Australian Government
Civil Aviation Safety Authority

Standard Scenario Application and Documents - Guidance Material

Owner	Branch Manager RPAS
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Table of contents

Reference material

Document type	Title
Publication	JARUS SORA version 2
Regulation	Part 101 Manual of Standards

Forms

Form no.	Title
Form 101-09	Application for RPA flight authorisation

Revision history

Revisions to this manual are recorded below in order of most recent first.

Version no.	Date	Parts / sections	Details
0.1	July 2020	All	First draft
0.2	March 2021	All	Draft for consultation

Glossary

Acronyms and abbreviations

Acronym / abbreviation	Description
ABS	Australian Bureau of Statistics
AEC	Airspace Encounter Category
AGL	Above Ground Level
AMSL	Above Mean Sea Level
ARC	Air Risk Class
AsA	Airservices Australia
ATC	Air Traffic Control
AU-STS	Australian Standard Scenario
BVLOS	Beyond Visual Line of Sight
CASA	Civil Aviation Safety Authority
C2	Command and Control
C3	Command, Control and Communication Link
CONOPS	Concept of Operations

Acronym / abbreviation	Description
CPA	Conventionally Piloted Aircraft
CRM	Crew Resource Management
CTR/CTZ	Control Zone
DAA	Detect and Avoid
EMS	Emergency and Medical Service
ERP	Emergency Response Plan
EVLOS	Extended Visual Line of Sight
ft	Feet
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HMI	Human Machine Interface
IAW	In Accordance With
JARUS	Joint Authorities for Rulemaking of Unmanned Systems
kJ	Kilojoules
km	Kilometre
LTE	Long Term Evolution. LTE is a 4G wireless communications standard.
MC	Maintenance Controller
MOS 101	Manual of Standards Part 101
MTOM	Maximum Take-off Mass
NM	Nautical Miles
OEM	Original Equipment Manufacturer
OSO	Operational Safety Objective
ReOC	RPA Operator's Certificate
RP	Remote Pilot
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft Systems
RPIC	Remote Pilot in Command
RPS	Remote Pilot Station
SAIL	Specific Assurance and Integrity Level
SORA	Specific Operation Risk Assessment
TMPR	Tactical Mitigation Performance Requirements
VMC	Visual Meteorological Conditions
VLOS	Visual Line of Sight

Definitions

Term	Definition
Active Participants	Those persons directly involved with the operation of the RPA or fully aware that the RPA operation is being conducted near them. They are fully aware of the risks involved with the RPA operation and have accepted these risks. They are informed on and able to follow relevant effective emergency procedures and/or contingency plans
Airport Environment	For the purposes of this document, SORA defined Airport Environment is generally defined (qualitatively) as the region surrounding an airport or heliport where arriving and departing manned aircraft typically fly. It may or may not be directly mapped to an airspace class. Competent authorities may locally define specific metrics for the definition of "airport environment". For instance, CTR/CTZ can be reasonably considered to be “airport environment”.
Atypical Airspace	This can be: • Restricted airspace (e.g. segregated/restricted areas) • Airspace designated "atypical" by the competent authority • Airspace where manned aircraft do not routinely fly (e.g. within 100 ft from buildings).
Beyond Visual Line of Sight (BVLOS)	An RPAS operation whereby the RPIC is not able to maintain at all times visual unaided contact with the aircraft.
Dwelling	A house, flat, or other place of residence.
Extended Visual Line of Sight (EVLOS)	An RPAS operation whereby the RPIC maintains an uninterrupted situational awareness of the airspace in which the RPA operation is being conducted via visual airspace surveillance through one or more human observers, possibly aided by technology means.
Improbable	For the purpose of this assessment, this term should be interpreted in a qualitative way as “unlikely to occur in each RPAS during its total life but which may occur several times when considering the total operational life of a number of RPAS of this type”.
Probable	For the purpose of this assessment, this term needs to be understood in its qualitative interpretation i.e. “anticipated to occur one or more times during the entire system/operational life of an item.”
Remote Australian Airspace	Airspace defined by CASA as being located in areas which have very low population density and negligible air activity so that these areas can be considered suitable for consideration for RPA BVLOS operations utilising mitigations agreed with CASA.
Remote Pilot in Command (RPIC)	The pilot responsible for the flight and all actions conducted by the operating crew in support of the flight. For BVLOS operations, the RPIC will hold an IREX or CASA approved BVLOS examination pass. Under Exemption CASA EX67/20, the RPIC does not have to be the RP controlling the RPA.

Term	Definition
Shielded Operations	An operation of an RPA within a specified distance, typically 100 metres from, and below the top of, a natural or man-made object.
Viewshed Analysis	A line-of-sight analysis for mapping the visibility of a place or area from a selected location.
Visual Line of Sight (VLOS)	An RPA is being operated within the visual line of sight of the person operating the aircraft if the person can continually see, orient and navigate the aircraft to meet the person's separation and collision avoidance responsibilities, with or without corrective lenses, but without the use of binoculars, a telescope or other similar device.

1 Introduction

Approval is required from CASA to conduct RPA operations beyond visual line of sight (BVLOS). Remotely piloted aircraft operator's certificate (ReOC) holders may apply to CASA for a BVLOS approval. As part of an application, operators need to demonstrate to CASA their ability to satisfy specified safety considerations.

CASA has adopted the Specific Operations Risk Assessment (SORA) process to assist in the assessment of these applications. The SORA is a bow-tie[1] based, detailed operational risk assessment developed by the Joint Authorities for Rulemaking of Unmanned Systems (JARUS). The SORA helps regulators and operators to gain a clear understanding of the risk posed by an operation in terms of ground and air risk and, hence, what the minimum requirements (technical, operational and organisational) should be required to be evidenced to produce an acceptable safety case.

