Australian Government
Civil Aviation Safety Authority

RPAS Beyond visual line of sight (BVLOS) outside of controlled airspace (OCTA) examination - Aeronautical Knowledge Standards Guide

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This document contains guidance material intended to assist CASA officers, delegates, and the aviation industry in understanding the operation of the aviation legislation. However, you should not rely on this document as a legal reference. Refer to the civil aviation legislation including the Civil Aviation Act 1988 (Cth), its related regulations and any other legislative instruments—to ascertain the requirements of, and the obligations imposed by or under, the law.

Table of contents

Glossary

Acronym / abbreviation	Description
AC	advisory circular
AIP	Aeronautical Information Package
ALA	aircraft landing area
BOM	Bureau of Meteorology
BVLOS	beyond visual line of sight
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulations 1998
CONOPS	concept of operations
CRM	crew resource management
DAA	detect and avoid
EFB	electronic flight bag
ERP	emergency response plan
ERSA	En Route Supplement Australia
GCS	ground control station
GNSS	global navigation satellite system
HLS	helicopter landing site
HMI	human machine interface
IFR	instrument flight rules
IR	instrument rating
IREX	instrument rating examination
LSALT	lowest safe altitude
MCC	multi-crew cooperation
MOS	Manual of Standards
NAIPS	National Aeronautical Information Processing System
NOTAM	Notice to Airmen
OCTA	outside of controlled airspace
PEXO	Pilot Examination Office
PPL / CPL	private pilot licence / commercial pilot licence
PRD	prohibited, restricted and danger areas
QNH	height above sea level
RAIM	receiver autonomous integrity monitoring
ReOC	remotely piloted aircraft operator’s certificate

Acronym / abbreviation	Description
RePL	remote pilot licence
RPA	remotely piloted aircraft
RPAS	remotely piloted aircraft systems
SORA	specific operations risk assessment
TEM	threat and error management
VFR	visual flight rules
VLOS	visual line of sight

References

Text	Description
Existing CASR Part 61 of PPL / CPL training packages	Books published by various training providers for a candidate to develop their aviation knowledge to pass CASA written and flight examinations.
CASA CNS-ATM kit	The CASA Communication, navigation, surveillance/ Air traffic management kit provides useful training material to industry on modern navigation and communication systems including GNSS, ADSB and others.
BOM Manual of Aviation Meteorology	A comprehensive guide to meteorology written by the Australian Bureau of Meteorology and published by Airservices Australia.
Part 101 of CASR	*Civil Aviation Safety Regulations 1998,* as published on the Rules page on the CASA website.
Part 101 MOS	Part 101 (Unmanned Aircraft and Rockets) Manual of Standards 2019 (as amended) published on the Rules page on the CASA website.
AIP	*Aeronautical Information Package (AIP)* document package, as published on the Air Services Australia website.
CASA AC	Advisory circulars to include 101-01 Annex A.
CASA BVLOS standard scenarios	Standard scenarios developed by CASA for pre-defined operational characteristics to determine the likely mitigations and SORA (specific operations risk assessment) outcomes for operations that meet those characteristics.

Revision history

Amendments/revisions of this guide are recorded below in order of most recent first.

Version No.	Date	Parts/Sections	Details
1.0	June 2023	All	First issue

1 Introduction

1.1 Purpose

The RPAS beyond visual line of sight (BVLOS) outside of controlled airspace (OCTA) examination - Aeronautical Knowledge Standards Guide (the Guide) will assist training organisations to develop training material related to the RPAS BVLOS OCTA - Aeronautical Knowledge Standards (the Standards) for the purpose of enabling a remote pilot licence (RePL) holder to obtain a pass credit in the RPAS BVLOS OCTA examination. The guide will also assist RePL holders to self-study for the examination.

CASA is developing a future remote pilot licencing framework which will include BVLOS operations inside and outside of controlled airspace. The BVLOS OCTA exam is the first step in this framework. **While the end state will be to provide for BVLOS ratings, the proposed exam will only provide a successful candidate with a pass credit in the BVLOS OCTA examination and not a rating.** A rating will require a pass in both the theoretical exam and a flight test demonstrating practical competencies; the practical competencies required for a flight test will be consulted and published at a later date.

