

# International Civil Aviation Organization UAS Study Group

By Leslie Carey, Secretary, ICAO UAS Study Group



Unmanned aircraft systems are a challenging part of the work programme of the International Civil Aviation Organization (ICAO). While one may see the unmanned aircraft as simply another aircraft, once it is airborne the differences from manned aviation become apparent. Who is responsible for the safe conduct of the aircraft? How will it avoid collisions with other aircraft, terrain or obstacles? Will it broadcast its position and intentions to air traffic control or pilots in the area? If it is remotely-piloted, what means will be used to pilot it and what knowledge and skills will the pilot possess?

The list of questions raised by the differences between manned and unmanned aircraft is never-ending and pertains to every aspect of aviation. Identifying the questions to ask, describing the scenarios and how they are both similar to and different from manned aviation then developing the work programme leading to the regulatory framework is the responsibility of ICAO's Unmanned Aircraft Systems Study Group (UASSG). Some of the initial concepts the UASSG is working on are described below.

### Background

The UASSG was established by the Air Navigation Commission (ANC) of ICAO in 2007 to assist the Secretariat in coordinating the development of international Standards and Recommended Practices (SARPs), Procedures for Air Navigation Services (PANS) and guidance material for civil unmanned aircraft systems (UAS) in order to support a safe, secure and efficient integration of UAS into non-segregated airspace and at aerodromes. Fourteen Contracting States and eight international organizations actively participate in the Study Group, many with backgrounds as regulators and inspectors, some with air traffic control experience and others from the technical design arena. UVS International, holding observer status, supports the work with its extensive global access to UAS information. The group is chaired by Mr. James Coyne of the Civil Aviation Safety Authority of Australia.

The UASSG is the focal point amongst the voluntary panel/study group work force at ICAO for all activities pertaining to UAS. Working together with ANC technical panels on issues such as frequency spectrum, airworthiness, surveillance, operations, flight crew licensing, registration and aerodrome design, amongst others, the UASSG will ensure that the work proceeds in a cohesive manner such that as one set of SARPs are developed, the many interdependencies are identified and progressed in concert. Where appropriate, ICAO will coordinate its work with external agencies such as the International Telecommunications Union, International Maritime Organization, European Organisation for Civil Aviation Equipment (EUROCAE), RTCA, Inc. and others.

### Work Programme

When considering the issues to address as part of the work programme, it was necessary for the Study Group to identify the gaps between manned and unmanned aircraft in the context of the current regulatory framework. This required a

detailed review of each of the ICAO Annexes to determine what SARPs apply as written, which will need to be amended and what unique characteristics will likely require development of new SARPs. Close coordination with legal experts at ICAO, EUROCONTROL and elsewhere highlighted various constraints as well as potential solutions to frame the work programme.

It is important to note that ICAO's role is to address international civil aviation and to develop the Standards and Recommended Practices that make international operations safe, secure and efficient, harmonizing procedures and terminology to the extent practicable across all airspaces and aerodromes of the world. Taking this into account, the UASSG focus is on those subjects that will make it possible for an unmanned aircraft to operate in non-segregated airspace without posing an undue hazard for civil airspace users. To look at it another way, one can ask "what is required of the UAS so as to permit that UAS to be treated like the other aircraft in its vicinity - airborne or on the ground?"

Keeping this thought at the forefront provides the UASSG the basis for establishing a way forward and setting priorities.

### Regulatory Framework

In order to develop a regulatory framework for unmanned aircraft systems, one must first be familiar with the existing framework that was built piece by piece as the phenomena of aviation grew. To this end, the UASSG is undertaking a detailed study of the Convention on International Civil Aviation (Chicago, 1944), also known as the Chicago Convention, and the 18 Annexes which come under it. A determination is made for each Article, Standard and Recommended Practice as to its applicability to UAS; does it apply exactly as written or will it need to be revised; if it does not apply, is there an underlying intent that needs to be addressed by developing a new SARP(s); and finally, is the issue entirely outside the existing framework thereby necessitating a new set of SARPs to be developed. This is an extensive process requiring painstaking work by many experts.

