Australian Government
Civil Aviation Safety Authority

ANNEX B TO AC 101-01 V6.0

Applying for approval to conduct one-to-many RPA operations

May 2024

About this guide

The Civil Aviation Safety Authority's CASA Guidance for Applying for approval to conduct one-to-many RPA operations summarises the requirements for applying for a regulatory approval.

However, this guide is not legislation and applicants are encouraged to refer to the Federal Register of Legislation at www.legislation.gov.au for the applicable legislation in force at any time.

Who this guidance is for?

This guidance is directed at ReOC holders seeking to apply for approval to conduct operations where a remote pilot operates more than one RPA simultaneously
(a one-to-many or swarm operation).

Feedback

We welcome feedback on the approach adopted in this guide and whether it provides regulatory information in a simple, easy-to-read, and concise language. Please provide comments and suggestions for improvement via the CASA website.

Contents

Acknowledgement of Country

The Civil Aviation Safety Authority (CASA) respectfully acknowledges the Traditional Custodians of the lands on which our offices are located and their continuing connection to land, water and community, and pays respect to Elders past, present and emerging.

Artwork: James Baban.

1 Reference material

1.1 Acronyms

Acronym	Description
AC	advisory circular
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulations
CONOPS	concept of operations
DPP	documented practices and procedures
MOS	Manual of Standards
NOTAM	notice to airmen
RA	risk assessment
RPA	remotely piloted aircraft
RPAS	remotely piloted aircraft systems
ReOC	RPA operator's certificate
RePL	remote pilot licence
RPIC	remote pilot in command
SOC	standard RPA operating conditions

1.2 Definitions

Terms that have specific meaning within this AC are defined in the table below. Where definitions from the civil aviation legislation have been reproduced for ease of reference, these are identified by 'grey shading'. Should there be a discrepancy between a definition given in this Annex and the civil aviation legislation, the definition in the legislation prevails.

Term	Definition
category	For an RPA, means one of the following: a. aeroplane b. helicopter (multirotor class) c. helicopter (single rotor class) d. powered-lift (vertical take-off and landing – VTOL)
documented practices and procedures	For a certified RPA operator, means the written practices and procedures of the operator, that have been approved in writing by CASA.
drone	For the purposes of this document, drone has the same meaning as RPA.

Term	Definition
one-to-many operation	Means an operation where multiple RPA are controlled centrally by a single remote pilot in command, typically using a single ground control station and a predefined flight path/s.
RPA	Means a remotely piloted aircraft, of a category other than a balloon, kite or a model aircraft.
swarm operation	A type of one-to-many operation where all RPA are operating together as a cohesive group to achieve the same goal.
type	Refers to whether the RPA is of a particular gross weight, being: Micro: not more than 250 g Very small: greater than 250 g but not more than 2 kg Small: greater than 2 kg but not more than 25 kg Medium: greater than 25 kg but not more than 150 kg Large: greater than 150kg

1.3 References

Legislation

Legislation is available on the Federal Register of Legislation website https://www.legislation.gov.au/

Document	Title
Part 92 of CASR	Consignment and carriage of dangerous goods by air
Part 101 of CASR	Part 101 Unmanned aircraft and rockets, Civil Aviation Safety Regulations 1998 (CASR)
Part 101 MOS	Part 101 (Unmanned Aircraft and Rockets) Manual of Standards 2019

Advisory material

CASA's advisory materials are available at https://www.casa.gov.au/publications-and-resources/guidance-materials

Document	Title
AC 101-01	Remotely piloted aircraft systems – licencing and operations

1.4 Forms

CASA's forms are available at http://www.casa.gov.au/forms

Form no.	Title
	RPAS multi-purpose application form

2 Licencing, certification and approval

2.1 RPA operator's certificate

2.1.1 Operating multiple RPA[1] from a single remote pilot, for example, a drone lightshow or multiple RPA conducting agricultural spraying, can only be conducted under an RPA operator's certificate (ReOC). Excluded RPA operators must abide by the standard RPA operating conditions (SOC), including only operating one RPA at a time[2].

2.1.2 For information on how to apply for a ReOC, refer to Advisory Circular 101-01.

2.2 Remote pilot licence

2.2.1 To operate under a ReOC, the remote pilot must hold a remote pilot licence (RePL)[3] that includes the type and category of the RPA to be operated.

