DRONES: THE EMERGING ERA OF UNMANNED CIVIL AVIATION

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The phenomenon of unmanned and remotely controlled (wireless) devices and crafts has been present for some time already in all modes of transport: air, land, space, underwater. An important distinctive feature of aircraft as opposed to land vehicles lies however in the third dimension of their evolution, which complicates the pertinent regulatory framework. In the present regime a drone falls within the definition of a power-driven aircraft (Annex 7 to the Chicago Convention), whether it is an aeroplane (fixed wing), an airship (lighter than air) or a helicopter (rotary wing). Annex 2 to the Chicago Convention recognizes the category of remotely piloted aircraft, but Art 8 of the Chicago Convention subjects the operation of such devices to national authorization. The consequence at present is a regulatory environment that differs between the respective countries: from permissive (regulatory vacuum) to restrictive (total ban). Legislators/regulators are hard at work developing new rules to make up a legal framework that will accommodate this new economic activity and integrate it into the existing aviation regime (USA, Italy, etc.). Given the international nature of aviation and in order to accommodate the international use of drones, an internationally coordinated approach is required to develop a harmonized regime. ICAO has already published a Manual on Remotely Piloted Aircraft Systems (RPAS) to provide guidance on drone matters in the legislative/regulatory process. ICAO and the EU have started to develop regulations. There seems to be a general consensus that unmanned aircraft must be allowed to operate without segregation from other air space users. The commercial use of drones has an impact on safety that must be solved. The security risk is to be mitigated. The potential invasion of privacy is a serious concern, as well as the tort of trespassing in case of non-authorised

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low level over-flight of private property. The awareness of the regulatory and operational restrictions amongst users will require the organisation of a public information campaign.

Key words: Drones, Chicago Convention, ICAO, Drone Commercial Use, Drone Regulation

1. INTRODUCTION

Technological progress (robotics, VTOL[1] capability of the craft, GPS navigation support, digitisation[2], etc.), mass production and a dramatic drop of retail prices have recently created opportunities for civilian (as opposed to military) use of unmanned aircraft. The potential of innovative drone services is unprecedented, for civilian public authority applications (e.g. border security (customs and migration), firefighting, disaster relief, SAR operations, ground traffic surveillance, pollution control, monitoring wildlife, etc.), but especially for civilian commercial exploitation (aerial photography, aerial mapping, remote sensing, camera platform for motion picture shooting, journalism, live event filming, scouting (e.g. vessel route through the polar ice), survey (e.g. pipeline and power line inspection), surveillance, herding livestock, wireless communication relay station, transportation (e.g. delivery of emergency aid, such as medication in remote/inaccessible areas), etc.).

Drones can perform duties too perilous for manned aircraft, such as sampling in radiation contaminated areas. They announce a new segment and a new era in commercial aviation. Unmanned automotive traffic/transportation is expected to replace its manned predecessor in the near future. Configuration of drones for the carriage of passengers and cargo (e.g. parcel courier services for mail-order and online shopping home deliveries) is just a matter of time and size. The challenge is to reconcile the exploitation of this new economic potential with safety and security concerns through an enabling regulatory framework.

1.1. A new phenomenon?

The phenomenon of unmanned and remotely controlled (wireless) devices, vehicles and craft has existed for some time already in all motion/traffic/

1 Vertical Take Off and Landing.

2 Miniaturization of electronic components for control and video transmission.

transport modes: surface (airport trains, remote control robots for mine clearance/demining and explosive device defusing, robot vacuum cleaners and lawn mowers), air (rockets, missiles, reconnaissance and assault craft), space (spacecraft), underwater (torpedoes, submarines for oceanographic exploration and offshore operations in depths beyond human diver accessibility). The first (military) drones were deployed in the First World War. Road traffic/transport research projects on driverless (autonomous) cars are ongoing.[3] Only the massive introduction of unmanned remotely controlled vehicles into normal public traffic will require suitable regulation.

1.2. A specific issue?

1.2.1. Compared to the past

This paper will examine if and to what extent unmanned (aerial) vehicles raise specific questions and issues and create new problems. Some aspects of unmanned vehicles may not be unknown, but pursuant to the propagation of the devices, their intensity and appearance have increased to a level that requires specific regulation. Remote controlled aerial devices used to be either toys for recreational purposes (model aircraft) without practical utility and with a limited operational range and endurance, or else very sophisticated and expensive tools for scientific and military usage (reconnaissance and intelligence gathering and combat).

1.2.2. Compared to other modes

The issues caused by unmanned systems in the respective modes are in many respects similar, but an important distinctive feature of aircraft as opposed to surface-craft lies however in the third dimension of their evolution, which complicates their safe deployment.

2. TERMINOLOGY AND CATEGORIES

2.1. Terminology

The many terms and acronyms in use require some clarification. In general terms unmanned ("crewless") means of transport are referred to as "Un-

[3] E.g. Google's *Driverless Car* and Volvo's *Driverless Road Train*.

manned Vehicles" (UV) ("drones"). Two categories of unmanned vehicles can be distinguished: (i) "Remotely Operated Vehicles" (ROV) or "Remote(ly) Control(led) Vehicle" (RCV) and (ii) "Autonomous Vehicles" (AV) ("robots") (cf. infra no. 2.2.1.). According to the traffic/transport mode, unmanned vehicles include (i) "Unmanned Aerial Vehicles" (UAV) ("pilotless"), (ii) "Unmanned Ground Vehicles" (UGV) ("driverless") and (iii) "Unmanned Marine Vehicles" (UMV). The last category is subdivided into (i) "Unmanned (Water) Surface Vehicles" (USV) and (ii) "Unmanned Underwater Vehicles" (UUV), sometimes called "underwater drones". In the air mode the terminology used for a "drone" is the following: "Unmanned Aircraft" (UA), "Unmanned Aerial Vehicles" (UAV), "Unmanned Aircraft Systems" (UAS), "Pilotless Aircraft", "Pilotless Aerial Vehicles" (PAV), and "Remotely Operated Aircraft" (ROA), "Remotely Piloted Aircraft" (RPA), "Remotely Piloted Aircraft Systems" (RPAS). The addition of the word "system" intends to reflect the ancillary remote equipment component required to operate the vehicle as opposed to the aircraft component. The offensive military (weaponized) type is referred to as "Unmanned Combat Aerial Vehicle" (UCAV).