To date, CASA has assessed BVLOS applications on a case-by-case basis according to the SORA process, with the process individually repeated for each new application. With increasing numbers of BVLOS applications being submitted, CASA has chosen to create standard scenarios for pre-defined operational characteristics to determine the likely mitigations and SORA assessment outcomes for operations that meet those characteristics. As these scenarios have been created according to specified operational characteristics, they can be applied to a wide range of use cases.

For each standard scenario, CASA has developed guidance material for operators to use when submitting a BVLOS application, including information about how to assess an area, and the mitigations and procedures required to support the application. This is covered in further detail in the BVLOS Standard Scenario (AU-STS) Applicant Response templates.

This document provides general guidance about some of the supporting documentation required for a BVLOS application, along with information about how to prepare specific documents to include essential information required by CASA when assessing a BVLOS application.

This document has not been endorsed by JARUS and is applicable to RPAS operations in Australian airspace only.

It is recommended operators download and read the SORA annexes to ensure familiarity with the terminology used before completing the CASA BVLOS Standard Scenarios (AU-STS). The SORA package is available from the JARUS website at http://jarus-rpas.org/publications.

[1] The bow-tie method is a risk evaluation method used to analyse and demonstrate causal relationships in high risk scenarios. The method takes its name from the shape of the diagram created. A bow-tie diagram both provides a visual summary of plausible accident scenarios that could exist around a certain hazard and, by identifying control measures, the bow-tie displays what an operator does to control those scenarios.

2 Scope

Currently, there are six standard scenarios (denoted by AU-STS) that have been developed for BVLOS operations in Australian airspace:

1. AU-STS 1: BVLOS operations near a vertical object(s) with a controlled ground environment.
2. AU-STS 2: BVLOS operations near a vertical object(s) with a sparsely populated ground environment.
3. AU-STS 3: [Reserved for a future release]
4. AU-STS 4: BVLOS operations in a remote area within 3 NM of a registered or certified non-controlled aerodrome.
5. AU-STS 5: BVLOS operations for emergency services or operators in response to a natural disaster (cyclone, bushfires, floods etc.) in sparsely populated areas or areas that are now considered evacuated.
6. AU-STS 6: BVLOS operations in remote Australian airspace (below 400 ft AGL).
7. AU-STS 7: BVLOS operations in remote Australian airspace (400 ft AGL to 5000 ft AMSL).

This document provides general guidance for applicants intending to apply for an approval to conduct BVLOS operations using one of these standard scenarios, along with detailed guidance for developing the documentation required by CASA to support a BVLOS application.

This guide should be read alongside the Applicant Response template for the required standard scenario.

3 Guidance for Supporting Documents

This guide contains detailed information to assist applicants when developing supporting documents and procedures for a standard scenario:

- BVLOS Procedures
- Training
- Emergency Response Plan (ERP)
- HMI Assessment
- Stakeholder Engagement Plan (SEP).

Some of these documents may not be required for a standard scenario, and applicants should check the Applicant Response template for their chosen standard scenario to identify the minimum supporting documents.

This guide contains suggested content that is considered to capture the minimum requirements to support the safety case for a BVLOS application. Applicants may provide alternative mitigations provided they meet or exceed the requirements. In any case, applicants should consider any additional safety mitigation measures, evidence and supporting documentation over-and-above the minimum requirements which are appropriate to best support their safety case.

3.1 Formatting supporting maps and images

Supporting maps and images should be submitted as KML (or similar) files which are readable in a geospatial software application, such as Google Earth. Files should contain the following information:

- RPA flight heights
- Flight operational area (including Flight Geography and Contingency Volume)
- 1:1 buffer (or appropriate Ground Risk Buffer)
- Vulnerable critical infrastructure and sensitive areas
- RPIC/RP location(s)
- Take-off and landing locations
- Alternate landing locations
- Planned flight path
- Dwellings
- Settlements
- Viewshed analysis
- C2 range from controller
- Any relevant airspace or aviation activities (e.g. app/dep path, VFR routes, model flying etc.)
- Open air gatherings (e.g. sports ground, community pitches/parks, school etc.)
- any other relevant information.

Examples of a correctly formatted file are shown below. These should be completed to align with the chosen standard scenario and proposed operation.

Note: The following examples are presented as static images (e.g. screenshots), but submitted files should be provided in a KML (or similar) format.