For the purposes of this guide, and the BVLOS OCTA aeronautical knowledge standards, the term BVLOS rating should be read as future tense.

1.2 Background

1.2.1 Context

There are 3 broad categories of uncrewed aircraft operations in Australia:

- recreational (including model aircraft)
- excluded category
- commercial operations.

For excluded category and commercial remotely piloted aircraft (RPA) operations, remote pilots are required to hold either a micro and excluded category accreditation or a CASA RePL to operate legally.

To obtain a RePL, the candidate must complete training (which includes a practical assessment and theory examination) with a CASA approved training organisation. Training organisations develop and deliver these courses after CASA has approved the training course content. Alternatively, a crewed pilot licensed under Part 61 of the *Civil Aviation Safety Regulations 1998* (CASR) can complete abbreviated training to achieve a RePL under Part 101 of CASR.

A RePL holder is restricted to operating RPA within visual line of sight. This means the RePL holder must operate the RPA at such a distance they can control the RPA based on visual observation of the RPA's position, speed, and direction of flight directly with their own eyes and not through a device or screen.

To expand the capabilities of remotely piloted aircraft operator's certificate (ReOC) holders and to further utilise remotely piloted aircraft systems (RPAS) technologies, ReOC holders require a mechanism to operate the RPA beyond visual line of sight (BVLOS) . The extension of these

capabilities introduces new skills and knowledge requirements beyond what standard RePL training covers. Prior to any specific BVLOS training, assessment, and qualifications for remote pilots, the only available mechanism to upskill was the Part 61 of CASR instrument rating examination (IREX).

CASA developed the IREX for crewed pilots to progress to an instrument rating (IR) through an initial process of theoretical learning and assessment. This theoretical study is supported by practical training that culminates in a flight test conducted by a flight examiner. As an integrated learning approach, the IREX tests the candidate's level of knowledge of instrument flight rules (IFR), procedures and techniques gained from theoretical study and practical flying lessons. CASA delivers the IREX through the Pilot Examination Office (PEXO) online system.

1.2.2 Creating a new BVLOS OCTA examination

Currently, a RePL holder may only operate an RPA BVLOS if they are operating under a BVLOS area approval issued to the ReOC holder and:

- hold a pass in the Part 61 of CASR IREX, or
- operate under CASA EX27/23—Remotely Piloted Aircraft Operations Beyond Visual Line of Sight Exemption Instrument 2023 (if acting in a team supervised by a remote pilot who holds a pass in the IREX system).

Though the IREX covers some areas that are relevant for planning RPAS operations, the examination was not designed for RPAS. The examination also places an obligation on the ReOC holder and RePL holder to become familiar with areas of knowledge that do not apply to RPAS operations.

During public consultation for the CASR Part 101 Post-Implementation Review conducted 15 December 2021 to 21 February 2022, respondents identified that:

- the IREX requirement is unnecessarily burdensome for industry
- the required level of knowledge is not necessary for the majority of RPAS operations
- some core RPAS BVLOS areas of knowledge are missing from the IREX due to its originally intended target audience and operations.

However, there are still potential use cases for IREX in the RPAS environment. For example, there is a greater requirement for the remote pilot to understand crewed operations:

- in certain complex operations, and / or
- that interact with crewed aircraft within an operational airspace environment that is more integrated.

CASA committed to developing a more fit-for-purpose examination for lower-risk BVLOS operations, which will benefit industry but also result in efficiencies for CASA. The proposed RPAS BVLOS OCTA Aeronautical Knowledge Standards and Guide were released for public consultation 7 December 2022 and closed 17 January 2023, receiving 128 responses and majority support. Minor changes to the Standard and Guide were made based on the results of public consultation.

CASA conducts regular quality reviews of published documentation and may amend this Guide from time to time. For the most current version of the Standards and Guide see the CASA website.