Whereas in everyday language the pilot steering the unmanned aircraft from a remote location could also be called the "controller" or the "operator", the latter terms have obtained a formally recognized and therefore officially reserved meaning under the Chicago Convention regime: the manipulator of the (unmanned) aircraft's flight controls is the "pilot", the "controller" is the air traffic manager and the "operator" is the entity engaged in aircraft exploitation.

2.2. Categories

For the purpose of their legal status and applicable regulatory regime, unmanned aircraft can be categorised according to different criteria.

2.2.1. Remotely operated versus autonomous

Various modalities of operating an unmanned vehicle can be distinguished. The qualification criterion for an unmanned vehicle is obviously the absence of a human occupant, who operates the vehicle: the lack of an on-board pilot. Two categories of unmanned ("driverless", "pilotless") vehicles can be distinguished: (i) Remotely Operated Vehicles (ROV) or Remotely Controlled Vehicles (RCV) and (ii) Autonomous Vehicles (AV).

The first category is operated in real time by humans, not on board, but external to the craft, from a distance at a remote location, on the basis of interpretation of data collected via an on-board camera, radar, satellite or other means. The remote station can be a ground station, but also an airborne or seaborne station.

The second category is a robot, self-guided, self-navigating, self-driving, self-steering/self-managing/self-controlling/self-governing, on the basis of preprogrammed instructions or artificial intelligence, processing data collected from on-board sensors and from other sources (e.g. radar or satellite tracking). They take decisions about navigation independently, without real-time human command, intervention or input, and are therefore called "autonomous". An autonomous craft is fully automated, steered by a machine without the possibility of real-time human intervention in the management of the flight[4] because it is pre-programmed.[5]

Means of transport may be subject to a varying degree of automation and, consequently, autonomy: ranging from full manual control over assisted control and semi-automation, to full automation.

In many cases there is "task-level autonomy" (e.g. an automatic gearbox or an automatic emergency braking system): automation of a particular function within programmed limits: the machine executes only certain well-defined component parts of a process, by way of assistance. Semi-autonomous craft perform tasks within the parameters of the routine manoeuvres and the confines of the instructions given, but they are supervised/monitored by humans and can, if necessary, be corrected or overridden (e.g. cruise control, auto pilot).

If a person on board (or in a remote location for that matter) keeps final control of the vehicle for critical decisions, because (s)he is capable to return to manual control by disengaging and/or overriding the automated control system (auto-pilot), there is "supervised autonomy" or "controlled autonomy" or "semi-autonomy".

An autonomous vehicle may or may not carry persons (passengers) on board, but the persons on board of an autonomous vehicle are not in a position to intervene and take over control by disengaging and/or overriding the auto-

[4] ICAO Cir 328/AN/190 on Unmanned Aircraft Systems (UAS), p. 7; available at: http://www.icao.int/Meetings/UAS/Documents/Circular%20328_en.pdf.

[5] Cf. e.g. "fire and forget" missile, a type of missile which does not require further guidance after launch, or a ballistic missile.

mated system. An aircraft being pre-programmed to fly an entire trajectory from take-off till landing on its own in complete autonomy and unsupervised independence (airborne robot) is technically conceivable.

2.2.2. Mission

2.2.2.1. Military versus civilian

The distinction between military and civilian drones is relevant, i.a. because of their differential legal status (cf. infra no. 3.2).

2.2.2.2. Recreational versus commercial

The commercial mission of an unmanned aircraft may consist of various types of sensing, recording, monitoring, surveying (presently) and transportation of cargo and passengers (in the future). Traditionally recreational "model aircraft" were deemed to be excluded from the scope of the regime of the Chicago Convention.[6] The predominant safety concern about the integration of unmanned aircraft in a non-segregated and thus shared airspace relates to their susceptibility to encounter traditional air traffic.

The recreational, as opposed to commercial, purpose is not a satisfactory criterion in this respect, as unmanned aircraft used for recreational purposes may have the same technical characteristics as aircraft used for commercial purposes.

This exclusion of "model aircraft" requires a precise definition in terms of e.g. size and/or weight (MTOM[7]) and speed (mass and velocity being the component factors of kinetic energy impact), operational range (altitude, line of sight, endurance, etc.) of the unmanned aircraft (cf. infra no. 2.2.3.). High Altitude Long Endurance (HALE) [8] types (spy drones) are used for intelligence, surveillance and reconnaissance (ISR), typically military applications and for that reason fall outside the civilian legislative/regulatory jurisdiction (cf. infra no. 3.2.).

6 Convention on International Civil Aviation, Chicago, 7 December 1944, hereinafter: the "Chicago Convention", the constitution for international civil aviation operations, supplemented by its SARPs (Standards and Recommended Practices) in Annexes pursuant to its Art. 37.

7 Maximum Take-Off Mass.

8 S. Kaiser, *Legal Aspects of Unmanned Aerial Vehicles*, Zeitschrift für Luft- und Weltraumrecht, vol. 55, 2006, pp. 344 – 346.

2.2.3. Size and speed

From a safety point of view, the kinetic energy (weight and speed) generated by an aircraft may be an important factor of potential damage caused to third parties on the surface, but not for mid-air collisions, where even lightweight devices may also have a catastrophic impact.[9]

2.2.4. Area of operation

The location and altitude of operations are also relevant criteria for categorisation. E.g. the indoor use of model aircraft will generally not be subject to any (aviation) regulation, certification and authorisation.

2.2.5. Payload and equipment

The drones' payload may be: cargo (parcels and heavier[10] items), passengers[11], equipment for particular applications or missions (cameras, microphones, sensors, etc.). The status of crew members (e.g. stewards) on board of a pilotless passenger aircraft may raise some more legal questions: e.g. designation of a crew member competent to maintain order on board in the absence of an on-board pilot-in-command.

2.2.6. Expendable versus recoverable

Especially for military drones the distinction between expendable (one-time use) and recoverable devices is relevant. In the modern era, drones are normally recycled, especially civilian pilotless aircraft will normally be recoverable. Spacecraft are in some cases expendable.

2.2.7. Wireless or tethered

In terms of modality of control, the following categories can be distinguished. Remotely Controlled Vehicles are connected in real time to a human operator, either via a wireless radio system (tele-operated craft) or through a

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[9] S. Kaiser, *UAV's: Their Integration into Non-segregated Airspace*, Air and Space Law, vol. 36, no. 2, 2011, p. 171.

[10] In the future.

[11] In the future: ICAO Manual on Remotely Piloted Aircraft Systems (RPAS) (Doc 10019) 1st edition 2015, no. 2.3.5.

cable (wire), for submarines called the "*umbilical cord*" or "*tether*". In aviation, the former modality will probably be predominant.