2.2.2 For information on how to obtain a RePL, refer to Advisory Circular 101-01.

2.3 One-to-many approval

2.3.1 Regulation 101.300 of CASR limits a remote pilot to operating one RPA at a time unless an approval under regulation 101.029 of CASR, to operate more than one RPA at a time (a one-to-many approval), is obtained from CASA.

2.3.2 Prior to conducting a one-to-many operation the ReOC operator must obtain an approval from CASA permitting the one-to-many operation.

2.3.3 Depending on the operation, CASA may approve a person or unnamed remote pilots who are operating under the operator's ReOC.

[1] Also known as drones.

[2] Regulation101.238 of CASR.

[3] Regulation 101.252 of CASR.

3 Application process

3.1 Applying to CASA

3.1.1 Completed applications should be submitted to CASA as early as possible prior to the intended start date of the operation. CASA suggests allowing at least 3 months for the approval process to be completed.

3.1.2 The submission of an incomplete application will delay the approval process and may result in the application being rejected. The approval timeframe will reset with every rejected application.

3.1.3 Applications should be submitted using the RPAS Multi-purpose Application Form. Applicants should ensure that all applicable form fields are completed and, at a minimum, the following supporting documentation is provided:

- concept of operations (CONOPS) detailing:
  - area of operations in point-to-point coordinate format, illustrating the launch area, flight volume, contingency area, and emergency buffer (attach Goggle Earth KMZ file)
  - maximum altitude
  - the operating profile (lightshow, agricultural, etc)
  - proposed dates and times of operations including flight duration
  - location of the test and training site for rehearsals and CASA on-site assessment (if different from the area of operations)
  - names and ARNs of remote pilot(s)
  - RPA make, model and weight.
- operational procedures (further guidance provided below)
- training procedures (volunteers and spotters)
- emergency procedures
- stakeholder engagement plan (if applicable)
- RPA swarm system manual
- landowner permission.

3.1.4 Operators intending to apply for a one-to-many approval for a drone lightshow swarm should read Appendix A of this advisory circular in addition to chapters 3, 4, 5 and 6.

3.2 Fee estimate

3.2.1 When an application is received by CASA, the applicant will be given an estimate of the application cost.

3.2.2 Travel time for any on-site assessments will be considered when calculating the cost of the application estimate.

3.2.3 CASA will issue a revised estimate if it becomes evident that the final charges to assess the application will exceed the previous estimate issued. The revised estimate must be paid before assessment can proceed[4].

[4] Regulation 11.030 of CASR.

3.2.4 After payment of the estimate, the application will be assigned to a CASA Inspector for assessment. Typically, the assigned RPAS Inspector will contact the applicant's nominated point of contact within 3 to 4 weeks to provide an initial response to the application.

4 Assessment process

4.1 The assessment process for a one-to-many approval will vary between applications as it depends on the complexity and location of the proposed operation as well as other variables.

4.2 Technical desktop assessment

4.2.1 The technical desktop assessment focuses on the risks, procedures and supporting documentation to ensure any deficiencies have been addressed.

4.2.2 The CASA Inspector will conduct a desktop assessment of all relevant documentation and procedures supplied in the application. At a minimum, the assessment will consider the:

- training and checking procedures for the operational crew, including induction and recurrent training
- minimum experience and qualification requirements for the operational crew
- risk identification and treatments for swarm-specific air and ground risks and the proposed operational areas
- RPAS technical design and limitations, including the relevant failsafe systems
- human machine interface and human performance limitations.

4.2.3 The technical desktop assessment will also determine whether a training and testing approval, including a CASA on-site assessment is required.

4.3 Training and testing approval

4.3.1 For initial and higher risk one-to-many operations, such as drone lightshows, CASA will generally issue an interim training and testing approval to enable the training and testing of the operation in preparation for a CASA on-site assessment.

4.3.2 The training and testing area should be located in a region of low population and low air traffic density and be of sufficient size to ensure that, in the event of an abnormal operation, all RPA are contained.

4.3.3 It is expected (and encouraged) that an operator's documented practices and procedures (DPPs) will be continually developed as a result of training and testing operations. Noting this, the training approval will only be issued once the operator's DPPs are sufficiently developed to ensure an acceptable level of aviation safety will be maintained during training and testing operations.

