



Regulation of UAS in Arctic Airspace

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Unmanned aircraft systems are being developed and built in more than 50 countries and more than 600 different makes and models are currently on the market or in development. Unmanned aircraft have been successfully employed in a wide variety of civilian scientific applications, including atmospheric and climate research. They have been used for decades by the military, with stunning advancements over the past fifteen years, but this technology offers tremendous opportunities for gathering environmental or scientific data in places where the risks and hazards to pilots and crew in traditional aircraft are such that unmanned aircraft are being used to fill the role. The issue at hand in this article is how and under what rules any of these systems can be operated in international airspace. This is of considerable importance to scientists and researchers who wish to use unmanned systems to explore the Arctic regions, to observe and monitor the habitat of marine mammals, and to collect data on global climate phenomena and the changes in the polar ice. UAS present an attractive alternative for airborne scientific platforms that are to be flown into hurricanes and other environments where manned aviation is too dangerous or in parts of the planet that are so remote and inhospitable that the risks to pilots and occupants of manned aircraft exceed tolerable limits.

So what is the problem? It can be argued that these uninhabited regions of the planet are so far away from people and structures that it should not matter whether a science mission is flown by a manned aircraft or a remotely piloted air vehicle. Some may further argue that, once their airplane leaves the sovereign airspace of a nation (usually 12 miles off the coast, or beyond if in restricted airspace or warning areas), thus flying over international waters in international airspace, the local or domestic aviation regulations that apply to operations in sovereign or territorial airspace no longer apply. If that is the case (without conceding for the purpose of this discussion that it is), then what rules do apply, if any? Can a scientist or science organization, or an aerial photographer or a sales representative for an unmanned aircraft manufacturer simply look at an aeronautical chart, pick out a block of international airspace that is not routinely occupied by other aircraft, and fly a UAS with impunity?

The issue of the operability of UASs in international airspace necessarily depends upon an understanding of what an «aircraft» is from a regulatory perspective, what the Convention on International Civil Aviation («ICAO») and the relevant Annexes thereto have to say about the subject airspaces, and what regulations, rules or laws control the operation of a particular type of aircraft (unmanned) in those airspaces.

What is an «Aircraft» Under ICAO's Rules?

An «aircraft» is «(A)ny 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. An «aeroplane» is «a power-driven heavier-than-air aircraft, deriving its lift in flight chiefly from aerodynamic reactions to surfaces which remain fixed under given conditions of flight.» Under either of these definitions even a radio-controlled model aircraft (fixed-wing or helicopter) purchased off-the-shelf from the local

hobby shop would be included. There is no definition anywhere in the Convention or the Annexes of an unmanned aircraft. However, Article 8 of the Chicago Convention states that:

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.

This provision only applies to pilotless aircraft being flown over the territory of a Contracting State without the State's permission, and each Contracting State agrees that pilotless aircraft will not be flown in a manner that endangers civil aircraft.

Article 3 of the Convention states that:

- *This Convention shall be applicable only to civil aircraft, and shall not be applicable to state aircraft.*
- *Aircraft used in military, customs and police services shall be deemed to be state aircraft.*
- *No state aircraft of a contracting State shall fly over the territory of another State or land thereon without authorization by special agreement or otherwise, and in accordance with the terms thereof.*

It is thus clear that the ICAO definitions of aircraft that are subject to its Articles, Annexes and Supplementary Agreements include any man-made contrivance that is capable of sustained flight above the immediate surface level of the Earth. An «aeroplane» is defined as a powered aircraft. No minimum size is described, so even a radio-controlled model aircraft would be covered under a literal definition. In the ICAO regulatory scheme, no distinction is made between manned and unmanned aircraft.

Are Contracting States Bound By ICAO Definitions of Aircraft and Aeroplanes?

In 1948 the ICAO Council adopted a resolution inviting the attention of Contracting States to the desirability of using, in their own national regulations, and as far as practicable, the precise language of those ICAO Standards that are of a regulatory character and also of indicating departures from the Standards, including any additional national regulations that were important for the safety or regularity of air navigation. Wherever possible the provisions of Annex 2 were written in such a way as would facilitate incorporation, without major textual changes, into national legislation.

Amendment 14 to Annex 2, relating to authority over aircraft operating over the high seas, emphasizes that it was intended solely to improve safety of flight and to ensure adequate provision of air traffic services over the high seas. The Amendment was in no way intended to affect the legal jurisdiction of States of Registry over their aircraft or the responsibility of Contracting States under Article 12 of the Convention for enforcing the Rules of the Air. Thus, Contracting

States are free to create their own definitions and categories of aircraft, and to the extent that those States retain jurisdiction over aircraft registered in their State even if they are operating in international airspace, the States' own laws and regulations apply.

The issue then becomes whether the aviation laws, rules and regulations of a Contracting State apply to operations in international airspace for which the Contracting State provides flight information or air traffic control services.

The «Rules of the Road» In International Airspace

The Rules of the Air developed by ICAO, which consist of general rules, visual flight rules and instrument flight rules, apply to all aircraft bearing registration marks of a contracting state, regardless of where the aircraft is flying, and apply without exception over the high seas, and over national territories to the extent that they do not conflict with the rules of the State being over flown. The pilot-in-command of an aircraft is responsible for compliance with the rules of the air, and regardless of the type of flight plan, is responsible for avoiding collisions when in visual flight conditions, in accordance with the principle of see-and-avoid. Flights operating under instrument flight rules are either kept separated by air traffic control units or provided with collision hazard information by the appropriate air traffic service (ATS) authority.