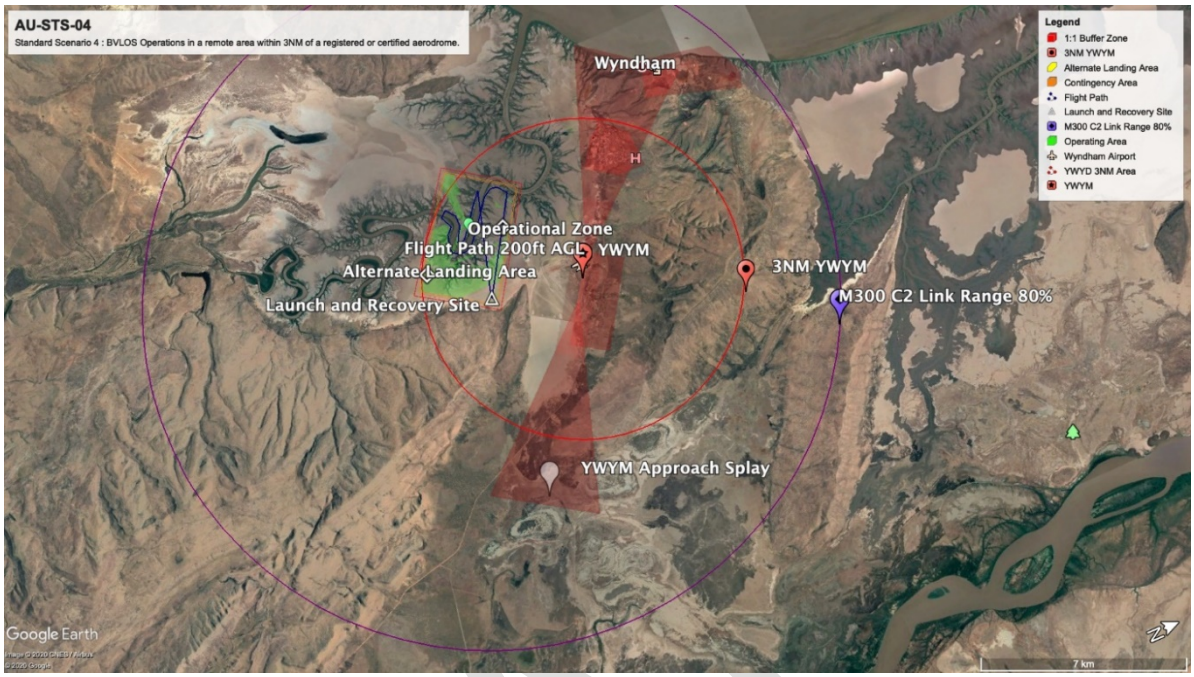

Figure 1: Example of KML file screenshot

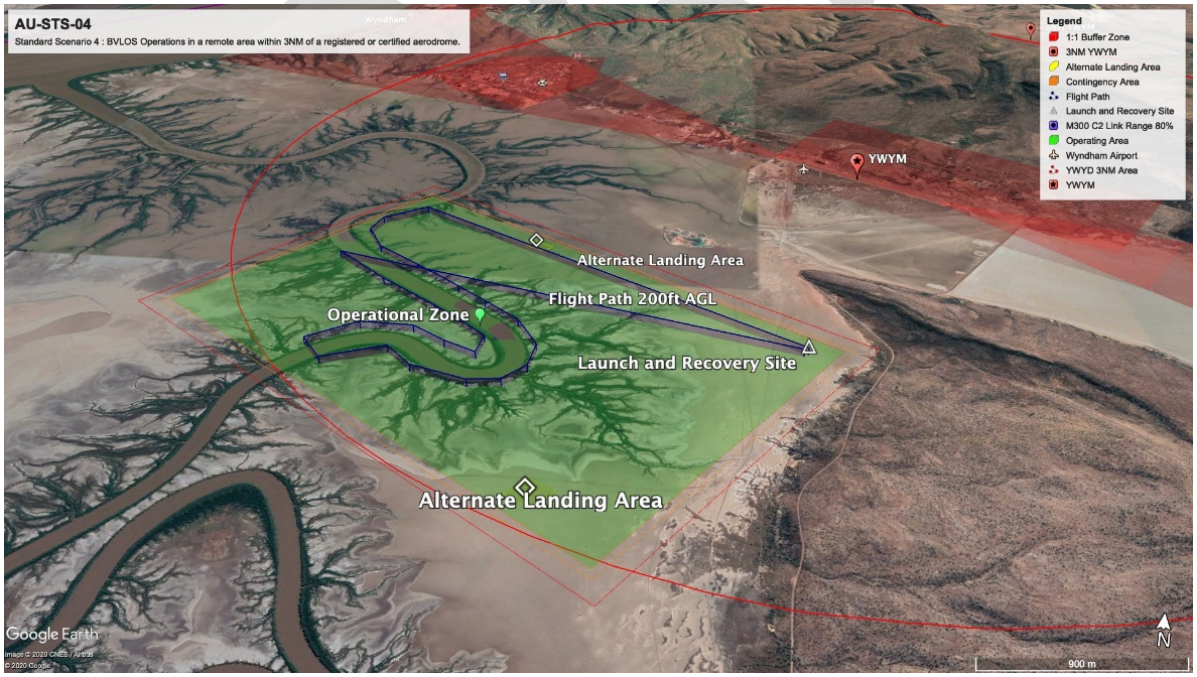

Figure 2: Example of KML file screenshot

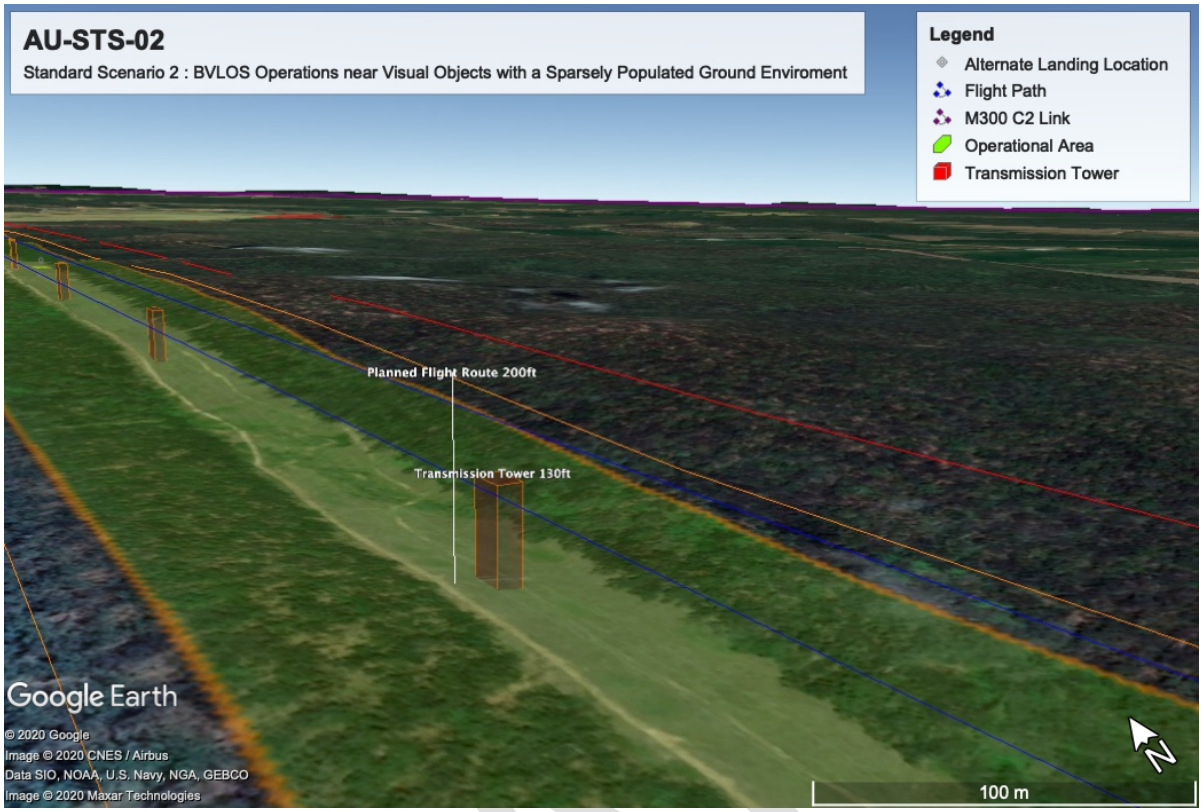

Figure 3: Example of KML file screenshot

4 APPENDIX A: Operations Manual

This appendix sets out the sections and procedures that should be included in the Operations Manual submitted as part of the BVLOS application supporting documentation.

Applicants may choose to use CASA's RPAS Sample Operations Manual (available at https://www.casa.gov.au/drones/documents-and-forms) as a template for this manual or develop their own manual. In any case, the following headings should be included in the submitted Operations Manual.

Example text (shown in *italics*) has been provided for some procedures. Applicants may choose to use this text as provided, add additional information, or develop new procedures, provided the submitted procedures detail how BVLOS operations will be conducted.

4.1 Schedule 1

The Operations Manual must include a table for RPAs approved for BVLOS operations.

RPAs Approved for BVLOS Operations		
RPA Type	**RPA Configuration Notes**	**Maximum Operating Distance**

The maximum operating distance is either 80% of OEM determined range or maximum C2 range determined by flight operations.

Note: If the operator has determined the range through flight operations, records must be kept of how this was determined.

4.2 Operational Procedures

CASA suggests containing the BVLOS procedures in a separate appendix of the Operations Manual.

4.2.1 Updated record keeping for BVLOS operations

The applicant should detail how information about BVLOS operations will be recorded for the following:

- Operational release
- Operational log
- Pilot log
- Technical log for RPAs to be used for BVLOS.

4.2.2 RPAs authorised for BVLOS operations

The applicant should detail how RPAs are approved for BVLOS operations.

Example text:

> *All BVLOS operations must be conducted in accordance with all the conditions of the CASA-issued instrument approving the BVLOS operation. This instrument details which RPAs category or type can be used by the REOC Holder. Any RPA listed in Schedule 1 for BVLOS operations will not be operated more than 80% of the maximum distance for the C2 link authorised by the OEM, or where not specified by the OEM, the C2 link range determined by actual flight operations. Ranges determined by flight operations are recorded in the Schedule 1 once approved by the CRP.*
>
> *The approved operating range is only one consideration on the maximum operating range for the C2 link for a specific operation; the other main considerations are operating height of the RPA, terrain shielding and antenna height. The RPIC should consider all these factors when deciding where to site the C2 antenna and pilot control station to ensure that the link between the RPA and control station is maintained throughout the RPA operation. The RPIC is to provide a viewshed analysis of the operating area as part of the operational release for all BVLOS flights.*

4.2.3 BVLOS communications