4.3.4 This training approval can be issued for limited time or as a standing approved area for continued currency and competency training. The instrument may be issued with a validity date aligned to the ReOC expiry date.

4.4 On-site technical assessment

4.4.1 Generally, CASA will require the applicant to undergo an on-site technical assessment prior to issuing an approval to conduct the proposed one-to-many operations. The on-site assessment is not normally required for a training and testing approval (see section 4.3) unless the operation is novel or has an anticipated higher inherent risk profile.

4.4.2 The purpose of the on-site technical assessment is to ensure that procedures are appropriate and are adequately followed by all operational crew, the system knowledge is to an appropriate standard, and the system behaves as expected.

Note: If the applicant has already been subject to an on-site assessment relevant to the approval sought, CASA may determine that a subsequent check is not required unless the operator intends to operate a new and untested system or there have been significant changes to the operational procedures.

4.4.3 During the on-site technical assessment, the CASA Inspector will assess key areas of the operation, including but not limited to:

- site setup
- crew briefings
- adherence to checklists and procedures
- remote pilot system knowledge and conduct of operational flights
- crew knowledge of roles and responsibilities
- system failsafes
- geofence/electronic barrier functional testing
- abnormal and emergency procedures
- non-technical skills, for example, crew coordination and maintaining situational awareness
- crew communication
- maintenance procedures
- record keeping.

NOTE: If the on-site technical assessment is not successful, another assessment will be required, and a revised estimate will be issued by CASA. Refer to section 3.2 for information on estimates.

4.5 Final review and consideration

4.5.1 Prior to issue of the approval, any required updates to the operator's DPP identified through training, testing or the on-site assessment must be incorporated and re-submitted to CASA for consideration.

4.5.2 After the on-site technical assessment has been completed, and any final amendments to DPP have been considered by the CASA Inspector, the application will progress through CASA's internal recommendation to the final stage of the process.

5 Assessment guidance

5.1 Managing risk

5.1.1 All one-to-many operations involve additional risks that are not present in single RPA operations. Prior to making an application for approval to conduct one-to-many operations, the operator must complete a comprehensive risk assessment to identify the risks specific to the operational profile and the mitigators required to ensure the safety of people and property on the ground, as well as other airspace users.

5.1.2 Containment

5.1.2.1 Generally, the risk assessment for one-to-many operations determines that the operations should be confined to controlled ground areas. In these areas, operators can have a higher level of confidence that, in case of an unexpected incident, persons and property will be safe and unaffected. This is particularly relevant when operating large one-to-many operations, such as drone lightshows, where the probability of a failure of an RPA during an operation is increased due to the higher number of RPA in the swarm.

5.1.2.2 Operators should consider the potential fall area for an RPA and include a ground risk buffer in the controlled ground area. The size of the buffer will depend on the RPAS, abnormal operations procedures, and the behaviour of the RPA in case of flight termination.

5.1.2.3 The performance of containment systems, such as geofencing and flight termination systems, should be representative of the risk to persons, aircraft, and property in adjacent areas.

5.1.3 Situational awareness

5.1.3.1 One-to-many operations present significant human factor issues for remote pilots. Situational awareness of airspace and ground areas present challenges for remote pilots, particularly where the operation involves complicated system interfaces or where RPA are located in separate areas. Operators should have procedures to manage these potential issues.

5.1.3.2 Some operations will require additional crew members to assist in situational awareness, operational control, and management of flight areas. Where the operations involve additional crew members, the roles and responsibilities of each crew member should be defined, as well as relevant crew coordination procedures.

5.1.3.3 Unless operating as an EVLOS or BVLOS operation, while is it is permitted for the remote pilot to look away from the RPA momentarily to maintain situational awareness of all relevant airspace, the remote pilot should keep all RPA within the their seeing field of view. The operator should have flight planning procedures to ensure that the required visibility of all RPA is maintained throughout the operation.

5.1.4 Other airspace users

5.1.5 Other users of the airspace (i.e., general aviation)may be affected by the one-to-many operation and should be considered by the applicant as part of the stakeholder engagement plan. Stakeholders should be contacted as early as possible to identify possible conflictions.

