HMA GLOBAL SOPs 2018

CHAPTER 10: USING SMALL UNMANNED AIRCRAFT

Date: July 2018

This Chapter describes the rules for working with Small Unmanned Aircraft (SUA) with a maximum take-off weight up to 7 kg.

SUA may also be called Unmanned Aerial Vehicles (UAV) or ‘drones’. The legal constraints on the use of SUA varies by country and permissions must be granted by the relevant national authorities before using SUA.

Before using this SOP, changes should be made to suit the model(s) of SUA that will be used and to meet the needs of the particular programme.

When an NMAA does not have a national standard for SUA use, it is suggested that this SOP can provide the basis for drafting a national standard.

CHAPTER 10: USING SMALL UNMANNED AIRCRAFT (SUA)

A version of these SOPs has been available since 2007. This Chapter was included in 2017 and has been updated for this 2018 release. Definitions that are necessary to understand this SOP are included at the start of the Chapter.

Contents

1. Glossary

The terms defined below are listed in alphabetical order. Terms not used in this SOP may be included for clarity. A full Glossary of terms used throughout the Global SOPs is included in the introductory Chapter.

Deminer (Searcher): a 'deminer' is a person engaged in Search & Clearance tasks in areas that may be contaminated with explosive hazards. A deminer must always be trained and qualified to carry our procedures related to searching. A deminer may also have EOD training, but does not have to be trained to appraise and manage the explosive hazards that are found. Persons with EOD training are called 'EOD specialists' and must also be trained as deminers/searchers.

Demining procedure(s): see the entry for 'procedure'.

Demining task: see the entry for 'task'.

Device(s): the term 'device' is sometimes used to describe any explosive hazard.

Explosive hazard: the term **'**explosive hazard' is used to describe mines and ordnance whether fuzed, fired or otherwise, and all explosive devices whether mass-produced or improvised. It also covers hazardous parts of these devices, including detonators, propellants and pyrotechnics. Following the usage in international treaties and conventions, the IMAS distinguish between 'mines', 'submunitions' and 'Explosive Remnants of War' (ERW) and treats them separately. This is confusing because, in normal language, 'mines' and 'submunitions' are also 'ERW'. Rather than trying to reclaim the commonsense meaning of ERW, the term 'explosive hazard' is used in these SOPs.

HIEDC: The acronym 'HIEDC' (Humanitarian Improvised Explosive Device Clearance) is used to describe those IED search & Clearance activities that are conducted in HMA. HIEDC differs from the counter IED work that is conducted by active combatants or security services because it prioritises the safe destruction of the hazard without adopting a forensic approach that is intended to assist in the identification of those who made or placed it.

National Mine Action Authority (NMAA): the NMAA is the national organisation mandated by the national government to control and monitor humanitarian mine action activities.

Procedure(s), demining procedure(s): 'demining procedures' are activities conducted on land that may be contaminated with explosive hazards as part of preparing it for land release. Searching with metal-detectors or MDDs are demining procedures. Cutting undergrowth or ground processing with a demining machine are also demining procedures. One or more procedure can be applied to process the same ground to give confidence that the area can be released. Not all procedures, or combinations of procedures, constitute full Search & Clearance and so guarantee that no explosive hazards remain to the required depth in the area. This is not important when there is found to be No Threat Evidence in an area and it can be reliably 'Presumed Clear'.

Safety distance: the 'safety distance' is the distance at which all staff must be from a deliberate detonation in order to avoid injury. This is also the distance at which staff must be from a demining procedure that may predictably detonate some devices (such as processing the ground surface using a machine). See also the entry for 'working distances'.

SUA or UAV: The term 'Small Unmanned Aircraft '(SUA) is preferred by the Civil Aviation Authorities in Europe and so is used instead of Unmanned Arial Vehicle (UAV). In this context, the terms are treated as synonyms. An SUA is an aircraft with a Maximum Take Off Weight (MTOW) of 7 kg or less. It may have rotors, fixed wings or gas lift in any combination and is controlled remotely by a pilot in real time or following a pre-programmed flight path.

Suspected Hazardous Area (SHA): at the start of a demining task, the entire task area is often referred to as a 'Suspected Hazardous Area (SHA)'. After a Technical Survey has been conducted and more becomes known as the task progresses, parts of the SHA should be designated Low Probability Areas (LPA) and High Probability Areas (HPA) where the 'probability' refers to the probable presence of explosive hazards. HPA and LPA designations and the Task Release Plan should be reviewed and revised as soon as more as soon as more evidence about the contamination in the SHA is gathered. As areas with No Threat Evidence are identified, they may be Reduced, Verified or Cancelled, as appropriate.

Task (demining task): a 'task' is a specified area of land on which a demining organisation must conduct activities detailed in a Task Release Plan in order to declare the area 'Cleared' or 'Presumed Clear' in preparation for land release.

Task site (demining Task site): a demining Task site is any place where some or all of the ground is processed to find mines and/or explosive hazards in preparation for land release. The perimeter of the task site must be accurately recorded on the task map and on the ground whenever practicable. When a task is linear (as with routes), the perimeter may be marked and recorded as work progresses.

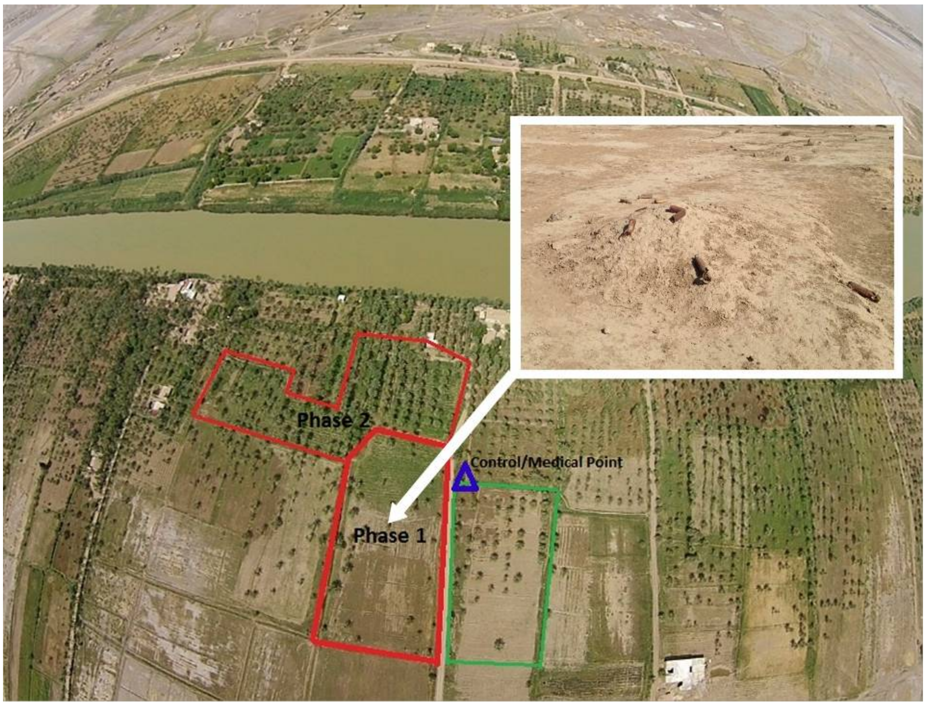
Working distance: the 'working distance' should make it unlikely that more than one person will be injured in a demining accident. Working distances can generally be shorter than safety distances because demining accidents are rare and injuries to a second worker rarer still. Reduced working distances can increase safety by improving the ease of supervision which ensures that procedures are conducted correctly and risks are appropriately managed. See also the entry for 'safety distances'.