The world's airspace is divided into a series of contiguous flight information regions (FIRs) within which air traffic services are provided. In some cases, the flight information regions cover large oceanic areas with relatively low air traffic density, within which only flight information service and alerting service are provided. In other FIRs, large portions of the airspace are controlled airspace within which air traffic control service is provided in addition to flight information and alerting services. Flight information service is provided to aircraft operating in controlled airspace and to others known to the air traffic services units. The prime objective of air traffic services, as defined in Annex 11, is to prevent collisions between aircraft. This Annex also describes ways to expedite and maintain an orderly flow of air traffic and to provide advice and information for the safe and efficient conduct of flights and alerting service for aircraft in distress. To meet these objectives, ICAO provisions call for the establishment of flight information centers and air traffic control units.

Most of the airspace in Oceanic FIRs/CTAs (control areas) is high seas airspace within which the ICAO Council has resolved that rules relating to flight and operations of aircraft apply without exception. The majority of the airspace is also controlled airspace, and instrument flight rules (IFR) apply to all flights in oceanic airspace when at or above FL060 (flight level 6000 feet) or 2000 ft. (600 m) above ground level (AGL), whichever is higher, even when not operating in instrument meteorological conditions (IMC).

Can Unmanned Aircraft Comply With ICAO Rules of the Air?

Arguably, before unmanned aircraft can be allowed to operate in international airspace, they must be able to comply with the rules of the air set forth in Annex 2 to the Convention, which requires that those rules apply to aircraft bearing the nationality and registration marks of a Contracting State. What standards then apply if the Contracting State that provides flight information, alert or air traffic control services in the international airspace sector of a Flight Information Region has no specific rules or regulations that address the unique

characteristics of unmanned aircraft?

Contracting States that provide air traffic control or information services in international airspace Flight Information Regions can, through supplementary ICAO agreements, establish additional rules or procedures for aircraft entering and transiting that airspace and for which the Contracting States choose to provide services. Whether those States can impose their own domestic aviation regulations on aircraft and pilots operating in those FIRs depends upon whether those local regulations conflict with ICAO's Rules of the Air and other Annexes to the Convention. Examples can be found in Canada, Denmark and Iceland, three nations that control or provide services in North Atlantic, North American and Arctic airspace. All three require that pilots and aircraft be IFR (instrument flight rules) rated for trans-oceanic flight, regardless of the altitude to be flown, making no distinction between high-flying airliners and lower-flying general aviation aircraft. However, other North Atlantic States allow Visual Flight Rules flight at or below FL055 (5500 feet above the surface), which means that no services such as navigation vectors or separation between aircraft are provided.

The «see-and-avoid» requirement that is both implied and stated in the Annexes to the Convention presents a unique challenge to those wishing to operate unmanned aircraft in international airspace. Although some UASs (generally for military use) can be flown by remotely situated pilots using a combination of computerized navigation systems, synthetic vision and on board forward-looking cameras, there is no airborne «see-and-avoid» system that has been certified by any civil aviation authority as being capable of replacing the ability of a human pilot on board the aircraft to provide the see-and-avoid capability that is required for flight in international airspace.

ICAO's regulations apply without exception to non-state aircraft in international airspace, and in territorial airspace to the extent that they do not conflict with the regulations of the Contracting State. Contracting States retain the right to publish exceptions to ICAO standards, recommended practices and procedures as set forth in the Annexes and Supplementary documents. The Regional Supplementary Procedures document published by ICAO sets forth all procedures that have been developed by each Contracting State for the Flight Information Regions or Control Areas for which their Air Traffic Service units provide service. None of the current regional agreements address flights of unmanned aircraft in their control or information areas.

Conclusion

If a Contracting State's own civil aviation regulations do not prohibit or restrict unmanned aircraft operations in international airspace falling under its jurisdiction, and there is nothing in any of the relevant ICAO documents that prohibits such operations, then it can reasonably be argued that they are allowed, so long as the operators can safely fly the aircraft in the airspace without creating an unreasonable risk of collision with manned aircraft or damage to persons or property that may underlie that airspace. Until ICAO promulgates Recommended Practices and Standards for the certification and operation of unmanned aircraft, or addresses the issue through the Annex amendment process, civil operators of UASs desiring to fly their aircraft at altitudes near the surface of the ocean or the ice caps in international airspace-or at altitudes that do not interfere with traditional commercial operations-currently face no ICAO-imposed barriers that would prevent such activity.

However, Contracting States can be expected to assert regulatory power over all aviation activity in the international airspace for which they provide services, which would include the authority to ban or cease operations of unmanned aircraft, even for legitimate humanitarian or scientific purposes, but until those States can establish a comprehensive set of rules for that category of aircraft, enforcement may be problematic, especially for operations at low altitudes that pose no serious threat to commercial airline traffic or other high altitude aviation traffic. Operators of unmanned aircraft seeking access to remote and sparsely traveled international airspace should be mindful of applicable ICAO rules of the air, but may find the process of seeking authority for those activities to be fraught with ambiguity and inconsistency between States and across flight information region boundaries.

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