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Classifications of unmanned aerial systems adopted in international organizations

The rapid development of UAV-related technologies at home and abroad, the wide variety of UAV systems and their distinctive features have resulted in large differences in size, quality, range, flight duration, flight height, flight speed, and missions. Due to the diversity of drones, there will be different classification methods for different considerations.

1. ICAO classification

The International Civil Aviation Organization is a specialized agency that focuses on the basic regulatory framework of civil aviation around the world. In the early stages, ICAO focused mainly on remotely piloted aircraft systems (RPAS), which is a category of large unmanned aerial vehicles. ICAO distributes UAVs to remote-controlled aircraft, autonomous and model aircraft.

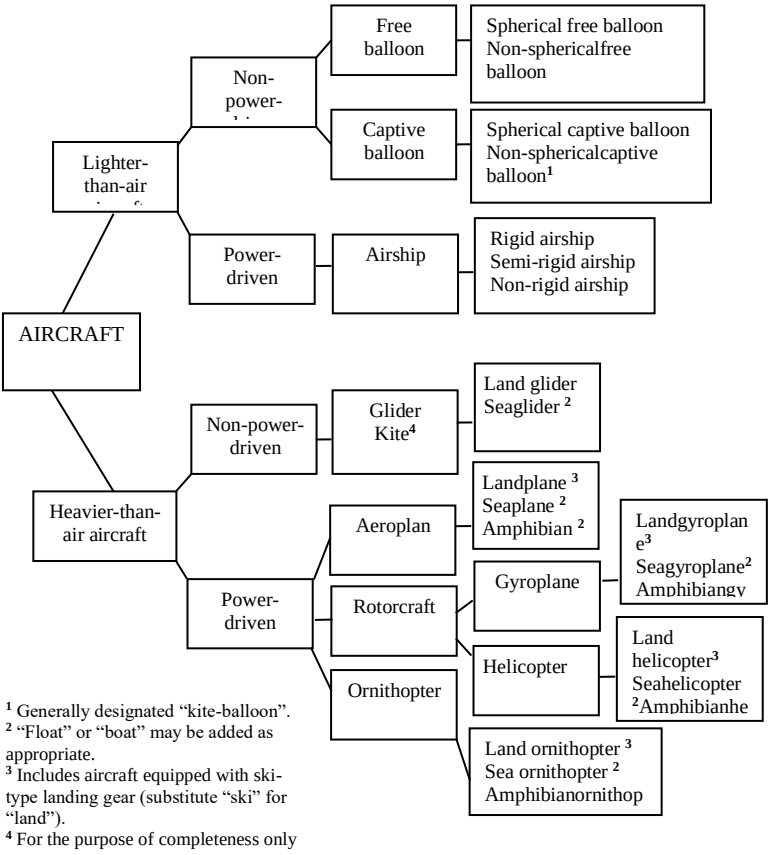
On March 1, 2021, the ICAO Council, at its 222nd session, adopted new and revised standards and recommended practices (SARPs) to promote the safety and interoperability of remote-controlled aircraft systems (RPAS) in international operations. Significant progress has been made in terms of gender.

The new conditions will come into force on July 12, 2021 and will apply from November 26, 2026. The most important point is related to Annex 8 of the Chicago Convention - the airworthiness of aircraft, which covers the certification requirements for remotely piloted aircraft and helicopters and remote control stations (RPS).

Member States have asked ICAO to develop a regulatory framework for unmanned aerial vehicle systems (UAS) operating outside the IFR international arena. ICAO has revised the existing BPS rules of many countries to identify common features and best practices that are consistent with ICAO's aviation framework and can be applied by a wide range of countries. The results of this activity are the ICAO Model (UAS Regulations) entitled Parts 101, 102 and 149.

The ICAO Model UAS Provisions and Related Advisory Circulars (ACs) offer Member States a template for implementing or supplementing existing PSA provisions. These regulations and variable requirements should become a living document and evolve as the industry develops, providing states and regulators with internationally agreed materials based on the latest developments.