5.1.6 Publication of a NOTAM may be required where there is a potential for the one-to-many operation to impact other airspace users. For more information on raising a NOTAM, refer to Advisory Circular 101-01.

5.1.7 Abnormal operations

5.1.7.1 Effectively managing abnormal situations is crucial in one-to-many operations. It can be challenging to identify and isolate an RPA experiencing issues, especially when operated from non-integrated ground control stations or when multiple RPAs are under the control of a single remote pilot.

5.1.7.2 In some cases, the only viable option to ensure the safety of persons, property, and other aircraft in the vicinity of the RPA swarm, is to command a flight termination of all RPA. CASA expects the operator to have rigorous abnormal operations procedures which also consider human performance limitations.

5.2 Operational area

5.2.1 Approval for one-to-many operations may be in the form of approval of a specific operation or as a location-agnostic approval.

5.2.2 An application for a location specific approval should include details of the operational area and safety buffers. Any areas of higher risk in the operational area, safety buffers, and the adjacent area where the RPA could enter in the event of a flyaway, should be identified.

5.2.3 Details of the chosen mitigators relevant to the operational area should be identified.

5.2.4 Where the operator applies for a location-agnostic approval, the operator's DPP should contain detailed instructions for crew on the assessment of site suitability and implementation of the appropriate mitigators.

6 Additional information

6.1 RPA registration

6.1.1 RPA registration applies to each RPA that is part of a one-to-many operation, including RPA that are part of a drone lightshows. Further information about how to register is available on the CASA website.

6.2 Carriage of dangerous goods

6.2.1 Dangerous goods are items or substances that are a risk to health, safety, property, or the environment when transported by air. For one-to-many operations, this includes fireworks and chemicals or poisons used for agricultural spraying.

6.2.2 If an operator is intending to carry dangerous goods as part of their one-to-many operation, they should refer to Advisory Circular 101-01 for more information.

Appendix A
Drone Lightshows

A.1 Background

A.1.1 Drone lightshows (also known as drone displays or lightshow swarms) are a type of one-to-many operation (or swarm operation) and require specific approval from CASA.

A.1.2 Lightshows present an increased risk profile due to the significant number of RPA that are operated simultaneously, are generally in close proximity to gatherings of people, and are conducted at night.

A.2 Approval area

A.2.1 Initial one-to-many approvals for a drone lightshow are generally issued for a specific location. Once the operator is sufficiently experienced they may seek an Australia-wide approval from CASA.

A.2.2 To consider an application for an Australia-wide one-to-many approval, the operator will need developed, detailed procedures for the assessment of site-specific risks and the adoption of appropriate mitigators.

A.2.3 Operations above 400 ft AGL require an additional approval from CASA.

A.3 Advertising drone lightshows

A.3.1 Drone lightshows should not be advertised until such time as the:

- operations are approved by CASA;
- the approval has been issued; and
- the approval is in the applicant's possession.

A.3.2 An email or verbal advice from a CASA Inspector indicating that the assessment has successfully been completed is **not** a basis upon which a drone lightshow display should be advertised or conducted.

A.3.3 The recommendation not to advertise does not apply where the drone lightshow advertised is likely to be approved and the advertisement clearly states that the drone lightshow is pending regulatory approval. The advertisement of a drone light show is not a basis for expediting regulatory approvals.

Note: We recommend all required approvals are obtained **before** publicly advertising or promoting the drone lightshow, including advertising as pending regulatory approval. This is to avoid having to change any details about the display that may happen throughout the assessment process.

A.3.4 Operators may not portray themselves as representing CASA or use the CASA logo, unless they have (under unique circumstances) express permission from CASA to do so. Use of the Commonwealth Coat of Arms is only through direct permission of the Department of Prime Minister and Cabinet.

A.4 Documented practices and procedures

A.4.1 Ground operations

A.4.1.1 Ground operations play an essential role in ensuring drone lightshows are carried out safely, this includes the pre and post flight actions of crew, stakeholder engagement/management, reporting any faults or defects identified with the equipment and general handling of the RPA and RPA components. Some of the main areas to consider when developing these procedures include the following topics:

Show management

This will likely include personnel to manage all of the relevant stakeholders and any operational requirements prior to conducting the drone display. A dedicated person should be considered.

Crew positions including duties and responsibilities of each position

These should be identified in the specific operational procedures that clearly identify each person's role.

