UNMANNED AERIAL SYSTEMS AND INTERNATIONAL CIVIL AVIATION ORGANIZATION REGULATIONS

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I. INTRODUCTION

The introduction of unmanned aircraft and their supporting systems to the world of aviation began well before the outbreak of World War II. Drones, as they were called then, were employed as targets for gunnery practice and some attempts were made to use them for surveillance. Germany employed relatively primitive but effective unmanned aircraft as

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weapons to rain destruction on England during the Second World War.[1] Although unmanned aircraft have been routinely used by the military for decades, with stunning advancements over the past fifteen years, this technology offers tremendous opportunities for gathering environmental or scientific data in places where the risks and hazards to pilots and crew members in traditional aircraft are heightened to the extent that unmanned aircraft present a potentially safer alternative. They also offer similarly attractive alternatives for border protection and law enforcement agencies sensitive to the cost and safety issues presented by manned aircraft operations.

Over 1100 makes and models of unmanned aerial systems (UASs) are currently on the market or in development in more than 50 countries.[2] The term system describes the entire package of technology that is required to operate one of these aircraft. The system includes the aircraft or platform itself, the on-board payload—including cameras, sensors, and radar—data links, the communications and navigation equipment, the radio links that permit the operator to control and communicate with the aircraft, the ground control station where the pilot and operators do their work, and the crew members themselves.

The challenge for anyone advocating the use of unmanned aircraft for civilian or non-military purposes is to determine where their aircraft can be flown without violating national or international aviation regulations. Since no global body of regulations or laws applies across borders to any category of unmanned aircraft, operators must navigate their way through the patchwork of national regulations and international standards. This article examines the international aviation regulatory scheme and how that scheme applies to unmanned aircraft operations.

II. WHAT IS AN UNMANNED AIRCRAFT?

Unmanned aircraft, drones, or UASs are generic terms that describe a category or class of remotely-piloted aircraft used for non-recreational purposes and intended for commercial, military, governmental, or scientific purpose.[3] Unmanned aerial vehicles (UAVs) have been widely used in combat operations since Operation Desert Storm in 1990. The broad category of unmanned aircraft includes a diverse collection of fixed wing,

1. BILL YENNE, ATTACK OF THE DRONES: A HISTORY OF UNMANNED AERIAL COMBAT 19 (Steve Gansen, ed., 2004).

2. *Unmanned Aircraft Systems*, UAS: THE GLOBAL PERSPECTIVE (Unmanned Vehicle Systems International, Pans, Fr.), May 2008, at 170-97.

3. *See* YENNE, *supra* note 1, at 11-13.

rotorcraft, and lighter-than-air flying machines, available in a wide variety of sizes and capabilities. The known technologies range from "micro" UAVs that are, in reality, flying robots designed to look and behave like a "bug," fit in the palm of a hand, and carry a high-resolution camera,[4] to 25,000-pound turbojets with wingspans wider than a Boeing 737, operating at or above 60,000 feet at speeds in excess of 530 miles per hour for over 35 hours at a time.[5] Others designed for scientific research have flown as high as 100,000 feet and have stayed in the air for nearly three days without landing. UAVs can be powered by reciprocating engines, turbojets, or electric motors.[6] The designs vary from traditional airplane or rotorcraft configurations to exotics that resemble birds, insects, Frisbees and "flying trashcans," or gigantic flying wings with twelve motors and solar-charged batteries. Some take off and land like a manned aircraft or radio-controlled models, others can be "launched" like a paper airplane, while still others are catapulted off of a launching mechanism or a moving vehicle and are recovered by either a controlled crash—during which the airplane may disassemble upon impact, but is capable of reassembly for another launch—or by flying into a suspended cable.[7]

These contrivances are designed to serve many purposes and missions, the best known being deployment by the military as Intelligence, Surveillance, and Reconnaissance (ISR) and weapons delivery platforms.[8] The rationale for this technology becoming known as Unmanned Aircraft Systems, rather than UAVs or drones, is that the devices consist of much more than simply the airframe and power plant. The primary function of these aircraft is to provide a platform for the transport of some device intended for employment as a tool to look at an object or person or to measure something, such as air contaminants or temperature layers in the atmosphere.[9] Since the aircraft cannot be flown safely without some mechanism to change direction and altitude and to bring it back to its desired landing spot, there must be some level of autonomy.

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4. *See* G.C.H.E. de Croon et Al., *Design, aerodynamics, and vision-based control of the DelFly*, 1 INT'L J. ON MICRO AIR VEHICLES 71, 71-97 (2009), *available at* http://www.delfly nl/?site=DIII&menu=&lang=en.

5. M. Amouzegar & D. Snyder, RAND Corp., *Project Air Force*, Presented to the U.S. Air Force (2005) (on file with author).

