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The Regulatory Framework for RPAs
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An Air Navigation Services Perspective

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Introduction

› " The current market for commercial RPAS services is practically inexistent due to difficulties for RPAS to obtain flight permissions and their restriction to segregated airspace. In the long-term, once safe but proportionate and reasonable rules are in place, the commercial and public RPAS markets will have huge growth potential as forecasted by several studies."

- Notice of Proposed Amendment (NPA) 2012-10, draft Opinion of the European Aviation Safety Agency for a Commission Regulation amending Commission Regulation (EC) No …/… laying down the common rules of the air and operational provisions regarding services and procedures in air navigation and amending Regulations (EC) No 1035/2011, (EC) No 1265/2007, (EC) No 1794/2006, (EC) No 730/2006, (EC) No 1033/2006 and (EU) No 255/2010 'Transposition of Amendment 43 to Annex 2 to the Chicago Convention on remotely piloted aircraft systems (RPASs) into common rules of the air', p 14

Regulatory effort

- Extensive regulatory effort undertaken to support the integration of RPAs in non-segregated airspace.
- ICAO
  - Circular 328 (2011) on UAS and amendments to Annexes 2 (Rules of the Air), 7 (Aircraft Nationality and Registration Marks) and 13 (Aircraft Accident and Incident Investigation) to the Chicago
  - RPAS Guidance Material expected 2014
  - Global Air Navigation Plan > ASBUs
- EASA
  - Notice of Proposed Amendment (NPA) 2012-10

Regulatory effort

- Current focus set on:
  - RPAs
    - “An unmanned aircraft which is piloted from a remote pilot station." ICAO Annex 2, Amendment 43
  - Airworthiness, RPAS and operator approval, RPAS components and remote pilot licenses and maintenance
- "The integration of remotely piloted aircraft into the future air navigation system is one of the key challenges for aviation regulatory authorities and future air traffic control systems.“
  - John PLUQUET, Remote Control, Aerospace International, April 2013, p. 14
- The ongoing regulatory effort will need to extend to Air Navigation Services

General Regulatory Policy Issues

- The regulatory framework serves a double fundamental purpose:
  - Protection of the general public from a variety of risks, in particular safety hazards, associated with air transportation.
  - Essential tool to support the development of international aviation.
- Both objectives are not always easy to reconcile. An excessively heavy regulatory intervention is likely to unnecessarily slow down or hamper the evolution of the aeronautical industry, whereas too distant a regulator runs a risk of failing its protective mission.

The double challenge of RPAs integration for ANS

- Institutional Challenge:
  - The role of ANS in support to the safeguarding of airspace sovereignty
- Operational Challenge:
  - The integration of RPAs in the technical and operational framework for Air Traffic Services

The ANS contribution to airspace sovereignty

- The primary mission of ANS is safety related, but they also play a key role in supporting airspace sovereignty
  - "*a State's right to regulate in a constraining manner the use of the airspace over its territory and to have such regulation enforced*." (Swiss federal Ordinance on the safeguard of airspace sovereignty in times of non-restricted air navigation, art. 3.1)
  - "*Every State, in the exercise of its sovereignty, is entitled to require the landing at some designated airport of a civil aircraft flying above its territory without authority…. it may also give such aircraft any other instructions to put an end to such violations*". (Art. 3, Chicago Convention)

The ANS contribution to airspace sovereignty

- Airspace sovereignty relates to the States' ability to retain full awareness of air navigation operations within their sovereign airspace and the capability to intervene at any location and moment within that airspace in case of infringement
- ANS act as interface between aircraft in non-segregated airspace and:
  - Competent State authorities
  - Intercepting aircraft
- RPAs raise multiple layers of cross-border operation issues

The ANS contribution to airspace sovereignty

› Requirements in respect of RPAs:

- For Air Navigation Services:
  - Notification of the presence of RPAs in non-segregated airspace
  - Ability to maintain communication with RPAs
- For RPAs
  - Ability to respond to ANS instructions
  - Ability to integrate and respond to standard (visual or other) signals

