

Unmanned Aircraft Systems

Background

IFALPA strives for protecting and enhancing aviation safety by the highest standards and promoting a single level of safety worldwide for all users of civilian airspace. This is especially important when introducing a new technology sector into civilian airspace such as Unmanned Aircraft Systems (UAS).

IFALPA welcomes and recognizes the potential benefits of this new technology. It is critically important to ensure the safe integration of UAS into the common civilian airspace.

Size, performance, type of operation and intended use of UAS vary to a much greater extent than in manned aviation. UAS can vary in size from below 250 grams (similar to a model aircraft) up to UAS with a wingspan similar to that of a Boeing 737. Their use can vary from local to intercontinental flights and from low altitudes up to very high altitudes. They often have unconventional shapes, with widely differing operating characteristics and a large spectrum of performance capabilities.

Accordingly, for IFALPA, three different aspects are paramount:

1. General
2. Unmanned Aircraft (UA) as a collision threat to manned civil aviation in general and in particular in lower airspace and near aerodromes;
3. UA as participants integrated into common airspace.

1. General

Although the innovations and technological advances brought by UAS have rapidly progressed, their introduction into non-segregated airspace cannot take place without consideration of existing users. On the contrary, they are being introduced into a highly regulated, often crowded sky. The rules and regulations, which govern these skies, have been written over the history of manned aviation.

POSITION 1: IFALPA believes that all UAS should be integrated into common airspace. Accommodation should only be a temporary measure.

Only one sky is available for all aviation users. Users with different tasks and roles and with different performance and size characteristics need to share the same airspace – this is generally done via the principle of integration. All users operate according to similar principles and a framework which makes them compatible to the extent necessary. Airspace users that are unable to comply with these common principles are normally separated and kept clear from other traffic. These non-compliant airspace users receive the services necessary to allow operations – a principle referred to as accommodation.. This practice however, reduces

the capacity in non-segregated airspace and should therefore be limited. All efforts should be undertaken to transform accommodation into integration.

POSITION 2: IFALPA considers that it is not acceptable to change rules and regulations for manned aviation in order to accommodate UAS integration.

The regulations for manned aviation have been established over a long period of time based on experience and best practices. These regulations should only change to enhance safety. UAS should be developed to follow these regulations without requiring changes that will burden manned aviation.

POSITION 3: Every UAS should have at all times a responsible person in command, who is suitably trained and qualified with an independent safety mandate, responsible for the safe operation of the flight, mission or task.

2. Collision threat of smaller Unmanned Aircraft (UA) to manned aviation

Manned aviation, from rotary aircraft to air transport, is faced with an exponentially increasing number of sightings and NEARMISSES with UA in all classes of airspace. This is particularly noticeable below 500 ft. AGL, where, there is a mixture of traffic particularly helicopter operations on air ambulance, police or fire fighting duties, aerial work, border control, military and newsgathering. These are all manned aircraft performing their tasks with specific authorization.

IFALPA is concerned that a collision between an UA and a manned aircraft is imminent.

POSITION 4: As a matter of urgency, in-depth research into the impact of collisions between small UA and manned aircraft is necessary to establish the severity of the impact of collisions.

Currently, there are no figures available from any scientific research to establish the risk of the collision of even small UA's with the critical surfaces and components of manned aircraft. Windscreens/canopies, primary flight controls, engines, rotor shafts of helicopters and their tail rotors are some examples of these. UA's, regardless of size, can cause significant or even catastrophic damage. Of particular concern on small UA are the motors and battery packs. Especially critical are helicopters due to the number of vulnerable safety critical components. Several bird strikes have demonstrated that even impact with small birds (below 200g) can have catastrophic results for a helicopter.

A risk in aviation is defined by the probability of occurrence multiplied by its severity. Since there are no data for the severity, it is not possible at present for a risk assessment to be achieved for the manned or unmanned side. The number of sightings, i.e. the probability of occurrences increases exponentially, therefore it has become a matter of urgency to establish the figures of severity.

POSITION 5: An approved, full and transparent risk assessment should be completed before an operation can be commenced.

