with the relevant CASA regulations. **Participants must ensure they contact their local CASA regional office to ensure that they are in compliance.**

The rules outlined in Section 5 will be strictly enforced in order to reduce the risk associated with holding the UAV Outback Challenge. The organising committee may disqualify any entry that they deem to pose an unreasonable safety hazard to people and infrastructure.

4 Schedule

Table 2 below sets forth the overall competition schedule:

Table 2. 2010 High-schools UAV Challenge schedule

Activity	Date
Registration *Registration details will be on the UAV Challenge website.*	closes on 23 July 2010 at 5pm AEST
Flight Readiness Review (Technical Report and Video) *A technical report (Section 6.1) must be provided. The underlying objective of this report is to convince the organising committee that the team has developed a reliable and safe UAV system, along with the appropriate operating procedures.* *A video must also be supplied that includes a flight demonstration of the dropping mechanism that will deliver the payload.*	27 Aug 2010 at 5pm AEST
Final team details required (pro-forma to organisers) *All participating teams must be approved to fly at the competition by CASA. Teams must supply the UAV Outback Challenge organisers with final team details. A form will be given to the teams to fill in.*	27 Aug 2010 at 5pm AEST
"Go" "No-Go" Announcement of Teams *Final approval to participate in the 2010 UAV Outback Challenge given to teams. The final approval to participate will be based on several aspects of the technical report, predominantly the demonstrated ability to operate within the competition safety standards.*	6 Sep 2010
CASA Application Update *The Organising committee are to submit an update to CASA advising them of the names of the participants for inclusion in the airspace approvals for the Outback challenge.*	6 Sep 2010
Team Insurance Deadline *Teams must provide documentation illustrating their insurance coverage. More details of insurance requirements and options will be posted on the UAV Challenge website. Teams that have not submitted this documentation by this date may be disqualified from the competition.*	10 Sep 2010
High schools UAV Challenge *Orientation, Safety Briefing and Scrutineering, Oral and Documentary Video Presentation.* ***Teams must arrive by 7am****.*	28 Sep 2010
High schools UAV Challenge *Competition day*	29 Sep 2010
Adverse Weather Day or Additional Competition Day (depending on number of teams) *A second competition day may be necessary depending on*	30 Sep 2010

Activity	Date
the number of teams. *An adverse weather day is allocated in case judges decide wind, rain or other adverse conditions interfere with the running of the competition.*	

5 Additional Rules

5.1 Aircraft Requirements and Limitations

All aircraft entered will be subject to the following requirements and limitations:

1. Must use an electric propulsion system;
2. Must be free flying;
3. Have no entangling encumbrances such as tethers;
4. Takeoff gross weight must be less than 7 kg;
5. Must have continuous radio communication with the *UAV Controller*; and
6. Platform and onboard systems can be commercial off the shelf or custom made.

5.2 Piloting Proficiency

UAV controller must be MAAA bronze-wing standard or equivalent. The onus of proof is on the UAV Controller.

5.3 Radio Equipment Frequencies (new for 2010)

Due to difficulties in previous years of the Challenge, where teams have experienced problems sharing frequencies between their video and command radio equipment, a new rule has been introduced for 2010.

The frequencies for video and radio control (command) transmitters-receiver sets shall not be the same. For example, combining 2.4GHz spread-spectrum technology with 2.4GHz video links is not allowed. However, 2.4GHz spread-spectrum technology with 5.8GHz video links is allowed.

Teams will be disqualified if they are found to be breaching this rule.

Please also note that video frequencies of 900MHz, 1.2GHz and 1.3GHz are illegal for use in Australia.

Command link can be 900Mhz, Video either 2.4Ghz/5.8Ghz is industry accepted standards.

Please refer to Section 8 of this document.