1.2.3 Aim of the BVLOS OCTA examination

As the RPAS industry continues to rapidly grow and diversify, application and demand for BVLOS operations are significantly increasing. The objectives and outcomes of the BVLOS OCTA examination is to:

- Develop a remote pilot's understanding of the aeronautical knowledge required for flying RPA BVLOS in non-controlled airspace safely.
- Provide basic understanding of flying outside of controlled airspace and near non-controlled aerodromes and communicating with crewed aircraft for deconfliction purposes.
- Emphasise the key aspects of safe aviation.
- Develop a safety culture across industry with knowledgeable and effective teams operating RPAS.
- Build on the existing RePL training content and expand beyond core knowledge by introducing higher-level concepts from existing theory within Part 61 of CASR.

1.2.4 Prequalification for the BVLOS OCTA examination

As this BVLOS OCTA examination further develops the skills and knowledge that are required for a CASA RePL, a RePL qualification is a prerequisite for a candidate to sit the BVLOS OCTA examination.

2 Aeronautical knowledge topics

2.1 Overview

The BVLOS OCTA examination aims to develop the knowledge and capability of a candidate, to be equipped with the necessary knowledge to operate safely, as BVLOS operations and RPAS become more complex.

The aeronautical knowledge required to obtain a pass in the BVLOS OCTA exam is contained in the RPAS BVLOS OCTA examination - Aeronautical Knowledge Standards document. Candidates can elect to self-study or study through a training organisation. The Standards document is available on the CASA website.

Both learning pathways will culminate in the candidate sitting an examination that is approved by CASA, with an invigilator who is also approved by CASA.

The examination is available through the PEXO testing system.

Note: The BVLOS OCTA examination only relates to BVLOS operations in Class G, outside of controlled airspace (OCTA).

2.2 Privileges and limitations

The candidate needs to understand and describe the various qualifications and authorisations required to be part of a BVLOS RPA operation.

The candidate needs to:

- know what the limitations on their RePL are (what they can and cannot do and how and where they can operate).
  BVLOS Aeronautical knowledge standards 2.1
- demonstrate an understanding of the relationship between the authority to operate BVLOS, the RePL holder and a certified operator (holder of a ReOC).
  BVLOS Aeronautical knowledge standards 2.2
- understand what approvals are required and what restrictions may apply to the ReOC holder (the policies, procedures and information that are contained in the ReOC holder's documented practices and procedures).
  BVLOS Aeronautical knowledge standards 2.2
- develop their knowledge beyond RePL knowledge standards, and an awareness of other approvals the ReOC holder may require (which may affect the BVLOS operations).
  BVLOS Aeronautical knowledge standards 2.3
- understand operation-specific material that was used to develop the concept of operations (that is, to operate legally). These components may include an emergency response plan, stakeholder engagement or any other job-specific process.
  BVLOS Aeronautical knowledge standards 2.3
- develop an understanding of any relevant regulatory limitations and conditions that apply to BVLOS operations, including those beyond the instrument of approval. As the regulatory framework and processes for BVLOS operations evolve over time, RePL holders need to stay informed of these changes.
  BVLOS Aeronautical knowledge standards 2.4

Note: The candidate does not need an in-depth knowledge of:

- specific operations risk assessment (SORA) process or
- what is required in an application to CASA for BVLOS, although they do need to have, and demonstrate, an awareness that a relevant process exists.

2.3 Supporting documents and information

The RePL qualification introduces the candidate to RPAS-specific rules, regulations, and procedures, but does not extensively cover integrated operations with crewed aviation.

The BVLOS rating requires the candidate to work beyond the RePL qualification to develop a wider knowledge of aviation resources and procedures, and where they can find the relevant information.

The candidate needs to:

- use existing pre-flight information sources, such as those that provide information about aviation weather conditions, hazards, events, and bulletins through Notices to Airmen (NOTAMs), and apply these to BVLOS operational planning.
  BVLOS Aeronautical knowledge standards 3.1