6. NASA, Dryden Flight Research Center, http://www nasa.gov/centers/dryden/news/FactSheets/FS-068-DFRC html (last visited Mar. 8, 2010).

7. *See* Insitu, Inc., http://www.insitu.com/index.cfm?navid=298 (last visited Mar. 8, 2010).

8. YENNE, *supra* note 1, at 59-83.

9. KIMON P. VALAVANIS, ADVANCES IN UNMANNED AERIAL VEHICLES: STATE OF THE ART AND THE ROAD TO AUTONOMY 6-7 (Springer 2007).

The pilot of a manned aircraft performs all the functions necessary to enable the airplane to leave the ground, stay in the air, and to land, all without bringing harm to the pilot, passengers, or people or property on the ground. The pilot must manipulate the controls, monitor and adjust the power settings for the engine, talk to air traffic controllers or other pilots if required, and keep up constant vigilance for other aircraft so as to avoid a collision. The transfer of these functions to an unmanned aircraft requires a system of command, control, and communications that permits the aircraft to perform all the necessary elements inherent in aviation, as well as the requirements of the particular mission without a pilot on board. The level of autonomy and system sophistication varies widely, from a relatively simple hand-held control box commonly seen in the radio-controlled model aircraft community to a complex configuration of computers, monitors, radars, and communications devices that may fill up a small room or mobile command center known as a ground control station.[10]

With this technological frame of reference in mind, how, and under what rules, can these systems be operated in international airspace? This question is of considerable importance to scientists and researchers who wish to use this technology to explore remote regions of the world such as the Arctic. This question is also of great importance to law enforcement agencies patrolling the borders or responding to situations where UAVs could save lives or prevent crimes such as piracy on the high seas or drug smuggling and trade in human cargo.

But scientists or government agencies might even question the existence of a problem. It could be argued that remote and uninhabited regions of the planet or the high seas are so far away from people and structures that it should not matter whether a scientific or law enforcement mission is flown by a manned aircraft or a remotely piloted air vehicle. The question is whether, once an airplane leaves the sovereign airspace of a nation thus flying in international airspace, the local or domestic rules or aviation regulations that apply to operations in sovereign or territorial airspace still apply.[11] If they do not apply, then what rules do apply, if any? More succinctly, can a scientist or science organization, a Customs and Border Protection aviation unit, 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 UAV with impunity?

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10. *See* YENNE, *supra* note 1, at 59-83.

11. An aircraft leaves the sovereign airspace of the United States when it is twelve miles off the coast. 14 C.F.R. § 91.1 (2009).

The answer to that question begins with a few basic definitions and a brief exploration of the Convention on International Civil Aviation[12] and its relevant annexes. Boiled down to the essentials, the operability of UAVs in international airspace depends on what an aircraft is from a regulatory perspective, what International Civil Aviation Organization (ICAO) authorities have to say about the subject airspaces, and what regulations, rules, or laws control the operation of an unmanned aircraft in those airspaces.

III. A BRIEF HISTORY OF ICAO

As early as 1919 an international agreement—the Convention for the Regulation of Aerial Navigation—recognized that the air above the high seas was not as "free" as the water of those seas.[13] In that 1919 convention, the contracting states recognized exclusive jurisdiction in the airspace above the territorial land and waters of the states, but agreed to allow, in times of peace, innocent passage of civil aircraft of other states so long as the other provisions of the 1919 convention were observed.[14] States still retained the right to create prohibited areas in the interests of military needs or national security.[15] During the course of the global hostilities of the 1940s, the United States initiated studies and later consulted with its major allies regarding further harmonization of the "rules of the road" in international airspace, building upon the 1919 convention.

The United States government extended an invitation to fifty-five states and authorities to attend a meeting, and in November 1944, it hosted an International Civil Aviation Conference in Chicago. Fifty-four states attended the Chicago conference, and fifty-two states signed, a Convention on International Civil Aviation, the Chicago Convention (Convention).[16] The Chicago Convention created the permanent ICAO as a means to secure international cooperation and the highest possible degree of uniformity in regulations, standards, procedures, and organization regarding civil aviation matters.[17] The Chicago Convention laid the foundation for a set of rules

12. The International Civil Aviation Organization Convention on International Civil Aviation art. 43, Dec. 7, 1944, 61 Stat. 1180, 15 U.N.T.S. 295 [hereinafter Chicago Convention].

13. Convention Relating to the Regulation of Aerial Navigation, Oct. 13, 1919, 11 L.T.N.S. 174 (superseded 1944) [hereinafter Versailles Treaty]. This convention was created by the Aeronautical Commission of the Peace Conference of 1919, otherwise known as the Versailles Treaty. *Id.*

14. *Id.* ch. 1, art. 2.

15. *Id.* art. 3.