2.2.8. Range: in or beyond line of sight

The real-time guided unmanned device may be either in Visual Line of Sight (VLOS) or "Beyond Visual Range" (BVR), hence in Radio Line of Sight (RLOS) or even Beyond Radio Line of Sight (BRLOS), maintaining indirect radio contact via a relay station (e.g. a satellite). Paradoxically Visual Line of Sight operations requiring visual meteorological conditions (VMC) are more challenging from a safety (collision avoidance) point of view, when they operate outside controlled airspace and for that reason do not benefit from the ATC[12] separation.[13]

2.2.9. Manoeuvrability

The classification of aerial vehicles is also based on their controllability/manoeuvrability characteristics. Under the Chicago Convention the right of way in the rules of the air takes into account the manoeuvrability (the restrictions in their ability to manoeuvre) of the aircraft (see Art. 3.2.2.3 Annex[14] 2 to the Chicago Convention). In the case of kites and weather balloons (either or not linked to the ground by a cable), in principle only the height of their evolution can be controlled. Self-propelled (i.e. powered so as to generate lift) vehicles are generally more susceptible for control and trajectory adjustment than devices that are catapulted in the air. However not all catapulted devices follow a gravitational (e.g. ballistic, or parabolic/elliptical) trajectory after launch. Some may also be controllable after launch (e.g. glider planes).

2.2.10. The pilot

The number of humans in control of the craft may differ. An aircraft may be controlled by more than one pilot (captain-commander and co-pilot-first officer). Vice versa (in this respect a remote-controlled aircraft differs from an on-board controlled aircraft), a remote pilot may control multiple unmanned craft simultaneously. Sequential remote control is also conceivable: a handover

[12] Air Traffic Control.

[13] No. 3.16 ICAO Cir 328-AN/190 on Unmanned Aircraft Systems (UAS).

[14] Containing the SARPs (Standards and Recommended Practices).

from a remote pilot in one location to a remote pilot in another location (even another country) in the course of the same flight.

3. PRESENT LEGAL/REGULATORY REGIME

Unmanned aircraft are aircraft and therefore the existing regulatory regime applies to a great extent.[15] The issues in themselves caused by drones are generally not new or different from traditional aviation, but because the operation of unmanned aircraft is more complex, they present a degree of intensity and acuteness that warrants a special approach and regulation. As mentioned earlier, it must be examined to what extent the present legal regime accommodates the use of pilotless aircraft. Military aviation is in principle not governed by the regime of the Chicago Convention (Art. 3 (a)). Therefore the regime of military pilotless aviation is to be distinguished from its civilian homologue.

3.1. Civilian aircraft

Art. 8 of the Chicago Convention recognizes the category of remotely piloted aircraft, but requires a special national authorization (possibly also in the form of a standing agreement between the countries[16]) from the competent authorities of the airspace traversed for the operation of a pilotless aircraft. The overflown country can set its terms and conditions for such authorization. The consequence at present is a far from harmonized, actually a fragmented regulatory environment, differing according to the country and ranging from permissive (regulatory vacuum) to restrictive (total ban).

Besides the implied qualification of pilotless aircraft as aircraft in Art. 8 of the Chicago Convention, a drone comes within the definition of the pertinent categories of "aircraft"[17] as classified by Annex 7 (on aircraft nationality and registration)[18] to the Chicago Convention, whether heavier than air or lighter than air (airship), power-driven or not (balloon), fixed-wing (aeroplane) or rotary-wing (helicopter), etc. Its unmanned nature does not exclude the drone from this qualification.

Art. 2.18 of Annex 11 to the Chicago Convention prescribes a timely (for the purpose of dissemination of information in accordance with Annex 15 on

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15 No. 1.7 ICAO Cir 328-AN/190 on Unmanned Aircraft Systems (UAS).

16 Art. 1.2. Chicago Convention Annex 2.

17 No. 1.7 ICAO Cir 328-AN/190 on Unmanned Aircraft Systems (UAS).

18 Table 1 in Annex 7.

information services) coordination of activities that are potentially hazardous to civil aircraft.

E.U. Regulation EC 996/2010 on accident investigation bases its scope of application on the registration of aircraft (Art. 3b). If drone accidents are to be covered by the Regulation, the drones must be subjected to registration. Of course, accidents (and incidents) in which other registered aircraft are involved are encompassed by the Regulation.

For lack of any express differentiation, the Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface, Rome 7 October 1952, encompasses pilotless aircraft, but it only applies to the compensation of damage caused on the ground and e.g. not to the damage caused to other aircraft by collision (cf. its title and Art. 1) and institutes a no-fault liability and compulsory insurance cover.

3.2. Military aircraft

Although the Chicago Convention (Art. 3) declares itself inapplicable to state (including military) aviation, it does contain the following provisions that (indirectly) regulate military aviation.[19] As military aircraft do not enjoy the right of innocent passage, foreign military aircraft require a special authorisation (that will spell out the conditions to comply with) from a host country to enter its air space (Art. 3(c) Chicago Convention). When regulating the operation of military aircraft, the countries must have due regard for the safety of navigation of civil aircraft (Art. 3 (d) Chicago Convention). This precept is repeated in an implied manner with respect to (military) pilotless aircraft in Art. 8 of the Chicago Convention. Art. 2.17 of Annex 11 prescribes coordination between military authorities and civilian air traffic services. Military deployment of drones may be subject to supranational regulation: e.g. the NATO STANAG[20] 4586 on Standard Interfaces of UAV Control System (UCS) for NATO UAV interoperability: it includes data link, command and control, and human/computer interfaces. EUROCONTROL issued specifications for the use of military remotely piloted aircraft as OAT[21] outside segregated airspace.[22]

19 M. Bourbonniere and L. Haeck, *Military Aircraft and International Law: Chicago Opus 3*, Journal of Air Law and Commerce, vol. 66, no. 3, 2000-2001, p. 885.