- develop an understanding of how Aeronautical Information Package (AIP) and En Route Supplement Australia (ERSA) provide useful information to Australian aviation (in particular, the procedures for loss of communications). This understanding should cover traditional resources such as National Aeronautical Information Processing System (NAIPS) and also include more modern sources such as an electronic flight bag (EFB).
  BVLOS Aeronautical knowledge standards 3.2
- further develop aeronautical chart reading skills to understand locations and movement of possible crewed aviation operations, to facilitate appropriate BVLOS pre-flight planning. The BVLOS examination introduces instrument approach charts, requiring the candidate to understand how a crewed aircraft will approach an aerodrome using standard instrument approach procedures depicted on these charts.
  BVLOS Aeronautical knowledge standards 3.3
- develop an understanding of the information that is available outside of the AIP that may be appropriate to facilitate deconfliction of RPAS from crewed aircraft.
  BVLOS Aeronautical knowledge standards 3.3

Note: the candidate does not need to understand an instrument approach chart to a level that they can fly the depicted procedure, although they do need to understand how to deconflict the RPAS from crewed aircraft who will be conducting the instrument approach procedure.

2.4 RPAS instruments, radios, and equipment

As RPAS become more capable and equipped with increasing sophisticated technology, it is important for the ReOC holder and remote pilot to understand these systems and limitations, and how to use them effectively. Understanding the functions of the various systems in modern RPAS and how to control and navigate the RPA is crucial. This section is focused on those systems used to navigate, control, and monitor the RPA.

When failures occur, the remote pilot must maintain control to ensure flight safety, while working toward a safe outcome. The consequences resulting from an aviation accident could be catastrophic if an out-of-control RPA collides with a crewed aircraft.

The candidate needs to:

- understand how to safely plan and use navigation systems based on global navigation satellite system (GNSS) or other industry standard technologies that may become available over time. Develop a more robust understanding of these systems, their components and how they can be used to improve accuracy and flight safety.
  BVLOS Aeronautical knowledge standards 4.1
- understand how to safely plan and use functions such as ‘return to home’, ‘flight termination’ and other automation functions that are based on GNSS as well as other RPA automation functions as they become available.
  BVLOS Aeronautical knowledge standards 4.2 a), d)
- understand in greater depth the function and application of altimetry instruments to RPAS. There are various instruments that can be used to measure height/altitude on an RPA with

differing accuracies, benefits, and drawbacks.
BVLOS Aeronautical knowledge standards 4.2 b)

- understand that C2/C3 link system technology is constantly developing, and each has its own strengths and weaknesses. By understanding the network characteristics of these varied technologies at a high level, agnostic of manufacturer or design, the most appropriate system can be used effectively, and any risks or weaknesses in that system can be anticipated and mitigated. An applied knowledge is required to enable problem solving when failures occur, or quality of service is affected.
BVLOS Aeronautical knowledge standards 4.2 c)
- For example:
  - when using a standard Wi-Fi based (2.4 and 5.8 GHz) radio line of sight links, both distance and obstacles are an impediment to the control signal and need to be planned for. The radio transmissions on these frequencies have a different likelihood of being interfered with, whether by manufactured or natural phenomenon.
  - the design of the link structure itself may require adaptation to other technologies. A network link can be simplex or duplex, but a VHF transceiver is not fully compatible with this structure and the remote pilot must be aware of these limitations to ensure safe and efficient operation.
- understand (as with the C2/C3 link) the benefits and limitations of aviation VHF communication systems that allow RPA to transmit a radio signal to crewed aviation; and the complexities when introducing a VHF system on the RPA along with the C3 link, and how to use these systems efficiently and correctly.
BVLOS Aeronautical knowledge standards 4.2 e)
- For example:
  - a new opportunity arises with BVLOS operations where the RPAS may have an onboard aviation very high frequency (VHF) transceiver, allowing the remote pilot to communicate with other aviation participants within line of sight of the RPA. This technology may increase the range of aeronautical radio communications beyond what can be achieved by a land based radio system.
- understand which communication devices on the RPA (such as transponders) can improve situational awareness and facilitate safer operation. An appreciation of how these might be developed into automated detect and avoid technologies or used by crewed aircraft to understand where an RPA is, in order to protect themselves from RPAS that may have lost link is also important.
BVLOS Aeronautical knowledge standards 4.2 f)
- be prepared for the operation and understand the underlying system components and technologies so that the RPA is operated to the highest safety standard. This involves the development of a deeper understanding of the RPA systems, connections and how increasingly complex RPA work. Standard aircraft instrument data as used in crewed aircraft is presented on the GCS but in a different format and with different units of measurement. Pitot static instruments that measure air speed and altitude all work on the

same principles and need to be understood to a greater depth for fault finding on an RPA that may have complex systems.
BVLOS Aeronautical knowledge standards 4.2 g)