16. Chicago Convention, *supra* note 12, art. 96.

17. International Civil Aviation Organization, Introduction, http://www.icao.int/cgi/goto_m.pl?/icao/en/chicago_conf/intro html [hereinafter ICAO Website] (last visited Mar. 8, 2009).

and regulations regarding air navigation as a whole, which was intended to enhance safety in flying and set the groundwork for the application of a common air navigation system throughout the world.

The Convention on International Civil Aviation—drawn up by the participants of the Chicago Convention—serves as the constitution of ICAO.[18] According to the terms of the Chicago Convention, the ICAO is made up of an Assembly, a Council of limited membership with various subordinate bodies, and a Secretariat.[19] The chief officers are the President of the Council and the Secretary General.[20]

ICAO works in close cooperation with other members of the United Nations family such as the World Meteorological Organization, the International Telecommunication Union, the Universal Postal Union, the World Health Organization, and the International Maritime Organization.[21] Non-governmental organizations that also participate in ICAO's work include the International Air Transport Association, the Airports Council International, the International Federation of Air Line Pilots' Associations, and the International Council of Aircraft Owner and Pilot Associations.[22]

IV. WHAT IS AN "AIRCRAFT" UNDER ICAO'S RULES?

The current regulatory structure under the ICAO is inadequate to address the unique characteristics of unmanned aircraft. Definitions provided in the Chicago Convention provide the first point of analysis in answering the key question of whether UASs are governed by ICAO rules. The Convention defines an aircraft as "[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."[23] An aeroplane is defined as "[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."[24] Under either of these definitions, even a radio-controlled model aircraft purchased off-the-shelf from the local hobby shop would be included because it meets each element of the Convention's definition. Neither the Convention nor its Annexes provide a definition for an

18. *Id.*
19. Chicago Convention, *supra* note 12, art. 43.
20. Id. art. 51, 54.
21. ICAO Website, *supra* note 17, *available at* http://www.icao.int/icao/en/howworks htm.
22. *Id.*
23. Annex 2 to the Chicago Convention, July 2005, *available at* http://www.scribd.com/doc/3899710/ANEXO-II-OACI-ICAO (last visited Mar. 8, 2010).
24. *Id.*

unmanned aircraft. But Article 8 of the Chicago Convention provides some guidance:

> 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.[25]

This provision only applies to pilotless aircraft being flown over the territory of a contracting state without permission. And each contracting state agrees that pilotless aircraft will not be flown in a manner that endangers civil aircraft. Article 8 was presumably included in recognition of the destruction of persons and property precipitated by Nazi Germany's deployment of guided missiles and bombs over England during the war that was still raging over Europe and the Pacific at the time the Convention participants first met. Article 3 of the Convention provides:

> a) This Convention shall be applicable only to civil aircraft, and shall not be applicable to state aircraft.
>
> b) Aircraft used in military, customs and police services shall be deemed to be state aircraft.
>
> c) 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.[26]

Therefore, it is clear that the ICAO definitions of aircraft that are subject to its articles, annexes, and supplementary agreements clearly include any man-made contrivance that is capable of sustained flight above the immediate surface level of the earth. The ICAO definitions effectively exclude toy airplanes, Frisbees, or some similar object that flies only because it has been thrown. An aeroplane is defined as a powered aircraft. There is no minimum size described, so even a radio-controlled model aircraft would be covered under a literal reading of the definition, and no legal authorities state otherwise. In the ICAO regulatory scheme, no distinction is made between manned and unmanned aircraft.

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25. Chicago Convention, *supra* note 12, art. 8.
26. Chicago Convention, *supra* note 12, art. 3.

V. ARE CONTRACTING STATES BOUND BY ICAO DEFINITIONS OF AIRCRAFT AND AEROPLANES?

Another way to frame this question is to ask whether contracting states are free to create their own definitions of airplanes or aircraft. If so, can they impose those definitions and any corollary regulations to operations in ICAO-defined international airspace. On April 13, 1948, the ICAO Council adopted a resolution inviting contracting states to use the precise language of those ICAO Standards that are of a regulatory character in formulating their own national regulations. The resolution also suggested that contracting states should indicate departures from the Standards, including any additional national regulations that were important for the safety or regularity of air navigation.[27] The Council noted that the provisions of Annex 2, including the definitions of aircraft and aeroplane, were written to facilitate incorporation into national legislation without major textual changes.[28]

To clarify the issue of which air traffic rules would apply for flights over the high seas, the Council adopted Amendment 14 to Annex 2 in November of 1972. This amendment provides that, for purposes of flight over those parts of the highs seas where a contracting state has accepted responsibility for providing air traffic services, the "appropriate ATS authority" is designated by the State responsible for providing those services.[29] The Council emphasized that the amendment was intended solely to improve safety of flight and to ensure adequate provision of air traffic services over the high seas. The amendment in no way affects 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, the states' own laws and regulations apply even if they are operating in international airspace.