The applicant should detail the communication methods that will be used to monitor airspace and communicate with observers if required. Also, the applicant should explain the process to ensure RPIC is contactable in the operating area and that communication coverage is satisfactory.

4.2.4 External systems

The applicant should detail any external systems (e.g. LTE, Internet etc.) required for the operation and how loss of these services will affect the operation and how this is managed.

4.2.5 Weather conditions

Weather and visibility conditions for a BVLOS operation

The applicant should detail the weather limits and how compliance with the weather limits will be achieved.

Example text:

> *A BVLOS approval is not an authorisation to fly in non-VMC conditions (e.g. cloud, fog etc.). An RPA may only be flown in a BVLOS operation when:*
>
> *a) visibility is at least 5000 m*
> *b) at least 1000 ft vertically clear of cloud*
> *c) not in the vicinity of thunderstorms*
> *d) forecast wind speed is 25 kts or less (not including gusts), and*
> *e) OEM weather limits are not exceeded.*

If the weather deteriorates to these limits, the RPA operations are not to be planned or, if in progress, the RPIC is instructed to land the RPA as soon as safely practicable.

The RPIC is responsible for ensuring that the RPA operates within weather limitations at all times.

The RPIC is to check the following weather sources prior to flight:

a) TAF/METAR for any airfields in the planned operating area
b) NAIPS Area forecast for the planned operating area
c) AWIS/ATIS for any airfields in the planned operating area
d) Weather radar for the planned operating area.

A copy of the weather briefing produced must be saved as part of the operational release / log.

The RPIC is to continuously monitor, from RPA take-off to landing, the following:

1) a weather radar, if available, to help identify rain showers and storm cell formation
2) the closest or closest set of METAR/AWIS/ATIS to the planned operating area
3) visibility distance, referencing a point in the operating area.

4.2.6 Operating area

Air Considerations

The applicant should explain how air risks are mitigated for the proposed operation, in particular around aerodromes or other areas of increased air activity. It is recommended the applicant outline how any other additional mitigations, such as ADS-B In, observers etc., will be used. In addition, the applicant should detail process for NOTAM submission and detail the actions to be taken if the RPIC becomes aware of a possible conflict with a manned aircraft.

Ground Considerations

The applicant should explain how:

1. any 1:1 buffer will be applied
2. the overflight of dwellings will be avoided
3. ground buffer is not adjacent to open air gatherings
4. overflight of towns will be avoided
5. critical infrastructure will be avoided
6. crossing roads will be managed
7. proximity to the vertical object(s) will be maintained
8. transits through or in close proximity to aerodromes will be managed
9. transits through danger areas will be managed
10. alternative landing areas will be identified.