20 Standardization Agreement.

21 Operational Air Traffic (as opposed to GAT, General Air Traffic).

22 EUROCONTROL-SPEC-0102, edition date 26 July 2007.

In the aftermath of the 9/11 massacre, drones have been deployed in the war on terror. While lacking the traditional chivalry because of the impersonalisation of battle and the absence of reciprocal risk[23], remote warfare[24] is not in itself unlawful. Weaponized/armed drones are not expressly prohibited by the law of armed conflicts (law of war, International Humanitarian Law (IHL)) and their deployment is not considered to be inherently indiscriminate or perfidious.[25]

But the modalities of their use must be compatible with the law of war.[26] While in principle one of their recognized qualities is precision, military drones have also been criticized for their lack of accuracy, causing in some cases collateral/incidental damage and unnecessary civilian casualties. For that reason their compliance with the discrimination (or distinction)[27], proportionality and precaution precepts has been questioned. Also drones enable strikes outside of the established war zones, thus operating on the borderline between military activity and intelligence services and possibly violating the sovereign airspace of another country. While combatants are legal targets under the law of war, targeted killings by UAVs have been called extrajudicial and summary or arbitrary executions.[28] But in all those respects, in their capacity of a launching platform, drones are not different from manned combat aircraft.

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[23] C. Enermark, *Armed Drones and the Ethics of War: Miltiary Virtue in a Post-Heroic Age*, Abington, Routledge, 2014.

[24] The question whether warfare in itself is legitimate (cf. art. 2§4, art. 51 and Chapter VII of the UN Charter) is not at stake here.

[25] See the prohibition of perfidy in Art. 37 Protocol I additional to the Geneva Conventions of 12 August 1949 and relating to the Protection of Victims of International Armed Conflict, 8 June 1977.

[26] P. Bergen and D. Rothenberg (eds.), *Drone Wars*, Cambridge, Cambridge University Press, 2014.

[27] Distinction between combatants and civilians and between military objectives and civilian objects. Article 48 of the 1977 Additional Protocol I to the 1949 Geneva Conventions provides: "[T]he Parties to the conflict shall at all times distinguish between the civilian population and combatant."

[28] Human Rights Watch, *Between a Drone and Al-Qaeda: The Civilian Cost of US Targeted Killings in Yemen,* 2013, available at: https://www.hrw.org/report/2013/10/22/between-drone-and-al-qaeda/civilian-cost-us-targeted-killings-yemen.

4. FUTURE LEGAL/REGULATORY REGIME

4.1. General observations

4.1.1. Integration into non-segregated airspace

There seems to be a general consensus that unmanned aircraft must not be segregated from other air space users, but that the new unmanned aviation is to be integrated into the existing manned aviation.[29] This option creates a safety risk, the main concern of legislators/regulators when accommodating the unmanned civil aviation.

4.1.2. Urgent need to fill the gaps

Whereas the present regime governs to a large extent the unmanned aviation activity (since a pilotless aircraft is an aircraft: cf. supra no. 3), there is not a total vacuum, but there are important gaps to be filled. As it is often the case with new technologies, the (international) legal and regulatory framework is lagging behind. Suitable regulation is required to support the development of this emerging, proliferating and even booming commercial application. The industry holds back while awaiting the legal certainty of a regulatory framework. Legislative and regulatory initiatives were started at the international, regional and national level. National (USA, Italy, etc.) and supranational (ICAO[30], EU) legislators/regulators are presently accelerating rulemaking to develop a legal framework that will accommodate this new economic activity and to integrate it into the existing aviation regime (cf. infra no. 4.2).

4.1.3. Harmonization required

Given the international nature of aviation and taking into account the potentially international use of drones, an internationally coordinated approach is required to develop a global harmonized/unified regime. Even if a drone were to operate only locally and did not travel abroad, it is susceptible to encountering in its domestic airspace foreign aircraft registered in other member countries of the Chicago Convention. The interaction is also possible in operations over the high seas.

29 EU Commission Communication, COM(2014)207, *New era for aviation – Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner*, p. 2.

30 International Civil Aviation Organisation.

4.1.4. Regulation commensurate with safety risk

The stringency of regulation should be proportional to the risk generated and therefore differential according to the type of device and operation.[31] Overkill risks to suffocate the emerging activity. Legislators have voiced their intention to regulate this segment of civil aviation in a manner commensurate to the safety risk created, e.g. by a differentiation in licensing requirements between recreational and professional remote pilots. For this reason recreational model aircraft operations would be excluded from the scope of the regulatory action.

There seems to be some consensus that devices for recreational purposes with a maximum weight of about 20 to 30 kilograms would be exempted from the special license requirement, but would be subject to operational restrictions: only in daylight, within line of sight of the remote pilot, at a certain distance from airports and populated areas, lower than a certain height, etc. Drones exceeding that weight or used for non-recreational purposes would require a special exemption or certification. So commercial applications would be subject to the full set of (adapted) regulation for manned aircraft.

4.1.5. Gradual development

Technology is not ripe yet to support all types of unmanned aviation in the non-segregated airspace. Only remotely piloted aircraft will be able to integrate into the international civil aviation system in the foreseeable future.[32]

For the time being ICAO intends to regulate only the remotely controlled drone applications and it did not address the deployment of autonomous aircraft, nor of other aircraft that cannot be managed on a real-time basis during flight (such as free balloons). Art. 2.3.1. and Art. 2.4. of Annex 2 to the Chicago Convention require a pilot who is responsible and who has final authority for the operation of the aircraft. Also, (heavy) cargo and passenger transportation will only be addressed in the long run.

4.2. Legislative/regulatory action undertaken

Supranational institutions have started the legislative/regulatory process to supplement the existing framework so as to accommodate the unmanned avia-

[31] Riga Declaration on Remotely Piloted Aircraft (drones) "Framing the Future of Aviation", Riga, 6 March 2015, principle 1; hereinafter: the "Riga Declaration".

[32] No. 2.2 ICAO Cir 328 AN/190 on Unmanned Aircraft Systems (UAS).

tion activity. JARUS[33] serves as a global think-tank to recommend technical, safety and operational requirements for the operation of Remotely Piloted Aircraft Systems (RPAS).

4.2.1. ICAO

In recent years a modest but gradual adjustment of the regulatory framework was already undertaken by ICAO through the instruments at its disposal, viz. the Standards and Recommended Practices (SARPs), with the supporting Procedures for Air Navigation Services (PANS). It has thus amended, in March 2012, Annexes 2 (Rules of the air), 7 (Nationality and registration marks) and 13 (Accident investigation) to the Chicago Convention in order to accommodate RPASs intended to be used by international civil aviation.