1.1 Should, Must, and Shall

Throughout these SOPs the distinction between the terms 'should' and 'shall' that is used by the International Standards Organisation (ISO) and in the International Mine Action Standards (IMAS) is adopted.

When 'shall' or 'must' is used, everyone working to these SOPs must comply with the requirements as they are written. No variation is permitted.

When 'should' is used, everyone working to these SOPs must follow the requirements unless they have a reason to vary them that has been approved by the senior staff with operational responsibility. Variations must be recorded in writing in the Task Release Plan and the person(s) making the variation must be identified.



The picture shows an example of SUA imagery used in task planning.

2. Introduction

Small Unmanned Aircraft (SUA) have been used in humanitarian demining operations for almost 20 years. The early devices were large and prohibitively expensive to both buy and use[1], so rarely deployed. The development of low-cost, lightweight aircraft with high resolution cameras has reduced the total cost of ownership and enhanced the potential utility dramatically. This SOP covers the use of small SUA (below 7kg total weight).

Remote pilot certification for the use of SUA is generally granted for a category of aircraft and a Maximum Take-Off Weight (MTOW) of the SUA. The MTOW means the weight including fuel/battery and any load that the SUA is designed to carry.

Weight		**Category**		**Engine type**	
0-7kg MTOW	√	Fixed wing	√	Piston	√
>7-20 MTOW	X	Multi-rotor craft	√	Turbine	√
20-50kg MTOW	X	Helicopter	√	Electric	√
>150 Kg MTOW	X			Hybrid	√

The table shows the categories used in UK regulations at the time of writing.

The defining feature of SUA covered in this document is that the aircraft should have a Maximum Take-Off Weight of less than 7 kg. This has the least restrictive requirement for Civil Aviation Authority (CAA) Remote Pilot certification in Europe. The CAA requirements in countries varies and should be researched before considered the use of SUA (for an unofficial guide, see www.droneregulations.info).

Most low-cost, light-weight SUA have battery powered electric motors which give them a limited flight time. Returning to the take-off point and changing batteries can allow the area covered around that point to be large but does require that the take-off point should be carefully selected to avoid wasted duplication of over-flight.

3. SUA Teams

An SUA team should comprise two pilots, one of whom acts as an observer at any one time.

SUA pilots should be responsible for the maintenance of the SUA and conduct all pre-flight checks and periodic service requirements as required in the manufacturer's documentation. The pilot must also be appropriately trained and experienced so that they can use the SUA safely and efficiently to achieve planned goals.

3.1 Pilot qualifications

In order to demonstrate having done everything reasonable to keep risk to the public and staff to a tolerable level, all SUA pilots must be:

- at least 18 years old;
- have demonstrated a good understanding of aviation theory (airmanship, airspace, aviation law and good flying practice);
- have demonstrated full knowledge of the relevant national aviation laws in the country of operation;
- have completed at least two hours flight time with the type and model of aircraft;
- have passed a practical flight assessment (flight test);

[1] Schiebel Camcopter – early development with HMA R&D funds from US Army CECOM NVESD in 1999.

- have passed bespoke tests designed to ensure that the pilot is able to make good use of the SUA's capacity to fly in a pre-programmed flight mode;
- have passed bespoke tests designed to ensure that tasks requiring tool delivery or delicate manoeuvres can be conducted with precision, flying without line of sight when the task risk assessment requires and permits this; and
- be proven capable of developing appropriate flight plans and recording them in a SUA pilot's log book.

Whenever possible, the pilot's abilities should be assessed and certificated by an independent organisation that is approved by the relevant Civil Aviation Authority (CAA). Organisations authorised to issue certification may be known as National Qualified Entities (NQEs). A national CAA may decide that a CAA certificate issued by an authority in another country is acceptable for a period of time before national certification is needed. When the national CAA has no capacity to approve NQEs to conduct SUA pilot test and certification, or there is no CAA in a country, a CAA certificate issued by an authority in another country should be accepted by the NMAA.

When there are no national requirements for SUA pilot certification, all pilots must have, as a minimum, been appropriately trained and passed a test of competence leading to the issue of a certificate listing what the pilot could do when the test was conducted, and who the test was conducted by.

3.2 SUA pilot responsibilities

The responsibilities of specialist SUA pilots in HMA are summarised below.

The pilot is responsible for ensuring that:

- appropriate written Task Risk Assessment and flight plans are produced before any flight is made over an area that may be hazardous;
- all liaison with local authorities, security forces, and the local community is conducted before deployment;
- appropriate control points from which to control and/or observe the SUA operation are selected;
- the pilot and observer have reliable communications with each other and with any other operational staff there may be at the site;
- every member of the SUA team receives a safety briefing at the start of each working day and is fully aware of their responsibilities during that day; and
- every member of the team is in a suitable physical and mental condition to conduct the work required of them.

The pilot may delegate some authority but retains overall responsibility for ensuring that all requirements are met.

3.2.1 SUA team supervisor responsibilities

The SUA team supervisor is responsible for ensuring that:

- the goals of the flight and its desired outputs are realistic and are fully understood by all involved;
- appropriate community liaison work has been conducted and the flight plan does not breach approved use parameters;
- the area of the task where the pilot and observer will stand is safe;
- the SUA is deployed in accordance with the flight plan; and

- all required SUA safety procedures are conducted.