Article 12 obligates each ICAO contracting state to adopt measures to ensure that persons operating an aircraft within its territory comply with that state's air traffic rules, or with Annex 2—known as Rules of the Air—when operating over the high seas.[30] The Federal Aviation Administration (FAA) satisfied this responsibility on behalf of the United States through

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27. *See* ICAO Website, *supra* note 17.

28. *See id.*

29. Annex 2 to the Chicago Convention, *supra* note 23. In the case of the United States, the authority is the Federal Aviation Administration's Air Traffic Organization.

30. *Id.*

Title 14 of the Code of Federal Regulations Part 91, which requires that operators of aircraft comply with operating rules when operating in the United States.[31] Part 91 also requires that registered aircraft comply with Annex 2 when operating over the high seas.[32] However, section 91.703 applies only to civil aircraft; state aircraft operating outside the U.S. are only subject to the "due regard" provisions of Article 3 of the Convention.[33]

The Standards and Recommended Practices (SARPs) in Annex 11 to the Convention, together with the standards set forth in Annex 2, explain the applicability of "Procedures for Air Navigation Services—Air Traffic Management" (PANS-ATM)[34] and the "Regional Supplementary Procedures—Rules of the Air and Air Traffic Services,"[35] which describes subsidiary procedures for regional application. Annex 11 pertains to the establishment of airspace, units, and services necessary to promote a safe, orderly, and expeditious flow of air traffic.[36] Under ICAO agreements, the SARPS in Annex 11 apply to airspace under the jurisdiction of a contracting state, which has accepted the responsibility of providing air traffic services over the high seas, or in airspace of undetermined sovereignty.[37] 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.

VI. THE "RULES OF THE ROAD" IN INTERNATIONAL AIRSPACE

The articles in Chapter 1 of the Chicago Convention, similar to the Articles in the United States Constitution, describe the framework of the Convention and establish the parameters for the regulatory scheme.[38] Article 1 provides that "[t]he contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory."[39] Article 2 states that "[f]or the purposes of this Convention the territory of a State shall be deemed to be the land areas and territorial waters adjacent thereto under the sovereignty, suzerainty, protection or

31. 14 C.F.R. § 91.1 (2009).

32. 14 C.F.R. § 91.703.

33. *See id.*; Chicago Convention, *supra* note 12, art. 3.

34. ICAO Doc. 4444, PROCEDURES FOR AIR NAVIGATION SERVICES—RULES OF THE AIR AND AIR TRAFFIC SERVICES (1996).

35. ICAO Doc. 7030, NAT Regional Supplementary Procedures (2008).

36. Annex 11 to the Chicago Convention, July 2001, *available at* http://www.scribd.com/doc/18147021/Anexo-11-Air-Traffic-Services (last visited Mar. 8, 2010).

37. *Id.*

38. Chicago Convention, *supra* note 12, ch. 1.

39. *Id.* art. 1.

mandate of such State."[40] All other airspace not defined as falling within the sovereign protection of a state, and not necessarily a contracting state, is common, or international airspace.[41]

The Foreword to Annex 2 to the Chicago Convention states:

> The Standards in this document, together with the Standards and Recommended Practices of Annex 11, govern the application of the *Procedures for Air Navigation Services—Air Traffic Management* (PANS-ATM, Doc 4444) and the *Regional Supplementary Procedures*—Rules of the Air and Air Traffic Services, contained in Doc 7030, in which latter document will be found subsidiary procedures of regional application.[42]

Chapter 2 of Annex 2 sets forth the territorial application of the rules of the air:

> 2.1.1 The rules of the air shall apply to aircraft bearing the nationality and registration marks of a Contracting State, wherever they may be, to the extent that they do not conflict with the rules published by the State having jurisdiction over the territory overflown.
>
> *Note.—The Council of the International Civil Aviation Organization resolved, in adopting Annex 2 in April 1948 and Amendment 1 to the said Annex in November 1951, that the Annex constitutes* Rules relating to the flight and maneuver of aircraft *within the meaning of Article 12 of the Convention. Over the high seas, therefore, these rules apply without exception.*
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> 2.1.2 If, and so long as, a Contracting State has not notified the International Civil Aviation Organization to the contrary, it shall be deemed, as regards aircraft of its registration, to have agreed as follows:
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> > For purposes of flight over those parts of the high seas where a Contracting State has accepted, pursuant to a regional air navigation agreement, the responsibility of providing air traffic services, the "appropriate ATS authority" referred to in this Annex is the relevant authority designated by the State responsible for providing those services.

40. *Id.* art. 2.
41. *Id.* art. 12.
42. Annex 2 to the Chicago Convention, *supra* note 23.

