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Regulating Drones - Creating European Regulation that is smart and proportionate

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Highlights

The proliferation of civil drones is a widespread phenomenon and the trend is likely to continue. This creates a regulatory gap as rules addressing drones specifically are still mostly absent. On the one hand, the risks posed by drones are becoming more visible: possible encounters with civil aviation, threats to security, invasion of privacy, etc. On the other hand, the drone sector has enormous economic growth potential and many of the benefits of drones cannot be enjoyed unless rules are established that allow the use of drones also for commercial operations. The 7th Florence Air Forum addressed this regulatory challenge by discussing with the relevant stakeholders.

It firstly addressed what regulatory approach is needed – most importantly what regulation wants to achieve and how to do this.

It then addressed how to integrate drones in the existing structure of aviation regulation and more specifically the existing framework for Air Traffic Control.

Finally it looked more closely at the local enforcement level: basic rules will most likely be decided on the supranational level yet enforcing them is a big challenge for local authorities.

Amongst other it emerged that technology may be the key component to many concerns posed by drones: automated collision avoidance system, geofencing and other technologies exist but need to be further developed, validated and standardized.

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Regulating drones: what is the right approach?

A comment by MATTHIAS FINGER | FSR-Transport Director

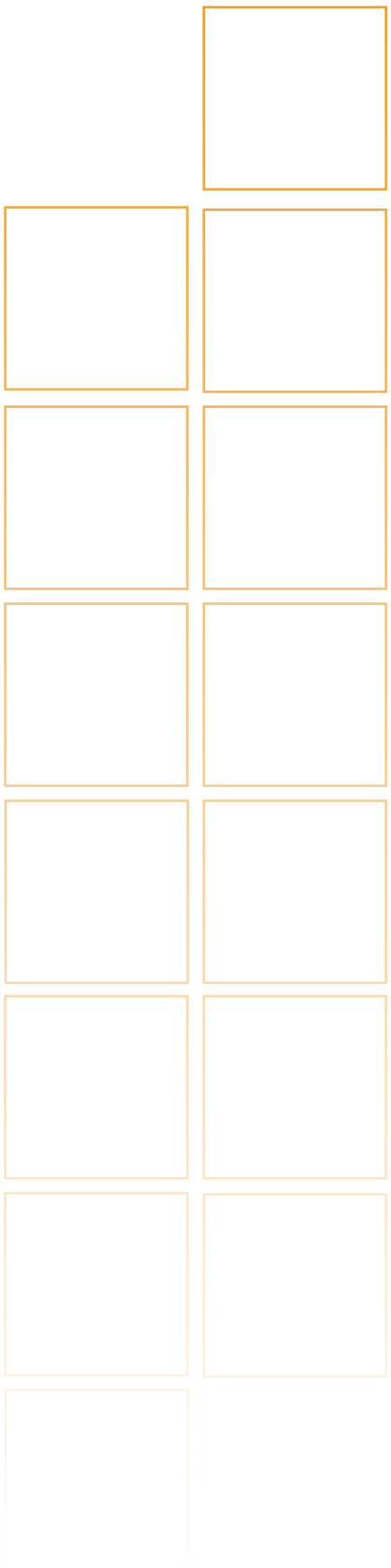
The proliferation of drones – everybody agrees – poses a series of new challenges to aviation, civil and military (e.g., safety), as well as to society more generally (security, privacy). Regulation, in Europe and elsewhere, lags behind. Yet, such regulation should be proportionate to the risks posed by drones and we should neither over-, nor under-regulate. Also, the phenomenon is still rapidly evolving, making it difficult to anticipate what kind of regulation is actually needed: on the one hand, regulation needs to frame the phenomenon, while, on the other hand, it should not stifle the development of drone technologies and the emerging drone industry. It is therefore essential that the regulation of drones is properly conceptualized from the very beginning.

The 7th Florence Air Forum wanted to achieve precisely that, i.e., define a series of consensual principles along which the regulation of drones can and should be thought and developed in Europe in the near future. And astonishingly consensus emerged, at least about the following aspects:

- Everybody agrees that there is an urgent need to regulate drones. Equally, everybody agrees that **Europe is the appropriate level** to develop drone regulation, even though implementation of such regulation can and even should be delegated to countries and interestingly also cities. Of course it would be desirable especially for the industry to have global rules but with the drone market exponentially growing (in the absence of appropriate regulation) there is no time to wait. Europe – together with the US which are more advanced at least in certain aspects – could actually lead the way to a more global approach.