Art. 3.1.9 of Annex (on rules of the air)[34] to the Chicago Convention now expressly acknowledges "Remotely Piloted Aircraft" (RPA) and Remotely Piloted Aircraft Systems (RPAS). Its Appendix 4 refers to the application of Art. 8 of the Chicago Convention and elaborates the procedure to apply for the host country authorisation. This Appendix provides in principle for the reciprocal recognition by the member countries of licenses and certificates (in the fields of Annexes 1 (on pilot licensing), 6 (on operator certification) and 8 (on aircraft airworthiness)) issued by the country of registration, pending the development of international licensing and certification standards. It stresses however the member countries' ultimate sovereignty in this respect. Annex 7 was amended so as to take into account the smaller size and shape of drones for the purpose of marking. Chicago Convention Annex 13[35] (on accident investigation) was amended so as to bring unmanned aircraft (UA) accidents and serious incidents under the same umbrella as those of manned aircraft.

ICAO has already published a circular (Cir 328 AN/190) in 2011 on Unmanned Aircraft Systems (UAS) and its UAS Study Group has developed a Manual on Remotely Piloted Aircraft Systems (RPAS) (Doc 10019) 1st edition 2015, to provide guidance on drone matters in the legislative/regulatory process.

[33] Joint Authorities for Rulemaking on Unmanned Systems.

[34] Since its amendment 43 adopted on 7 March 2012.

[35] Tenth edition, 2010.

4.2.2. EU

The EU had already addressed the regulation of unmanned aviation in its Regulation EC 216/2008. Regulation EC 216/2008 mandates EASA[36] to regulate unmanned aircraft systems and in particular Remotely Piloted Aircraft Systems (RPAS) when used for civil applications and with an operating mass of 150 kg or more, leaving civil unmanned aircraft below 150 kg and all governmental (military and non-military) unmanned aircraft under national responsibility of the member states (Art. 4(4) and Annex II). Consequently, experimental or amateur build RPAS, military and non-military governmental RPAS flights, civil RPAS below 150 kg as well as model aircraft are regulated by individual Member States of the European Union. Toys, even if capable of flying but not equipped with an internal combustion engine, are subject to Directive 2009/48/EC on the safety of toys.

More recently the EU Commission published a communication[37] and the EU posted the Riga declaration. The ERSG[38] elaborated a roadmap for the integration of civil remotely-piloted aircraft systems into the European aviation system. Drones shall be integrated in the SESAR[39] programme, the technological pillar of the Single European Sky. The regulatory reform will be implemented through the revision of the basic European Aviation Safety Regulation EC 216/2008 and according to the recommendations of the EASA.

4.3. The inspiration from other traffic/transport modes

In order to avoid re-inventing the wheel, advantage should be taken from lessons learned and inspiration from best practices in other traffic/transport modes, if any.

4.3.1. Road

E.g. in the road mode[40] the 1968 Vienna Convention[41] on Road Traffic requires:

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36 European Aviation Safety Agency.

37 See fn. 29 and EESC Opinion TRAN/553 of 15 October 2014.

38 European RPAS Steering Group.

39 Single European Sky Air Traffic Management Research.

40 Cf. the International Task Force on Vehicle-Highway Automation, Vienna, 21 October 2012.

41 Convention on Road Traffic, Vienna, 8 november 1968.

Art. 8.1: "*Every moving vehicle or combination of vehicles shall have a driver.*"

Art. 8.5: "*Every driver shall at all times be able to control his vehicle [...].*"

Art. 13.1: "*Every driver of a vehicle shall in all circumstances have his vehicle under control [...].*"

Arguably, the current definition of the concept of 'driver' (Art. 1 v: "any *person* who drives a motor vehicle or other vehicle (including a cycle), or who guides cattle, singly or in herds, or flocks, or draught, pack or saddle") is anachronistic and obsolete in the face of technological progress. If interpreted in a teleological manner, those provisions could still accommodate remotely operated motor vehicles and possibly also self-driving cars. A remote driver is also a driver and it can be questioned whether a driver needs to be human. Inventive and creative solutions were proposed to accommodate automated vehicles under the present legislation/regulation: e.g. the assimilation[42] of an unmanned vehicle's trajectory with a virtual track and thus a cybercar with a vehicle running on rail tracks, so that an Automated Road Transport System can be certified as a train (applying the European railway standard EN 50126). Yet, as the said Vienna Convention provisions were felt to bar the operation of self-driving cars (autonomous vehicles), the UN Working Party on Road Traffic Safety[43] agreed to amend it so as to allow self-driving cars, provided the system "can be overridden or switched off by the driver". So a driver must be present and able to take the wheel at any time.

4.3.2. Sea

The potential of unmanned shipping was acknowledged primarily based on the advantage of cheaper operation and reduced risk for seafarer casualties. A European Union project called MUNIN[44] is developing an autonomous and remote-controlled ship system. The matter of unmanned shipping is however even less researched than its aviation or road traffic counterparts. The existing (international) legislation and regulation is considered in general to be capable of accommodating the unmanned modality of shipping activity, but to require

[42] Cf. the Italian Ministry for Infrastructures and Transport.

[43] Economic Commission for Europe Inland Transport Committee, Working Party on Road Traffic Safety, proposal to amend the Vienna Convention. Report of the 68th session of the Working Party on Road Traffic Safety, ECE/TRANS/WP.1/145, 17 April 2014.

[44] Maritime Unmanned Navigation through Intelligence in Networks.

some adjustment and refinement.[45] COLREGs[46] (the international traffic rules for seagoing vessels, developed by the International Maritime Organisation (IMO)) focuses on the control status of a vessel, by setting up a hierarchy of vessel categories, based on their (in)ability to manoeuvre and their (lack of) command. These categories oblige other vessels navigating in the vicinity of a vessel so categorised to respect certain rules, including 'keep out of the way'. A tele-operated vessel is clearly under command. In its current form the COLREGs regime seems to provide autonomous vehicles with a navigable right of way over any other vehicles directly under command.[47]

5. DRONE-RELATED ISSUES TO BE ADDRESSED

The operation of unmanned aircraft causes three main categories of concerns: safety, security and privacy. Awareness of the regulatory and operational restrictions amongst users will require the organisation of a public information campaign. Finally a suitable liability and insurance regime to compensate victims of accidents is needed.

5.1. Technical issues

Although interrelated with and to be embedded in the regulatory framework, a few issues to be solved are of a more technical nature.

5.1.1. Safety

Above all, by far the most important concern about the commercial use of drones is safety, viz. the risk of: (i) interference and conflict with other airspace users (mid-air collision, drone ingestion in aircraft turbine engine, etc.) and (ii) damage to the public and property on the ground (crash). Specific regulation (through Standards and Recommended Practices (SARPs)) will be required to assure aviation safety in the field of traffic separation and collision avoidance capability. The challenges are on the technical (both airborne equipment

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[45] E. Van Hooydonk, *The Law of Unmanned Merchant Shipping*, The Journal of International Maritime Law, vol. 20, 2014, p. 403.