- understand the theory of radio line of sight and how obstructions to this can greatly affect the quality of the data captured and ultimately the safety of the operation. The candidate needs an understanding of which planning techniques can be utilised to prevent obstructions reducing the safety margin for control of the RPA.
BVLOS Aeronautical knowledge standards 4.3 a)
- have a better understanding of how atmospheric conditions and human made electromagnetic radiation can affect RPA systems and how that can change over the generally larger distance flown for BVLOS operations. The candidate needs to understand these systems and how to compensate for this through planning of flight, aircraft system configuration and operational procedures.
BVLOS Aeronautical knowledge standards 4.3 b), c)
- have a more developed understanding of what performance means when applied to an aircraft; the same theories apply for an RPA or a crewed aircraft. How is the RPA's flight performance affected by changes in the weight, and balance of the RPA. Just like crewed pilots, remote pilots must understand how air density, temperature, and pressure of the day, affects the operation of the RPA.
BVLOS Aeronautical knowledge standards 4.5

2.5 Meteorology relevant to BVLOS operations

Meteorology theory and the various information sources of meteorology are introduced in the CASA RePL training, but with the emphasis on a VLOS operation.

With the development of BVLOS operations, operating over increasingly larger areas, a greater understanding of meteorology and its impact on aviation is necessary.

The candidate needs to:

- develop an understanding of how the operation of crewed aircraft is affected by the weather, with a basic understanding of the two different flight rule sets of visual flight rules (VFR) and instrument flight rules (IFR). Understanding how the changing weather affects the requirement for crewed aircraft to operate either VFR or IFR (and when they would switch between these two rule sets) assists the remote pilot to deconflict from crewed aircraft when the flight path of the crewed aircraft changes due to changing weather conditions.
BVLOS Aeronautical knowledge standards 5.1
- understand the process for gathering and analysing weather data to a standard appropriate for BVLOS operations and be able to identify the most appropriate source of information for the particular operation. Australian weather products provide multiple sources of relevant data, but to decode and apply this information requires knowledge and training to apply to the RPAS operation correctly.
BVLOS Aeronautical knowledge standards 5.2
- develop an understanding of how weather systems over large areas would affect RPAS operations when flying long distances across the country, and how to plan and achieve

longer distance cross country flights with various weather fronts and the associated hazards. BVLOS operations will potentially cross multiple weather fronts with the RPA subjected to changes in precipitation, pressure, wind, and temperature. The remote pilot must be confident in planning for and dealing with these real-world effects and ensure safety of the operation.
BVLOS Aeronautical knowledge standards 5.3

- develop a robust understanding of the various meteorology phenomena, and associated hazards to ensure appropriate BVLOS flight planning. This information can be found in training materials for crewed aviation meteorology or the specified manual from the BOM.
BVLOS Aeronautical knowledge standards 5.4
- understand the effects that potentially damaging weather can have on an RPA. Crewed aircraft have systems and procedures to avoid turbulence, icing and other meteorological conditions that can affect the flight. RPAS may not have these systems; the emphasis must be on the ability to use meteorological forecasts and reports to avoid inclement conditions.
BVLOS Aeronautical knowledge standards 5.5

2.6 BVLOS operations – general

Operations in Australian Class G airspace have some defined procedures, radio calls and rules. For BVLOS operations to be conducted safely in non-controlled airspace at all heights, the candidate must understand these rules and procedures to fit into the existing framework.