Before qualifying certain small and mid-sized UA, sometimes referred to as drones, as a low risk operation; an approved, full and transparent risk assessment should be completed. This would allow identification of all the risks, including collision with manned aviation, and its possible impact. Operation should only be allowed after all threats have been properly mitigated to an acceptable level.

POSITION 6: As there is no formal qualification for certain categories of UAS, it cannot be assumed that there is a qualified, trained and competent responsible pilot in command of the UA. For operation in airspace where an encounter of a manned aircraft is possible, mandatory training and a certificate/license should be required.

As a result of the commercial success of particularly the smaller UA, ICAO and regional/national authorities should regulate all UAS ‘proportionally’ according to their risk. Eventually, the vast majority of small UAS will remain very lightly regulated or not regulated at all. That means in practice, that manned aviation pilots cannot assume that the UA is certified or that the pilot in command has been similarly trained to operate the UA.

Where an encounter of a manned aircraft is possible, the pilot of the small UA should have the competency to see and avoid the manned aircraft. States should establish formal licenses for the pilots of UAs to ensure safe integration into common airspace. Such licenses should be commensurate to the risks and should ensure as a minimum that the pilot understands the aircraft, the airspace, the operating environment, and the other aircraft that could be encountered while flying.

Pilots of UAS/RPAS that are used for commercial purposes should be commercially licensed with an instrument rating when necessary for the category and class of aircraft to be flown and have appropriate aeromedical certification to ensure the continuity of safety that now exists in the civil airspace.

POSITION 7: Every state should conduct an extensive public awareness campaign about the safety risks, duties, liabilities, insurance requirements, responsibilities and third party privacy issues associated with operations of UAS.

States should make all efforts to inform the public, particularly the potential UAS-user, about the prerequisites and risks of UAS operations.

It is the obligation of States to ensure that every potential pilot knows about the operational risks and is able to comply with the limitations of his operation. This would include knowing where and where not to operate the UAS by finding and understanding the official published information. States should also require the manufacturers/sellers of UAS to provide this information at point of sale.

POSITION 8: Registration via a state-system should be compulsory for all UAS. This facilitates enforcement of rules and motivates training within the UAS community.

Except in some states, the vast majority of UAS are sold without obliging the seller and the buyer to make sure the UA is properly registered. Registration helps enforcement of the rules by enabling the authorities to trace a UA to its owner/pilot, similar to the registration of cars in road traffic. It thereby can serve as an important element in fostering adherence to the rules, while also encouraging UA owners/pilots to acquire the necessary skills and qualifications. Mandatory registration should be at the point of sale.

POSITION 9: The responsible authorities charged with the enforcement of rules to operate UAS should be staffed, trained and equipped sufficiently to increase the effectiveness of enforcement.

With dwindling resources, the aviation authorities have delegated the responsibility of safety oversight of certain sectors of UAS operations to other authorities, such as the police. The main argument is that the risk to aviation of those sectors is perceived as low and the necessary resources required apparently do not justify the use of dedicated aviation personnel. Although IFALPA questions the underlying risk analysis, States should recognise that for an effective enforcement of any regulation, their authorities should be well staffed, trained and equipped. In addition, the UA pilot community needs to develop a professional attitude towards their training and responsibilities as prerequisites for their operations. Anyone flying a UAS that is a hazard to other aircraft in the airspace, especially those who choose to do so recklessly near airports or by operating unairworthy UAS, should be identified and appropriately prosecuted. IFALPA believes that intentional unsafe operation of UAS should be criminalized and penalties should be developed for unintentional unsafe UAS operations.

POSITION 10: As long as there is no means for manned aviation to safely see and avoid small UA, the responsibility to see and avoid belongs to the pilot of the UA.

Airline pilots should be able to see UA on cockpit displays, controllers should have the ability to see them on their radar scopes, and UAS should be equipped with active technologies that ensure that the UAS is capable of avoiding collision with manned aircraft.