[46] Convention on the International Regulations for Preventing Collisions at Sea, 1972.

[47] B. Gogarty and M. Hagger, *The laws of man over vehicles unmanned: the legal response to robotic revolution on sea, land and air*, Journal of Law, Information and Science, vol. 19, 2008, no. 8.2.

and ground infrastructure and equipment, i.a. the ground control station) and the procedural level. The "see and avoid" precept will also be more difficult to comply with on the side of manned aviation due to the limited conspicuity of drones. Particularly, adjustments will be required in the fields of Annex 1 (personnel licensing)[48], Annex 6 (flight operations) and Annex 8 (aircraft airworthiness).

Air space traffic management procedures will have to support the new traffic modality (4-dimensional (three spatial dimensions plus time) Area Navigation (RNAV)), etc. Air space restrictions may be required. Risk-mitigating measures by enabling technology are to be considered: e.g. collision avoidance system (ACAS[49] or (T)CAS[50]), contingency measures, such as automatic homing in case of remote control disruption or malfunctioning of the craft, automatic landing in case of power failure/fuel shortage (autonomous operation as fall back mode[51]), location transmitter (transponder), etc.

5.1.2. Security

Also, the security risk (malicious use of the device for criminal purposes, i.a. terrorism, hacking, jamming of the ground control station, spying, attacks on infrastructure, etc.) is to be mitigated. For the purpose of repression of criminal misuse, an important factor is the opportunity to trace, track down and identify the owner, operator and pilot of the device.

Like other aircraft, drones ought to be subject to registration on the basis of the manufacturer, make and model, and serial number. In addition, an electronic identity chip is conceivable.[52]

Implementing Art. 20 of Annex 7 to the Chicago Convention prescribes that nationality and registration marks on the aircraft appear in a manner so as to allow identification *de visu* (cf. Art. 3.1., Art. 3.3.2. and Art. 4.2.3.).

Visual identification of drones may be complicated by the combined effect of their small size and distant location. Again this problem is not specific for

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48 For autonomous unmanned aviation the issue of personnel licensing does not arise: the technical specifications of the aircraft and systems will be all the more important.

49 Airborne Collision Avoidance System

50 (Traffic) Collision Alert System.

51 S. Kaiser, *Third Party Liability of Unmanned Aerial Vehicles*, Zeitschrift für Luft- und Weltraumrecht, vol. 57, 2008, p. 232.

52 See Riga Declaration, no. 5.

drones and not different from the situation of commercial jetliners cruising at an altitude of about 40,000 feet. In this respect, other means of identification are to be considered (transponder). Also, unmanned aircraft themselves require protection against illegal acts[53]: sabotage and hi-jacking through hacking of the operator's ICT (Information and Communication Technology) equipment or interception of the radio transmission for the guidance of the device.

5.1.3. Environment protection

Drones are generally more environmentally friendly.[54] Small drones are often electrically powered. Thanks to the absence of pilots on board, the fuel consumption and CO2 (carbon dioxide) emission of combustion engine-driven drones is lower than their manned homologues' and therefore they have a smaller ecological footprint. Environmental concerns about drones primarily relate to noise nuisance. If operating in urban areas and flown low and in great numbers, drones may become a nuisance.

5.1.4. Allocation of radio frequency spectrum?

Reliable, stable and secure wireless communication is an important factor in unmanned aviation because the physical control of the aircraft depends on it. Modern encryption and authentication technology may assure secure data links, avoiding unintentional interference and offering protection against intentional interference (jamming). Allotting space for the purpose of UAV command and control communication on the secure and protected frequency spectrum reserved for civil aviation may be difficult because of congestion.[55]

5.2. Legal matters

Other issues of unmanned aviation to be addressed are more of a legal nature.

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[53] Cf. the Convention for the Suppression of Unlawful Acts against the Safety of Civil Aviation, Montreal 23 September 1971, sometimes referred to as the Sabotage Convention or the Montreal Convention.

[54] Riga Declaration, preamble.

[55] M. Degarmo, *Issues Concerning Integration of Unmanned Aerial Vehicles in Civil Airspace*, McLean, Virginia, MITRE, 2004, pp. 2 – 32.

5.2.1. Privacy

The potential invasion of privacy via unmanned aircraft is a serious concern: photo, video and sound recordings while flying over private property, etc. The problem firstly relates to intrusion (the common law tort of trespassing) in case of unauthorised low-level over-flight of private property. The unlimited vertical property right, under the soil from the centre of the earth and above the land up to the limit of the atmosphere according to the "*ad coelum*" doctrine, expressed in the Latin maxim "*cujus est solum ejus est usque ad coelum et ad inferos*" or "*ex inferis usque ad sidera*"[56], was curtailed with the advent of modern aviation, but a flight of an aircraft over private land that is so low as to be a direct and immediate interference with the enjoyment and use of the land, is still not permissible.[57] In the second place citizens' fundamental rights, such as the protection from privacy incursion and the protection of confidentiality of personal data, must be guaranteed e.g. under Article 8 of the European Convention on Human Rights[58], not only by public authorities (save exceptions for national security, public safety and order, prevention and repression of crime, etc.) but also by private persons.

For non-aviation lawmakers/regulators, the protection of privacy[59] is the most acute concern about drones. The problem again is not peculiar to drone deployment as traditional overflying manned aircraft (e.g. a hovering helicopter) and high-resolution real-time satellite imagery may create the same type of threat to citizens' privacy. Because of their characteristics (low operating speed and altitude, small size, low noise level, anonymity, stealthiness, real-time viewing, etc.), the use of drones may be more invasive/intrusive and more prone to abuse than manned aviation. Art. 36 of the Chicago Convention expressly provides for possible regulation by the member countries of photography from aircraft in their airspace. National legislations may regulate photographing from an aircraft: e.g. the Belgian legislation that subjected aerial photography from manned (as opposed to unmanned)[60] aircraft to an authori-

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[56] From hell to the stars (heaven) or vice-versa.

[57] U.S. Supreme Court, 27 May 1946, United States v. Causby, 328 U.S. 256 (1946).

[58] Convention for the Protection of Human Rights and Fundamental Freedoms, Rome, 4 November 1950.

[59] Cf. J. Davis, *The Laws of Man Over Vehicles Unmanned*, Journal of Law, Information and Science, vol. 10, 2012, p. 166.