5.4 Safety Inspections

All aircraft and ground-based controlling equipment will undergo rigorous safety evaluations leading up to the Challenge. Physical inspections will occur during the orientation, practice days and competition days. These inspections must be passed before the aircraft will be permitted to fly. All decisions by the organising committee in relation to airworthiness are final.

Safety inspections will include (but not be limited to) the following:

- Structural verification of the aircraft to ensure structural integrity including,
  - Components adequately secured and fasteners tightened
  - Propeller structure and attachment integrity
  - Inspection of all wiring
  - Controls move as expected
  - Payload general integrity
- Radio range checks with motor off and on;
- Flight termination behaviour tested (transmitter switched off);
- Aircraft will be weighed to ensure they fall within the weight restrictions;
- Video evidence and flight logs of flight tests demonstrating safe operations; and
- Flight demonstration.

5.5 UAV Controller Override for Autonomous Operations

For safety reasons, all aircraft that are demonstrating any autonomous operation must provide an override capability where the aircraft can be switched from autonomous flight to manually flown radio control mode.

5.6 Flight Termination Behaviour

All teams must implement a safe flight termination behaviour for their aircraft. Specifically, teams must use radio receiver(s) that are capable of reverting to pre-defined failsafe values when radio communications is lost from the UAV Controller's radio transmitter. If for any reason the aircraft appears to be out of control during the competition or during practice flights, the UAV Controller must turn off their transmitter, and invoke the flight termination mode.

The flight termination servo positions (programmed into the radio receiver) for fixed-wing aircraft are:

- Throttle closed;
- Full up elevator;
- Full right rudder;
- Full down on the right aileron;
- Full up on the left aileron; and
- Full flaps down (if applicable).

The flight termination servo positions for rotary-wing aircraft is to simply close the throttle.

In the case of lighter than air aircraft, strategies should be developed that ensure that the aircraft can be brought to ground in the case of failure, noting maximum

crosswinds and the estimated maximum distances that the vehicle could exceed the mission boundary.

5.6.1 Alternate Flight Termination Systems

If a team wishes to use an alternate Flight Termination Method, such as a parachute, then the details of such a system must be outlined in the Technical Report (Section 6.1). It is up to the team to convince the judges that the alternate system is safe.

5.7 Flight Demonstration

Before attempting the Challenge, all teams must demonstrate their aircraft in flight to the organisers. A circuit must be flown in piloted mode and autonomous mode (if applicable) to demonstrate the competency of the aircraft and the UAV Controller. The details of this circuit will be given to the teams on the practise days of the Challenge.

5.8 Take-off and landing

Teams must be capable of executing takeoff and landing from a rough mown grass runway. In order for a team in the Robot Delivery Challenge to claim bonus points for autonomous take-off and landings, these take-offs and landings must take place as part of the main mission.

5.9 Criteria for Flight Termination

The Range Safety judges can demand that the flight be terminated if they deem that the aircraft is out of control.

The UAV Controller must comply without delay or argument.

The team will be disqualified if the flight termination mode is selected.

5.10 Team Sponsors

Teams must advise the organising committee of their sponsors and the terms of the sponsorship. Full disclosure of sponsors must be provided as part of the technical report. Sponsors should be aware that footage of a team's aircraft and team members could form part of the official UAV Outback Challenge documentary and promotional material.

5.11 Liability and Insurance

It will be mandatory for all teams to implement their own insurance, including Public Liability insurance for both flight testing and competition flights. The organising committee will require evidence of a Certificate of Currency from each team.

Information on insurance required and insurance that can be purchased through the organisers of the competition will be available on the UAV Outback Challenge official website.

5.12 Loss of UAV Controller

In the case that a team's designated UAV Controller (pilot) is unable to fly the aircraft on the competition or scrutineering day for any reason (such as sickness, etc), then the judges have the discretion to allow another suitably qualified pilot (Section 5.2) to take their place. The replacement must also be a current high-school student.

5.13 Sharing of Equipment between Teams

Teams may not share airframes.