Amongst the obvious items is Article 8, "Pilotless aircraft", of the Chicago Convention which reads:

*No aircraft capable of being flown without a pilot shall be flown without a pilot over the territory of a contracting State without special authorization by that State and in accordance with the terms of such authorization. Each contracting State undertakes to insure 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.*

Article 8 details conditions for operating a "pilotless" aircraft over the territory of a Contracting State. To understand the implications of this Article and its inclusion from the Paris Convention of 1919 (Article 15) into the Chicago Convention, the intent of the drafters must be considered. Remote-control and uncontrolled aircraft were in existence at the time, operated by both civil and military entities. "[A]ircraft flown without a pilot"

therefore refers to the situation where there is no pilot on-board the aircraft. As a consequence, any remotely-piloted aircraft is a "pilotless" aircraft, consistent with the intent of the drafters of Article 8.

Second, the drafters placed emphasis on the significance of the provision that aircraft flown without a pilot "shall be so controlled as to obviate danger to civil aircraft", indicating that they recognized that "pilotless aircraft" had a measure of control being applied to them in relation to a so-called 'due regard' obligation. In order for a UAS to operate in proximity to other civil aircraft, a remote pilot is, therefore, essential.

More recently, the Eleventh Air Navigation Conference (Montreal, 22 September to 3 October, 2003) reiterated this understanding when it endorsed the global ATM operational concept which contains the following statement: "[a]n unmanned aerial vehicle is a pilotless aircraft, in the sense of Article 8 of the Convention on International Civil Aviation, which is flown without a pilot-in-command on-board and is either remotely and fully controlled from another place (ground, another aircraft, space) or programmed and fully autonomous."

Standards to facilitate application and processing of authorizations will likely be contained in an Appendix to Annex 2 - Rules of the Air. In all cases, the safety of other civil aircraft will have to be considered by the State authority before granting an authorization. It is envisaged that once the broad range of SARPs are adopted for each of the Annexes affected, Contracting States will be able to facilitate and foster international operations of qualifying unmanned aircraft to a similar extent as that being enjoyed by manned aviation.

### **Development Process**

Once the scope of regulatory work has been identified, priorities will be established, based on two factors - what is most critically needed for work to progress and what interdependent subjects can be developed as "packages". An example of a package might be all the aspects contributing to an airworthiness approval, including the 'command and control' and 'detect and avoid' capabilities, the aircraft itself and the remote pilot station, any one of which is insufficient by itself.

### **Remotely-Piloted Aircraft**

ICAO recognizes many categories of aircraft, among them balloons, gliders, aeroplanes and rotorcraft. They can be land, sea or amphibious. Whether the aircraft is manned or unmanned does not affect its status as an aircraft. Each category of aircraft will potentially have unmanned versions in the future. Of particular concern for the UASSG however, is the ability of the aircraft to be integrated into the global air traffic management system, something which can only be achieved by complying with the rules set forth in Annex 2 - Rules of the Air. This requires the presence of a pilot-in-command. Not all unmanned aircraft will have pilots, however those that do will be designated "remotely-piloted aircraft" (RPA). It is this group of aircraft that are being addressed by the UASSG, within the framework provided by the Chicago Convention.

### **Remote Pilot**

Remotely-piloted aircraft will be piloted by a new class of pilot referred to as "remote pilot" who conduct their piloting duties from a "remote pilot station". Remote pilots will no doubt need to be licensed in accordance with SARPs that will be set forth in Annex 1 - Personnel Licensing, in due time. Other members of the remote crew will likewise have pertinent licensing

requirements. Article 32 of the Chicago Convention mandates that pilots be licensed by, or to have their license rendered valid by, the State of Registry of the aircraft. This Article, however, was specifically drafted for those individuals who conduct their piloting duties on-board aircraft. Nonetheless, an equivalent level of training, knowledge and skill will be required for remote pilots. Among the options being considered by the UASSG is whether the remote pilot license should be associated primarily with the remote pilot station with type ratings for individual aircraft or if the traditional association between license and aircraft is paramount.