Note.—The phrase "regional air navigation agreement" refers to an agreement approved by the Council of ICAO normally on the advice of a Regional Air Navigation Meeting.[43]

In summary, 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.[44] The Rules of the Air 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.[45] Regardless of the type of flight plan, the pilots are responsible for avoiding collisions when in visual flight conditions, in accordance with the principle of "see-and-avoid."[46] 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.[47]

To facilitate an orderly management of the Rules of the Air, the ICAO divided the world's airspace into a series of contiguous flight information regions (FIRs), within which air traffic services are provided. In some cases, the FIRs cover large oceanic areas with relatively low air traffic density.[48] Only flight information service and alerting service are provided within these regions.[49] In other FIRs, large portions of the airspace are controlled airspace within which ATS is provided in addition to flight information and alerting services.[50] Flight information service is provided to both aircraft operating in controlled airspace and to others known to the ATS units.[51] The prime objective of ATS, as defined in Annex 11, is to prevent collisions between aircraft.[52] 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

43. *Id.*
44. *Id.* § 2.1.1.
45. *Id.* § 2.3.1.
46. *Id.* § 3.2.
47. *Id.* ch. 3.
48. ICAO Doc. 7030, NAT Regional Supplementary Procedures (2008). For example, the "PAC FIR" covers the entire Eastern and South Pacific, the Anchorage Oceanic, Auckland Oceanic (east of 180°), Easter Island, NADI, Oakland Oceanic, and TAHIT high altitude airspaces, where there is very little air traffic.
49. *Id.*
50. *Id.* (explaining that the "NAM FIR" covers North America, including the United States and Canada—a high-density airspace).
51. *See* Annex 11 to the Chicago Convention, *supra* note 36, § 2.9.
52. *Id.* § 2.2.

service for aircraft in distress.[53] To meet these objectives, ICAO provisions call for the establishment of flight information centers and air traffic control units.[54]

Most of the airspace in oceanic CTAs/FIRs (control areas) is high seas airspace where the ICAO Council has resolved to apply their rules relating to flight and operations of aircraft without exception.[55] The majority of the airspace is also controlled airspace, and instrument flight rules apply to all flights in oceanic airspace when at or above FL060 (flight level 6000 feet) or 2000 feet above ground level, whichever is higher, even when not operating in instrument meteorological conditions.[56]

According to FAA Order 7400.2D, "Procedures for Handling Airspace Matters," offshore airspace areas may be designated for aircraft operations between the United States territorial limits and the oceanic CTA/FIR boundary or domestic point-to-point flights which operate in part over the high seas.[57] These areas are established to permit the application of domestic air traffic control services. For example, an aircraft flying from Bangor, Maine, on a direct routing to Miami, Florida, would transit both domestic airspace as well as international airspace and American-controlled warning areas offshore and beyond the 12-mile limitation. Offshore airspace areas may extend from the shoreline out to the inner limits of the U.S. CTA/FIR boundary. Beyond that point, but "[w]ithin the CTA/FIR area itself, ICAO oceanic ATC procedures are used instead of domestic procedures"[58] even though U.S. air traffic authorities are providing air traffic management services.[59] As mentioned above, offshore airspace areas are still international airspace, but under ICAO agreements, the FAA may apply domestic ATC separation procedures in those areas.[60] It is important to reiterate that state aircraft—including customs and law enforcement agencies—are subject only to the "due regard" provisions of the Chicago Convention when operating beyond 12 nautical miles from the U.S. coast.[61]

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53. *Id.*

54. *Id.* § 2.8.

55. *See* Annex 2 to the Chicago Convention, *supra* note 23.

56. *Id.*

57. *See* FED. AVIATION ADMIN., AIR TRAFFIC BULLETIN 99-3, WARNING AREAS AND OFFSHORE AIRSPACE (1999).

58. FED. AVIATION ADMIN., AIR TRAFFIC BULLETIN 00-1, WARNING AREAS AND OFFSHORE AIRSPACE (CORRECTION TO PREVIOUSLY PUBLISHED ARTICLE) (2000).

59. FED. AVIATION ADMIN., ORDER JO 7400.8R (2009).

60. AIR TRAFFIC BULLETIN 00-1, *supra* note 58.

61. Chicago Convention, *supra* note 12, art. 3 ("due regard for the safety of all air and surface traffic").

Once again, these rules do not distinguish between manned and unmanned or remotely piloted aircraft.

