

UAS Flight Rules

Presented by TOC

SUMMARY

Integration of crewed and uncrewed aircraft requires common basis and procedures. To date, flight rules have been one of the key elements to ensure the safety of the operations. These rules require performance and capabilities to be met. Often, these performances are not achievable by UAS traffic, due to the peculiarity of having no pilot on board.

By providing an overview of the work several organizations are performing on the topic, this paper will analyse the constituting elements of the current flight rules and the need for performance-based flight rules, to integrate UAS with other traffic.

1. INTRODUCTION

- 1.1. Unmanned Aircraft Systems (UAS¹) comprise a wide variety of operations including, but not limited to, leisure drones, parcel delivery, Remotely-Piloted Aircraft System (RPAS), and High-Altitude Pseudo-Satellites (HAPS). Harmonisation is considered a priority to ensure the safety of the operations. This raises the question of how current VFR and IFR operations can support UAS operations, considering both IFR and VFR were designed, factoring a pilot in the aircraft.
- 1.2. Due to the wide array of UAS, the focus is on the capabilities UAS have to comply with VFR and IFR and/or on the possibility of developing a new set of flight rules to better accommodate UAS needs. As each stakeholder (ANSPs, UAS operators, and manned aviation) has their own insight about how UAS should be regulated, it is imperative that safety remains the primary focus of any rules developed. As there is an increased number of UAS entering the aviation system, there is a need to define how these users will fit.
- 1.3. This paper will analyse the constituting elements of the current flight rules and propose a possible approach for the development of a new set of flight rules for all traffic, including UAS.

2. DISCUSSION**2.1. What are Flight Rules?**

¹ ICAO Circular 328, Unmanned Aircraft Systems (UAS): *an aircraft and its associated elements which are operated with no pilot on board*".

- 2.1.1. Flight rules are regulations and procedures governing who, where, when and how to fly an aircraft under various conditions with the aim to protect persons and property, as well as to avoid collision.
- 2.1.2. In a portion of airspace, the application of defined sets of flight rules in relation to the type of traffic operating ensures the correct provision of the necessary level of services to integrate the traffic thereof.

2.2. The History and Evolution of Flight Rules

- 2.2.1. Flight Rules are present in the entire ICAO lifecycle, starting from the Convention on International Civil Aviation with Article 12 “Rules of the air”²:

Each contracting State undertakes to adopt measures to insure that every aircraft flying over or maneuvering within its territory and that every aircraft carrying its nationality mark, wherever such aircraft may be, shall comply with the rules and regulations relating to the flight and maneuver of aircraft there in force. Each contracting State undertakes to keep its own regulations in these respects uniform, to the greatest possible extent, with those established from time to time under this Convention. Over the high seas, the rules in force shall be those established under this Convention. Each contracting State undertakes to insure the prosecution of all persons violating the regulations applicable.

- 2.2.2. PICA0 (Provisional International Civil Aviation Organization) started working on Flight Rules in 1945 with the Rules of Air and Air Traffic Control (RAC) Division. The result of the work was the first version of the current Annex 2 which was called “Annex 2 – International Standards and Recommended Practices - Rules of the Air” (effective 15 September 1948). Almost in parallel, the Air Traffic Committee of the Regional Route Service Conference for the North Atlantic Region (Dublin, March 1946) proposed the first edition of the “Procedures for Air Navigation Services – Air Traffic Control (PANS-ATC)” that, after being called “Procedures for Air Navigation Services – Rules of the Air and Air Traffic Control (PANS-RAC)” between 28 November 1951 till 31 October 2001, it became the current “Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)” (1 November 2001)³.
- 2.2.3. VFR and IFR were already present in the first edition of Annex 2, but they were associated with meteorological conditions. In fact, it stated that “when the weather conditions permit a pilot to conduct his flight in conditions of visibility and distance from clouds equal to or greater than those specified in the Annex, he is said to be in “VFR weather conditions”⁴. Below these conditions, there are “IFR weather conditions”. The document listed a series of Standards and Recommended Practices as Flight Rules to be followed when operating in VFR weather conditions (i.e. Authority of the pilot in command, Air traffic control instructions, Rule for quadrantal altitude and others) and an additional set of rules for the portion of flight conducted under the IFR weather conditions (Pilot qualification, Aircraft equipment, Minimum altitude IFR and others). The responsibility to assess weather conditions, and consequently the set of rules to be followed, lies on the pilot in command. In that respect, PANS-ATC stated that “control of air traffic operating under Instrument Flight Rules is based on the provision of PICA0 rules of the air”⁵ and that “the only responsibility of Air Traffic Control for the separation of air traffic operating under VFR minima shall be that effected by