A fundamental principle to avert collisions in aviation is the ‘See and Avoid’ principle established in Annex 2 to the ICAO Chicago Convention. This is an obligation for all involved aircraft, manned or unmanned. Since UAS can be much smaller than manned aircraft, the possibility for the manned aircraft to detect and ‘see’ a small UA is hampered or made impossible if not achieved by electronic means, e.g. a transponder, FLARM or an ADS-B-based system. In addition, during approach and departure manoeuvres, helicopters have very limited avoidance capabilities, exacerbated by the nature of the sites they operate from.

POSITION 11: In case of an encounter of a small UA with a manned aircraft, the UA should be conspicuous to the manned aircraft in order to allow ‘Collision Avoidance’.

As a last line of defense to avoid a collision the UA should be made conspicuous by means of lighting, electronic visibility, colour, shape or other methods in case the UA-pilot did not perform a correct see-and-avoid maneuver.

POSITION 12: Where the proper execution of ‘See and Avoid’ cannot be guaranteed, no operation of an UA should be granted.

The UA operation should not be permitted if the UA-pilot has no proven skill or means to avoid manned aviation, or a certified system which enables the UA to be visible to the manned aircraft.

POSITION 13: The operation of small UAS in VLOS cannot be compared to model aviation, since the intent and the location of operations differs significantly. Therefore, safety comparisons are invalid.

Where States intend to integrate recreational UA into national Model Aircraft Flying Regulations, they should establish specific rules for them.

Although operated mainly in Visual Line Of Sight (VLOS), as with model aircraft, a comparison to model aircraft safety is invalid. The main purpose of small UAS is surveillance and recording, or taking pictures. Thus, their operation does not normally take part in confined areas such as model aircraft airfields and is not normally managed as flight operations are on model aircraft airfields, instead their area of operation takes place where the recording or the pictures are required.

Whereas the pilots of a model aircraft normally can be trained at a model aircraft airfield and have an understanding of aviation requirements, particularly in respect to the risks to manned aviation, most pilots of small UAS, do not have such an aviation background or the opportunity of such training. The main intent of their operation is not aviating, but fulfilling a task of surveillance or recording or taking pictures from an aerial perspective.

POSITION 14: If the pilot of an UA is not properly qualified and formally licensed, mandatory Technical Performance Limitations such as Geofencing and altitude and range-limitations should be introduced in order to mitigate the risk of collision and airspace-infringement.

Manned aviation are required to operate with a license which is formal proof of training, this should be a prerequisite for all UAS operations. If a license cannot be achieved, it could be mitigated in part by limiting the performance of the UA. Technologies such as Geofencing (i.e. the UA flies only in preapproved locations and only up to predefined altitudes) and range limitations (i.e. the UA does not fly further from its pilot than a predefined distance) could serve as mitigation measures.

With respect to the above, IFALPA calls for a minimum of standard rules for UAS operations to ensure safety in lower level airspace when integrated with other traffic. These rules should apply to prevent operations near hospitals, landing fields, farm strips, military establishments, power plants etc. In some States, these no operation areas are referred to as “No Drone Zones”. This should also apply to UAS operations near controlled and uncontrolled airfields, including heliports.

3. Integrating Unmanned Aircraft (UA) into the common civil airspace

Unmanned Aircraft (UA) is the over-arching term for aircraft, which do not have a pilot on board¹. It basically consists of 2 different archetypes:

- Those which do not allow pilot intervention in the management of the flight². They are called “**Autonomous aircraft**”
- Those which are still controlled by a human pilot, but remotely. They are called “**RPAS, Remotely Piloted Aircraft Systems**”³

3a. Autonomous aircraft

ICAO defines autonomous aircraft as “*an unmanned aircraft that does not allow pilot intervention in the management of the flight*”⁴. An example of already existing aircraft in this category are unmanned free balloons as described in Annex 2, Chapter 3.1.10 and its Appendix 5. With the exception of “light balloons used exclusively for meteorological purposes and operated in the manner prescribed by the appropriate authority”⁵, all other balloons are subject to the provisions of article 8 of the Chicago Convention⁶. This basically makes them an exception to the ICAO framework under national sovereignty, but according to the principles described in article 8: “Each contracting State undertakes to ensure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft”⁷.