The ICAO regulations also specifically recognize the need for segregating routine aviation operations from those that present an increased risk to other aircraft. A warning area is one of the six types of special use airspace that have been designated for that purpose.[62] It is airspace of defined dimensions, extending from three nautical miles outward from the coast of the United States that contains activity that may be hazardous to nonparticipating aircraft.[63] The purpose of such warning areas is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both.[64]

> These areas may contain a wide variety of aircraft and non-aircraft activities, such as: aerial gunnery, bombing, aircraft carrier operations, surface and subsurface operations, naval gunfire, missiles, etc. Although warning areas may contain hazards similar to those found in a restricted area, the U.S. does not have the authority to prohibit flight by nonparticipating aircraft in international airspace. Therefore, warning areas are designated to alert nonparticipating aircraft to the potential danger.[65]

The Department of Defense continues to conduct hazardous activities in the area between 3 and 12 nautical miles from the United States coast, and nonparticipating pilots are warned about the presence of hazards, but are not prevented from entering the area.[66] Furthermore, Part 91, Subpart B,[67] applies within warning areas between 3 and 12 nautical miles from the coast; however, when the warning area is active, participating pilots may deviate from the rule to the extent that they are not compatible with the mission.[68] "The FAA has made clear that all special use airspace, including warning areas, should be made available for use by nonparticipating aircraft when all or part of the airspace is not needed by the using agency, provided there is no derogation to the using agency's mission."[69]

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62. Annex 11 to the Chicago Convention, *supra* note 36, § 2.17.

63. *See* 14 C.F.R. § 1.1 (2009).

64. 14 C.F.R. pt. 1 (2009).

65. FED. AVIATION ADMIN., ORDER 7400.2G (2008).

66. 14 C.F.R. § 91.1; FAA AIRMAN'S INFORMATION MANUAL, SPECIAL USE AIRSPACE § 4 (2010).

67. 14 C.F.R. § 91.101-91.147. Subpart B—Flight Rules—General, describes the flight rules governing the operation of aircraft within the United States and within 12 nautical miles from the coast of the United States.

68. FED. AVIATION ADMIN., ORDER 7400.2G (2008).

69. AIR TRAFFIC BULLETIN 00-1, *supra* note 58.

Air Traffic Bulletin 00-1 states that "[t]he FAA will not route nonparticipating IFR aircraft through an active warning area unless provided for in an LOA (Letter of Agreement). Otherwise, FAA will clear nonparticipating aircraft via routing which will provide approved separation from the airspace."[70]

> To initiate joint use of a warning area, an LOA is executed between the controlling agency and the using agency. These LOA's are prepared on a site-specific basis in order to accommodate the unique circumstances of each particular location. The LOA provides for the activation and deactivation of the warning area and defines the conditions under which nonparticipating aircraft may be authorized to operate within or through the area. The incident described at the beginning of this article highlights the importance of the LOA in ensuring the efficiency and safety of joint use of warning areas. It is most important that the LOA clearly define the conditions, the procedures, and the separation to be applied when a nonparticipating aircraft is transiting the area.[71]

The preceding sections described the nature and scope of remotely piloted aircraft technology, offering a framework for determining whether these devices fall within the legal definitions of "aircraft." A summary of the relevant passages from the Chicago Convention and its Annexes laid the foundation for the following discussion of the circumstances, both geographical and legal, under which these contrivances can be operated over the high seas, in international airspace, and remain in compliance with ICAO regulations.

VII. CAN UNMANNED AIRCRAFT COMPLY WITH ICAO RULES OF THE AIR?

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. As noted above, Annex 2 requires that those rules apply to aircraft bearing the nationality and registration marks of a contracting state.[72] But what standards apply if the contracting state that provides flight information, alert services, or air traffic control services in the international airspace sector of a flight information region has no spe-

70. *Id.*
71. *Id.*
72. Annex 2 to the Chicago Convention, *supra* note 23.

cific regulations that address the unique characteristics of unmanned aircraft?

Regardless of whether the flight in international airspace is being conducted under visual or instrument flight plans, the pilot in command is responsible for avoiding collisions when in visual flight conditions, in accordance with the principle of see-and-avoid.[73] The see-and-avoid rules of Annex 2 provide for controlled separation of aircraft operating under instrument flight rules by air traffic controllers, or the controllers may provide collision hazard information (warnings of potential collision). The provision of separation or collision hazard information to pilots does not relieve them of the obligation to not operate their aircraft in a negligent or reckless manner so as to endanger life or property of others[74] and does not permit them to operate their aircraft in such proximity to other aircraft as to create a hazard of collision.[75]

In the United States, the Federal Aviation Regulations (FARs) contain two sections that address the basic see-and-avoid obligation:

> § 91.111 Operating near other aircraft.
>
> (a) No person may operate an aircraft so close to another aircraft as to create a collision hazard.
>
> (b) No person may operate an aircraft in formation flight except by arrangement with the pilot in command of each aircraft in the formation.
>
> (c) No person may operate an aircraft, carrying passengers for hire, in formation flight.[76]
>
> § 91.113 Right-of-way rules: Except water operations.
>
> (a) *Inapplicability.* This section does not apply to the operation of an aircraft on water.
>
> (b) *General.* When weather conditions permit, regardless of whether an operation is conducted under instrument flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other

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73. *Id.* Annex 2 provides that:

> The pilot-in-command of an aircraft shall, whether manipulating the controls or not, be responsible for the operation of the aircraft in accordance with the rules of the air, except that the pilot-in-command may depart from these rules in circumstances that render such departure absolutely necessary in the interests of safety.