Standardised site layout instructions

Diagrams or instructions for crew will assist in standardising the setup and layout of equipment, especially if the orientation of the drones is critical for a safe flight.

Safe drone handling

This may include instructions on how to carry the drones, limits on the number of drones one person may carry or how to insert and remove the drone batteries.

Fault and defect identification

All ground crew, regardless of whether the remote pilot conducts pre and post flight checks, should be trained on how to identify and report faults or defects on the drones.

Quarantining of drones or associated equipment e.g., batteries, drones for repair

A clearly defined area should be setup for any equipment that is deemed unserviceable, there may be separate areas for unserviceable drones and batteries.

Battery management procedures

This should include charging procedures, quarantining suspected faulty batteries and insert and removal of batteries from the drones.

A.4.2 Air operations

A.4.2.1 Most drone lightshows will be controlled by a single remote pilot who will be referred to as the remote pilot in command (RPIC). Their roles and responsibilities are directly related to the safe operation of the drone lightshow, considering relevant ground and air risks. The operator needs to consider the following things when developing procedures to operate the drone lightshow:

- pre-flight checks on the drones
- ground control station setup, including software configuration
- uploading data to the drones
- specific operating procedures for the system
- abnormal operating procedures e.g. airspace incursion, breach of operational limits
- emergency procedures e.g. GPS failure, loss of link
- recovery and post-flight procedure.

A.4.2.2 A checklist should be developed and made readily accessible for the RPIC. Consideration should be given as to whether a second remote pilot crew member is required to ensure there is adequate support for the RPIC; this will aid in checklist discipline and reduce the chance of missing steps.

A.4.3 Show manager

A.4.3.1 Given the large number of stakeholders that are generally involved in a drone lightshow (e.g., event management, security, other authorities), it is advised that a dedicated crew member, a show manager, is assigned to the task of liaising with the stakeholders to ensure that drone lightshow can commence. Additionally, if there are any safety or operational requirements the show manager should control this communication to the stakeholders. The main purpose for employing a position such as this is to reduce the workload on the RPIC, which in turn, allows them to focus on operating the drone lightshow system safely.

A.4.3.2 The roles and responsibilities of the show manager should be outlined in the operational procedures, these may include:

- managing stakeholders through relevant communication channels
- clearing launch and recovery areas of ground crew and others
- confirming a ‘green light’ to the remote pilot for the operation to commence
- sterilising the ground control station area to essential crew, prior to and during the drone operation
- conducting aviation broadcasts (as required)
- maintaining situational awareness of possible threats to the operation.

A.4.3.3 A checklist should be created that identifies when and how stakeholders need to be engaged for the show to be conducted; this may be unique to each operation. The checklist may include checks such as, a temporary exclusion zone has been set, event management has confirmed a green light for the show, weather in range (confirmed with remote pilot) etc.

A.4.4 Stakeholder engagement

A.4.4.1 Particular attention should be given to military operations, law enforcement or aeromedical transport as they may operate at short notice and low level at night. Additionally, given the exposure of such events, it should be identified if other drone operators have been tasked to film the event and identify communication plans with these operators. Detailing the exclusion zones to the other RPAS operators will also assist in mitigating the potential risk other RPAS operators may pose.

A.4.5 Ground risk buffer

A.4.5.1 A minimum lateral buffer of 1:1 height to horizontal distance should be put in place that ensures any person or property that is outside this buffer is unlikely to be affected by a failure of the system. CASA may accept valid data that demonstrates a smaller buffer; however, the onus will be on the applicant to provide this information and may be required to demonstrate aspects of the claims made such as geofencing systems, or provide third-party validation.

A.5 Environmental consideration

A.5.1 To achieve a controlled ground area in a location relative to public viewing, lightshow operations are often conducted over water or parkland.

A.5.2 The large number of simultaneous RPA operating in a swarm significantly increases the probability of an RPA departing from controlled flight. A number of lightshow RPA are designed to make an emergency landing upon an abnormal event.

A.5.3 The operator should have procedures in place to ensure that, in the event of a failure of an RPA, there is no negative environmental impact, such as pollution or fire.

A.5.4 Certain operating profiles and platforms will dictate the need for personnel on standby to retrieve any RPA that departs controlled flight to avoid a negative environmental outcome.