POSITION 15: Currently, IFALPA does not believe that autonomous unmanned aircraft can be integrated into common airspace.

Non-segregated airspace, based on the Chicago Convention, operates under the assumption that there is a pilot in command that may depart from these rules in circumstances that render such departure absolutely necessary in the interests of safety (reference ICAO Annex 2 paragraph 2.3.1). As autonomous unmanned aircraft cannot comply with this premise, they cannot be integrated into common airspace.

POSITION 16: IFALPA rejects the denial of airspace to manned aviation in order to accommodate autonomous UAS.

Currently, Regulators close certain airspace to segregate non-compatible aircraft that are unable to comply with the requirements for common airspace. This reduces the amount of available airspace which reduces capacity and is not acceptable for manned aviation.

1. See ICAO convention, article 8

2. See ICAO Doc10019, xiv, ‘Autonomous aircraft’

3. See ICAO Doc10019, xviii, RPAS’. As a remotely piloted aircraft cannot fly without a station where a pilot manipulates the controls and a command and control link between the station and the aircraft, the common terminology is RPAS (= Remotely Piloted Aircraft System)

4. See ICAO Doc10019, xiv, ‘Autonomous aircraft’

5. See ICAO Annex 2, Appendix 5, 2.2

6. The prerequisites for the launch of such balloons are written down in ICAO annex 2, appendix 5, 2.2ff,

7. See ICAO convention, Article 8

3b. Remotely piloted aircraft

In contrast to autonomous aircraft, all other unmanned aircraft are remotely piloted. The fact, that they are under the control of a human pilot, makes them in principle compatible to the ICAO framework, irrespective, if they fly nationally or internationally, in VLOS or IFR.

The fact that the pilot is not onboard the aircraft does pose significant challenges in the way an UAS may be utilized. New technical solutions should be developed to help compensate for the lack of having a human onboard.

POSITION 17: IFALPA believes that UAS technology is not capable of replacing all necessary capabilities of a human pilot on board, particularly in complex time and safety critical situations.

Many serious aircraft incidents could have ended in catastrophe but have been averted because a human pilot was onboard. This human element provides an add-on for safety and can serve as a final barrier to accidents. Humans have the ability to make decisions in ambiguous situations, to take over functions of failed systems, and the unique ability to learn in real-time. Without being onboard, it is difficult for a human to have enough situational awareness in order to capitalize on these human attributes.

POSITION 18: IFALPA does not believe that UAS can perform an operation as complex as air transport with an equivalent level of safety.

POSITION 19: All UAS engaged in non-segregated public airspace should be certified and compliant with the provisions described hereafter before being allowed to operate.

The safe integration of UAS into civilian, non-segregated airspace can only be achieved if UAS and their operations must comply and be compatible with the existing rules and regulations applicable to other aircraft in the same class of airspace. Non-compliant UAS will imply non-acceptable reductions in capacity, especially in high density airspaces and aerodromes.

Integration of UAS into civilian airspace:

For the most part, a vast majority of all rules and policies that apply to manned aircraft also apply to unmanned aircraft. In terms of operations and performance design and levels of aircraft/systems certification, the need to differentiate between manned vs. unmanned in regulatory structures and framework should be limited to the necessary items and commensurate to similar manned aviation:

Licensing and duty time

- The criteria for the selection, licensing, instruction, and training of UAS Operators/Pilots should be established by the Certification Authorities.
- The skills necessary to pilot an aircraft remotely should be established
- Adequate medical requirements, including for mental health should be established
- The duty time of remote pilots and associated crewmembers should be adequately limited.
- These criteria and limitations should be based on the existing regulations for pilots and scientific data.

Design and Operation

- The design standards and certification specifications for civilian and military UAS that operate in non-segregated, civilian airspace should be subject to similar directives as manned aircraft.

Note- The special characteristics of these systems and their operations have to be taken into account.