QC is conducted on the recorded data to facilitate improving the efficiency of use in future planning.

3.3 Flying constraints

Unless the pilot is otherwise certified and authorised by the national CAA (of other NQE) the following constraints apply. Exceptions are permitted for safety reasons depending on the task risk assessment.

1. Visual Line Of Sight (VLOS) should be maintained between the pilot and the SUA. VLOS should generally be unaided, so should not require the use of binoculars, telescopes or zoom lenses.
2. The SUA must not fly higher than 220 ft (vertically) above ground level.
3. The SUA must not fly further than 500 metres (horizontally) from the pilot.
4. The pilot must comply with any local controlled airspace rules and shall coordinate with local Air Traffic Control (ATC) authorities when close to any airfield. The ATC may publish relevant Notices To Airmen (NOTAMS) about Air Information Publications (AIPs) which must be complied with.

International aviation norms use measurements in feet for height above the ground. 220 feet is about 67 metres.

When maintaining risk at or below a tolerable level requires that these constraints be varied, the requirement should be documented and the reason for the breach recorded.

3.3.1 Insurance

All national requirements for third party insurance must be complied with in full. When no national requirements are known, insurance provision to meet any legal representation and compensation costs associated with claims arising from damage to persons or property as a result of SUA use should be held. Appropriate and realistically priced insurance cover may be hard to source so insurance needs may be met by setting aside sufficient funds for use in case of claims being made.

4. General use constraints

The use of SUA may be controversial and may raise security and privacy concerns. It may also attract curiosity and attract members of the public to observe its use.

Whenever it is safe to do so, the public should be informed about the use of the SUA before any flights. When this may attract an audience, the SUA pilot and observer/spotter should be accompanied by sufficient staff to establish a perimeter and keep outsiders at a safe distance from both the possible hazardous area and the SUA itself.

4.1 Task liaison

Overflying residential areas or people may cause privacy concerns, embarrassment or anger, so should be avoided whenever possible.

Whenever there are, or may be, privacy concerns, a task liaison officer (or another person with designated liaison responsibilities) should ensure that the community in or near the flight path are told in advance that the flight will be conducted and the reasons for it. They should be reassured that their privacy will be respected.

It may also be necessary to inform local authorities, police and/or security services about the use of the SUA before any flights are conducted.

Before any flight plan is finalised, the task liaison person should check with any other potential SUA users in the working area that they are not planning to fly their SUA at the same time.

4.2 Medical support

Generally, because the SUA is operated and observed from known safe areas, there is no requirement for the presence of a paramedic during the use of the SUA unless it is conducted at the same site as other activities where the presence of a paramedic is required.

5. Safety rules

The following safety principles must be applied.

1. The SUA pilot must check the integrity of the SUA's control system as comprehensively as possible before starting any flight.
2. SUA that have a return to take-off feature in the event of signal loss or the receipt of confused control signals should be used.
3. Flights must be conducted with the pilot and observer standing in a known hazard free area at all times.
4. A flight plan that is designed to minimise the flight time necessary to gather the required data or conduct the required task should be made.
5. The flight should not take the SUA within 25 metres (or 75 vertical feet) of any person inside or outside the worksite other than the pilot and observer.
6. The flight plan should minimise the requirement for the pilot to change position to retain line of sight of the SUA during the flight.
7. The flight plan should ensure that the SUA lands with at least 30% of its potential fuel/power unused (in many cases, battery powered SUA will alert the pilot when power reserves reach 30%). Fuel/batteries capable of powering the SUA for at least twice the predicted flight time should be available.
8. In the event of the SUA landing or crashing inside an area that may be hazardous, the SUA must not be approached until the approach has been searched using tools and procedures approved for Search & Clearance and clearly marked.

5.1 Control signal disruption

Whenever a wireless signal jammer may be used in the area, wireless signals used to control the SUA may be compromised. Telephone jamming should not affect the SUA's controls but multi-spectrum jammers may do so. Even if the control signals are compromised, it may still be safe to fly the SUA using an on-board pre-programmed flight plan that does not rely on pilot signals as long as the jammer in use is proven not to influence the SUA's GPS based navigation system.

GPS systems are not disrupted by telephone signal jammers but may be separately blocked in time of open conflict when the combatants may find a tactical advantage in blocking signals which they also generally rely on. (It is variously reported that the accuracy of civil GPS systems is currently degraded by anything between 6 cms and 3 metres from optimal.)

Every means possible must be taken to check the integrity of the control system before starting a flight and to ensure that control signals are not compromised during a flight.

Whenever two SUA are flown in close proximity, there is a risk that the control signals may interfere with each other and the pilots lose control of their SUA. Before using two SUA in signal range of each other, full checks must be made to ensure that the control frequencies cannot overlap and influence the other's flight.

To reduce the risk of remote control being influenced by another organisation using radio controlled equipment, the task liaison person should check with any other organisations working in the area around the task that they will not be using radio controlled equipment at times that would coincide with the flight plan.

The effective range of the SUA control system should be checked at the start of the day and at regular intervals throughout the working day. The conditions of the batteries in the control system can be critical to signal strength and must be regularly checked.

5.2 PPE requirements

Pilots and observers who remain outside the area to be over-flown and stand in an area known to be safe need not wear PPE unless Search & Clearance activities are being conducted in the area and the pilot or observer is positioned inside the safety distance for the anticipated hazards at the task.

If the pilot or observer may enter the safety distance for a task where work is being conducted, they must wear PPE that meets the minimum guidelines in Chapter 2.

5.3 SUA risk management

Risk assessment is a part of all task planning. The flight plan must take account of the need to avoid all predictable risks and to minimise the consequences of any accident should one occur. Predictable accidents may occur because of either equipment failure or pilot error.

Predictable risks to be managed include:

- the risk of the SUA causing injury or damage to persons or property (inside or outside the flight plan area);
- the risk of the SUA incurring damage during the flight due to collision with trees, cables or other aerial obstacles;
- the risk of the SUA flying outside the range of the remote control system;
- the risk of the control of the SUA being influenced by other signals nearby;
- the risk of the SUA running out of sufficient fuel to reach/return to the planned landing area;
- the risk of the SUA making an unplanned landing inside a hazardous area;
- the risk of the SUA attracting close-contact curiosity or hostility from birds;
- the risk of the SUA coming under attack from people on the ground; and
- the risk of the use of the SUA conflicting with other local aeronautical activity (light aircraft or helicopters that may be conducting MEDEVAC, policing, redeployment, or survey flights).