4.2.7 Pre-flight preparation

Flight Planning Requirements

Example text:

All BVLOS operations will be planned to operate below 120 m AGL unless authorised to operate above 120 m AGL by an instrument issued by CASA and all the conditions of this instrument are complied with.

The RPIC will select the RPA to be used to complete the operation. RPAs are only to be operated a maximum of 80% of the OEM C2 link performance; the RPIC is to plan the mission to remain within this distance of the remote pilot station. The RPIC is also to complete a viewshed analysis to ensure that C2 link coverage is adequate. The location(s) of the RPIC is selected to be elevated and clear of trees and buildings.

Any vertical hazards and terrain in the planned operating area must be identified and considered during the planning phase and continually re-assessed for change during operation. The following heights need to be calculated:

1. *operating height to ensure vertical separation between terrain and obstacles*
2. *operating height to ensure that C2 link in not lost due to terrain or obstacle screening*
3. *return to home height to ensure that the RPA does not collide with a vertical obstacle or terrain in the event of a lost link event.*

The RPIC must plan the operation and consider the power requirements for any operation. Power warnings must be set to reflect the maximum power requirements of any routing back to the planned landing site or RTH logic which may include a climb. The OEM manuals should be consulted for maximum flight durations and range in still air. The effects of any headwind is to be considered.

The RPIC should complete pre-flight mission planning prior to departing for the operating location and ensure that it loads to the RPA/controller.

An alternate landing site (or multiple alternate landing sites, where this is necessary) is to be identified in the BVLOS operating area which can be used if the RPA cannot be recovered to the planned landing location. The RPIC is instructed to clear this location using a camera prior to landing, and the RTH location must be set to the alternate location to prevent the RPA RTH to the original take-off location when the C2 link is lost.

The RPIC is required to also identify a location which can be used to perform an in-flight termination of the RPA if the RPIC is unable to be landed safely or recovery to the primary or alternate landing locations is not possible.

The RPIC is instructed to check mobile phone coverage of the operating location. If no mobile coverage is available, a satellite phone is required to be taken into the field. The RPIC must ensure a NOTAM is active prior to operating. The phone number provided must be for a mobile or satellite phone which has coverage in the operating area.

The applicant will need to explain how any parts of the mission will be planned VLOS or EVLOS, and show how these are integrated into the mission. Additionally, if the operation is intended to include shielded operations, the applicant needs to detail how a shielded operation will be planned.

The applicant should explain how the operations will be conducted if there is a possibility of electronic interference.

The applicant should explain how any required external services will be integrated into the operation.

Pre-Flight RPA Checks

The applicant should explain how the site will be set up for BVLOS operations.

Normal Procedures

The applicant should detail the additional procedures to be completed as part of the RPA preparation for flight, operation and post flight.

The applicant should explain how the following will be monitored:

- RPA position, height or altitude, ground speed or airspeed and tracking are monitored
- RPA position reference areas and dwellings to be avoided
- how the RPA height reference to the vertical object(s) will be verified
- how the RPA height will be monitored with reference to terrain
- how the RPA will track around/along the vertical object(s) to maintain the required lateral spacing
- RPA energy status (fuel, batteries etc.)
- status of critical functions and systems; as a minimum, for services based on RF signals (e.g. C2 Link, GNSS etc.) means should be provided to monitor the adequate performance and triggering an alert if level is becoming too low.
- detecting interference with C^2 or other RPA systems.

4.2.8 Abnormal procedures

The applicant should detail the following procedures:

Procedures if manned aircraft are active in the airspace

The applicant should detail the procedures that will be followed if manned aircraft are active in the airspace, including how the operator will:

- detect a manned aircraft
- decide and command a course of action
- ensure that course of action is completed in a timely manner.

Procedures for loss of control/C2 of an RPA in a BVLOS operation

The applicant should describe the procedures for a loss of control/C2 during a BVLOS operation.

Actions if RPA navigation performance degraded

The applicant should explain the actions that will be taken if RPA navigation performance is degraded.

Actions if an essential external service is degraded or lost

The applicant should explain the actions that will be taken if an essential service is degraded or lost.

Actions if weather deteriorates

The applicant should explain the actions that will be taken if the weather deteriorates.

Flight termination or deliberate controlled flight into terrain

The applicant should describe the procedure for an abnormal flight termination or deliberate controlled flight into terrain.

Actions after a crash during BVLOS operations

The applicant should explain the actions that will be taken following a crash during BVLOS operations.

4.2.9 Annual BVLOS Remote Pilot proficiency or recurrency check

The applicant should detail contents of a proficiency check, assessment criteria and what constitutes an RP being considered proficient.

4.2.10 Advanced operations

Controlled airspace and BVLOS operations

Example text:

> *An approval of an BVLOS operation conducted in controlled airspace applies only if the operation is conducted in accordance with:*
>
> 4. *the requirements of Part 101 of CASR and MOS 101*
> 5. *any other conditions in any approval from CASA, and*
> 6. *any permission from the air traffic control service for the aerodrome, for operations in the relevant controlled airspace.*

Night BVLOS operations

Example text:

> *BVLOS operations may be conducted at night provided the conditions of any BVLOS and night approvals issued by CASA are complied with.*

Handover between remote pilot for BVLOS operations

The applicant should

- explain how handover between pilots will be conducted during BVLOS if required
- explain how transition from BVLOS to VLOS / EVLOS and vice versa will be conducted
- explain crew responsibilities if applicable
- details procedures and responsibilities if an IREX-qualified (or CASA-approved examination) RP is supervising other RPs.

Shielded Operations

The applicant should detail how you will conduct shielded operations if required.

5 APPENDIX B: Training

The applicant should provide an appendix in the Operations Manual of how crew members and trainers internally train for BVLOS operations.

5.1 Remote Crew

The following are provisions applicable to RPA operators to ensure proficiency, competency and clear duty assignment to the flight crew. RPA operators may decide to expand these requirements as applicable to operations.