The candidate needs to:

- understand how a modern RPA is navigated under both normal and abnormal conditions. Using both GNSS and charts to be aware of the RPA's location is vital to inform the decision-making process when failures occur, or when situations arise that require informed action or emergency procedures to be enacted. A key component of BVLOS operations is containment, ensuring the RPA does not leave the operational area. To achieve this, the remote pilot must be aware of where the RPA is located at all times, so that appropriate decisions can be made to continue flight, land or terminate the RPA.
BVLOS Aeronautical knowledge standards 6.1

- understand the rules to be applied to RPA when flying near aerodromes. Whether flying near, or operating from an aerodrome, helicopter landing site (HLS) or aircraft landing area (ALA), the RPA must be deconflicted from any traffic in its vicinity. Understanding these rules and procedures will enable the remote pilot to plan to reduce the likelihood or requirement to take avoiding action when operating in these areas.
BVLOS Aeronautical knowledge standards 6.2
- understand power requirements of the RPA (fuel or battery storage), as there must be sufficient power for the operation to be completed with a safety reserve. Understanding the difference between airspeed and groundspeed is a necessary skill to correctly plan a flight for increasingly longer flight duration.
BVLOS Aeronautical knowledge standards 6.3
- understand how lowest safe altitude (LSALT) affects the planning and operation of crewed aircraft for the purpose of deconfliction. A remote pilot who can interpret a chart (a map or

instrument approach chart), and calculate the LSALT, will understand what altitude crewed aircraft are likely to operate at and can therefore plan the operation to strategically deconflict from crewed aircraft.
BVLOS Aeronautical knowledge standards 6.4, 6.5

- understand the aviation information presented on charts, as it provides information that can be used to strategically deconflict RPA operations. By planning to remain clear of other aircraft, the operation can be strategically deconflicted against other traffic. Charts are designed to show obstacles, terrain and in some cases, lanes of aviation traffic.
BVLOS Aeronautical knowledge standards 6.6
- understand how using height above sea level (QNH) gives a standard vertical datum that all aircraft can reference, and thus provides deconfliction. RPAS traditionally use height above take-off point as the vertical reference but now, with BVLOS operations flying over varying terrain, the standard reference of ‘altitude’ is required. This reference of 'altitude' may be affected by changing weather patterns which may influence the accuracy of the QNH sources. A candidate's knowledge of how aviation uses QNH as a height datum to deconflict, and which are the most appropriate QNH sources, is vital.
BVLOS Aeronautical knowledge standards 6.7
- further develop the knowledge gained in the RePL training on prohibited, restricted and danger (PRD) areas and the process to gain access to these areas, as well as understanding how to operate in the vicinity of these areas safely.
BVLOS Aeronautical knowledge standards 6.8
- understand why crewed aircraft use instrument approach procedures to arrive at an aerodrome, and the charts that describe these procedures. The candidate needs to understand an instrument approach chart sufficiently and where crewed aircraft will be flying during an approach, with the aim to deconflict the RPA against crewed aviation conducting IFR procedures. The remote pilot does not need to know the chart to such a degree that the remote pilot can conduct an instrument procedure with the RPA.
BVLOS Aeronautical knowledge standards 6.9
- know what standard altitudes crewed aircraft will fly at depending on their heading and flight rules. A candidate will need to then apply this knowledge to ensure positive deconfliction between the RPA and all other air traffic.
BVLOS Aeronautical knowledge standards 6.10

2.7 Operations outside of controlled airspace (OCTA)

When flying outside of controlled airspace, crewed pilots are required to separate their aircraft from other nearby aircraft, through the use of standardised radio calls and procedures. Remote pilots must understand these crewed aviation procedures and how to deconflict RPA from nearby crewed aircraft.

The candidate needs to:

- have a deep understanding and awareness of their responsibility to separate their RPA from other nearby crewed aircraft correctly, and how to practically do this in various scenarios. Due to the nature of non-controlled airspace, where there isn’t an air traffic controller directing traffic, there are specific procedures and methods for safe operation; to

ensure aviation safety is maintained the remote pilot must also understand these. The procedures and methods can nominally be broken down into the different components listed in the standards. Each component will have different priorities, safety requirements and related radio calls.
BVLOS Aeronautical knowledge standards 7