The Authorisation Regime

- Art. 8 Chicago Convention
- Annex 2 Chicago Convention – Appendix 4 (AMD 43)
  - 1.1 A remotely piloted aircraft system (RPAS) engaged in international air navigation shall not be operated without appropriate authorization from the State from which the take-off of the remotely piloted aircraft (RPA) is made.
  - 1.2 An RPA shall not be operated across the territory of another State, without special authorization issued by each State in which the flight is to operate. This authorization may be in the form of agreements between the States involved.
  - 1.3 An RPA shall not be operated over the high seas without prior coordination with the appropriate ATS authority."
  - 1.4 The authorization and coordination referred to in 1.2 and 1.3 shall be obtained prior to take-off if there is reasonable expectation, when planning the operation, that the aircraft may enter the airspace concerned.

The Authorisation Regime

- “An authorisation is required even in the case of flights planned in the airspace of a single State."
- “If the flight is planned to cross borders between EU Member States, each Member State shall issue its authorisation."
- "Unlimited duration of the authorisation is not proposed since it is not deemed appropriate until common rules on the certification of the RPAS operator are not promulgated.“
    - EASA (NPA) 2012-10

Regulatory policy – Operational Aspects

- RPAs are to be treated like “ordinary” aircraft
- "Insertion of RPAS into the total civil aviation system can only happen after the definition of rules for airworthiness, personnel and operations have been done and the compliance with these has been demonstrated. It must also be achieved in a transparent and cooperative way with other airspace users. RPAS must not have a negative impact to overall aviation safety objectives, must not require changes to ATM procedures and must not have an impact on the air traffic control capacity of the Air Navigation Service Providers."
  - European Commission , Commission Staff Working Document, "Towards a European strategy for the development of civil applications of Remotely Piloted Aircraft Systems (RPAs), Brussels, 4.9.2012, SWD(2012) 259 final

RPAs to be treated like “ordinary” aircraft

› “*Whether the aircraft is piloted from on board or remotely, the provision of ATS should, to the greatest practicable extent, be one and the same. The introduction of RPA must not increase the risk to other aircraft or third parties and should not prevent or restrict access to airspace. ATM procedures for handling RPA should mirror those for manned aircraft whenever possible…*"

- ICAO Circ. 328, § 5.10

RPAs to be treated like “ordinary” aircraft

› Consequences

- RPAs differ from unmanned free balloons (treated as “obstacles” from an ANS perspective)
- Integration of RPAs in the ANS framework is more a matter of technical ability than one of producing new ATM procedures
- Presence of pilot on board or not should be (largely) irrelevant from an ANS perspective
- Impact on the division of responsibilities between (remote-)pilot and air traffic controller should remain minimal

ATM Procedures

- "There should be no difference in landline communications or transponder data procedures, nor should the controller apply different rules or different criteria. Therefore, the air traffic controller should adopt the same procedures when using telephony or landlines for both manned aircraft and UAVs".
  - Anna Masutti, "Proposals for the Regulation of Unmanned Air Vehicle Use in Common Airspace, Air & Space Law, vol. 34, Issue 1, February 2009, Kluwer, p 7
- "When operating in controlled flight, typically under instrument flight rules (IFR), the pilot-in-command has to maintain radio contact with the responsible Air Traffic Control (ATC) unit. The same has to apply when a UAV operates under the same conditions, except that this interface must be reliably established between the pilot on the ground and ATC. This can be achieved by radio or ground-based voice and data communication.“
  - Stefan A. Kaiser "UAV's: Their Integration into Non-segregated Airspace", Air & Space Law, vol. 36, Issue 2, April 2011, Kluwer, p. 164

Technical ability

- RPAs must be able to interface with the ATS system like any ordinary aircraft
- Level of service ensured, operational responsibilities and equipment carriage required (e.g. transponder, radio, datalink, etc.) will depend on:
  - Airspace class
  - Type of flight rules

Technical ability

- RPAs, must have capability to:
  - Respond to ATC clearances and instructions;
  - Avoid collision with other aircraft in accordance with the rules applicable;
  - Integrate and respond in an appropriate manner to information provided by Flight Information Service
- Information to be integrated extends beyond other aircraft and include:
  - Terrain, clouds, weather phenomena, volcanic ash clouds, parachutes, obstacles, birds, etc.