5.1.1 Remote flight crew training and qualifications

Example text:

Prior to starting BVLOS training the RP must have:

1. *An aeronautical radio qualification*
2. *Twenty hours' RPA experience, and*
3. *Two hours' on type and model of RPA.*

The operator should ensure the entire remote crew (i.e. any person involved in the operation) are provided with competency-based theoretical and practical training specific to their duties consisting of the following elements:

BVLOS: Beyond visual line of sight - Description of training

1.0 Unit description

This unit describes the skills and knowledge required to operate an RPA in BVLOS operations.

2.0 Elements

2.1 BVLOS pre-flight preparation

2.2 BVLOS operations

2.3 BVLOS landing

3.0 Range of variables

1) Operations during daylight, at night or under artificial illumination
2) Various weather conditions
3) Conduct C2 electronic line of sight analyses such as viewshed.

4.0 Underpinning knowledge of the following:

1) RPA equipment and performance requirements
2) Human performance and multi crew cooperation considerations

3) BVLOS operational considerations
4) Principles of SORA
5) Network limitations and dependencies
6) ERP responsibilities
7) Multi crew co-ordination training for handovers working with:
    a. Payload operators
    b. Observers
    c. RPIC supervising RPs.

5.0 Performance criteria

The applicant should explain how assessments will be conducted; what are the assessment criteria; and who can conduct the assessment and the assessors' competencies.

BVLOS-P: Beyond visual line of sight - Practical flight test requirements

The applicant should outline the contents of the practical flight assessment for crewmembers and trainers.

BVLOS-T: Beyond visual line of sight - Theory

The applicant should provide details of the theory training that must include mission planning and trainer's syllabus.

ERP Training:

The applicant should provide internal BVLOS trainer's syllabus with qualification and experience requirements

5.2 Training Records

The applicant should explain how training will be recorded and currency maintained. In addition, the applicant should ensure that certificates of completed training are provided IAW MOS 101. Examples of any forms that will be used should also be provided.

6 APPENDIX C: Standard Emergency Response Plan (ERP) Template

An Emergency Response Plan (ERP) is a plan that is activated if there is an accident or major in-flight incident. The ERP sets out what an operator will do in the case of an emergency and, importantly, how an operator will return to normal operations.

As described in SORA Annex B: “The Emergency Response Plan (ERP) proposed by an applicant **is different from the emergency procedures**”.

The ERP is expected to cover:

- a plan to limit the escalating effect of crash (e.g. notify first responders), and
- the conditions to alert Air Traffic Management.”

Emergency procedures are enacted to attempt to either recover or terminate a flight. The ERP deals with the consequences and any associated accidents or incidents of a terminated (or lost) flight.

The ERP should be capable of dealing with any hazards identified in the risk register that occur.

The ERP can either be a stand-alone document or contained within the Operations Manual.

6.1 Emergency Response Plan (ERP) Content

Generally, an ERP suitable to the proposed operations (and operating environment) should be developed which details the processes and procedures to address the following overarching elements:

- Provides for an orderly and efficient transition from normal to emergency operations
- Delegation of emergency authority
- Assignment of emergency responsibilities
- Authorisation by key personnel for actions included in the ERP
- Coordination of efforts to handle the emergency (in terms of both internal resources, and external emergency services/agencies)
- Safe continuation of operations, or return to normal operations, as soon as possible
- Planned and coordinated action to manage and minimise the risks associated with an emergency.

The operator shall establish an ERP that covers all relevant items listed below:

1. Scope and applicability of the ERP.
2. Defined criteria to identify emergency situations.
3. What authority is delegated, and to whom to manage the emergency and decide on how operations are continued.
4. Definition of safety roles and responsibilities for Remote Crew.
5. Identification of first aid trained personnel.
6. Identification and records of relevant ERP stakeholders (Emergency services units).

7. Identification of response times and location of emergency services and medical assistance.
8. Contact list for internal personnel and external agencies.
9. Communication and coordination procedures between Remote Crew and external parties (Emergency services, Air Traffic Services, landholders etc.).
10. Any devices used for communication should be verified to have adequate availability of service (mobile phones, radios etc.).
11. Documented accident and incident procedures/checklists, including priority of actions (immediate actions + subsequent actions). This should include aide memoir of essential actions.
12. Any required emergency equipment and personnel trained to use that equipment.
13. Checklist of emergency items, who is responsible for them. There is little point providing lights, flares, fire extinguishers etc. that do not function.
14. Map of operating area with reporting points.
15. Specific location considerations.
16. Procedures for accident and incident reporting, including recording and preservation of evidence.
17. Media interactions.
18. Site clean-up procedures.
19. Hazardous material procedures.
20. Post-incident actions.

The ERP training syllabus should be documented in the Operations Manual. The operator should provide competency-based theoretical and practical training covering the ERP that includes related proficiency requirements and training recurrences. Records will be maintained in accordance with MOS 101. ERP training and competency records are maintained.

The ERP is validated through a representative table-top exercise consistent with the ERP training syllabus. The table-top exercise may or may not involve all third parties identified in the ERP.

CASA has developed a checklist to help organisations develop and implement their ERP. This is contained in Booklet 2 of CASA's safety management system resource kit (available at https://www.casa.gov.au/safety-management/safety-management-systems/safety-management-system-resource-kit) and is shown below.

7 APPENDIX D: HMI Assessment Template

A Human Machine Interface (HMI) assessment may be required as part of a SORA assessment. Each applicant should conduct a human factors evaluation of the RPAS to determine whether the HMI is appropriate for the mission. The HMI evaluation should be based on inspection or analyses of systems and displays. It must include how RPAS information and control interfaces are clearly and succinctly presented and do not confuse, cause unreasonable fatigue, or contribute to remote crew error that could adversely affect the safety of the operation.