Other, unforeseen, events that could add risk should be recorded and included in future risk assessments.

Most risks can be managed by predicting and avoiding them. Checking control systems and limiting flight plans to ensure control coverage and sufficient fuel can avoid many risks. Maintaining line of sight of the SUA during the flight and having an observer to help identify flight hazards can avoid most other predictable risks.

5.4 CBRN hazards

Chemical, Biological, Radiological and Nuclear (CBRN) hazards present unique risks and SOP additions covering the use of the specific model of SUA where these hazards are anticipated must be appended before using an SUA when there is reason to believe that these hazards may be present.

When a possible unconventional hazard is anticipated, the SUA should be equipped with an appropriate means of detecting the hazard remotely so that the pilot is aware of a positive result before the SUA returns and lands. If a life threatening CBRN hazard is detected, the SUA must either be designed to allow for full decontamination or to be landed in a prepared area and appropriately destroyed after use. The pilot, observer and any others present should be equipped with PPE designed to protect against the hazard and should be withdrawn from the hazardous area for decontamination as soon as possible.

If an unanticipated possible unconventional hazard is identified during a flight, it must be a priority to land and isolate the SUA, then report the unconventional hazard and await competent advice on how best to proceed. Pilots, observers and other team members who may have been exposed to the hazard should be kept in isolation until appropriate detection, decontamination and/or treatment can be arranged.

6. General uses of SUA

The use of SUA in HMA is expanding as their value is recognised and as the technology is developed. Their capacity to gather data and deliver cargo is changing and this SOP must be revised whenever necessary to document the abilities and constraints associated with the SUA that are in current use.

6.1 SUA cameras

Low cost and efficient camera systems allow a wide range of resolution, zoom and infrared features.

The SUA pilot must be fully aware of the limitations of the camera(s) on board and ensure that each flight results in the gathering of the appropriate data.

The type of cameras used on the SUA will depend in part on the type of SUA, on its weight carrying capacity, power capacity and whether it has fixed wings or rotors.

Ideally, a multi-rotor SUA should have a camera providing a pilot's view and a separate camera gathering the visual data required from the flight.

Data gathered may be streamed to the ground for collection or recorded on board, or both. When the SUA is flying a pre-programmed flight path that is independent of ground control, the data gathered should be recorded on board.

Gyro-stabilised cameras (gimbals) may be used for one or more on-board cameras and the image resolution and zoom capacity must be suitable for the planned use.

The pilot should not pay attention to data recorded from any camera not facing in the direction of flight while the SUA is moving in relation to the ground because the pilot should retain VLOS with the SUA. The pilot should be accompanied by an observer looking at the ground data whenever the flight plan may need to be adapted depending on ground data feedback.

When the SUA can hover, the observer may draw the pilot's attention to ground features that may reward closer investigation while the SUA is hovering. Generally, the ground data recorded in the flight should be examined after the flight and any close-in inspections made during a separate flight that has its own flight plan.

6.2 Potential SUA tasks

Potential uses of an SUA include, but are not limited to, the following tasks:

- pre-deployment Task Assessment survey including access selection;
- mapping and detailed task planning as part of Technical Survey;
- progress mapping;

- monitoring of demolition sites;
- training/testing;
- close visual inspection;
- inspecting vehicles;
- placing remote tool systems;
- providing a camera overview of other remotely controlled machine to assist in their use; and
- placing lightweight hook and line equipment.

Other uses that meet the general safety and security principles outlined in this SOP may be added as Annexes.

Only pilots that have been appropriately trained to conduct the required task and have practiced in a hazard free area enough to give full confidence in their competence can be asked to conduct any specified SUA task.

NOTE: *During any of these uses, if the risk to the pilot from an unintended detonation is greater than the risk associated with the pilot losing control of the SUA, flying by camera without line of sight is permitted. Alternatively, the pilot may be behind appropriate protection and use a shatter-resistant periscope to retain some line of sight control.*

The pictures above were taken during an SUA photographic survey that included looking through windows and doors and that identified an IED (in the cardboard box)

6.2.1 Pre-deployment survey

The use of an SUA for a pre-deployment Task Assessment survey or as part of Technical Survey involves making one or more over-flights of a suspected hazardous area. Data may be recorded as video and/or as still-shots that are later combined to provide a visual map of the area.

Careful study of the camera data from the flight may identify areas or features of special interest which then require the production of a second flight plan to allow inspection from a closer distance of discrete areas/features.

Pre-deployment camera survey can be expected to help identify:

- ground conditions;
- vegetation levels;
- obstructions in the working area;
- evidence of land use in the area (past or present);
- livestock or wildlife in the area;
- water courses;
- hills, depressions and geographic features; and
- visible items that may be indicators of the presence of explosive hazards.

In some cases, explosive hazards may be identified using the camera data.

Data gathered during pre-deployment camera survey can prove that an area is hazardous but it cannot prove that it is not hazardous, so should not be used as evidence that there are no explosive hazards present.

6.2.2 Mapping

When photographic data is to be combined into a map, the SUA should have the facility to be programmed to follow a pre-determined route capturing images at set intervals.

Photographic maps of the area may be overlaid onto other map sources and help to provide an up-to-date guide to the ground conditions in the area surveyed.

The map can also provide the basis for a ground survey (Technical survey) task map, and will be a planning resource used when deciding a Task Release Plan.

6.2.3 Progress mapping and QA

While any HMA work that involves area marking is being conducted, scheduled over-flights capturing data in the same map grid as the original map may be used to record the movement of marking and automatically generate data about the area that has been searched. Progress maps made in this way can automatically provide progress statistics and provide objective evidence in support of quality management audits.

Progress mapping can be combined with internal QA over-flights as long as the height of the SUA is sufficient to ensure that persons working in the area are not distracted by it. This will require that the ground-data camera have a powerful zoom capacity. A camera record of QA concerns can provide objective evidence of issues that need to be addressed.

6.2.4 Demolitions overview

A multi-rotor or helicopter SUA with a suitable camera capacity may be used to observe controlled demolitions while hovering at a safe distance and zooming in on the demolition. Even at a nominally safe distance, the SUA may be at a small risk of being struck by explosive debris or influenced by the blast pressure, so the SUA should only be used when the risk of damage to the SUA is considered tolerable.

In tests, a fast high resolution camera has been able to record throw-outs, their trajectory and landing places, so providing a record that is uniquely useful for the QA of demolition events.

