Code of Practice

Upstream High Density Polyethylene Gathering Networks – CSG Industry

Companion Paper CP-02-002

Remotely Piloted Aircraft Systems Awareness Guideline

Revision 1

June 2025

Contents

1. Introduction

This guideline has been developed to assist members of the Australian Pipelines and Gas Association (APGA) and people involved in coal seam gas gathering systems with the safe and effective employment of the disruptive technology of RPAS.

This is a guideline only and the authors, editors and APGA are not responsible in any way for any errors or omissions, nor the result of any actions taken based on information in the guidelines.

This guideline will not give details of technology used to capture data, the associated data processing, storage, visualisations nor algorithms to filter the captured information. It will identify different systems available, but it is down to the individual companies or 3rd party service providers to make the decisions on what technology to use, how to process that data and the results obtained.

2. What is RPAS?

The term RPAS stands for remotely piloted aircraft system (RPAS). It refers to the whole system that is used to safely operate a remotely piloted aircraft (RPA). The RPAS system is comprised of the following sub-systems:

- remotely piloted aircraft (RPA) including sensor/s and/or payload
- command and control (C2) data links – telemetry and communication systems
- remote pilot station (RPS) or ground control station (GCS)
- RPAS Operations Crew
- Launch and land equipment

When planning the use of RPAS, consideration must be given to the operation and the risks associated with each of these sub systems, not just the RPA.

There are two modes of operating drones, they are,

VLOS – Visual line of sight – Flying the unmanned aircraft in visual line of sight without binoculars, telescopes or zoom lenses, and

BVLOS – Beyond visual line of sight – Flying the unmanned aircraft beyond unaided sight and using telemetry to monitor its position. This mode of operation has significant advantages for monitoring long linear assets or gathering networks in forested or hilly areas, for example.

3. Why use RPAS?

RPAS is a disruptive technology that allows an organisation to conduct aerial surveillance in lieu of, or complementary to, traditional aerial and ground surveillance methods.
From a safety perspective, manned aerial pipeline surveillance activities have been one of the highest fatality incident types in oil and gas aviation so to transition to unmanned aerial surveillance is a safer option whilst still capturing anomalies from the air that may not be visible from the ground.
Using digital sensor capture with GPS functionality also allows for temporal analysis to identify changes in topography (subsidence, erosion, etc.), vegetation growth rates or 3rd party encroachment that may be missed with traditional manned visual surveillance. Plus, the accuracy of sensors these days allows for small anomalies to be detected. Sensors being electronic, previous issues can be monitored for change and no anomaly goes uncaptured.

RPAS would complement land based means of inspection but wholesale use would need to be evaluated based on the following:

- Sensitive land use and Landholders approval – interpreted privacy issues
- Livestock startling or disturbance
- The sensitivity of some sensors needs to be ground based for effectiveness (current methane gas detection technology).
- Cost per km of service and delivery time frames between driven and aerial surveys
- Access – flying river crossings would suit RPAS, so would cropped/cultivated fields that the buried assets pass through or fenced paddocks with no gate access, for example.

In lieu of sending vehicles over long distances or through challenging terrain, with the associated fatality risk, an RPAS program can identify an issue that then is inspected by a ground-based team, increasing safety, reducing driven kilometers, and optimising time.

4. Regulatory information

The most relevant aviation legislation regarding RPAS is CASR Part 101[1].

It is recommended that prior to starting any RPAS operations at an APGA Member company site, a review of the legislative requirements is undertaken by the company legal representative as well as engagement of an RPAS operator who has a Remote Piloted Aircraft Operators Certificate (ReOC) to review for them.

5. Risk Management

The Joint Authorities for Rulemaking on Unmanned Systems (JARUS) have developed an internationally recognised risk assessment process for RPAS operations called the Specific Operations Risk Assessment (SORA)[2]. It is recommended that any RPAS operation for any APGA member use this process.

It is also recommended that no excluded or landholder category operations are permitted as defined on the CASA Excluded Category rules[3]. Rather, use of operators who use Remote Pilots License (RePL) holders who operate under a CASA approved RPA Operators Certificate (ReOC) is recommended.