Id.

74. *Id.*

75. *Id.*

76. 14 C.F.R. § 91.111 (2009).

aircraft. When a rule of this section gives another aircraft the right-of-way, the pilot shall give way to that aircraft and may not pass over, under, or ahead of it unless well clear.

(c) *In distress.* An aircraft in distress has the right-of-way over all other air traffic.

(d) *Converging.* When aircraft of the same category are converging at approximately the same altitude (except head-on, or nearly so), the aircraft to the other's right has the right-of-way. If the aircraft are of different categories—

(1) A balloon has the right-of-way over any other category of aircraft;

(2) A glider has the right-of-way over an airship, powered parachute, weight-shift-control aircraft, airplane, or rotorcraft.

(3) An airship has the right-of-way over a powered parachute, weight-shift-control aircraft, airplane, or rotorcraft.

However, an aircraft towing or refueling other aircraft has the right-of-way over all other engine-driven aircraft.

(e) *Approaching head-on.* When aircraft are approaching each other head-on, or nearly so, each pilot of each aircraft shall alter course to the right.

(f) *Overtaking.* Each aircraft that is being overtaken has the right-of-way and each pilot of an overtaking aircraft shall alter course to the right to pass well clear.

(g) *Landing.* Aircraft, while on final approach to land or while landing, have the right-of-way over other aircraft in flight or operating on the surface, except that they shall not take advantage of this rule to force an aircraft off the runway surface which has already landed and is attempting to make way for an aircraft on final approach. When two or more aircraft are approaching an airport for the purpose of landing, the aircraft at the lower altitude has the right-of-way, but it shall not take advantage of this rule to cut in front of another which is on final approach to land or to overtake that aircraft.[77]

77. 14 C.F.R. § 91.113.

Parts 91.111 and 91.113 are the two sections of U.S. aviation regulations that arguably present the greatest challenge to UAS operators, since they impose requirements for seeing and avoiding other aircraft and observing "rules of the road" for navigation that currently cannot be met by remotely piloted aircraft. An operator of an aircraft or unmanned system who desires access to international airspace also faces similar barriers imposed by 14 CFR 91.701(a).

Part 91.701(a) requires that civil aircraft must comply with ICAO Annex 2 when operating over the high seas.[78] Annex 2 requires that "Aircraft shall be equipped with suitable instruments and with navigation equipment appropriate to the route being flown."[79] Also, Annex 6, Part II, requires that an aircraft operated in international airspace be provided with navigation equipment which will enable it to proceed in accordance with the flight plan and with the requirements of ATS.[80]

Consistent with ICAO policy and Annex 2 of the Convention, any operation conducted in international oceanic airspace on an instrument flight rules (IFR) flight plan, a VFR controlled flight plan, or a flight at night, as continued beyond the published range of normal airways navigation facilities (NDB, VOR/DME), is considered to be a long-range Class II navigation operation.[81] Long-range Class II navigation in ICAO Controlled Airspace (CTA) requires the aircraft to be navigated within a degree of accuracy required for air traffic control—that is, follow the centerline of the assigned route, maintain the assigned altitude, and maintain the speed filed or assigned.[82]

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78. 14 C.F.R. § 91.701(a). Part 91.701(a), entitled "Applicability," provides:

> (a) This subpart applies to the operations of civil aircraft of U.S. registry outside of the United States and the operations of foreign civil aircraft within the United States.
>
> (b) Section 91.702 of this subpart also applies to each person on board an aircraft operated as follows:
>
> (1) A U.S. registered civil aircraft operated outside the United States;
>
> (2) Any aircraft operated outside the United States—
>
> (i) That has its next scheduled destination or last place of departure in the United States if the aircraft next lands in the United States; or
>
> (ii) If the aircraft lands in the United States with the individual still on the aircraft regardless of whether it was a scheduled or otherwise planned landing site.

14 C.F.R. §§ 91.1(a)-(c).

79. Annex 2 to the Chicago Convention, *supra* note 23.

80. Annex 6 to the Chicago Convention, July 2001, http://www.scribd.com/doc/18012974/Anexo-06-Operation-of-Aircraft (last visited Mar. 8, 2010).

81. FAA National Policy Notice N8000.340, Appendix 1, Section 3; Navigation Concepts Chapter 1, Section 4, Class II Navigation.