Teams may share avionics, piece parts and ancillary equipment. If a part is swapped between teams, the aircraft must be re-scrutineered. Records should be kept of items that are exchanged, from both the perspective of the donor and the recipient, including serial numbers (where they exist), make, model, etc.

Sharing of equipment is not possible is two teams run consecutively due to timing issues.

The sharing provision exists to assist teams that may suffer equipment damage while travelling or at the Challenge.

6 Judging

A team of at least three judges will determine compliance with all rules. Judges will be professional staff from within the UAV industry. Official times and measurements will be determined by the judges.

The judges will evaluate and score each of three elements, which will form the total Team score. The three elements are as follows:

- Technical Report : max 15 points
- Oral Presentation: max 15 points
- Flight Performance:
    - Airborne Delivery Challenge: max 70 points
    - Robot Airborne Delivery Challenge: max 120 points

The technical report and oral presentation must be completed prior to the team's mission flight. All decisions by the Competition Judges are final. There is a total of 100 points for the Airborne Delivery Challenge and 150 points for the Robot Airborne Delivery Challenge.

6.1 Technical Report and Video

Each Team is required to electronically submit a Technical Report in PDF format and a flight demonstration video in a common video format.

The technical report and video MUST be submitted on or before August 27, 2010.

The technical report must use the following headings:

1. Executive Summary (1 page)
2. Introduction (1 page)
3. Design Approach and Rationale (3 pages)
4. Risk Management Approach (2 pages)
5. Flight Test Results and Discussion (2 pages)
6. Conclusions (1 page)

One page is also allowed for the title page and one for that table of contents (gives total maximum page count of 12). No appendices are allowed.

The report and video will be assessed as follows:

Technical Report and Video (total of 15 Points)	
Scoring Components	**Max Points**
Executive Summary	2
Design approach and rationale	2
Risk Management Approach	2
Flight test results and discussion	2
Quality of writing	3
Overall style/presentation	2
Overall quality of video	2
Late submissions	MINUS 5 points per day
Over page limit (12 pages)	MINUS 2 points per page

Note to Teams: CASA will be given copies of the technical report as part of the compliance information for the Challenge event. CASA reserves the right to check teams at the competition to ensure that their aircraft are as described by the technical report and that teams are performing the safety procedures they outline in the technical report correctly.

6.2 Oral Presentation

Each Team will deliver a presentation (not exceeding 12 minutes, plus 3 minutes of questions from the judges) highlighting:

- their approach,
- system design,
- expected performance and
- what they have learned from the process.

Unique or innovative features and safety approaches should be included. Judging will be based on briefing effectiveness.

Each team will be allocated a presentation time (when they register at Kingaroy airport on the first day of the Challenge flying event).

Teams MUST be ready to present at their allocated time.

All presentations will finish at the end of the allocated time slot regardless of when they started. For example, if a team is 5 minutes late, they will only have 7 minutes to present.

Teams MUST supply their own laptop with the presentation loaded. Challenge organisers will provide a VGA projector and screen. Teams must test their computer compatibility with the data projector at registration.

The presentation will be assessed as follows:

Presentation (total of 15 Points)	
Scoring Components	**Max Points**
Quality and clarity of the oral presentation	4
Quality and clarity of the presentation slides	4
Does the presentation convey the overall team's achievements	4
Ability to answer questions	3

6.3 Mission Performance (Flying)

Each team will demonstrate their ability to deliver a rescue package to Outback Joe in a single 20 minute session for Airborne Delivery Challenge and 30 minutes session for Robot Airborne Delivery Challenge on the flying field at Kingaroy airport.

Teams will be invited out onto the flying field and given three identical "packages" that conform to the specification given in Section 2.1.1. Teams will then perform the Airborne Delivery mission as outlined in Sections 2 and 5.