² ICAO DOC 7300 Convention on International Civil Aviation, ninth edition, 2006

³ https://applications.icao.int/postalhistory/annex_2_rules_of_the_air.htm (consulted 29 January 2024)

⁴ Annex 2, 1st edition 1948, chapter 2, 2.3.1 note 1

⁵ PANS-ATC 1st edition March 1946, 1.0102

Aerodrome Control while such aircraft constitute aerodrome traffic”⁶. This concept was confirmed in 1951 with the publication of Annex 11 “Air Traffic Services”, stating that the Air Traffic Control service shall be provided to all IFR flights in control areas and control zones and to aerodrome traffic at controlled aerodromes.

- 2.2.4. From the initial situation described above, the concept of flight rules and all elements connected (separation provision and airspace classification) evolved. In 1952, with the second edition of Annex 2, General Rules were created as a common concept to be added to VFR and IFR (that were expanded). In 1966, the 5th edition of Annex 11 introduced the provision of ATC to VFR, in particular portions of controlled airspace⁷[6]. In 1990, the 9th edition of Annex 11 introduced the current Airspace Classification with the provision of ATS in accordance.
- 2.2.5. It is understandable how the evolution of Flight Rules (as well as of Airspace Classification and Air Traffic Services) is strongly linked to the technological development of both ground and airborne equipment. This progress has shifted the separation assurance from the pilot’s ability to see and avoid, towards an ATC-centric system. This has naturally lowered the pilot’s situational awareness of surrounding traffic, thus the ability/possibility of recognizing traffic hazards, is barely comparable with the ATC one. ATC, on its side, has increased its dependency on automation of ATC systems, to safely handle the growing volumes of operations.
- 2.2.6. Today’s level of automation is so high that humans involved in a task are provided only with the results of the process, as the process itself would be difficult to comprehend. The tendency introduced by the digitalization of Airspace and Services is to drift from a human-centred architecture towards a system-centric one where the role of the human is considered a supervisory role and where the concept of “manage by exception” is applied. This new architecture is based on information-sharing to enhance the situational awareness of all parties involved. Considering this aspect, the allocation of the role of the Separator might shift from the current recognizable and unique figure of the ATCO, to a more vague and indistinct cooperative separation.
- 2.2.7. In this context, current Flight Rules shall be evaluated considering their performances, impact on traffic (current and new type of traffic), applicability and sustainability.

2.3. **What are the current Flight Rules?**

- 2.3.1. In the current air traffic system, traffic is subject to General Flight Rules and IFR or VFR rules, according to the type of operations and weather conditions.
- 2.3.2. General flight rules constitute the basic principles for interaction between aircraft, such as protection of persons and property and avoidance of collisions. These rules apply to all traffic and, on top of them, VFR and IFR complete the regulatory framework for services provision.
- 2.3.3. The existing rules for VFR operations are based on the pilot’s ability to visually recognise hazards, traffic, locations, and on the possibility of elaborating information provided by the Air Traffic Services in that respect. Visual Meteorological Conditions (VMC) support VFR by providing standard references.
- 2.3.4. IFR operations can be conducted in either VMC or in conditions below VMC (Instrument Meteorological Conditions - IMC). For this reason, IFR operations require

⁶ PANS-ATC 1st edition March 1946, 1.05000 Visual Flight Rules

⁷ Annex 11 ATS - 3.1.1, 5th edition, August 1966

additional actions and capabilities from both the pilot and the airframe aiming to improve ATS provision by increasing the predictability of the flight and ensuring minimum Communication, Navigation and Surveillance (CNS) performances.