Technical ability

- "Much of this ability will be subject to technology — the ability of the aircraft to be controlled by the remote pilot, to act as a communications relay between remote pilot and air traffic control (ATC), .."
- The ability to be developed is essentially related to the need for UAS to comply "*… with directions and instructions provided by the air traffic services (ATS) unit…*" regardless of whether the pilot sits on board the aircraft or not. It will be the responsibility of UAS designers and manufacturers to take all practical measures to ensure that UAS can effectively operate as any other aircraft.
    - ICAO Circ. 328 § 3.6

Detect and avoid ability

- "8.5 Detect and avoid
- Airworthiness certification is considered to address the intrinsic safety of the UAS. ‘Detect and avoid’ falls outside this area as its sole purpose is for anticollision. The operating criteria on which it relies to adequately perform its function is dependent on the airspace being used and the aircraft flying into it (e.g. cooperative targets and noncooperative targets). Such criteria should be defined by the authorities responsible for the safety regulation of air navigation services. Once the operating criteria have been established, the design, production, installation and operation of the equipment to ensure it functions correctly would be subject to design approval, similar to other installed avionic systems and equipment."
    - EASA Policy Statement Doc # **E.Y01301,** Airworthiness certification of Unmanned Aircraft Systems (UAS), 25/08/2009

Target Level of Reliability

- " 4.1 Airworthiness objective
- With no persons onboard the aircraft, the airworthiness objective is primarily targeted at the protection of people and property on the ground. A civil UAS must not increase the risk to people or property on the ground compared with manned aircraft of equivalent category.
- Airworthiness standards should be set to be no less demanding than those currently applied to comparable manned aircraft nor should they penalise UAS by requiring compliance with higher standards simply because technology permits."
  - EASA Policy Statement Doc # **E.Y01301,** Airworthiness certification of Unmanned Aircraft Systems (UAS), 25/08/2009

Target Level of Reliability

- "The information exchange between ATC and the remote pilot will likely require the same levels of reliability, continuity and integrity, referred to as QOS, that are required to support operations with manned aircraft in the airspace in which a UA is intended to operate.
- The exchange of control information between the aircraft and its remote pilot station will require an extremely high level of availability, reliability, continuity and integrity."
  - ICAO Circ. 328
- Social acceptability may however require higher standards of reliability

Limits to the assimilation of RPAs to ordinary aircraft

- "ATM provisions may need to be amended to accommodate RPA, taking into account unique operational characteristics of the many aircraft types and sizes as well as their automation and non-traditional IFR/VFR capabilities; ….". It further concedes that "There will be some instances where the remote pilot cannot respond in the same manner as could an on-board pilot (e.g. to follow the blue C172, report flight conditions, meteorological reports). ATM procedures will need to take account of these differences." ICAO Circ 328, § 5.9
- RPAs status is not fully irrelevant from an ANS perspective and must be known from ATC.
- Need for contingency measures
  - emergency recovery capability in case of failure of the command and control link (C2)

Division of responsibilities

- 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.
    - ICAO Annex 2, § 2.3.1 Responsibility of pilot-in-command
- "In accordance with Article 12 and Annex 2, the pilot-in-command is responsible for the operation of the aircraft in compliance with the rules of the air. This also extends to having final authority as to disposition of the aircraft while in command. This is true whether the pilot is on board the aircraft or located remotely."
    - ICAO Circ. 328, p. 15
- Motivation:
    - The aviation risk
    - The particular position of the pilot-in-command (situational awareness)