6.3.1 Airborne Delivery Challenge

For the Airborne Delivery Challenge, the mission performance will be assessed as follows:

Airborne Delivery Challenge (total of 70 Points)	
Scoring Components	**Max Points**
Pre-flight checks, team communication and organisation, and demonstration of good judgement (airmanship)	15
Landing (safety, controllability and condition of the aircraft)	5
Accuracy of best payload drop that does not hit Joe (measured from where it rests)	Points = 5x(10-d), where d is distance in m to the closest point of Joe (max points 50, min 0)
Payload drop that hits Joe	50 (a maximum of 50 points is awarded regardless of how many

	times the payload hits Joe)
Time penalty	Minus 10 points for each minute over 20 minutes on the field
Exiting the flying zone (excluding the no-fly zone)	Minus 10 points per breach

6.3.2 Robot Airborne Delivery Challenge

For the Robot Airborne Delivery Challenge, the mission performance will be assessed as follows:

Robot Airborne Delivery Challenge (total of 120 Points)	
Scoring Components	**Max Points**
Pre-flight checks, team communication and organisation, and demonstration of good judgement (airmanship)	15
Landing (safety, controllability and condition of the aircraft)	5
Accuracy of best payload drop (measured from where it rests)	Points = 5x(10-d), where d is distance in m from centre of drop zone (max points 50, min 0)
Payload drop that hits Joe	50 (a maximum of 50 points is awarded regardless of how many times the payload hits Joe)
Autonomous flight: 1. Maintain commanded altitude 2. Maintain good flight path control 3. Good line over the hurdles	 10 10 10
Autonomous payload dropping (Mission Manager role is automated)	10
Autonomous take-off bonus	5
Autonomous landing bonus	5
Time penalty	Minus 10 points for each minute over 30 minutes on the field
Exiting the flying zone (excluding the no-fly zone)	Minus 10 points per breach

7 Awarding of Prizes

For the Airborne Delivery Challenge and the Robot Airborne Delivery Challenge, the team with the highest points will be awarded the prize money for first place **assuming that the team also flew at the competition and dropped at least one package within 10m of Outback Joe.**

Australian high school students may enter the competition without the approval of their schools (and be entitled to the full cash prize themselves), however they must do all the work in their own time (not school time) and obtain insurance themselves.

If project work is conducted in school time with school resources and cost subsidised by the school, prize money will be awarded directly to the school.

8 Guidelines for Spectrum Compliance

The following information has been summarised from the official ACMA website (refer below) and correspondence with the Authority, on behalf of the UAV Challenge Organising Committee for the UAV Outback Challenge.

Please note that the following information should only be considered as GUIDELINES designed to assist competitors in understanding the issue of spectrum compliance. Each team should ensure they understand and comply with all relevant spectrum regulations prior to their Flight Readiness Review.

8.1 The ACMA, Spectral Planning and Licensing

The Australian Communications and Media Authority (ACMA) are the Australian federal regulatory body responsible for radio-communications compliance and manage the access to the radiofrequency spectrum within Australia.

As an independent Statutory Authority to the Commonwealth of Australia, the ACMA manages the spectrum in accordance with the Radiocommunications Act 1992, as outlined by the Ministry of Communications, Information Technology and the Arts.

While the ACMA encourages competitiveness and self-regulation of the RF spectrum, spectral planning provides the overall Statutory framework for the allocation and administration of radiofrequency transmissions for different types of services, as granted under the Act. This is done to maximise the efficient use of the spectral resource and minimise interference of adjacent channels.

The Australian Radiofrequency Spectrum Plan (ARSF)2009 is the latest spectrum plan used in Australia and is based upon the outcomes of the International Telecommunication Union (ITU) World Radiocommunication Conferences. As Australia is an obligatory member of the ITU, the ARSF must be drafted so that it takes into account the spectral allocations moved by the ITU.

The ARSF is used in conjunction with frequency and administrative band plans to structure the available RF spectrum for use within Australia.