[60] Royal Decree of 21 February 1939; J. Stragier, *Fotografie als bewijsmateriaal*, Antwerp, Maklu, Reeks Politie Praktijk Boeken, 2004, p. 69.

sation from the Civil Aviation Administration, was abolished. It was suggested to subject the aerial photographing of a (private) building or property to the advance permission from the owner and/or resident.[61]

5.2.2. Regulatory competency of local authorities

Local authorities (municipal level) tend (through by-laws) to regulate and even prohibit, the evolution of drones, e.g. on the occasion of public events, or above city centres. It raises the question of competence of local authorities to regulate civil aviation. The entity that represents the national territory and subscribed to international commitments (e.g. in the context of the Chicago Convention) is responsible for their observance and implementation.

The national distribution to sub-state entities of the competence in aviation matters is an internal (constitutional) issue.[62] In some countries there is exclusive federal jurisdiction over aeronautics.[63] *Prima facie* in that case, the right to operate an aircraft, that flows from the registration and certification issued by the national authority, cannot be curtailed by a local authority. But such a local measure may be related to other fields of competence, different from aeronautics: e.g. land zoning, environment protection, maintenance of public order and safety, etc. where the local authority has express designated jurisdiction.[64]

5.2.3. Liability

The legal system is on the whole adequately equipped to deal with liability issues related to the deployment of unmanned aircraft. Proven negligence (errors, mistakes, shortcomings, omissions) of humans involved in their operation may trigger civil, disciplinary and criminal liability.

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61 J. Stragier, *loc. cit.*

62 L. Van Den Brande, *The international legal position of Flanders: some considerations*, in K. Wellens (ed.), *International Law, Theory and Practice, Essays in honour of Eric Suy*, The Hague, Kluwer, Martinus Nijhoff, 1998, pp. 145 et seq.

63 J. Straub, J. Vacek and J. Nordlie, *Considering Regulation of Small Unmanned Aerial Systems in the United States*, Air and Space Law, vol. 39, no. 4-5, 2014, p. 275.

64 Cf. Supreme Court of Canada, 15 October 2010, Quebec (Attorney General) v Lacombe, 2010 SCC, 38; Constitutional Court of Belgium, 2 March 2011, file no. 4831, sentence no. 33/2011.

5.2.3.1. Criminal liability

Infringement of aviation regulation is generally criminally sanctioned. Lethal aviation accidents are in most legal systems qualified as cases of involuntary manslaughter or homicide.

The Chicago Convention (Art. 12) itself requires the signatory countries to prosecute offenders of the rules of the air. The deployment of unmanned aircraft raises some questions in the field of criminal law.

5.2.3.1.1. Conflicts of Laws

When the aircraft and the remote pilot are situated in the jurisdictions of different countries, a conflict of laws problem may arise. In particular the question arises which criterion determines the localisation of the offence for the purpose of criminal liability. According to the *doctrine of ubiquity*[65], the *locus delicti* can be situated wherever a constitutive element of the offence takes place: the behaviour of the wrongdoer, the instrument of impact, the occurrence of the damage.

5.2.3.1.2. Imputation

As not all potential external factors are foreseeable for the purpose of integration into the software of the operating system, autonomous vehicles steered by artificial intelligence, may raise ethical dilemmas, e.g. with respect to the decision making for accident avoidance. The distinction between remote controlled and autonomous craft is particularly relevant on account of criminal liability, as a remote pilot is a pilot and can control the craft.

The remote pilot of an unmanned aircraft acts as the pilot in command (the pilot responsible for the operation and safety of the aircraft during flight time (Chicago Convention Annex 2, Art. 2.3.1. and Art. 2.4.) and may incur in that capacity all possible types of liability.[66] Such assimilation is not possible for autonomous craft, steered by artificial intelligence. The titular person or user of the vehicle will not be held criminally liable for causing traffic accidents when the autonomous machine, as programmed by the manufacturer, decides. Cri-

[65] C. Van Den Wyngaert, *Strafrecht en strafprocesrecht*, Antwerp, Maklu, 2011, pp. 143 – 149; C. Hennau and J. Verhaegen, *Droit Pénal Général*, Brussels, Bruylant, 2003, p. 77, fn. 201.

[66] In a number of legal systems the employed servant may benefit from immunity and escape civil third party liability for damage caused to third parties due to his/her shortcomings (except gross negligence and wilful misconduct), but his/her employer is held vicariously liable.

minal liability is in principle[67] personal and not vicarious. Arguably there is an analogy with the case of the master of an ill-trained animal.[68] It is questionable whether the concept of "driver" may be stretched to the extent that the author of the artificial intelligence (the software) steering the autonomous vehicle is considered to be the (indirect) driver of the vehicle.

The designer of a malfunctioning autonomous aircraft system may however incur personal criminal liability if the flaw in the programming due to his error is found to be the cause of an aviation accident. As a robot is a thing, direct[69] criminal liability of the autonomous vehicle itself as a wrongdoer seems futuristic.

5.2.3.2. Civil liability

Besides tort liability for proven negligence (error, mistake, omission) of persons involved in the operation of unmanned aircraft, the failure of the automated system causing a mishap, must be qualified as a defect. In civil law the holder of a defective thing may incur civil liability vis-à-vis the victim(s) (Art. 1384 Civil Code), but he may then take recourse against the manufacturer of the artificial intelligence.[70] The manufacturer may incur direct product liability vis-à-vis the victim.[71]

The Rome Convention[72] (cf. supra no. 3.1.) imposes a strict third party liability on the aircraft operator for damage caused to third parties on the ground. However, it provides for a monetary limitation of liability, based on the weight of the aircraft (Art. 11), that is futile and may amount to a virtu-

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67 Save the exception of corporate liability.

68 Although a bird cannot be considered as an unmanned aircraft : M. De Juglart, *Traité de droit aérien*, Paris, L.G.D.J., 1989, p. 275, no. 476.

69 G. Hallevy, *Unmanned Vehicles: Subordination to Criminal Law under the Modern Concept of Criminal Liability*, Journal of Law, Information and Science, vol. 21, 2012, p. 200; *idem*, *The Criminal Liability of Artificial Intelligence Entities*, Akron Intellectual Property Journal, vol. 4, no. 2, 2010, p. 171; *idem*, *When Robots Kill - Artificial Intelligence under Criminal Law*, Boston, Northeastern University Press, 2013.