This is to ensure organisations will use personnel who have conducted a regulatory recognised competency assessment and who operate under a set of operational procedures that have been reviewed and approved by CASA.

For any RPAS operation, it is recommended that a trial of the technology be undertaken, then phase the operational change through the member company management of change process.

Also, any RPAS operator should be audited by an accredited RPAS auditor prior to being contracted to ensure they meet the guideline's intent and any APGA member company specific requirements.

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1 Civil Aviation Safety Regulations (CASR) Part 101 (https://www.casa.gov.au/standard-page/casr-part-101- unmanned-aircraft-and-rocket-operations)

2 JARUS SORA (http://jarus-rpas.org/content/jar-doc-06-sora-package)

3 CASA Rules (https://www.casa.gov.au/drones/rules)

6. Operations

6.1 Visual Line of Sight (VLOS) Operations

The majority of RPAS operations in Australia are in this category, VLOS, which means the remotely piloted aircraft (RPA) is always within visual range. VLOS operations should be within **500m** of the remote pilot on the ground who should also have a competent observer assisting. The types of RPA used in this category are typically the multi-rotor systems.

6.2 Beyond Visual Line of Sight (BVLOS) Operations

For longer distances **greater than 500m** the RPA becomes hard to see from the remote pilot on the ground. At this stage, the operation starts to become a BVLOS operation. This requires more controls as the situational awareness of keeping the RPA in visual range is now lost. The operational safety objectives (OSO) mentioned in the SORA are the type of extra controls required when operating in BVLOS mode to achieve ALARP. One of the key controls will be the ability to detect and avoid other airspace users.

BVLOS operations will need CASA approval as well as company approval.

For long-distance surveillance, BVLOS is going to be the preferred mode of operation. The most efficient RPA for BVLOS operations would be a fixed wing RPA.

6.3 Sensors and/or Payloads

The types of operations performed by RPAS both in VLOS and BVLOS modes are being expanded as innovative methods, sensor improvements and complicated algorithms and AI (Artificial Intelligence) technology are replacing traditional manual, inaccurate methods.

Care must be taken to evaluate the accuracy and sensitivity of sensors being offered as the sales pitch is based on what they want to accomplish not what they can deliver at that point in time.

For Right of Way patrols in both the steel pipeline easements and HDPE Gathering network corridors, the patrol is looking for anything that might be reducing the effect of physical or procedural protection measures that were designed to ensure the design life of the buried asset is maintained. Some examples of issues and suggested sensors are:

- visual inspection of assets to determine integrity and compliance using electro optical (EO)/InfraRed (IR) sensors and RGB orthomosaic.
- subsidence monitoring using light detection and ranging (LiDAR)
- emergency (fire/flood) monitoring, as required (visual, InfraRed and RGB orthomosaic)
- methane detection (Laser or InfraRed)
- environmental compliance using multispectral sensors. (LiDAR, InfraRed, RGB orthomosaic)

For steel pipelines and HDPE gathering systems, a BVLOS RPAS operation that can use the EO/IR/LiDAR/RGB sensors would be recommended.

7. Emergency Response Plan

RPAS are not as robust as aircraft designed to carry passengers and do not have the same level of redundancy, therefore they will typically have a higher failure rate.

It is recommended that any RPAS operation has a site-specific emergency response plan (ERP) that addresses the emergency scenarios within the area of operation. This should include at least, but not limited to, the following:

- propulsion failure
- lost link
- GPS failure
- airframe failure
- other airspace user collision
- collision with property on the ground
- fauna attacks (including raptors)
- Environmental factors including wind gusts, lightning.

For any BVLOS operation it will also be important to consider alternate landing areas within the area of operation.

From company and regulatory information, the key causes of RPAS incidents can be distilled to two primary factors:

- Airworthiness (both hardware and software) – The systems are built with component and use software that are not currently regulated to the high degree that passenger transport aircraft are, so they have a lower mean time to failure

- Remote pilot competency – most of the RPAS controls are highly automated and easy to use. However, the remote pilot must be able to react immediately to abnormal situations, such as loss of GPS.