ICAO classification



[1] Generally designated "kite-balloon".
[2] "Float" or "boat" may be added as appropriate.
[3] Includes aircraft equipped with ski-type landing gear (substitute "ski" for "land").
[4] For the purpose of completeness only

2. EUROCONTROL classification

In 2002 The European Joint Aviation Agency (JAA) and the European Organization for the Safety of Air Navigation have jointly established an UAV Task Force. As the successor to the JAA, EASA has continued to do so since 2008 and has issued various documents to formulate a European policy on drones.

The idea of EASA UAV surveillance is to: focus on the actual operation of the UAV, appropriate surveillance based on UAV characteristics and risk, using JARUS UAVs to manage 3 categories. EASA draws attention to the system and logic of laws and regulations, and has established a relatively complete system of legal system for the operation and management of drones and continues to supplement and improve within this system. The Basic Regulation (EU) 2018/1139, revised in August 2018,

extends the administrative powers of the European Union to all PSBs and is a higher-level law formulated by UAV laws and regulations.

In June 2019, EASA issued the Authorization Act No. (EU) 2019/945 (on drones and operators of third country unmanned aerial vehicle systems) and the Implementation Act (EU) 2019/947 (on UAV operating rules and procedures), denoting the legislation on The UAV process has entered the implementation stage. (EU) 2019/947 provides detailed regulations on 3 types of PSB operations and related requirements; (EU) 2019/945 provides for PSB and remote identification when the PSB operates in accordance with the rules and conditions provided for in (EU) 2019/947. components must meet certain design and manufacturing requirements. Rules have been formulated for "open" drones and remote identification accessories that can be freely sold on the market. It is also formulated for operators of unmanned aerial vehicles of third countries to work in EU airspace. According to (EU) 2019/947 rules to be followed during work. To help drone users adapt to the new regulations, EASA will publish relevant guidance materials and two proposed "standard scenarios", formulate compliance methods (AMC) and guidance materials (GM) and use SORA JARUS as Article 11 AMC.

EUROCONTROL classification

	CLASS	EASA MAPPING	TRAFFIC TYPE	AIRSPACE	OPERATIONS	PURPOSE	SPECIFICITY
VLL	I	Open Category	Buy and Fly primarily	From ground to 120m/400ft AGL In low traffic density areas UAS ONLY	VLOS	Recreational	• Mandatory declaration of operation • UAS must self-separate in 3D • Geofencing ensures that this category remains separated from no-drone zones
	II	Specific Operation/ Certified Category (possible operations)	Specific/Certified Category	From ground to 500 FT	VLOS/ BVLOS	Surveys, filming, search and rescue and other	• Has surveillance capability (4G chip or other means) • Free flight Capability • UAS must self-separate in 3D • BVLOS shall have barometric measurement equipage
	III	Specific Operation / Certified Category (possible operations)	Medium/Long haul traffic	From ground to 500 FT	BVLOS Free Flight or Route structure	Mainly transport purposes	• Mandatory authorisation for operation • Has surveillance capability • Shall have barometric measurement equipage
	IV	Specific Category/ Certified Category	Special operations	From ground to 500 FT	VLOS/ BVLOS	Highly specialised operations (civil, state or military, etc.)	• Addressed on case by case basis • Require special authorisation • Could require surveillance capability, depends on the mission requirements

	CLASS	EASA MAPPING	TRAFFIC TYPE	AIRSPACE	OPERATIONS	PURPOSE	SPECIFICITY
IFR/ VFR	V	Certified Operations	UAS not meeting pan-European network Performance requirements	From 500 FT AGL up to FL 600, including uncontrolled aerodromes	IFR/VFR Operating outside of the pan-European network Not flying SIDs and STARs	Mainly transport or military	• UAS operating in the environment will file a flight plan including information such as type of UAS, planned Contingency procedure and a contact phone number • UAS will meet CNS airspace requirements • UAS will be able to establish two-way communication with ATC if required • UAS will remain clear of manned aircraft • UAS operator must be able to contact ATC (if required) in regard to special conditions such as data link loss, emergency or controlled termination of flight • UAS D&A capability will be compatible with existing ACAS systems
	VI	Certified Operations	UAS meeting pan-European network performance requirements	From 500 FT AGL up to FL 600, including aerodromes	IFR/VFR According to airspace classes requirements Operating in the pan-European network, including SIDs and STARs	Any	• UAS operating in the environment will file a flight plan including information such as type of UAS, planned Contingency procedure and a contact phone number • UAS will meet CNS airspace requirements • UAS will be able to establish two way communication with ATC • UAS operator must be able to contact ATC (if required) in regard to special conditions such as data link loss, emergency or controlled termination of flight • UAS D&A capability will be compatible with existing ACAS systems