- 2.3.5. Flight rules have adapted over time as new technology, both airborne and ground equipment, has developed. Nevertheless, it is extremely important to underline that both IFR and VFR were designed factoring in a pilot in the aircraft. The lack thereof opens a new set of challenges to overcome. How the UAS operations fit relative to these rules will be a challenge that will have to be addressed, if they are to be integrated into the airspace system.

2.4. **Applicability of ICAO Annex 2 “Rules of the Air” for UAS**

- 2.4.1. The applicability of Annex 2 “Rules of the Air” for UAS is uncertain. According to ICAO Annex 2 “Rules of the Air”: “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.”
- 2.4.2. Nonetheless, under ICAO Model UAS Regulations Part 101, all UAS under 25kg are required to be registered. The registration allows easy identification of the UAS and the owner and provides the Civil Aviation Authority with data regarding the operation of UAS in the industry. Nonetheless, there is no mandatory requirement for the UAS to bear nationality and registration marks on the body similar to manned aircraft.
- 2.4.3. The registration arrangement is for administrative purposes rather than aiming to mandate the UAS to follow the rules, as stated in Annex 2. Thus, there are numerous interpretations from different States on the applicability of Annex 2 for UAS.

2.5. **Why do we need UAS Flight Rules?**

- 2.5.1. At the 39th Session of the ICAO Assembly in 2016, States and the aviation industry requested that ICAO urgently address the increasing number of UA.²

“ANSPs anticipate that UAS operations will occur in all classes of airspace, and will include transit across the boundary between controlled and uncontrolled airspace. The safe and efficient integration of UAS, particularly small UA, into existing controlled and uncontrolled airspace presents a variety of issues and novel challenges. A significant amount of UAS operations are expected in the low-level environment and above populated areas, with various types of operations and UA.”

- 2.5.2. Furthermore:

“It is understood that the current flight rules (VFR, IFR) are insufficient to accommodate UAS operations. Any changes to the flight rules will need to be consistent and complementary to the ones defined for manned aviation.”

- 2.5.3. Automation related to UAS operations should also be considered when developing flight rules. This can also lead to a complete revision of mechanisms that are behind current flight rules for manned aviation and to the creation of a new complete set of flight rules that can accommodate both crewed and uncrewed operations.

2.6. **Present Approaches to Flight Rules**

2.6.1. ICAO

- 2.6.1.1. In 2020, ICAO published the “ICAO Model UAS Regulations”, in response to the Member States’ request to have examples and guidelines on regulations for the implementation of UAS operations.
- 2.6.1.2. Using the risk-based approach, ICAO has provided guidance on the classification of UAS operations, where they might be conducted, and which might be the parameters to be respected. For example, it is stated in the ICAO Model UAS Regulations that “A person who is operating a UA shall give way to and remain clear of all manned aircraft on the ground and in flight”.
- 2.6.1.3. Guidelines in ICAO Model UAS Regulations have assisted member states to better protect people and properties as well as avoid collision in handling UAS operations. Unlike the ICAO Annex 2 - Rules of the Air where member states shall comply with, application of ICAO Model UAS Regulations is “optional” to member states. In the description of ICAO Model UAS Regulations: “Model regulations included herein are not intended to be prescriptive, mandatory, or construed in any way as to pre-empt individual States’ legal structures.” Moreover, the performance parameters required for UAS operations in the ICAO Model UAS Regulations are not specific and are subject to change for local adaptation. Thus, ICAO Model UAS Regulations cannot be considered as flight rules as it only serves as a guidance material to member states to facilitate their establishment of UAS regulations according to different local situations.

2.6.2. JARUS

- 2.6.2.1. In April 2023, JARUS (Joint Authorities for Rulemaking of Unmanned Systems) published a document called “classification and impact analysis scheme to help support discussions and regulatory development for automated UAS operations centred on the role of the human in performing operational functions”²⁰.
- 2.6.2.2. The document proposes to classify UAS operations according to the level of automation of the UAS and, consequently, to the buffer of interventions humans might have (human in the loop, on the loop or, off the loop).

Level 0 – Manual Operation: The human is fully responsible for function execution, with no machine support.

Level 1 – Assisted Operation: The machine operates in an out-of-the-loop supporting role to the human in executing the function, e.g., provision of relevant information.