Division of responsibilities

- " A fundamental principle of the rules of the air is that a pilot can see other aircraft and thereby avoid collisions, maintain sufficient distance from other aircraft so as not to create a collision hazard, and follow the right-of way rules to keep out of the way of other aircraft. Integration of RPA may not require a change to the Standards, however, as RPAS technology advances, alternate means of identifying collision hazards will have to be developed with appropriate SARPs adopted."
- " The pilot-in-command of a manned aircraft is responsible for detecting and avoiding potential collisions and other hazards. The same requirement will exist for the remote pilot of an RPA. Technology to provide the remote pilot with sufficient knowledge of the aircraft's environment to fulfil the responsibility must be incorporated into the aircraft with counterpart components located at the remote pilot station."
- "Under no circumstances will the pilot responsibility be replaced by technologies in the foreseeable future."
    - ICAO Circ. 328

Liability Aspects

- Liability aspects primarily related to the automation of flight functions
- Shift from human fault based liability to product liability
- Focus on the RPA operator / manufacturer
- “[T]third party liability for damage caused by RPAS should be developed on the basis of the principles for manned aviation. Automation creates an additional level of complexity to the question of responsibility and liability. However, legal experts concluded that strict liability will fall on the operator of the RPAS… The responsibility for accidents, liability claims and the obligation to take insurance for a RPAS falls generally on the operator of the system.
    - European Commission , Commission Staff Working Document, "Towards a European strategy for the development of civil applications of Remotely Piloted Aircraft Systems (RPAs), Brussels, 4.9.2012, SWD(2012) 259 final

Liability aspects

- Legal liabilities closely related to operational responsibilities
- Prevalence of the of the principle of the final authority of the pilot-in command, … but:
  - No clear cut between respective responsibilities of (remote-) pilots and air traffic controllers which are deeply intertwined;
  - Allocation of liabilities always determined on a case by case basis, depending on the specific circumstances of the event

Liability aspects

- Lack of visual ability will not relieve (remote-) pilots from all liability as this handicap will need to be substituted by an alternative ability:
  - “Flight crew members have a continuing duty to be aware of dangers which they can perceive with their own eyes. Pilots cannot fail to use their own eyes and ears to be aware of danger. Pilots are charged with a duty to see that which is plainly visible." (*PanAm* v. *Port Authority*, 787 F.Supp. 312 (E.D.N.Y. 1992 at 318.
  - "the pilot, after his clearance has been given remains primarily responsible for the movement of his aircraft" and is "required to follow his clearance, not blindly, but correlative with his duty to exercise care for his own safety." (*Hartz* v. *United States*, 249 F.Supp. 119 (N.D. Ga. 1965) at 125).
  - "The pilot has a continuing duty to be aware of dangers which are discernible with his own eyes and instruments.“ (*First of America Bank-Central* v. *U.S.*, 639 F. Supp. 446 (W.D. Mich. 1986) at 454)

Conclusion

- Regulatory intervention
  - must focus on those areas where legal uncertainties exist and on those aspects that cannot be left to the discretion of the aviation industry stakeholders.
  - should be performance oriented, in the sense that it must serve the purpose of maintaining and enhancing the safety, operational efficiency, economic effectiveness and environmental efficiency of air transportation.
- The challenge for the regulatory authorities is to allow the regulatory framework to evolve in such a manner that it supports the development of international air transportation, without jeopardising the public interests that that framework is intended to protect and without leading to excessive complexity.

Conclusions

- Regarding specifically the regulatory integration of RPAs into the ANS framework:
  - The operation of RPAs in non-segregated airspace raises a double institutional and operational challenge
  - Amendment 43 to ICAO Annex 2 addresses the need for a prior authorisation and should satisfy the needs of ANSPs in their role to support States' airspace sovereignty protection
  - Integration of RPAs in the ANS framework is more a matter of technical ability than one of producing new ATM procedures
  - Presence of pilot on board or not should be (largely) irrelevant from an ANS perspective
  - Impact on the division of responsibilities/liabilities between (remote-)pilot and air traffic controller should remain minimal