UNMANNED AIRCRAFT SYSTEMS (UAS)
REPORT ON THE GLOBAL REGULATORY & STANDARDS SITUATION - 2022

Introduction

Aviation is a sector with mature regulations and standards built on over a century of experience but the advent and proliferation of UAS has outpaced the traditional regulatory processes. As a result the global regulatory situation is fragmented across nations and regions, ranging from an outright ban on UAS, through an absence of regulations to a partial or incomplete framework. This report aims to identify what is available and what is not, so that UAS operators and pilots can better understand the challenges and be prepared to meet them.

INTERNATIONAL

International Civil Aviation Organisation (ICAO)

References:

1. *Article 8 of the Convention on International Civil Aviation 1944 and as amended*
2. *Document 10019 Manual on Remotely Piloted Aircraft Systems (RPAS) 1st Edition 2015*
3. *ICAO UAS Model Regulations Part 101 & 102 June 2020 (https://www.icao.int/safety/UA/Pages/ICAO-Model-UAS-Regulations.aspx)*
4. *ICAO Advisory Circular (AC) 101-1 Unmanned Aircraft Systems (UAS) [25 kgs or less] Operating in compliance with [Part 101] Rules June 2020*
5. *ICAO Advisory Circular (AC) 102-1 Unmanned Aircraft System Operations – Certification*
6. *ICAO Circular 328 Unmanned Aircraft Systems (UAS) 2011*
7. *ICAO Implementation Package (iPack) for Establishing a Regulatory Framework for UAS (https://www.icao.int/secretariat/TechnicalCooperation/Pages/UAS-iPACK.aspx)*
8. *Annexes 1, 2, 6, 7, 8, 10, 11, 12, 14 & 19 to the Convention (for a summary of references in these annexes see notes at the end of this report)*

Article 8 of the Convention requires that no pilotless aircraft shall be flown without 'special authorisation' of the State over which it is flown and should be so controlled as to obviate danger to civil aircraft. Annex A of Doc 10019 provides a proposed template for an application for special authorisation.

Doc 10019 explicitly addresses a sub-set of UAS; those that are remotely piloted or RPAS (1.5 Scope of the Manual) and states its purpose as providing guidance on the integration of RPA into non-segregated airspace (1.4 Purpose of the Manual), in accordance with instrument flight rules (IFR) in controlled airspace. This document therefore only addresses the operation of RPAS under IFR in controlled airspace between 500 feet and flight level 600, whereas at the time of writing much UAS activity falls outside of this specification. Current technology, airworthiness and operational regulations are not yet ready for the full integration of manned and unmanned aircraft in controlled airspace, although some experimental flights have been conducted.

Recognising that Doc 10019 does not address the majority of UAS activity, ICAO drafted Model UAS Regulations to help guide States in preparing and publishing national regulations for UAS. These were accompanied by some model Advisory Circulars as guidance material. Several States which had not previously published UAS regulations are following these model regulations in the preparation of their national frameworks. However, the Model Regulations allow States flexibility in the values

attached to many of the parameters, so while there may be commonality in structure there may well be differences in the specifics. ICAO has recently released an 'Implementation Package' or iPack to assist States in the implementation of these Model Regulations, with a programme of training and guidance.

ICAO Circular 328 was an early discussion document setting out ICAO's understanding of UAS technology and its expected approach to the establishment of regulations.

International Organisation for Standards (ISO)
References:

1. ISO 21384 Part 1 – General Specifications
2. ISO 21384 Part 2 – Product Systems
3. ISO 21384 Part 3 – Operational Procedures
4. ISO 21384 Part 4 – Terms and Definitions
5. ISO 21895 – Categorisation and Classification of Unmanned Aircraft Systems

ISO charges a substantial fee for access to its publications and for that reason the author of this report has only had sight of ISO 21384 Part 3 – Operational Procedures. This does not offer a regulatory framework, rather a set of operational standards for UAS. It would be advisable for any UAS operator to be familiar with these standards, especially when compiling a UAS operations manual or designing operational procedures but they are written in quite loose terms and frequently refer readers to the local State regulations. Because many States have incomplete or absent UAS regulations (see below) that advice may not always be helpful.

Flight Safety Foundation
References:

1. Basic Aviation Risk Standard (BARS) Remotely Piloted Aircraft Systems Version 3 October 2020 https://flightsafety.org/bars/the-bar-standards-and-manuals/
2. BARS RPAS Implementation Guidelines October 2020

Like ISO 21384, BARS RPAS is a framework of standards (free of charge in this case) rather than regulations. It is based on the Bow-tie risk management methodology and identifies potential operational safety threats together with controls to mitigate against them. FSF has also published open-source Implementation Guidelines for the RPAS standards. BARS includes a Question Master List of audit questions with which to evaluate the standards of a UAS operator. Because BARS was created to support aviation safety in the resource industry it leans heavily towards this sector and includes specific provisions for underground UAS operations and UAS under-slung loads.