Level 2 – Task Reduction: The machine operates in an in-the-loop management role in reducing human workload to accomplish the task, e.g., conflict alert and resolution advisory based on predicted flight paths.

Level 3 – Supervised Automation: The machine executes the function under the supervision of the human who is expected to monitor and intervene as required, e.g., an automatic traffic collision and avoidance (TCAS) system tied to an autopilot which can automatically perform a manoeuvre when a Resolution Advisory is alerted.

Level 4 – Manage by Exception: The machine executes the function alerting the human in the event of an issue. The human is not required to monitor the function in real-time and is able to intervene at any time after being alerted by the machine to an issue.

Level 5 – Full Automation: The machine is fully responsible for function execution. The human is unable to intervene in real-time either due to practical limitations or deliberate exclusion within the Operational Design Domain (ODD).

2.6.2.3. Levels reported above represent only the capabilities of UAS of handling their operations. However, these operations won't be conducted in a sterile environment and interactions with other UAS are only marginally considered in this analysis. It is envisaged that there will be a traffic management system that will provide services to ensure the safety of the operations and the provision of these services will be balanced to the level of automation UAS has. This also implies a certain level of digitalisation and automation of both the airspace and the traffic management system. At the time this WP is written, JARUS is working on further developing these concepts and IFATCA is involved in the work.

2.6.3. **CORUS/ CORUS-XUAM (Concept of Operations for EuROpean UTM Systems - eXtension for Urban Air Mobility)**

2.6.3.1. In 2019, CORUS composed a Concept of Operations (ConOps) for the management of UAS in the VLL European airspace. The ConOps detailed the definitions of services (U-space services) needed to ensure safe operations and it proposed four new airspace structures X,Y, Zu and Za. This classification was based on the provision of the conflict resolution service, which is not provided in X, strategic in Y and tactical in Zu and Za.

2.6.3.2. CORUS consortium has recently extended the ConOps to include Urban Air Mobility (UAM). One of the most important updates to the ConOps is the introduction of the UFR (U-space Flight Rules) concept. UFR are rules intended to apply uniquely to airspace users in Zu in receipt of U-Space services and, due to the highly digitalised nature of the U-space, traffic operating into Zu shall meet certain capabilities to be able to use U-space services under UFR. For example:

- *be Electronically Conspicuous to the ground system(s) and to other aircraft within the U-Space Airspace*
- *be in receipt of a traffic information service(s), as required, with respect to other aircraft*
- *adhere to any [Digital] ATS clearance/instruction deemed necessary by the controlling authority*

2.6.3.3. Even if the CORUS ConOps doesn't detail UFR and U-space services in terms of separation minima, environmental conditions and procedures, it clarifies that airspace, services and flight rules are highly interdependable aspects that need to be considered and evaluated with a systemic approach view in integrating new type of traffic and operations.

2.6.4. **EASA and EUROCONTROL**

EASA and EUROCONTROL published a document in 2018 called "UAS-ATM integration - Operational Concept"⁸. The document is probably the first European document to provide an overview on all type of operations that might involve UAS from an ATM perspective. One of the suggestions was the development of two new sets of rules to manage VLL and high-altitude operations (HAO).

⁸ UAS ATM Integration – Operational Concept Edition 1.0, **EASA**, November 2018

Visual Flight Rules VFR ICAO Annex 2 Chapter 4 SERA 5001-5010	Instrument Flight Rules IFR ICAO Annex 2 Chapter 5 SERA 5015-5025	Low-level Flight Rules LFR To be developed	High-level Flight Rules HFR To be developed
General Flight Rules ICAO Annex 2 Chapter 3 SERA Section 3			

2.6.4.1 The document recognised the importance of having specific rules for VLL and HAO to improve European standardisation and facilitate the development of UAS operations. It states that *“if these rules are not supported by harmonised rules of the air, it will become very difficult to implement them in environments where the airspace is not organised in a standard way to take all users and all needs (including, for example, emergencies) into account.”*

2.6.4.2 Embracing all levels, from ground and above FL660, and all different types of traffic, both crewed and uncrewed, the document highlights the necessity to develop and organise the airspace structure considering many differences in performance.