In order to utilise the RF spectrum, a relevant licence must be obtained from the ACMA for anyone who makes use of a transmitter, as implied under the Act. The licensing of operators using RF devices falls under several different categories:

- Apparatus Licence – based on the type of service provided by the communication link.
- Spectrum Licence – based on the area the communication link is routed.
- Class Licence.

Both Apparatus and Spectrum Licences are issued on an individual basis and there are subsequent Licence fees incurred, as well as the need for direct consultation with the ACMA by the licensee over the terms and conditions of the Licence.

Class Licences cover designated parts of the spectrum set aside for shared access by the general populous. Users of devices under a Class Licence conform to a common set of conditions applicable to all users and do not need to register or pay the ACMA for the Licence.

Under the current regulatory framework, there are no "un-licensed" bands for RF communication purposes.

All radiofrequency bands are subject to frequency and power restrictions, as defined within the applicable Licence category. This includes Class Licences.

8.2 Class Licensing and The Challenge

Class Licences are a common choice of Licence given the ease of their use and the wide range of readily-available communication devices that fall within the operational conditions of the various Licences.

Class Licences vary according to the type of services provisioned under the Licences, the bandwidth of frequencies each Licence is defined over and the maximum allowable transmitted power over that bandwidth.

As such, not all Class Licences are applicable for UAV operations from legal, technical and safety perspectives.

The Technical Committee has deemed the following Class Licences, or parts there of, applicable to the UAV Challenge for competitors to use in their link budget designs:

- Radiocommunications (Low Interference Potential Devices) Class Licence 2000
- Radiocommunications (Radio-Controlled Models) Class Licence 2002

8.3 Guidelines for Using Class Licences

Competitors are entitled to use the aforementioned Class Licences for their radio links, on the provision that they act in accordance with the conditions defined under the Licence.

In general, this requires competitors to conform to:

- The class of transmitter specified by the Licence (eg. Digital modulation, Frequency hoping).
- The maximum radiated power for that frequency band. This is usually expressed in Effective Isotropic Radiated Power (EIRP).

If competitors fail to meet the conditions specified by the Class Licence, they are no longer deemed to be acting in accordance with it. Unless competitors gain another type of Licence from the ACMA to do so, it is classified under the Act as an illegal activity.

The ACMA has stated to the Technical Committee that devices used under the Radio communications (Low Interference Potential Devices) Class Licence 2000 must be low interference. They are within their right, should circumstantial evidence be provided, to turn off any transmitter causing potential interference and prevent further usage of the offending device.

8.4 ISM Frequencies

Several of the Industrial, Scientific and Medical (ISM) bands fall under the Radio communications (Low Interference Potential Devices) Class Licence 2000 and devices used for radio communication purposes across these frequency bands are subject to the provisions outlined by the Class Licence.

It should be noted that the frequency range for the 900MHz ISM band for Region 3 (Australia) is different to other parts of the world and competitors should take this into consideration when designing their system.

Furthermore, the ACMA warns that radio communication services operating over ISM frequencies cannot be afforded protection from interference caused by non-radio communication ISM applications. As such, the suitability of using ISM bands for radio applications should be assessed by competitors (refer NOTE § 3 of the LIPD Class Licence).

8.5 FINAL NOTE TO COMPETITORS

Spectrum compliance is an issue that the organisers of the UAV Challenge take very seriously.

It is the responsibility of each team to ensure their UAV operations are spectrum compliant for the UAV Challenge.

Details of frequency management at Kingaroy will be provided during competitor orientation and safety briefing.

Failure to comply with any of the rules in Section 8.5 may result in team disqualification or other appropriate penalties (at the judges discretion).

For more information regarding spectrum planning, licensing and frequency allocation, please refer to the ACMA website available at:

www.acma.gov.au

9 Disclaimer

This document is subject to change by the Challenge organisers. The current rules document will be available from the challenge website. Registered participants will be notified of any changes.