SUPRA-NATIONAL

European Union Aviation Safety Agency (EASA)
References:

1. Regulation (EU) 2019/947 on the rules and procedures for the operation of unmanned aircraft
2. Regulation (EU) 2019/945 on unmanned aircraft systems and on third-country operators of unmanned aircraft systems

3. EASA Easy Access Rules for Unmanned Aircraft Systems https://www.easa.europa.eu/sites/default/files/dfu/Easy%20Access%20Rules%20for%20Unmanned%20Aircraft%20Systems%20%28Revision%20from%20September%202021%29.pdf

The EU via its aviation regulator EASA has implemented a regulatory framework for the operation of UAS within EU member states. This framework divides UAS into three categories: Open; Specific, and; Certified. The Open category includes UAS up to a maximum of 25 kg when operated within a strictly defined set of operational parameters, which if followed will result in a very low risk profile. The Certified category applies to UAS and/or UAS operations in which the competent authority determines that the risks can only be mitigated by certification of the UAS and its pilot, and generally includes larger UAs conducting complex operations. The Specific category embraces all other UAS and UAS operations that are neither very low risk (Open) nor very high risk (Certified). Each of these categories is further divided into sub-categories and UAS themselves are subject to s certification framework.

EASA's regulations introduce the Specific Operations Risk Assessment (SORA) to assess the varied risks encountered in Specific category operations and to apply appropriate mitigations. SORA recognises that the principal risk in conventional aviation, that of harm to persons on board, does not apply to UAS. The methodology instead addresses 'air risk' – that of harm due to a collision with a manned aircraft or another UA, and 'ground risk' – that of harm due to a collision with persons or property on the ground. The conduct of a SORA is set out in great detail in the regulations and, to those not familiar, it presents a complex multiple-step process. Regular and consistent application of SORA within an organisation will require a substantial commitment to training.

Joint Authorities for Rulemaking on Unmanned Systems (JARUS)
References:

1. JARUS Publications http://jarus-rpas.org/publications

JARUS is an international group of aviation regulatory experts, whose stated purpose is to recommend a single set of technical, safety and operational requirements for all aspects linked to the safe operation of the UAS. An extract from its website states, "JARUS is a group of experts gathering regulatory expertise from all around the world. At present, 63 countries and the European Aviation Safety Agency (EASA) and EUROCONTROL are contributing to the development of JARUS work products."

JARUS publications constitute recommendations to State authorities for the development of UAS regulations and standards, and include certification specifications, flight crew licencing and the specific operations risk assessment (SORA) referred to in the EASA section above.

JARUS publications are free to access via the link and provide a learned resource for States.

NATIONAL

References:

1. Global Drone Regulations Database https://droneregulations.info/
2. Example: US Code of Federal Regulations Title 14, Chapter 1, sub-Chapter F, Part 107 Small Unmanned Aircraft Systems https://ecfr.federalregister.gov/current/title-14/chapter-I/subchapter-F/part-107

3. EASA Easy Access Rules for UAS
   https://www.easa.europa.eu/sites/default/files/dfu/Easy%20Access%20Rules%20for%20Unmanned%20Aircraft%20Systems%20%28Revision%20from%20September%202021%29.pdf

The Global Drone Regulations Database at Reference 1 is compiled by a not-for-profit group using funding and contributions from a variety of donors and contributors. The stated objective is to provide humanitarian and non-humanitarian actors with a database of relevant national regulations, additional resources, and links to original regulatory documents to ensure that drones are deployed safely and in compliance with national regulations. The regulations found may not be definitive or entirely up-to-date, therefore whilst a useful reference, users should always obtain the official version of the regulations from the country of interest. A good starting point is the website of the national aviation authority and/or the aviation ministry.

Many countries have not yet published UAS regulations and others have an incomplete framework. The US for example has only regulated for small UAS up to 25 kgs in Part 107. Nevertheless, larger UAS are being flown in the US under experimental permissions. Very few countries have mature regulations for operations beyond visual line of sight (BVLOS), which is the only operational segment for which ICAO has published guidance (see above). Countries such as the UK have permitted limited BVLOS operations in segregated airspace, from which manned aircraft are excluded. The absence or incompleteness of national regulations does not necessarily preclude UAS operations. Some countries have delegated the authorisation of specific UAS operations to government bodies such as emergency management agencies, or to the military.

COMMON FEATURES

Weight categories – most, if not all regulatory frameworks divide UA up into categories based at least to some extent on weight, or more specifically Maximum Take-off Mass (MTOM) which is the highest weight that the manufacturer states it can take-off at. The risk of injuries or damage increases with increasing weight and therefore the operational limitations and technical requirements tend to increase proportionately for heavier categories.