- understand the standard procedures for crewed aircraft when operating in the vicinity of non-controlled aerodromes. This awareness is vital for any flight near or at an non-controlled aerodrome and includes knowing how crewed aircraft depart, operate enroute, arrive and operate in the circuit.
BVLOS Aeronautical knowledge standards 7.1 a), b), d), f)
- understand how the aviation system works when aircraft are flying a long distance enroute across Australia, the radio calls required and who they are broadcast to, as well as what that information means for a remote pilot.
BVLOS Aeronautical knowledge standards 7.1 c)
- understand how the varying flight performance (both vertical and horizontal speed) of the RPA in relation to other aircraft affects deconfliction in the circuit pattern of an aerodrome.
BVLOS Aeronautical knowledge standards 7.1 e)
  - For example, a microlight or small aircraft may be operating at a circuit height of 500 ft, larger jet aircraft will be faster and operate at 1500 ft, however balloons will operate very differently with little to no directional control.
- understand the radio calls involved for each of these segments and the difference in procedure, based on crewed aircraft performance.
BVLOS Aeronautical knowledge standards 7.2
- understand the content and consequences of radio calls involved in emergency situations to ensure if an emergency is ongoing, the remote pilot is aware and able to ensure their RPA doesn't contribute to the emergency.
BVLOS Aeronautical knowledge standards 7.3

2.8 Navigation with global navigation satellite systems (GNSS)

BVLOS flight with current RPAS technologies is completely reliant on GNSS for navigation. GNSS is a system based on satellite constellations. To operate safely, remote pilots must understand this system to a greater depth than what is required for the RePL qualification.

The candidate needs to:

- understand and be able to explain at a high level the concept behind the design of a GNSS and how the components of the system work together. With this understanding, the candidate will need to develop a working knowledge of how the system works correctly so any failures or reduction in accuracy can be identified and controlled, to prevent any undesired aircraft states.
BVLOS Aeronautical knowledge standards 9.1
- understand what affects the accuracy and performance of the GNSS, including the knowledge needed to develop an ability to plan a safe flight based on GNSS as the primary navigation source.
BVLOS Aeronautical knowledge standards 9.1

- understand the known faults and potential failures, allowing the remote pilot to ensure the RPA is flown within tolerances and stated accuracies. Other airspace users will be reliant on the remote pilot to both accurately navigate and report the position of the RPA to ensure deconfliction with other aircraft, both crewed and uncrewed.
  BVLOS Aeronautical knowledge standards 9.2
- explain and use existing processes like receiver autonomous integrity monitoring (RAIM) predictions in National Aeronautical Information Processing System (NAIPS) to inform the RPAS crew (at the planning phase) whether they may encounter problems.
  BVLOS Aeronautical knowledge standards 9.3
- explain how the augmentation systems, both ground and space based, increase accuracy and reliability of GNSS based navigation.
  BVLOS Aeronautical knowledge standards 9.4

2.9 Human factors relevant to BVLOS operations

While instrument flying in a crewed aircraft has observable effects on the pilot and crew, flying an RPA may have other, more subtle effects that can lead to undesired aircraft states. Additionally, BVLOS operations are more likely to be conducted with multiple crew members and multi-crew skills and tools need to be developed.

The candidate needs to:

- understand the human-machine interface to prevent mistakes that can eventually lead to undesired aircraft states or accidents. How the system is programmed, controlled, and monitored will vary by both design and manufacturer. A general awareness of the skills required to ensure flight safety is maintained is required, similar to crewed aviation that have developed over many years using electronic flight instrument systems (EFIS) and integrated systems.
  BVLOS Aeronautical knowledge standards 10.1
- understand the limitations of the human machine; that the human body can be affected by both heavy and light work which cause fatigue in their own way. Develop an understanding of how monotonous work or looking at screens affects the person involved and how best to combat fatigue to maintain aviation safety.
  BVLOS Aeronautical knowledge standards 10.2
- develop their own professional persona that creates a ‘safety-centric’ aviation culture through understanding existing aviation safety tools and practices. A few common terms used in human factors training are ‘threat’ and ‘error management’ and ‘crew resource management’ (particularly multi-crew cooperation) skills. These are powerful tools used to avoid undesired aircraft states. The emphasis for this training should be to introduce the basics of these components and allow the candidate to make use of these skills, tools and checklists when operating BVLOS under an ReOC in a multi-crew environment.
  BVLOS Aeronautical knowledge standards 10.3