	CLASS	EASA MAPPING	TRAFFIC TYPE	AIRSPACE	OPERATIONS	PURPOSE	SPECIFICITY
VHL	VII	Certified Operations	Very high level IFR operations transiting non-segregated airspace	Above FL600, transition through lower airspace	IFR/VFR	Stratospheric commercial operations (unmanned aircraft and balloons)	• UAS must file a flight plan • UAS will meet CNS airspace requirements • UAS must inform the responsible ATC unit in case of emergency re-entry into controlled airspace • UAS must inform ATC about the type of contingency procedures to be used (balloons deflating or orbiting descent) • A regional centralised system should have an overview of the ongoing operations • Departure and arrival procedures should be developed

3. CLASSIFICATION CHINA (CAAC)

With the rapid development of high technologies such as big data, artificial intelligence and the Internet of Things, drones as a new technology continue to demonstrate their potential value in society. In December 2016, the State Council issued the "Thirteenth Five-Year" National Strategic Plan for the Development of the New Industry, which stated: "Accelerate the development of strategic aviation equipment, such as multi-purpose unmanned aerial vehicles and new configuration aircraft." It is clear that drones play an important role in the development of new industries in the country.

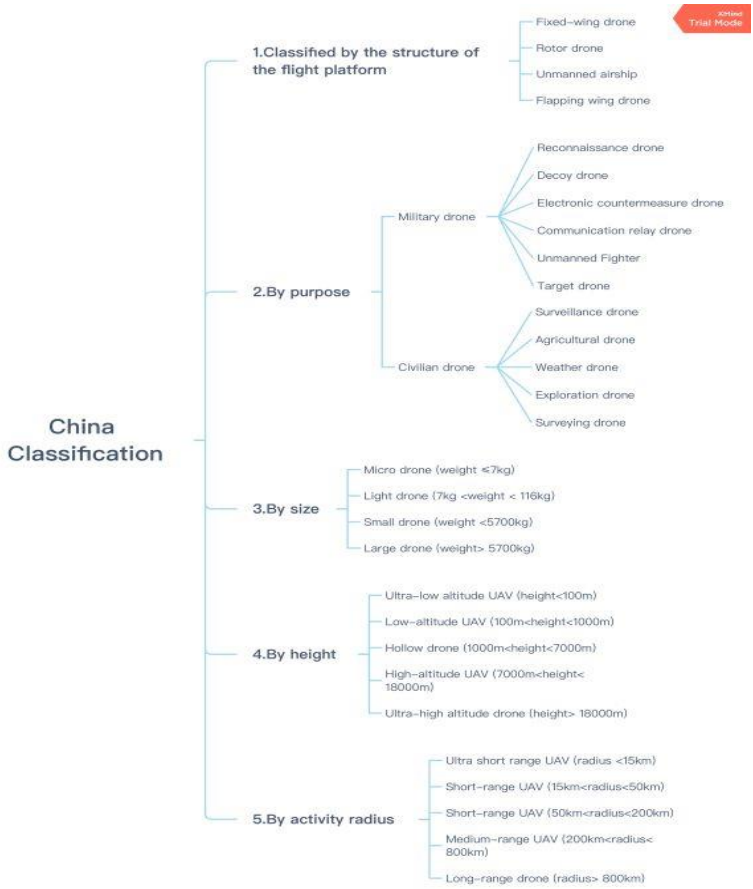
In August 2018, the Chinese Civil Aviation Administration's Department of Flight Standards issued the "Rules for the Control of Pilots of Civil Unmanned Aerial Vehicles", which defines unmanned aerial vehicles (UA) as: "Controlled by a control station (including remote control or autonomous flight)" Regulations on the management of the registration of real names of civil unmanned aerial vehicles ", issued by the Airworthiness Certification Department of the Civil Aviation Administration of China in May 2017, defines a civilian UAV as:" No pilot control, provided flight control systems, participation in non-military, police and customs missions. It does not include aircraft models, unmanned free balloons and tethered balloons. "Today, people generally believe that unmanned aerial vehicles are unmanned processing and remote-controlled aircraft.