In general terms, the pilot-in-command of a remotely-piloted aircraft, has the same responsibilities as an on-board pilot-in-command. These responsibilities include the safe operation of the aircraft; familiarity with all available information appropriate to the intended operation; and final authority as to the disposition of the aircraft. The pilot-in-command shall ensure the aircraft is not operated in a negligent or reckless manner so as to endanger life or property of others; shall avoid collisions and follow the right-of-way rules; and shall comply with signals in the event of an intercept.

### **Remote Pilot Station**

Remote pilot stations (RPS) can be anything from a handheld unit to a full scale cockpit equivalent. They can be mobile or fixed. An RPS can be dedicated to a single aircraft or can be part of a series allowing aircraft handovers to occur from one such station to another. They can also be utilized for piloting more than one aircraft, although it is recognized that Standards may restrict this capability to one aircraft at a time.

### **Airworthiness**

Every aircraft engaged in international navigation must possess a Certificate of Airworthiness issued by the State in which it is registered. Discussion is on-going with regards to how the certification of remotely-piloted aircraft will be handled. It is possible that like engines and propellers, the RPS, which is an essential component in the operation of the RPA, will require a type certificate issued by the State of Design. The RPS would effectively then be "installed" in the aircraft and could be replaced by any other approved RPS, as needed. This "installation" would have to be certified in conjunction with the RPA by the State of Design of the aircraft and documented in the Type Certificate Data Sheet of the aircraft. This would give the State of Design responsibility for the overall system design while the State of Registry would have responsibility for the operation and continued airworthiness of the RPA.

Allowing for the potential of commercial RPS in future years, it is envisaged that RPS operators, separate from RPA operators, will have regulatory oversight provided by the State in which they are located. Determining consequential issues such as the entity/person having operational control of the aircraft at any given moment during its flight will have to be addressed.

### **Terminology**

Terminology is critical for every subject. Without an established set of terms with corresponding meanings, subjects can be ambiguous or disjointed. Developing such a list of terms for UAS is fundamental to progressing all future work. The first term dealt with by ICAO was that unmanned aircraft are, by definition, aircraft and must be so referred. An aircraft is defined as "any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface."

A second term which came to early prominence was that of “accident” which was dependent upon a person being on-board the aircraft involved. The UASSG began its work by developing a revision to this definition in order to accommodate unmanned aircraft and proposed the following which has since been adopted by the Council of ICAO for applicability on 18 November 2010:

**Accident.** An occurrence associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time it comes to rest at the end of the flight and the primary propulsion system is shut down, in which:

...

The list of new terms needed to support UAS regulations is extensive. Terms must be compatible with those already in use, in some instances, like with “accident”, existing definitions can be expanded easily to include UAS while in others, such as “command and control”, “detect and avoid” and “lost link”, entirely new definitions will need to be agreed upon and promulgated. Other terms being developed by the UASSG include “remotely-piloted aircraft”, “remote pilot station” and “remote pilot”.

## UAS Circular

The first deliverable to be provided by the UASSG will be in the form of a Circular. The Unmanned Aircraft Systems (UAS) Circular (Cir 328) provides an overview of UAS activities including background information for use by States in developing their regulatory frameworks. Likewise, it will assist industry in understanding what goals to aim for and subjects for which performance-based SARPs are to be anticipated in the future. Terminology with agreed meanings is included along with examples of solutions States have already implemented. The circular should be available in final (unedited) draft in June 2010 on the ICAO website.



Leslie Carey  
Secretary  
UAS Study Group  
International Civil Aviation  
Organization

The ICAO UAS Study Group members at the conclusion of their 4 day working meeting at the facilities of the Council for Scientific & Industrial Research (CSIR) in Pretoria, South Africa, which was hosted by the South African Civil Aviation Authority