A link to the UK Aircraft Accident Investigation Board RPAS incident summary highlights some of the seen issues of operating an RPAS. AAIB Record-only UAS investigations reviewed: December 2022 - January 2023 - GOV.UK (www.gov.uk)

8. Data Management

8.1 Data Analytics

Most RPAS operators should also provide a data analytics service rather than just pass on raw image product. This can include machine learning change detection, orthorectified imagery, point cloud 3D imagery, LiDAR survey imagery.

It is recommended that the image product provided by the RPAS operator be within the specifications of the GIS/spatial system specifications of the APGA Member company.

8.2 Data workflow

The main reason for starting an RPAS program is to give company management an effective tool to enable better decision making. Therefore, before starting an RPAS program, careful attention should be made to how the program's output will be used internally.

It is recommended that a clear company Scope of Work including the deliverables (exception reporting, proof of routes covered, etc.), imagery specifications, data format, workflow of work requests and associated close out, by who and by when, is established prior to the first flight.

The RPAS owner is responsible for gaining approvals to fly from CASA.

8.3 Data Security

It is recommended to develop a data custody of transfer process in accordance with company IT processes to ensure that the image data is securely transferred as well as tracked to the correct users and departments within the organisation.

9. Social Risk Management

APGA Members and their engaged RPAS operators are responsible for minimising impact to the community. RPAS activities have the potential to affect landholders, APGA member companies and have a key role in avoiding, negotiating, or minimising these impacts.

The recommended approach before embarking on a RPAS program is to conduct a social risk assessment led by the social performance teams of each company. This process will help address any concerns about issues such as privacy and what controls the company will put in place to address. Once this has been done, a stakeholder engagement process is recommended prior to the first flight.

It is important to note that not just external stakeholders be considered and consulted but also internal stakeholders as well. Some internal stakeholders may perceive RPAS use as a risk to their employment.

10. RPAS use checklist (Guide Only)

In summary, RPAS provides an effective tool that will assist in making a pipeline operation safer and more effective. Some of the key points from above are summarised in this RPAS use checklist:

1. Has a legal review of a potential RPAS operation been conducted?
2. Does the APGA Member company have a clear scope of what they want to achieve with RPAS?
3. What imagery/deliverable outputs are required by the RPAS program and at what specification?
4. Has a workflow for the imagery/deliverables/anomaly outputs been determined?
5. Has an ReOC operator with RePL holders been contracted?
6. Has the contracted ReOC operator been able to conduct a SORA?
7. Has the ReOC operator been able to get the required regulatory approvals?
8. Has a social risk assessment and engagement activity been conducted by the APGA member company before starting RPAS operations?
9. Has a trial area been identified, and a proof-of-concept scope developed?
10. Has the APGA member company management of change process commenced?
11. Has a site-specific emergency response plan been developed in conjunction with the ReOC operator and the APGA member company? For BVLOS operations, have alternate landing areas been identified?
12. Has a data management and chain of custody process been developed for the imagery produced?

Appendix

Acronyms and definitions

Acronym	Meaning
ALARP	As Low as Reasonably Practicable
APGA	Australian Petroleum and Gas Association
BVLOS	Beyond Visual Line of Sight
CASA	Civil Aviation Safety Association
CASR	Civil Aviation Safety Regulations
C2	Command and Control Data
EO	Electro Optical
ERP	Emergency Response Plan
GCS	Ground Control Station
GIS	Geospatial Information System
GPS	Geographic Positioning System
IR	Infrared
JARUS	Joint Authorities for Rulemaking on Unmanned Systems
LiDAR	Light Detection and Ranging
OSO	Operational Safety Objectives
ReOC	Remote Piloted Aircraft Operators Certificate
RePL	Remote Pilot License
RPA	Remote Piloted Aircraft
RPAS	Remote Piloted Aircraft Systems
RPS	Remote Pilot Station
SORA	Specific Operations Risk Assessment
UAS	Unmanned Aerial Systems
VLOS	Visual Line of Sight