Below is an example of what CASA would consider the minimum information required to cover the SORA requirement for low integrity and assurance for BVLOS activities. Not all parts will apply to all operations and the applicant should tailor the assessment as required.

7.1 RPIC Location Set Up

This step should ensure that the BVLOS RPIC is setting up the pilot station in an environmentally controlled site. This could be as simple as a shaded location or sunshade to a purpose-built room or containers.

Item	Assessment
Noise	Were pilots able to hear radio transmissions? Were headsets used? If so, were they comfortable for long periods? Were speakers used? Were any noise levels distracting? Were any noises irritating? Were non-safety critical conversations taking place nearby?
Lighting	Was lighting adequate? Was there any glare on displays? If so, how was this mitigated Were pilots able to set brightness to their personal preferences?
Crew Comfort Temperature	How was rain managed? How was temperature managed? Was the pilot protected for wind? Did the crew have to wear excessive clothing which reduced dexterity? Were the crew exposed to high temperatures?
Access to RPIC	Was access to the site controlled? Could the RPIC be disturbed during flights?

	Was signage present to say that operations were in progress? Was eating and drinking allowed? Were personal mobiles allowed?

7.2 Crew Furniture

Item	Assessment
Seats	Is the seat height adjustable? Does it have a curved lower back (lumbar) support on the backrest Is the backrest height adjustable? Is the backrest adjustable tilt? Is the seat pan tilt adjustable? Does the seat have a rounded front edge? Are the adjustment controls easy to operate from the seated position? Does the base have five points? Is the cushioning and covering on the seat and backrest comfortable?
Desk/Table	What shape is the desk? Does it have adequate space for all equipment and books? Can pilot reach all equipment without standing up? Does it have space for drinks/water bottles? Can monitor heights be adjusted to reduce fatigue?
Any Other furniture:	
Storage, shelves etc.	

7.3 RPIC Workstation Set Up

Overview:

Item	Assessment

Computer	
Displays	
Input Devices	
Communications	Radio VHF Airband and speaker/headset Radio UHF and speaker Telephone Landline Telephone Mobile Telephone Satellite Data messaging Datalink Email Web access: NOTAMs, Weather, Camera feeds, Live traffic
Workstation cleaning / Health controls	Was hand sanitizer available? How often is the RPIC workstation cleaned? Are cleaning materials available to the RPIC before and after a mission?

7.4 Normal Operation

Phase	**Assessment**
General	Were any tabs overlapping critical information? Was the aircraft status and location always displayed to the pilot? Was the pilot always aware of the radio being monitored?

	Were colours and resolution of display adequate during all phases of flight? Were any audio alerts clear and unambiguous? Were any displays or devices fatiguing to use? Were checklists available and logically presented? Were checklists easy to follow and complete?
Planning	Was it apparent that all information used was up to date? Were symbols on the map clear and unambiguous? Were colours used logically? Was map clutter satisfactory or were declutter functions used? If so, was it obvious when a map was decluttered? Were any cross-checks of entered data in place?
Pre-Flight Checks	Was it apparent that the aircraft was serviceable? Was it apparent that the flight had been authorised and aircraft released for flight? Was it apparent where the aircraft was going to head to and what height it was going to climb to? Was it apparent that the correct mission was loaded? Was the status of datalink, GNSS, radios, and networks apparent to the pilot?
Pre-Departure / Take-off	Was it apparent that the weather was suitable for take-off? (parameters including visibility, cloud, wind etc.) Was it apparent if there were any obstacles or people in the vicinity or on the initial route? Was it apparent if any other aircraft were airborne in the area?
Transit to Operational Area (If EVLOS, VLOS utilised)	
Operations	Was the aircraft location and height apparent? Were the operating area and no-fly zones apparent? Was it easy to determine where the aircraft was flying to and the next waypoint? Was it easy to re-route the aircraft?

	Was the state of the aircraft apparent? Power level, GNSS performance, datalink/LTE health Were warnings obvious? Was it apparent what frequency was selected? Was it apparent what the volume level of the radio was? Was other air traffic apparent? Were weather condition changes apparent? Visibility, cloud, wind, temperature
Recovery to Land	Was it apparent where the aircraft was going to land? Was it apparent what the weather at the landing location was?
Landing and post-flight procedures	Was it apparent that aircraft had landed in the correct location? Was it apparent that the aircraft had shut down? Was it apparent if the aircraft was serviceable or damaged?
Emergencies	Was it apparent that the aircraft has suffered a failure? Was it apparent that ancillary equipment (ie radio, etc) had failed? Was its apparent what action the pilot needed to take? Was its apparent what automatic action had been taken? Were emergency checklists available? Was an ERP checklist available?

7.5 Summary

Is the RPAS information and control interfaces clearly and succinctly presented?
Does the RPAS information and control interfaces cause confusion or a loss of situational awareness?
Does the RPAS information and control interfaces cause unreasonable fatigue?

Do the RPAS information and control interfaces contribute to remote crew error that could reasonably adversely affect the safety of the operation?

8 APPENDIX E: Stakeholder Engagement Plan (SEP) Template

Effective stakeholder engagement is a vitally important mitigating tool when conducting BVLOS operations in unsegregated airspace. Conducting this SEP will ensure the widest possible dissemination of operational information and flying profiles to other airspace and ground users. The operator becomes a known quantity prior to the arrival of Conventionally Piloted Aircraft (CPA) in the vicinity of the RPA's area of operation and positive deconfliction can be achieved. This will not be required for operations within atypical airspace, but if the applicant requires any operation outside of atypical airspace, even for a short period, this template will assist the applicant in preparing a case to determine the air risk.