82. Annex 2 to the Chicago Convention, *supra* note 23.

All requirements of Annex 2, as supplemented by Regional Supplementary Procedures, Document 7030 and Annex 6, are incorporated in 14 CFR 91.1 for those aircraft operating under United States civil certifications in international oceanic airspace.[83] The ICAO Regional Supplementary Procedures (SUPPS) form the procedural part of the Air Navigation Plans developed by Regional Air Navigation (RAN) Meetings to meet those needs of specific areas which are not covered in the worldwide provisions.[84] The SUPPS complement the statement of requirements for air traffic control facilities and services that are imposed upon the contracting states providing those services in the language of Air Navigation Plan publications. Procedures of worldwide applicability are included in either the Annexes to the Convention on International Civil Aviation as Standard Recommended Practices or in the Procedures for Air Navigation Services (PANS).[85]

The Regional Supplementary Procedures do not have the same status as SARPs. The PANS are recommended to contracting states for worldwide use, while the SUPPS are recommended to contracting states for application in the groups of flight information regions to which they are relevant. PANS were originally developed from common recommendations of regional meetings and were given worldwide application by the ICAO Council after action thereon by ICAO Divisions.[86] Subsequently, there has been a gradual evolution of procedures from the regional to the worldwide category as ICAO Divisions have been able to adapt regionally developed procedures to worldwide requirements. Concurrently, some of the worldwide procedures have been found suitable for classification as Standards or Recommended Practices and therefore are gradually being incorporated into the Annexes to the Convention.[87]

> In summary, Contracting States that provide air traffic control or information services in international airspace Flight Information Regions can, through these supplementary agreements, establish additional rules or procedures for aircraft entering and transiting that airspace and for which the Contracting States chose to provide services. Whether those States can impose their own domestic aviation regulations on aircraft and pilots operating in those FIRs

83. 14 C.F.R. § 91.1 (2009).

84. INT'L CIVIL AVIATION ORG., DOCUMENT 4444, PROCEDURES FOR AIR NAVIGATION SERVICES (1996).

85. *Id.*

86. *Id.*

87. INT'L CIVIL AVIATION ORG., DOCUMENT 7030, DRAFT PROPOSAL FOR AMENDMENT OF THE ICAO REGIONAL SUPPLEMENTARY PROCEDURES (1999).

> 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.[88]

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. An unmanned aircraft by definition has no human on board to provide the see-and-avoid capability that a pilot brings to manned aviation, which is the ability to look for and see another aircraft, process the information as only a human can, and then take the necessary actions to avoid a collision. Although many UASs are equipped with some sort of camera or visualizing device, the equipment is generally used for surveillance or observing whatever the aircraft has been deployed to observe. Others carry remote sensing apparati that have no camera at all and are navigated through the air autonomously via pre-programmed flight plans that rely upon global positioning system technology and other sensors that monitor the aerodynamic performance and system health of the aircraft. Although some UASs, generally for military and law enforcement 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.

As discussed above in section VI, "[c]ontracting states retain the right to publish exceptions to ICAO standards, recommended practices and procedures as set forth in the Annexes and supplementary documents."[89] This statement, in essence, acknowledges that ICAO's regulations apply

88. *Regulation of UAS in Arctic Airspace*, UAS: THE GLOBAL PERSPECTIVE (Unmanned Vehicle Systems International, Pans, Fr.), May 2009, at 124-26.

89. *Id.*

without exception to international airspace and in territorial airspace to the extent that they do not conflict with the regulations of the contracting state. In the United States, the FAA publishes and keeps current an extensive list of exceptions to ICAO's Annexes.[90] The FAA has not published any exceptions that address the operation of unmanned aircraft in international airspace or airspace in which the United States provides ATS. 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 its ATS units provide service. None of the regional agreements address flights of unmanned aircraft in their control or information areas.

VIII. CONCLUSION

An official of an Arctic nation's civil aviation authority who shall, for obvious reasons, remain anonymous, has publicly declared that "what is not prohibited is allowed," a sentiment that best describes the regulatory environment for the operation of unmanned aircraft in international airspace. 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 operation is allowed. The only qualification is that operators be able to 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 in international airspace—or at altitudes that do not interfere with traditional commercial operations—currently face no regulatory barriers that would prevent such activity.

Consequently, contracting states can be expected to assert regulatory power over all aviation activity in the international airspace for which they provide services, including 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. Enforcement will be

90. ICAO Doc. 7030, NAT Regional Supplementary Procedures (2008).

especially difficult 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. For law enforcement and customs operations, the ICAO standard of operating with "due regard for the safety of all air and surface traffic" would apply so long as they are considered to be state aircraft under the provisions of Article 3 of the Convention. For those whose UAS operations or status do not qualify for "state aircraft" designation, access to international airspace is subject to the whim of the air traffic organization that provides air traffic management services in the region where they desire to fly. Anyone operating in that environment without specific authorization from the controlling authority does so at their peril.