70 S. Wu, *Unmanned Vehicles and US Product Liability Law*, Journal of Law, Information and Science, vol. 21, 2012, p. 234; Council Directive 85/374/EEC of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products, *O.J.* L., no. 210/29, 7 August 1985.

71 Council Directive 85/374/EEC of 25 July 1985.

72 Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface, Rome, 7 October 1952.

al exoneration for lightweight drones. Also for the sake of compensation of damage inflicted by drones, the identification problem arises (cf. supra no. 5.1.2.). Vis-à-vis the (future) payload customer (cargo owner/passenger), the Montreal Convention[73] will apply.

5.2.4. Insurance

E.U. Regulation EC 785/2004[74] excludes from its scope of application: "model aircraft with a MTOM of less than 20 kg" (Art. 2 b). Very light aircraft (MTOM below 500kg) are exempted only from the war and terrorism insurance obligations, if they are used for non-commercial purposes or for local flight instruction which does not entail the crossing of international borders (Art. 2(2)g). Besides the gap in the victim protection due to those exclusions, the Regulation defines the minimum third party liability insurance cover according to the weight category of the aircraft (Art. 7), which again may prove insufficient for lightweight drones compared to the potential damage they may cause. For third party liability caused by aircraft with a MTOM of less than 500kg the minimum cover is 0.75 million SDR.[75]

From other perspectives as well, the present regime does not assure an effective victim protection in case of an aviation accident. For an "airtight" system, inspiration can be drawn from the motor third-party liability regime (E.U. Directive 2009/103/EC).[76] This system provides for: (i) the establishment of a guarantee fund, a compensation fund as a safety net against the risk of uninsured vehicles (Art. 10), (ii) the immunization of the damage sufferer from the insurer's defences against the insured wrongdoer (Art. 13) (iii) the grant of a direct action right to the damage sufferer against the wrongdoer's third party liability insurer (art. 18).

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[73] Convention for the Unification of Certain Rules for International Carriage by Air, Montreal, 28 May 1999.

[74] Regulation EC 785/2004 of the European Parliament and of the Council of 21 April 2004 on insurance requirements for air carriers and aircraft operators, *O.J.* L., no. 138/1, 30 April 2004.

[75] Special Drawing Right, an IMF (International Monetary Fund) basket currency.

[76] Directive 2009/103/EC of the European Parliament and of the Council of 16 September 2009 relating to insurance against civil liability in respect of the use of motor vehicles, and the enforcement of the obligation to insure against such liability, *O.J.* L., no. 263/11, 7 October 2009.

6. CONCLUSION

Since a pilotless aircraft qualifies as an aircraft a number of legislative and regulatory provisions apply indiscriminately. Bottom line, most unmanned aviation issues are not fundamentally different from those encountered in manned aviation. To a large extent the existing regulatory framework for manned aviation will apply to unmanned aircraft. Taking into account the specificities of unmanned aviation, adaptation, upgrading and supplementing of the present regime will be required, especially in the navigation safety field (collision avoidance with airborne (mid-air) and with fixed objects and terrain (crash)). The Chicago Convention and its annexes were designed to deal with conventional aircraft, and are thus based on the assumption that the 'pilot' is a human.[77] In this respect there is no fundamental difference between the fly-by-wire on-board pilot (often supervising the auto-pilot) and the remote pilot. For that reason remote-controlled unmanned aviation fits better into the present regulatory framework than the autonomous type, which is altogether of a different order, because its "detect and avoid"-capability is more problematic. The effective enforcement of regulation will be a challenge due to the difficulty of airborne identification of the craft and tracing of the owner, operator and pilot of the device. The weight-based liability and insurance cover limitations in force may not be very effective in victim protection against damage caused by small drones.

[77] B. Gogarty and M. Hagger, *op. cit.* (fn. 47), no. 8.1.1.

Sažetak

Kristian Bernauw *

BESPILOTNE LETJELICE: NOVO DOBA U ZRAKOPLOVSTVU

Fenomen bespilotnih uređaja i vozila na daljinsko (bežično) upravljanje prisutan je već neko vrijeme, i to u raznim oblicima prijevoza: zemaljskom, zračnom, svemirskom i podvodnom. No, važno razlikovno obilježje letjelica u odnosu na zemaljska vozila nalazi se u trećoj dimenziji njihove evolucije, što komplicira izradu regulacijskog okvira. Prema trenutačnom uređenju bespilotna letjelica ulazi u definiciju letjelice na motorni pogon (prilog 7. Čikaške konvencije) bez obzira na to je li riječ o zrakoplovu s nepokretnim ili pokretnim krilom, ili zrakoplovu lakšem od zraka. Prilog 2. Čikaške konvencije prepoznaje kategoriju letjelice na daljinsko upravljanje, ali prema članku 8. Konvencije ona podliježe nacionalnom uređenju. Stoga se regulacijski okvir trenutačno veoma razlikuje od države do države: od liberalnog (regulatorni vakuum) do restriktivnog (potpuna zabrana). Zakonodavci/regulatori ubrzano rade na razvoju novih pravila kako bi stvorili pravni okvir koji će podržati tu novu gospodarsku djelatnost i integrirati je u postojeći zrakoplovni sustav (SAD, Italija itd.). S obzirom na međunarodnu prirodu zrakoplovstva i međunarodnu upotrebu bespilotnih letjelica potreban je međunarodno koordinirani pristup u razvoju jednog usklađenog sustava. Međunarodna organizacija civilnog zrakoplovstva (ICAO) već je izdala Priručnik za sustave letjelica na daljinsko upravljanje (Remotely Piloted Aircraft Systems), koji sadržava smjernice za izradu relevantnog zakonodavstva/regulative. ICAO i EU rade na razvoju pravnog okvira. Čini se da postoji opći konsenzus da bespilotnim letjelicama mora biti dopušten promet bez odvajanja od ostalih korisnika zračnog prostora. Komercijalna upotreba takvih letjelica ima učinak na sigurnost koji svakako treba riješiti. Sigurnosne je rizike potrebno svesti na najmanju mogući mjeru. Moguće ugrožavanje privatnosti ozbiljan je problem, jednako kao i prijestup smetanja posjeda u slučaju nedopuštenog niskog prelijetanja zemlje u privatnom vlasništvu. Bit će potrebno organizirati informativne kampanje kako bi se među korisnicima podigla svijest o regulatornim i operativnim ograničenjima.

Ključne riječi: bespilotne letjelice, dronovi, Čikaška konvencija, ICAO, komercijalna uporaba bespilotnih letjelica, regulacija bespilotnih letjelica

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