The first step in characterising the air risk is to conduct stakeholder engagement to determine:

1. Who are the airfield users?
2. What times of day and which days are the airfield used? Is any time of year busier?
3. Has the airport operator published any guides for operating from the airport?
4. Is the aerodrome in a restricted or danger area? If so when are the areas active?
5. Are there any regular / scheduled flights?
6. Are there any flying training schools?
7. Are any other flying activities taking place (gliding, balloons, model flying etc.)?
8. What airfield facilities are there (grass or tarmac runway, terminal facilities, fuel, lighting, navaids etc.)?
9. Are there any instrument approach procedures? If so, where does the missed approach procedure take aircraft?
10. Who owns and controls the airfield?
11. Conduct or install a traffic monitoring system to characterise flights over a typical period to or from the aerodrome.

This will provide a picture of the typical aircraft movements, their type and what equipment they typically carry.

This table shows the techniques and strategies that can be used to effectively engage interested stakeholders prior, during and at the conclusion of a BVLOS activity.

8.1 Stakeholder Engagement Techniques and Strategies

SEP Techniques & Strategies
One of the first steps should be to conduct a review of documents and internet sites associated with the aerodrome. The list of documents, apps and/or Internet sites reviewed should be recorded in the stakeholder engagement document with page and/or section references if appropriate. The following is a possible list of information sources to consider, but the sources reviewed may be more or less depending on the operations taking place at the airport:

• ERSA • AIP • Instrument approach and departure charts • CASA Approved Drone App • Electronic Flight Bag • Charts – VTC / ERC-L • Airport operator web site – often part of a council's website • RPT operator website – should include schedule of flights • Flying school training website • MAAA – https://www.maaa.asn.au/ • Gliding federation of Australia – https://glidingaustralia.org/ • Flight tracking sites such as flightradar24, Ozrwys, webtrak etc. • Airservices Australia for copies of AIP, ERSA, Instrument approach charts and resources such as ADS-B coverage - https://www.airservicesaustralia.com/projects/ads-b/ads-b-coverage/
Strategies and processes to engage with and inform identified stakeholders of any intended operations: • Face-to-face meeting/workshop • E-mail • Telephone • Mail.
Processes and procedures defined to enable effective and timely communication and coordination of activities with relevant stakeholders, including: • Method of communication (primary, secondary if necessary) • Content and format of communications (what information is being promulgated and/or exchanged between parties) • Communication timeframes / communications plan (what is communicated and when) • Strategies to enable effective coordination of activities to reduce number of potential encounters: – Defined areas of operation – Times of operation – Duration of operations – Communication methods/capabilities.

8.2 Aerodrome Stakeholder Engagement Proforma

Below is what would be considered the minimum information required from the stakeholder engagement; applicants should add additional lines and information fields a required. Text in italics/yellow is for applicants to complete.

Aerodrome Stakeholder Engagement			
Aerodrome	*Name*	Designator	*YXXX*

Location	*Coordinates - provide en-route chart / VTC to identify any relevant airspace, restricted or danger areas, aerial activities*		
Runways	*Number provide landing chart and include on KML app/dep path*	Runway Surface	*Asphalt / Grass / etc.*
Operating times	*Days* *Times* *Annual Variation in traffic – e.g. is it busier in summer than winter* *Any annual events – air shows, competitions, cadet camps, fly-ins etc.*		
Visual Circuit	*Provide details on the visual circuit – height, direction, ground track*		
CTAF Freq		Area Freq & Agency	
Lighting		NAVAIDS	
Fuel Types available		Passenger Facilities	
ASA ADS-B coverage		Weather Services	
Environmentally or Noise sensitive areas	*Provide details of any environmentally or noise sensitive areas within 4 NM of the aerodrome*		
VFR routes or reporting points	*List VFR routes and reporting points within the operating area or adjacent to it – attach VTC chart or add points/routes to KML*		
Restricted / Danger areas	*If the aerodrome is in a restricted/danger area - List designator, altitudes, operating times, controlling agency with contact details and type of activity*		
Other local air activity	*Model flying, other RPA operations, hot air balloons etc.*		
Instrument Apps	*Provide details of number, type and altitudes, identify missed approach routes – include any relevant instrument approach charts with application*		
Obstructions or Hazards	*List any obstructions or hazards that prevent manned operations occurring in certain locations within 4 NM of the aerodrome i.e. masts, towers, powerlines etc.*		
Aerodrome Operator	*Name* *E-mail*		

	Phone
Aerodrome Users	
Aerodrome User 1 Name & Type of operation	*Name* *E-mail* *Phone* *Notes*
Aerodrome User 2 Name & Type of operation	*Name* *E-mail* *Phone* *Notes*
Aerodrome User 3 Name & Type of operation	*Name* *E-mail* *Phone* *Notes*
Aerodrome User 4 Name & Type of operation	*Name* *E-mail* *Phone* *Notes*
RPT schedules	*List days and times for scheduled RPT flights – attach a copy of timetables*
Aerodrome Traffic Patterns	
Take-offs / Landings	*List number of take-offs and landings which should be broken into RPT, Charter, Recreational / Private, IFR, VFR, Day, Night as appropriate for each day of the week and by time to show aerodrome usage pattern – the airfield operator will normally be able to provide this information*
Traffic information (ADS-B, Radar etc.)	*Provide traffic count from an electronic source for relevant traffic (e.g. within 1000 ft of the maximum operating altitude). If this is not possible, document why (e.g. no ADS-B or radar coverage)*
Operator Traffic Survey	*Record the results of any traffic survey you undertake as a minimum list:* 1. *techniques used (e.g. visual observer on aerodrome/off aerodrome, passive / active electronic surveillance etc.)* 2. *number of days and times that the survey was conducted* 3. *weather conditions forecast & current*

	4. *air traffic recorded by type with associated radio calls and equipage* 5. *any relevant NOTAMs, aerodrome unserviceabilities or aerodrome work in progress.*
Summary	
Provide a summary of the air density and what days and times have the lowest air density (similar to those that would be expected in a rural area below 500 ft AGL). Provide any details of any areas where manned operations are lower with an explanation of why traffic density in these areas is lower.	
Documents Reviewed	*Provide details of documents, apps, internet site or other sources of information reviewed as part of the stakeholder engagement – include any relevant copies, links or screenshots*