2.6.5 CANSO

2.6.5.1 UAS has introduced challenges to ATC daily operations especially when these UAS are operating in the vicinity of, or within the non-segregated controlled airspace. As mentioned in the ANSP Considerations for UAS Operations by CANSO:

“Currently there is an increase in civil operations of smaller UAS, and day-to-day presence of UAS operating within, or in the vicinity of, controlled airspace may pose challenges for ANSPs to ensure separation of UAS from both manned and other unmanned aircraft in non-segregated airspace. UAS operations at low altitudes near airports are creating safety concerns from local air traffic control (ATC) providers.”⁴

2.6.5.2 The challenges experienced by ATC are partly due to the unpredictable nature of UAS operations, which are directly related to the UAS flight performance characteristics and UAS pilots’ backgrounds.

“Speed, maneuverability, climb rate, performance characteristics, and avionic system equipment may differ substantially from conventional aircraft and may necessitate changes in standards and procedures governing ATM in the future.”⁴

2.6.5.3 The common strand between all of the groups is that there is a growing need to figure out how UAS will be handled. The difference sits primarily about how this path will be forged and the specific regulations thereof. The development of UAS flight rules could set a harmonized standard for ANSP to manage UAS operations. However, performance characteristics of UAS must be considered during the development of UAS flight rules.

2.6.6 IATA

2.6.6.1 The International Air Transport Association (IATA) has authored a High Level Concept Paper on a Changing Environment for Flight Rules. The document analyses the functional blocks of an ATM system and concludes that

“Gradual introduction in dedicated airspace of an additional or amended set of flight rules with careful monitoring will ensure safety and learning from operations to accommodate adjustments and improvements as needed without disruption to IFR and VFR operations.”

2.6.6.2 From ATCOs’ perspective it has an interesting human-centric approach. Automation is in support of both ATCOs and users, even if the manage by exception concept is foreseen as the concept to be applied due to the expected amount of traffic and all the different capabilities traffic will have.

2.6.7 IFALPA

2.6.7.1 The International Federation of Airline Pilots’ Association (IFALPA) has a 2017 Position Paper which highlights Unmanned Aircraft (UA) as a collision threat to manned civil aviation in general and in particular in lower airspace and near aerodromes. Furthermore, the document states:

“IFALPA considers that it is not acceptable to change rules and regulations for manned aviation in order to accommodate UAS integration.

The regulations for manned aviation have been established over a long period of time based on experience and best practices. These regulations should only change to enhance safety. UAS should be developed to follow these regulations without requiring changes that will burden manned aviation.”

2.6.8 Federal Aviation Administration (FAA)

2.6.8.1 In December 2022, FAA published its initial concept of operations of future Info-Centric National Airspace System (NAS). The concept of operations accommodates increased diversity and number of operations within NAS, including small UAS, high altitude long endurance (HALE) vehicles and spaceplanes etc.

2.6.8.2 Concept of new flight rules to allow aircraft to carry out performance-based operation in a future integrated and cooperative environment was proposed. While some of the new entrants of NAS will be able to operate routinely under current flight rules, other vehicles like UAS operating at low altitude will need modified flight rules to operate. New Tailored Flight Rules (TaFR) has been established to *“ensure safety for new operations when vehicles and operations cannot meet IFR or VFR regulatory requirements”*.⁹

2.6.8.3 TaFR will be one of the key elements to achieve the performance-based outcome by new entrants like UAS, in the NAS environment. TaFR will be developed as part of regulations to *“ensure safety and interoperability with existing flight rules”* through defining *“the behaviours around integrating, accommodating, and segregating diverse operators”*.¹⁰

2.7 IFATCA Considerations

⁹ Initial Concept of Operations for an Info-Centric National Airspace System, A-1

¹⁰ Three elements for performance-based outcome: flight rules, performance based standards and operating practice, described in Initial Concept of Operations for an Info-Centric National Airspace System, 2-2 to 2-5

- 2.7.1 There is no question that whether the UAS operations are segregated from or integrated into conventional ATM, safety should always come first.