First of all, according to the classification of targets, it can be divided into meteorological drones, inspection and rescue drones and geodetic and cartographic drones. Civilian drones are widely used and are widely used to ensure public safety, monitor the environment of marine and lake areas, fight crime and control traffic, inspect cables and pipelines, inspect forests and crops, rescue and firefighting, and aerial film and television.

Secondly, according to the classification of the fuselage design, it can be divided into UAVs with a fixed wing, UAVs by helicopter and UAVs with multi-rotor motion. Fixed-wing UAVs are similar in appearance to civil aircraft, and they need to use runways for takeoff and landing; UAVs for helicopters are similar to helicopters and can hang at a fixed point; The axes-rotors of the UAV and the UAV of the eight-rotor have small size, simple structure and speed in flight.

Third, according to the classification of the flight control system, it can be divided into three types: UAV hybrid control type, type of autonomous flight control and type of wireless remote control.

Classification CHINA (CAAC)



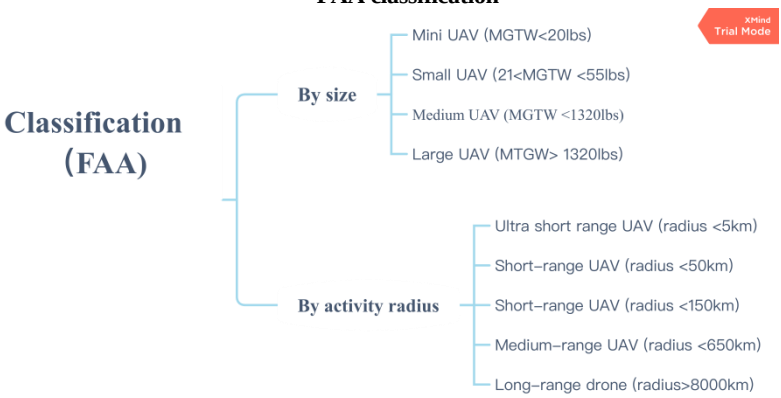
4. FAA classification

With the development of unmanned aerial vehicle technology, drones of different types and uses continue to appear, which have different characteristics in operation and operation, so it is necessary to classify and control drones. Recent UAV legislation in the United States also reflects this feature: it distinguishes between small drones, model aircraft and microplanes, and applies different rules. As noted earlier, in 2016, the Federal Aviation Administration formulated a control rule specifically for small drones, which is part of Code 107 of the Federal Rules. According to Part 107, "Small Unmanned Aircraft" refers to unmanned aerial vehicles weighing less than 55 pounds (25 kg), including all cargo. Part 107 also contains more detailed provisions on the registration, control of pilots and restrictions on the operation of small drones.

In general, US UAV legislation has relatively few legal restrictions on the management of small, model, and microbial UAVs, and they are gradually declining, mainly

because the above types of UAVs are usually relatively light and slow. the security threat is relatively small. In addition, based on the distribution of drones mainly by weight, different rules are also considered according to the use of drones, which reflects the further improvement of the rules for managing the classification of US UAVs.

FAA classification



4.Statement of the research problem

Once you find out the value of the expected drones, the next thing to think about is what business relationships drones should apply to, how to deploy them, and how to work with existing companies to maximize the usefulness of drones. we recommend to engineers Industrial users are considering expanding the drone business from "horizontal and vertical" areas:

Horizontally - in the end-to-end value chain of UAVs, deeply intervene in one step (eg data collection) and become an expert in the module, or in several stages (data collection from the interface + data analysis in the background), comprehensively improve the use and automation of corporate data;

Vertically - based on the implementation of autonomous operation and use of drones, the study of the expansion of other links in the industry chain (such as flight training, technical guidance) and integration with other businesses (eg, copying from power line inspection operations to pipeline inspection line) opportunity. on the value of resources. At the same time, taking into account the expansion of the drone business, appropriate consideration can be given to capital mergers (for example, the acquisition of drone data analysis companies) and the release of technology.

As a basis for business expansion, companies should focus on improving basic capabilities such as unmanned aerial vehicle operations, data collection and data processing, obtaining relevant business qualifications, and building a professional training and support system.

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