The camera overview of a demolition can be followed by a close overhead inspection of the result of the demolition, so allowing some potentially hazardous results to be identified before people approach.

6.2.5 Training/testing overview

When conducting training in a safe area, it can be useful to overfly aspects of the training and show the film to help trainees identify any errors. The same approach can be used to support self-assessment of MEDEVAC practice. The overview from the SUA is more comprehensive than that of supervisors or trainers on the ground and may be more difficult to dispute. The video record also provides evidence of the training having been conducted (and where) which can be of value during internal or external quality management audits.

Tests of equipment, especially when testing inside a hazardous area or with small, controlled explosions, can be usefully recorded on camera using SUA that can hover at the safety distance and zoom in on the test. Even at the safety distance, the SUA may be at a small risk of being struck by explosive debris or influenced by the blast pressure, so should only be used when the risk of damage to the SUA is considered tolerable.

6.2.6 Close visual inspection

When hazards sensitive to any movement or electrical/mechanical activity within a radial proximity are anticipated, the initial approach should be made using a remotely controlled machine carrying one or more cameras providing visual feedback. The remotely controlled machine may be a large or small ground machine or a multi-rotor/helicopter SUA. A well trained SUA pilot may be required to make a visual survey of buildings by hovering in doors and windows. This may allow a partial visual search of multiple floors in a building, including its roof.

Any downdraft from the SUA should not cause greater disturbance than the potential movement of wind in the area, and this constraint may require that the SUA is not flown low over the subject of the inspection. When this is the case, it may be possible to move around the subject at a low height to gather inspection data without significant downdraft disturbance.

To comply with the constraints of pilot certification, the pilot should have line of sight to the SUA at all times unless the Task Risk Assessment makes the deployment an exception. When the use of an observer to relay camera information would place two people inside a hazardous area, the pilot should take both roles to minimise risk.

Maintaining full 3D spatial awareness may require the pilot to be close to the suspected hazard and the pilot may need to glance between camera view and line of sight frequently. PPE must be worn as required for other staff in the area.

6.2.7 Inspecting vehicles

The use of a SUA to inspect a suspect vehicle may be severely limited by the type of vehicle and its context.

Any SUA that can hover may be used to provide a visual inspection through the windows of the vehicle and may rest on the ground at intervals around the vehicle to allow the underside to be viewed. When light conditions under the vehicle are poor, the SUA should have the capacity to be fitted with a powerful battery powered light and/or a lo-lux camera.

To comply with the constraints of pilot certification, the pilot should have line of sight to the SUA at all times unless the Task Risk Assessment makes the deployment an exception. When the use of an observer to relay camera information would place two people inside a hazardous area, the pilot should take both roles to minimise risk.

Maintaining full 3D spatial awareness will mean that the pilot may have to be close to the suspected hazard and may need to glance between camera view and line of sight frequently. PPE must be worn as required for other staff in the area.

The camera views should be recorded for remote inspection by suitably experienced staff.

6.2.8 Inspecting inside buildings

The correct small SUA can be used to gain access to unoccupied buildings through missing windows and doors when its control system is not compromised, so allowing a rapid visual assessment to be made inside rooms. The positioning of the pilot can be critical to maintaining control and, when appropriate, the placement of proven signal repeaters can be used to extend control. In these circumstances, the risk of maintaining line of sight is likely to be greater than the risk of trying to keep line of sight, so flying by camera is permitted.

6.2.9 Placing tools

Whenever it is necessary to place a tool from a distance using a remotely controlled machine, that machine may be a multi-rotor or helicopter SUA with suitable cargo carrying and delicate release capability.

This SOP is deliberately restricted to SUA with a take-off weight of under 7kg. SUA of this weight may be used to deliver and place lightweight tools over short distances.

In all cases, the tool delivered by an SUA must be able to be operated by lightweight cable or by remote control. Until remotely activated systems have been tested and proven, this may involve the slow flight of the SUA while a lightweight electrical activation cable is slowly paid out behind them. This should only be done when there is no risk of the cable being snagged. To keep the number of persons in the hazard area to a minimum, the pilot should operate without an observer close by, so minimising risk.

Whenever the pilot and/or observer is in the hazard radius for any energetic material used in a tool, the pilot and any observers must wear appropriate PPE.

Tools must only be prepared and placed in the SUA’s cargo delivery system by suitably qualified and experienced staff.

After the tool has been placed, the SUA team should withdraw and a HIEDC EOD3+ C-IED qualified specialist should use the emplaced tool. When the tool is radio controlled, the control system should have a separate two-stage switch for use by a suitably experienced and qualified person.

Detailed instructions for the testing and use of any wireless control system must be added to this SOP before use.

6.2.10 Placing lightweight hook and line equipment

When the SUA is able to deliver lightweight micro-fibre line and hooks or nets that allow a suspected hazard to be remotely pulled, it may be used for this purpose. Generally, weight constraints may limit the distance over which this can be realistically conducted and so the micro-fibre may not be long enough to allow safe pulling. When this is the case, the micro-fibre line placed by the SUA should be manually spliced/joined to an extension before the pulling takes place.

Generally, the hook, net, or array of hooks attached to a net should be placed on the ground beyond the suspected hazard so that the hook(s) snag the suspected item when the line is pulled.

To comply with the constraints of pilot certification, the pilot should have line of sight to the SUA at all times unless the Task Risk Assessment makes the deployment an exception. When the use of an observer to relay camera information would place two people inside a hazardous area, the pilot should take both roles to minimise risk.

Maintaining full 3D spatial awareness will mean that the pilot may have to be close to the suspected hazard and may need to glance between camera view and line of sight frequently. PPE must be worn as required for other staff in the area.

7. Finding human remains

If human remains, or suspected human remains, are located during SUA visual data gathering, the procedures required by the NMAA must be followed. When the NMAA does not have published procedures, the requirements given below should be applied.

SUA visual survey/search is often conducted in battle areas where civilians and combatants may have died during the fighting. When the areas are known to be potentially hazardous, their remains may have been undisturbed by people since the fighting ended. They may also have remained undisturbed because they have been booby-trapped after death, or died carrying or wearing hazards such as suicide vests. In these circumstances, the safety of the staff takes precedence over any procedures that might be applied in other circumstances. Generally, the SUA team should be limited to recording the position and providing images for use by any subsequent HMA Search & Clearance teams.