ICAO Circular 328 - Unmanned Aircraft Systems (2011)

“The principal objective of the aviation regulatory framework is to achieve and maintain the highest possible uniform level of safety. In the case of UAS, this means ensuring the safety of any other airspace user as well as the safety of persons and property on the ground.”³

- 2.7.2 The initial assumption for integrating crewed and uncrewed operations was to request UAS to adapt to the ATM system. Research, technological development and business-driven use cases have demonstrated that this approach is (generally) mismatching with UAS objectives and capabilities.

“A key question is how to deal with regulatory issues without hindering innovation. Rules are necessary to ensure safety, security and fair-play of all players in the UAS value chain, including the public. However, past experience has shown that a more relaxed and supportive approach to technology development and the work of pioneers could speed up the technology development process.”⁸

- 2.7.3 The analysis conducted by this WP identifies four main elements that are critical for the integration of crewed and uncrewed operations:

- performances and capabilities of the traffic,
- airspace structure and classification,
- services to be provided;
- flight rules.

- 2.7.4 These items are not new, and they constitute part of the skeleton of the current ATM system. Furthermore, they are strictly interrelated, and it is almost impossible to modify a single item without affecting the others. From the operators' or an ATC's perspective, flight rules can be considered the main umbrella policy from which all other items are derived.

- 2.7.5 Considering current flight rules, so far the only usable set for UAS seems to be IFR, even if its applicability is limited by capability and performance requirements only a few UAS can meet (RPAS).

- 2.7.6 This leads to the conclusion that to ensure a safe integration of different types of operations, flight rules need to be adapted in accordance. The adaptation required can be:

- A. to modify existing flight rules, or
- B. to add a new specific set of flight rules, or
- C. to develop new flight rules applicable to all traffic.

- 2.7.7 A: to modify existing flight rules

To adapt current flight rules might be considered the easiest and quickest solution, but it poses some challenges. The main one sits directly on the foundation of IFR and VFR that is, again, meteorological conditions to allow pilots to see and avoid. Visibility and distance from clouds are only marginally affecting UAS operations (especially BVLOS operations) and changing limits cannot help manned aviation in the visual recognition of small UAS operating close to them. To partially mitigate this, right-of-way rules in

favor of crewed aviation can be introduced. Although, this is probably unacceptable considering the expected volume of UAS operations or considering SAR or emergency services provided with UAS. ATS provision is another difficult aspect, especially considering CNS capabilities of small UAS and the hypothetical payload reduction caused by CNS equipment.

2.7.8 B: to add a new specific set of flight rules

This option is for sure supporting accommodation/integration of traffic, but it poses some questions on the provision of the services that are required to ensure the safety of the operations. Furthermore, it may require the continuous development of new flight rules as soon as a new type of traffic/operations is developed.

2.7.9 C: to develop new flight rules applicable to all traffic

This option is probably the most complete and accurate to ensure integration of all types of traffic. For this reason, it is the preferred vision of most researchers and organisations. On the other hand, it requires a huge investment in terms of time and resources, and it will probably be achieved only after intermediate steps, via option A and/or B.

2.7.10 In all cases, all elements reported above shall be considered because the Flight Rules (FR) are a function of the airspace, performances of the traffic and services to be provided.

$$FR := f(\text{performances}, \text{airspace}, \text{services})$$

2.7.11 Considering current levels of technology and research, only a simplified, high level and agnostic approach is possible.

The future is anticipated to be digitalised and automated. As never before, connectivity and information sharing are paramount for the provision of any service. Capabilities and performances will probably be the discriminating factors to classify traffic/operations. Access to the airspace will be linked to the possibility of being subject to certain services and the same service might have different levels based on automation capabilities. The position of the ATCO in the system will probably change and the level of services provided by humans will probably be inverse to the level of automation of the traffic. This might reflect into a shared responsibility for the separation provision between the service provider and the traffic supported by the increased situational awareness introduced by the enhanced information sharing.

2.8 New policy proposal

2.8.1 There is a need for integration of UAS traffic with manned traffic, with the understanding that they follow the same flight rules. In any circumstances, current safety standards of manned aviation shall not be lowered due to UAS operations.