- A safety assessment with target levels of safety appropriate for the type of operation should be proven to the certification authorities.
- Flight critical components of the communication / data-link and of the ground control station have to be regarded as aircraft parts and therefore included in the certification criteria. They may either be part of a UAS as a whole or under separate type designations.
- Human factors are at least as important in unmanned aviation as in manned flight. Human factors should be considered in the design of control stations/devices and in particular the controls, displays, software, and interface as well as the operation of a UAS.

The operational concept of a UAS should:

- Provide all information necessary to enable the pilot-in-command to exercise responsibility for the flight,
- Enable the pilot to control the flight path as necessary for the safe conduct of the flight.
- Not allow a remote pilot to operate more than one UA at any time
- Keep pilots controlling UAS free from distractions that compromise safety of operations (“sterile cockpit” concept).
- Not allow external loads to be carried on a UAS unless a level of safety equivalent to that of manned aircraft can be achieved.

Air traffic control

- A UAS should behave like a manned aircraft and be subject to the Rules of the Air. The operation of UAS in civilian airspace should not make any difference - for example through special flight procedures - to the daily operation of other air traffic participants (commercial and general aviation).
- Each UAS should have a designated pilot-in-command at all times, who should ensure that the UAS complies with the Rules of the Air and ATC instructions and clearances.
- The response time of a UAS - following ATC instructions - should be comparable to that of a manned aircraft. Delays due to data-link/communication transmission time are not acceptable.
- UAS should be equipped to provide collision avoidance at all times in all airspaces and safe separation when positive ATC separation is not provided (See and Avoid). They should be equipped with Mode C/S transponders, or other approved systems, that are compatible and cooperative with airborne collision avoidance systems installed on manned aircraft.
- UAS should fit into the existing and future ATM environment and the generally accepted performance criteria for the environment they are operating in.
- State-operated UAS should not be exempt from the above requirements.

Security

- A security threat and risk assessment of all types of UAS should be undertaken to identify and understand the threat and risk for civil aviation.
- This risk-based UAS security should be regulated robustly. Where regulation is limited, not possible or non-existent, the UAS should be restricted in its operational capability.
- The premises where the UAS or system components (including remote pilot and programming stations) are operated, stored, maintained and prepared should have access and security controls and procedures in order to prevent; unauthorized entrance, sabotage, unlawful interference, and to detect tampering and ensure the

integrity of vital components. Persons, including their items carried, entering these premises should be subject to screening and security controls.

- Personnel responsible for programming, pre-flight preparation, servicing, operating and/or remotely controlling the UAS and persons granted unescorted access to the aforementioned premises should be security background checked. Security should be part of the training and awareness programs for all personnel.
- The integrity and immunity of the communication/data link including used hardware and software should be protected against acts of sabotage, (cyber) attacks and acts of unlawful interference, including denial of service and system failure.

Dangerous goods

- Dangerous goods shipments should not be carried on a UAS unless a level of safety equivalent to that of manned aircraft can be achieved.
- UAS carrying dangerous goods should be fitted with an inflight leak/fire detection system, and a fire suppression system.
- Dangerous goods shipments aboard UAS should comply with the ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air for passenger aircraft, including packaging, labelling, per package quantity limitations, notification of pilot-in-command, and reporting requirements.

Note 1- *Lower standards for UAS are not acceptable. The unavailability of an airborne crew to fight DG-related incidents should be taken into account.*

Note 2- *Implications of DG to environment, people on the ground and property stemming from a crash of an UA due to lower airworthiness-requirements should be taken into account.*

- Special attention should be given to the requirement for notifying the appropriate authorities, including emergency response personnel, of dangerous goods information in case of an incident or accident.

Ground operations - Airport layout

- The impact of UAS operations at civilian aerodromes should be considered thoroughly.
- UAS operations at civilian aerodromes should not require special procedures causing disruption to normal operations, especially in inclement weather.

Safety Management Systems

UAS Operators should implement Safety Management Systems in accordance with ICAO provisions and approved by the State of the Operator.

Legal

The same legal rules should apply to UAS as manned aircraft.