When human remains are discovered in areas that will not be subject to Search & Clearance, the appropriate authorities should be informed so that they can decide whether an investigation of the circumstance surrounding the death is necessary. When no national authorities are available or are able to attend, the remains and associated artefacts may be bagged and tagged during Search & Clearance as described in Chapter 6, Part 15 but recent human remains should not be approached.

The recovery, identification and storing of human remains is usually the responsibility of national police and health workers. The SUA team may provide them with assistance by providing video covering the approach routes to the remains and close-up views of the remains if appropriate.

8. QA/QC of SUA use

Conventional methods of conducting Quality Assurance (QA) and Quality Control (QC) during HMA activities by repeating some of the work are not necessary during specialist SUA camera survey because the area will not be declared ‘Cleared’ or ‘Presumed Clear’ after the work of the SUA team. The methods to be used for QA/QC are described below.

8.1 Internal QA

Internal QA is provided by the second member in each pair of SUA operators. All team members must be suitably qualified and have supervisory experience, so each can be the QA for the other. Every person in a SUA team must have been appropriately trained to conduct internal QA.

They will check:

- that the appropriate equipment, including fuel/batteries, and data recording equipment is available;
- that the required pre-flight SUA safety and preparation checks are made;
- that the pilot has prepared a coherent flight plan that can achieve the flight goals;
- that the data gathered can realistically be expected to be sufficient to meet the flight goals; and
- that there are no conditions in the flight area that put the safety of the fight at avoidable risk.

8.2 Internal QC

After each working day, the SUA team supervisor will check the pilot’s log, flight plan(s) and the record of recorded data to ensure that all have been recorded and saved in a way that will allow efficient data retrieval at a later date.

A periodic QC check of the SUA flight outputs should be made to determine the extent to which flight goals have been achieved and to identify ways of possibly improving flight planning.

8.3 External QA and QC

External QA and QC may involve observing the flight(s) but will generally be confined to examining the flight plans and comparing the data gathered against the goals with a view to determining whether the SUA use has been efficient. External QC may also be conducted on the interpretation of data gathered and its accuracy when compared with data gathered on the ground.

9. Reporting

All work conducted by the SUA teams must be recorded and reported as required internally and as required by the NMAA and the donor. Reports must be completed and submitted on time.

Close liaison with any external QA/QC authority should be maintained throughout the work so that they can conduct their work appropriately.

9.1 SUA data management

Except in emergency situations, all basic flight data must be recorded in the pilot’s log.

Digitised data collected during the flight, in terms of GPS coordinates and geo-referenced imagery must be recorded as required for data management using a formalised file naming system. A secure back-up should be made before data is transferred. Before deleting any data recorded on-board the SUA, the pilot should ensure that at least two copies of the data exist on other media.

Video data may be immediately copied for examination on a large screen in order to identify areas that may reward closer inspection and provide the basis for subsequent flight plan(s) for the area.

9.1.1 GIS data integration

The software available may vary but should always be able to provide the required access, retrieval, manipulation and overlay services. Generally, any maps generated should be compatible with other maps to allow overlays that enrich the images recorded.

Whenever visual evidence of a potential explosive hazard is later confirmed, a picture should be included in an Annex to this SOP as an example to aid recognition in future.

Annex A: Civil Aviation Authorities

Users should check that this list of national and supra-national civil aviation authorities is not out of date and update it as required.

Country	Authority name in English	Website
United Nations	International Civil Aviation Organization	www.icao.int
Afghanistan	Ministry of Transport and Civil Aviation	www.motca.gov.af
Albania	Albanian Civil Aviation Authority	www.aac.gov.al
Algeria	Directorate of Civil Aviation and Meteorology	www.ministere-transports.gov.dz
Angola	National Civil Aviation Institute	www.inavic.gv.ao
Argentina	National Civil Aviation Administration	www.anac.gov.ar
Armenia	General Department of Civil Aviation of Armenia	www.aviation.am
Aruba	Department of Civil Aviation of Aruba	www.dca.gov.aw
Australia	Civil Aviation Safety Authority	www.casa.gov.au
Austria	Federal Ministry for Transport, Innovation and Technology	www.bmvit.gv.at
Bahamas	Department of Civil Aviation of Bahamas	www.bahamas.gov.bs
Bahrain	Department of Civil Aviation Affairs	www.caa.gov.bh
Bangladesh	Civil Aviation Authority, Bangladesh	www.caab.gov.bd
Barbados	Civil Aviation Department of Barbados	www.bcad.gov.bb
Belarus	Aviation Department of Belarus	www.avia.by
Belgium	Federal Public Service Mobility and Transport	www.mobilit.fgov.be/fr/ www.mobilit.fgov.be/nl/
Benin	National Civil Aviation Agency	www.anac.bj
Bermuda	Bermuda Department of Civil Aviation	www.dca.gov.bm
Bhutan	Bhutan Civil Aviation Authority	www.bcaa.gov.bt
Bolivia	General Directorate of Civil Aviation of Bolivia	www.dgac.gob.bo
Bosnia and Herzegovina	Bosnia and Herzegovina Directorate of Civil Aviation	www.bhdca.gov.ba
Botswana	Department of Civil Aviation of Botswana	www.dca.gov.bw
Brazil	National Civil Aviation Agency of Brazil	www.anac.gov.br
Brunei	Department of Civil Aviation of Brunei	www.civil-aviation.gov.bn
Bulgaria	Directorate General Civil Aviation Administration	www.caa.bg
Cambodia	Secretariat of State for Civil Aviation	www.civilaviation.gov.kh
Cameroon	Cameroon Civil Aviation Authority	www.ccaa.aero
Canada	Transport Canada Civil Aviation Directorate	www.tc.gc.ca/eng/civilaviation/menu.htm
Cayman Islands	Civil Aviation Authority of the Cayman Islands	www.caacayman.com
Chile	Directorate General of Civil Aviation	www.dgac.gob.cl
China	Civil Aviation Administration of China	www.caac.gov.cn
Colombia	Special Administrative Unit of Civil Aeronautics	www.aerocivil.gov.co
Cook Islands	Pacific Aviation Safety Office	www.paso.aero
Costa Rica	Directorate General of Civil Aviation of Costa Rica	www.dgac.go.cr
Croatia	Croatian Civil Aviation Agency	www.ccaa.hr
Cuba	Institute of Civil Aeronautics of Cuba	www.cubagob.cu
Cyprus	Department of Civil Aviation of Cyprus	www.mcw.gov.cy
Czech Republic	Civil Aviation Authority of the Czech Republic	www.caa.cz
Denmark	Danish Transport Authority	www.trafikstyrelsen.dk
Dominican Republic	Dominican Institute of Civil Aviation	www.idac.gov.do
Ecuador	Directorate General of Civil Aviation of Ecuador	www.aviacioncivil.gob.ec
Egypt	Ministry of Civil Aviation of Egypt	www.civilaviation.gov.eg
El Salvador	Civil Aviation Authority of El Salvador	www.aac.gob.sv
Estonia	Estonian Civil Aviation Administration	www.ecaa.ee