Proximity to people – with regard to UA proximity many regulations differentiate between persons involved with the UAS operation and those who are not. Generally, flight over uninvolved persons is permitted only with the smallest UA, typically those weighing less than 250 g, and even then not over ‘assemblies of people’. As the weight category of the UAS increases so does the minimum horizontal separation from uninvolved persons.

Maximum flight altitude – it is common for UAS regulations to limit the maximum flight altitude to 400 feet or 120 metres, with a reference datum of the surface over which it is flown. The basis for this limit is that the international standard for manned aircraft under visual flight rules (VFR) requires them to maintain a minimum altitude of 500 feet, thereby allowing for 100 feet separation. Some alleviation to the 400 feet limitation for UAS is often provided when flying over tall structures.

Line of Sight – most regulations differentiate between UAS operations within the remote pilot’s visual line of sight (VLOS) and those beyond visual line of sight (BVLOS). The significantly increased complexity of BVLOS operations, using radio and satellite communications, tends to attract more rigorous operational limitations and technical requirements. Many frameworks also recognise an

extended visual line of sight (EVLOS) that uses one or more visual observers to watch the UA in flight.

Carriage of persons and dangerous goods – UAS regulations generally preclude the transportation of people or dangerous goods as defined by the ICAO Technical Instructions (Document 9284).

SUMMARY OF REFERENCES IN ANNEXES TO THE CONVENTION

The remote pilot licence and associated medical provisions become applicable this year but there haven't been any new RPAS-related SARPs adopted this year and none are planned for 2023. A significant package of SARPs will be adopted in 2024-2025 for applicability 26 November 2026.

The current status is as follows:

Annex 1 – Personnel Licensing: SARPs for the remote pilot licence (focused on remote pilots conducting IFR operations with certificated RPAS) and Class 3 medical expanded to include remote pilots (previously only for ATCOs); complemented by PANS-TRG. These SARPs become applicable 3 November 2022.

Annex 2 – Rules of the Air: high level Standards in Appendix 4 mandating approvals, certifications and licence have been applicable since November 2012. Minor consequential amendments adopted for applicability in November 2026. Most of the work for Annex 2 is in development and should enter the review/approval process in the second quarter of 2023 for 2026 applicability.

Annex 6, Part IV – International Operations, Remotely Piloted Aircraft Systems: proposed new Part will be sent out for State comment summer 2022. Anticipated adoption in March 2024 with applicability in November 2026. Part IV is based on Annex 6, Parts I and III, and addresses aeroplanes and helicopters without distinction between commercial and general aviation. Aerial work is included. The provisions were developed to support IFR type operations but are not exclusive to IFR.

Annex 7 – Nationality and Registration Marks: Standards applicable since 2012 that cover any type of aircraft, regardless of size or configuration.

Annex 8 – Airworthiness: SARPs have been adopted for RP aeroplanes, RP helicopters and remote pilot stations (RPS) with applicability of 26 November 2026. The intent is for Annex 8 SARPs to complement Annex 6, Part IV operations with a primary focus on the certification of RPA/RPS for international IFR operations, in controlled airspace/aerodromes and with no persons on board.

Annex 10, Vol IV – Aeronautical Telecommunications, Surveillance and Collision Avoidance Systems: detect and avoid (DAA) systems specifically for conflicting traffic will enter review/approval process in the second quarter of 2023 for November 2026 applicability. DAA for other hazards will be developed in due course.

Annex 10, Vol V – Aeronautical Telecommunications, Frequency Spectrum: SARPs for command & control (C2) link spectrum have been adopted and will be applicable from November 2026.

Annex 10, Vol VI – Aeronautical Telecommunications, Communications Systems and Procedures Relating to RPAS C2 Link: general, non-technology-specific SARPs and PANS have been adopted;

technology-specific SARPs will enter review/approval process in the second quarter of 2023 for November 2026 applicability.

Annex 11 – Air Traffic Services: in development and should also enter the review/approval process in the second quarter of 2023 for November 2026 applicability.

Annex 12 – Search and Rescue: until there are persons on board RPA, the focus is only on RPA/UA engaged in SAR operations; in development for November 2026 applicability.

Annex 13 – Accident Investigation: definition of accident and serious incident expanded to include unmanned aircraft has been applicable since November 2010. Specific SARPs to address accidents/incidents involving RPAS are in development with possible 2028 applicability.

Annex 14 – Aerodromes: in development, possibly for November 2026 applicability, but more likely November 2028. Will include vertiports as a new type of aerodrome.

Annex 19 – Safety Management: includes RPAS operators and manufacturers; proposed amendment ready to enter review/approval process for November 2026 applicability.

Most other disciplines/Annexes are also in development, but timelines are not yet clear.