2.8.2 Due to the absence of a pilot on board, a UAS might be unable to comply with existing Flight Rules (VFR for example). As also stated by major stakeholders in the industry e.g. ICAO¹¹ and IATA¹², there is a need to develop a set of global harmonized flight rules applicable to UAS. These Flight Rules might not be automatically applicable in the current classification of airspace as defined in ICAO Annex 11. They might,

¹¹ UTM Guidance Edition 4, ICAO, 2023

¹² High-Level Concept Paper on a Changing Environment for Flight Rules, IATA, 2021

however, apply to newly defined airspace with the aim of enabling mixed operations of UAS and manned aviation.

- 2.8.3 With the Flight Rules developed, aircraft shall receive services to ensure safety of operations and flight rules must take into account the performance characteristics of all traffic.
- 2.8.4 Future UAS operations possibilities should have been taken into consideration when developing the framework of flight rules, e.g. automated UAS operations, Urban Air Mobility etc.
- 2.8.5 IFATCA recommends the development of performance-based flight rules and these proposed policy statements should be added to the TPM:

IFATCA supports the development of performance-based Flight Rules applicable for both crewed and uncrewed traffic.

In the development of performance based flight rules, airspace architecture and services provision shall be taken into consideration.

2.9 IFATCA policies on UAS and UTM¹³.

- 2.9.1 Related to UAS, IFATCA TPM reports the following policy:

AAS 1.10 Operational Use of Unmanned Aircraft (UA)

- **IFATCA is opposed to the operations of any autonomous aircraft in nonsegregated airspace.**
- **All UAS operations shall be in full compliance with ICAO and/or national and/or local regulations.**
- **For the purposes of air traffic control, the same division of responsibilities and liabilities shall apply to manned and unmanned aircraft.**
- **ATCOs shall not be held liable for incidents or accidents resulting from the operations of UAS that are not in compliance with ICAO and/or national and/or local regulations.**
- **Standardized procedures, training and guidance material shall be provided before integrating UAS into the Civil Aviation System.**
- **IFATCA recommends the development of risk-based procedures for UAS operations regardless of whether the operation is authorized or not.**
- **Contingency procedures and controller training shall be provided for the management of infringements**
- **IFATCA urges the development and implementation of technology to prevent infringements into controlled airspace by Unmanned Aircraft. IFATCA encourages education and awareness campaigns on the use of UAS for the general public.**

- 2.9.2 The analysis conducted by this WP and the new policy statements proposed in 2.8.5 require a revision of AAS 1.10. The revision suggests modifications for two sentences (see 2.9.3 and 2.9.4), with all other policy statements remaining unchanged.

- 2.9.3 **IFATCA is opposed to the operations of any autonomous aircraft in nonsegregated airspace.**

¹³Extracted from the IFATCA Technical and Professional Manual, Version 66.0, October 2023

2.9.3.1 Autonomous aircraft refers to automated aircraft operations, without human intervention.

2.9.3.2 With the development of technology, RPAS equipped with DAA systems with integrated ACAS (CA capability) would carry out automated CA manoeuvres during lost C2 link as a contingency procedure. Such action taken by RPAS is considered fully automated and is carried out without human intervention. This action is defined as an autonomous reaction to RA events and is an essential performance required before accommodating or integrating RPAS into non-segregated airspace. IFATCA TPM AAS 1.22 has stated that “The RPA shall always be able to perform CA without any external inputs” (WP163 – Montego Bay 2023). This contradicts this policy statement.

2.9.3.3 It is anticipated that UAS, including RPAS, is required to meet certain performance-based specifications in order to operate in accommodated or integrated airspace in the future.

2.9.3.4 An approach to adopt “Performance-based requirements” for UAS to operate in non-segregated airspace is proposed as a new item of AAS 1.10, to address the concern related to autonomous aircraft operations. See 4.1 below.

2.9.3.5 Considering all the above, it is suggested to delete the first item of AAS 1.10. The development of autonomous aircraft operations in non-segregated airspace will be monitored continuously by IFATCA RPAS TF.

2.9.4 Standardized procedures, training and guidance material shall be provided before integrating UAS into the Civil Aviation System.

2.9.4.1 Knowing the rules and regulations related to UAS operations to handle UAS traffic becomes essential for ATCO's daily operations.