Country	Authority name in English	Website
European Union	European Aviation Safety Agency	easa.europa.eu
Fiji	Civil Aviation Authority of Fiji	www.caafi.org.fj
Finland	Finnish Transport Safety Agency	www.trafi.fi
France	Directorate General for Civil Aviation	www.dgac.fr
Gabon	National Civil Aviation Agency	www.anacgabon.org
Gambia	Gambia Civil Aviation Authority	www.gambia.gm/gcaa/
Georgia	Georgian Civil Aviation Agency	www.gcaa.ge
Germany	Federal Office for Civil Aviation of Germany	http://www.lba.de/EN/
Ghana	Ghana Civil Aviation Authority	www.gcaa.com.gh
Greece	Hellenic Civil Aviation Authority	www.hcaa.gr
Guatemala	Directorate General of Civil Aviation of Guatemala	www.dgacguate.com
Guyana	Guyana Civil Aviation Authority	www.gcaa-gy.org
Hong Kong	Civil Aviation Department	www.cad.gov.hk
Iceland	Icelandic Transport Authority	www.icetra.is
India	Directorate General of Civil Aviation	dgca.nic.in
Indonesia	Directorate General of Civil Aviation	hubud.dephub.go.id
Iran	Civil Aviation Organisation of Iran	www.cao.ir
Iraq	Directorate General of Civil Aviation of Iraq	www.iraqcaa.com
Ireland	Irish Aviation Authority	www.iaa.ie
Israel	Civil Aviation Authority	caa.gov.il
Isle of Man	Isle of Man Aircraft Registry	www.gov.im/ded/aircraft/
Italy	National Agency for Civil Aviation	www.enac-italia.it
Jamaica	Jamaica Civil Aviation Authority	www.jcaa.gov.jm
Japan	Japan Civil Aviation Bureau	www.mlit.go.jp
Jordan	Civil Aviation Regulatory Commission of Jordan	www.carc.jo
Kenya	Kenya Civil Aviation Authority	www.kcaa.or.ke
Democratic People's Republic of Korea	Civil Aviation Administration of Korea	
South Korea	Korea Office of Civil Aviation	koca.go.kr
Kiribati	Pacific Aviation Safety Office	www.paso.aero
Kosovo	Civil Aviation Authority of Kosovo	www.caa-ks.org
Kuwait	Directorate General of Civil Aviation	www.dgca.gov.kw
Kyrgyzstan	Civil Aviation Agency of Kyrgyz Republic (Kyrgyzstan)	www.caa.kg
Laos	Department of Civil Aviation of Laos	
Latvia	Civil Aviation Agency of Latvia	www.caa.lv
Lebanon	Lebanese Civil Aviation Authority	www.dgca.gov.lb
Lesotho	Department of Civil Aviation of Lesotho	www.civilair.gov.ls
Libya	Libyan Civil Aviation Authority	www.lycaa.org
Liechtenstein	Office of Civil Aviation of Liechtenstein	
Lithuania	Civil Aviation Administration of Lithuania	
Luxembourg	Directorate of Civil Aviation of Luxembourg	www.dac.public.lu
Macau	Civil Aviation Authority	www.aacm.gov.mo/english/comm/e-comm-index.html
Macedonia	Civil Aviation Agency of Macedonia	www.dgca.gov.mk
Malaysia	Department of Civil Aviation of Malaysia	www.dca.gov.my
Malawi	Department of Civil Aviation of Malawi	www.malawi.gov.mw/Transport/Home%20CivilAviation.htm
Maldives	Civil Aviation Department of the Maldives	www.aviainfo.gov.mv
Malta	Civil Aviation Directorate of Malta	www.transport.gov.mt/aviation/civil-aviation-directorate
Marshall Islands	Directorate of Civil Aviation of the Marshall Islands	rmipa.com/airports/
Mauritius	Department of Civil Aviation of Mauritius	civil-aviation.govmu.org

Country	Authority name in English	Website
Mexico	Directorate General of Civil Aviation of Mexico	sct.gob.mx/transporte-y-medicina-preventiva/aeronautica-civil/
Moldova	Civil Aviation Administration of Moldova	en.caa.md
Mongolia	Civil Aviation Authority of Mongolia	www.mcaa.gov.mn?page_id=6161
Monaco	Monaco Civil Aviation Authority	en.gouv.mc/Government-Institutions/The-Government/Ministry-of-Public-Works-the-Environment-and-Urban-Development/Civil-Aviation-Authority
Montenegro	Civil Aviation Agency of Montenegro	www.caa.me
Mozambique	Civil Aviation Institute of Mozambique	www.iacm.gov.mz
Myanmar	Department of Civil Aviation of Myanmar	www.mot.gov.mm/dca/
Namibia	Directorate of Civil Aviation	www.dca.com.na
Nauru	Pacific Aviation Safety Office	www.paso.aero
Nepal	Civil Aviation Authority of Nepal	www.caanepal.org.np
Netherlands	Human Environment and Transport Inspectorate	www.ilent.nl/onderwerpen/transport/luchtvaart/
New Zealand	Civil Aviation Authority of New Zealand	www.caa.govt.nz
Nicaragua	Nicaraguan Institute of Civil Aviation	www.inac.gob.ni
Nigeria	Nigerian Civil Aviation Authority	www.ncaa.gov.ng
Niue	Pacific Aviation Safety Office	www.paso.aero
Norway	Civil Aviation Authority of Norway	luftfartstilsynet.no/caa_no/
Oman	Directorate General of Civil Aviation and Meteorology	www.paca.gov.om
Pakistan	Pakistan Civil Aviation Authority	www.caapakistan.com.pk
Panama	Civil Aviation Authority of Panama	www.aeronautica.gob.pa
Papua New Guinea	Civil Aviation Authority of Papua New Guinea Pacific Aviation Safety Office	www.casapng.gov.pg www.paso.aero
Paraguay	National Directorate of Civil Aviation of Paraguay	www.dinac.gov.py
Peru	Directorate General of Civil Aviation of Peru	www.mtc.gob.pe
Philippines	Civil Aviation Authority of the Philippines	www.caap.gov.ph
Poland	Civil Aviation Office	www.ulc.gov.pl
Portugal	National Institute of Civil Aviation of Portugal	www.anac.pt
Qatar	Civil Aviation Authority of Qatar	www.caa.gov.qa
Romania	Romanian Civil Aeronautical Authority	www.caa.ro
Russia	Federal Air Transport Agency	www.favt.ru
Rwanda	Rwanda Civil Aviation Authority	www.caa.gov.rw
Samoa	Pacific Aviation Safety Office	www.paso.aero
San Marino	San Marino Civil Aviation and Maritime Authority	www.caa-mna.sm
Saudi Arabia	General Authority of Civil Aviation	www.gaca.gov.sa
Senegal	National Civil Aviation Agency of Senegal	www.anacim.sn
Serbia	Civil Aviation Directorate of Serbia	www.cad.gov.rs
Seychelles	Seychelles Civil Aviation Authority	www.scaa.sc
Singapore	Civil Aviation Authority of Singapore	www.caas.gov.sg
Slovakia	Civil Aviation Authority of the Slovak Republic	www.caa.sk
Slovenia	Civil Aviation Directorate of Slovenia	www.mzp.gov.si
Solomon Islands	Pacific Aviation Safety Office	www.paso.aero
Somalia	Somali Civil Aviation and Meteorology Authority	www.scama.so
South Africa	South African Civil Aviation Authority	www.caa.co.za
Spain	Spanish Aviation Safety and Security Agency	www.seguridadaerea.gob.es/lang_en/home.aspx
Sri Lanka	Civil Aviation Authority of Sri Lanka	www.caa.lk

Country	Authority name in English	Website
Sudan	Civil Aviation Authority of Sudan	www.caa-sudan.net
Suriname	Civil Aviation Department of Suriname	www.cadsur.sr
Sweden	Swedish Transport Agency	www.transportstyrelsen.se/en/aviation/
Switzerland	Federal Office for Civil Aviation	www.bazl.admin.ch/index.html?lang=en
Syria	Syrian Civil Aviation Authority	scaa.sy
Taiwan	Civil Aeronautics Administration	www.caa.gov.tw
Tanzania	Tanzania Civil Aviation Authority	www.tcaa.go.tz
Thailand	The Civil Aviation Authority of Thailand	http://www.caat.or.th/
Timor-Leste	Civil Aviation Division of Timor-Leste	gov.east-timor.org/CAA/
Togo	Civil Aviation Agency of Togo	www.anac-togo.tg
Tonga	Pacific Aviation Safety Office	www.paso.aero
Trinidad and Tobago	Trinidad and Tobago Civil Aviation Authority	www.caa.gov.tt
Tunisia	Office of Civil Aviation and Airports	www.oaca.nat.tn
Turkey	Directorate General of Civil Aviation of Turkey	www.shgm.gov.tr
Turks and Caicos Islands	Turks and Caicos Islands Civil Aviation Authority	tcicaa.org
Tuvalu	Pacific Aviation Safety Office	www.paso.aero
Uganda	Civil Aviation Authority of Uganda	www.caa.co.ug
Ukraine	State Aviation Administration of Ukraine	www.avia.gov.ua
United Arab Emirates	General Civil Aviation Authority	www.gcaa.ae
United Kingdom	Civil Aviation Authority	www.caa.co.uk
United States	Federal Aviation Administration	www.faa.gov
Vanuatu	Pacific Aviation Safety Office	www.paso.aero
Venezuela	National Institute of Civil Aviation	www.inac.gov.ve
Vietnam	Civil Aviation Administration of Vietnam	www.caa.gov.vn
Yemen	Civil Aviation and Meteorological Authority of Yemen	www.cama.gov.ye
Zambia	Department of Civil Aviation	www.dca.com.zm
Zimbabwe	Civil Aviation Authority of Zimbabwe	www.caaz.co.zw

International Civil Aviation Organisation

ICAO Headquarters, Montreal, Canada

International Civil Aviation Organization (ICAO), 999 Robert-Bourassa Boulevard, Montréal, Quebec H3C 5H7, Canada.
Tel.: +1 514-954-8219
Fax: +1 514-954-6077
E-mail: icaohq@icao.int
Web Support: web@icao.int
Customer Services: sales@icao.int

The International Civil Aviation Organization (ICAO) is a UN specialized agency, established by States in 1944 to manage the administration and governance of the Convention on International Civil Aviation (Chicago Convention).

ICAO works with the Convention's 191 Member States and industry groups to reach consensus on international civil aviation Standards and Recommended Practices (SARPs) and policies in support of a safe, efficient, secure, economically sustainable and environmentally responsible civil aviation sector. These SARPs and policies are used by ICAO Member States to ensure that their local civil aviation operations and regulations conform to global norms.

Annex B: SUA pilot log book

Small Unmanned Aircraft (SUA) Pilot’s Log Book

Pilot’s name: . . . .

Book No.: . . . .

Safety Reminders

Has the machine been checked to ensure all parts are undamaged?

Is the battery/ fuel source charged and ready?

Do you have a flight plan that ensures that the SUA has the power to land where required?

Are the launch and landing areas safe to use?

Is there an observer/spotter when there may be birds or other aerial hazards?

Flying Qualifications

Description	Date issued	Type	Renewal date

Certificates obtained

Certificate:	Date:	Issued by:

Types of SUA flown

Make/Model	Dates flown	Remarks

Total takeoffs brought forward:
Total flying time brought forward:

Flight no.	Date	SUA type	Takeoff location	Landing location	Launch type	Supervisor's name	Hours and minutes			Remarks
							Under instruction	Practice flight	Work flight	

Total takeoffs taken forward:
Total flying time taken forward:

Total takeoffs brought forward:	
Total flying time brought forward:	

							Hours and minutes			
Flight no.	Date	SUA type	Takeoff location	Landing location	Launch type	Supervisor's name	Under instruction	Practice flight	Work flight	Remarks

Total takeoffs taken forward:	
Total flying time taken forward:	

Annex C: SUA manufacturer's documentation

The pilot/operator's manual and service/maintenance instructions for each model of SUA used should be added here.

The pilots should make additions that add to clarity and reliability based on their field experience whenever necessary.