2.9.4.2 Integration of UAS into the ATM/Civil Aviation System is considered the ultimate goal in adopting the phased approach of handling UAS operations. Before integration, UAS will operate in a segregated and/or accommodated phase. There will be chances for UAS traffic coming close to the boundary of or passing through airspace where manned traffic is receiving ATS.

2.9.4.3 A new formulation of the policy is proposed.

Standardized procedures, training and guidance material on handling UAS operations shall be provided.

2.9.5 An analysis has been conducted also on the IFATCA UTM policy.

AAS 1.21 Unmanned Aircraft Systems (UAS) Traffic Management (UTM)

- **The roles of ATM and UTM related to traffic management shall be clearly identified.**
- **The UTM-ATM boundary shall allow an unambiguous identification of responsibilities and functions of the two systems.**
- **The interface between the ATM and UTM shall guarantee the exchange of the necessary information for the safe management of the traffic.**
- **Comprehensive regulatory framework and procedures for the ATM-UTM interaction shall be established before implementation.**

2.9.5.1 No changes are proposed.

3 CONCLUSIONS

- 3.1 The absence of the pilot onboard the RPA is limiting the possibilities for UAS to operate using VFR and IFR. Regulations for a specific set of UAS (RPAS) to fly IFR are under development. VFR operations, so far, are not suitable for UAS.
- 3.2 This WP has analysed several approaches and positions of different Researchers and Institutions. All agree on the inability of UAS to comply with current flight rules in a technical and cost-effective manner and they suggested the development of new flight rules for UAS possibly applicable to crewed aviation.
- 3.3 The integration of different types of operations and traffic starts from a common set of rules. To achieve integration, it is IFATCA's opinion that a set of flight rules for both crewed and uncrewed aviation shall be developed.
- 3.4 Flight rules should/shall be performance-based and parameters such as performances and capabilities of the traffic, airspace structure and classification, and services to be provided shall have to be considered.
- 3.5 IFATCA Professional and Legal Committee should consider investigating aspects related to responsibilities and training for ATCO in case of new performance-based flight rules.

4 RECOMMENDATION

4.1 It is recommended that current IFATCA policy:

AAS 1.10 Operational Use of Unmanned Aircraft (UA)

- IFATCA is opposed to the operation of any autonomous aircraft in nonsegregated airspace.
- All UAS operations shall be in full compliance with ICAO and/or national and/or local regulations.
- For the purposes of air traffic control, the same division of responsibilities and liabilities shall apply to manned and unmanned aircraft.
- ATCOs shall not be held liable for incidents or accidents resulting from the operations of UAS that are not in compliance with ICAO and/or national and/or local regulations.
- Standardized procedures, training and guidance material shall be provided before integrating UAS into the Civil Aviation System.
- IFATCA recommends the development of risk-based procedures for UAS operations, regardless of whether the operation is authorized or not.
- Contingency procedures and controller training shall be provided for the management of infringements
- IFATCA urges the development and implementation of technology to prevent infringements into controlled airspace by Unmanned Aircraft.
- IFATCA encourages education and awareness campaigns on the use of UAS for the general public.

is amended to:

AAS 1.10 Operational Use of Unmanned Aircraft (UA)

- ~~IFATCA is opposed to the operations of any autonomous aircraft in nonsegregated airspace.~~
- All UAS operations shall be in full compliance with ICAO and/or national and/or local regulations.
- For the purposes of air traffic control, the same division of responsibilities and liabilities shall apply to manned and unmanned aircraft.
- ATCOs shall not be held liable for incidents or accidents resulting from the operations of UAS that are not in compliance with ICAO and/or national and/or local regulations.
- Standardized procedures, training and guidance material on handling UAS operations shall be provided, before integrating UAS into the Civil Aviation System.
- IFATCA recommends the development of risk-based procedures for UAS operations regardless of whether the operation is authorized or not.
- IFATCA supports the development of performance-based Flight Rules applicable for both crewed and uncrewed traffic.
- In the development of performance-based Flight Rules, airspace architecture and services provision shall be taken into consideration.
- Contingency procedures and controller training shall be provided for the management of infringements
- IFATCA urges the development and implementation of technology to prevent infringements into controlled airspace by Unmanned Aircraft. IFATCA encourages education and awareness campaigns on the use of UAS for the general public.

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