- Everyone also agrees that such regulation must respond to the main concerns of the **different involved groups**, among which the different airspace users (safety), but also the drone producing industry (innovation), the ATM industry (innovation), the flying public (safety, security) and citizens more generally (environmental protection, privacy, safety on the ground).

- There was furthermore consensus that appropriate regulation must be based on a relevant **categorization**, according to the risks posed by the different types of drones. At the Forum, EASA presented a categorization that had been the basis of the Riga declaration and is already supported by most stakeholders. This categorization essentially makes a differentiation among drones according to the different levels of risk they pose.



Low Risk - Open Category

This Open category includes small drones that fly at a maximum altitude of 150m and need to remain in the visual line of sight of the pilot at all times maintaining a safe distance to airports and restricted airspace. Drones in the open category should be regulated lightly, probably by way of inbuilt technological solutions, namely geo-fencing. Aviation Authorities should not be involved here. Yet, as this category will see a massive increase in numbers, it will be up to local authorities to define some rules that will increase safety such as mandatory registration of drones and a further subcategorization according to weight and range. The open category will certainly pose more problems when it comes to enforcement: even simple rules such as maximum allowed flight height are hard to be controlled from police forces. Adding to that is the problem that the drone users that are now massively increasing in numbers are to the largest part newcomers and not members of the aviation community: they may neglect rules or even knowingly break them. Their compliance and dedication to safe operations cannot be taken for granted by regulators.

Medium Risk - Specific Category

The real challenge in drone regulation is thus this specific category, which includes a wide variety of professional (commercial) uses of drones, such as parcel delivery, inspection of infrastructures, surveillance (environment, agriculture, people), filming, and others more. Most important for this category is to develop technologies that will allow the integration of these drones into the current system of air traffic control. In fact in order to reap the full potential for new services based on the use of such drones, a system of air navigation for unmanned autonomous aircraft needs to become available. Unmanned Traffic Management (UTM) is indeed a key technology that would provide for planning and monitoring of flight paths and assure separation from obstacles, other vehicles and geo fenced areas for drones.

High Risk - Certified Category

For drones in this category a regulatory regime equal to the one in place for manned aviation should be adopted. Accordingly, EASA should be the agency in charge of certification and authorisation.

On the basis of this categorization a typical methodology of developing regulation can now be applied. The methodology goes as follows:

- Which problem does the regulation need to address? Typical such problems in the context of drones are safety, security, privacy, environmental protection and noise, and innovation (R&D).

- At this point, one needs to ask whether **regulation** is the most appropriate tool to address the problem, as, in some cases, technologies directly built into the drones (and regulated again), may well also do the job.

- As a next step, the question of the exact **object of regulation** must be asked: are we regulating the owners and operators of drones (e.g., licenses for drone pilots), or are we regulating the technology (e.g., technical standards, product safety standards) or are we regulating the usage of drones (e.g., restricted airspaces, times of day, etc.)?

- Next comes the question of the **regulatory instruments**, such as prohibitions, prescriptions, incentives and corresponding sanctioning mechanisms. What are the most appropriate tools to achieve the different goals?

- There is furthermore the question of the appropriate **level_of regulation**; while everyone seems to agree that the European Commission – or EASA for that matter – defines the broad rules, an interesting question arose as to the growing importance of cities, especially when it comes to regulating the open category of drones.

- Finally, there is the question of the costs and subsequently of the **financing of regulation**: who, for example, is bearing the costs of increased safety regulation of the airspace? It would be unfair to burden the existing airspace users (via ATC costs) with the increased costs caused by drones.

In any case, it will be essential to develop flexible (or as it is now called smart) regulation. Drone technologies are evolving rapidly and the drone industry is just at its beginning. Regulation will have to evolve with the technology and be as innovative as the technology itself. Nevertheless, this cannot be taken as an excuse not to regulate, as there is indeed urgency, especially when it comes to the safety of the airspace users and citizens.

7th Florence Air Forum

Summary of discussions

The proliferation of civil drones poses a new challenge for the regulation of aviation. The 7th Florence Air Forum discussed this challenge by bringing together relevant stakeholders from the aviation and Air Traffic Management (ATM) industry, manufacturers, regulators, international institutions as well as operators of drones from different sectors. Discussions were structured around three main themes:

- **Which regulatory approach?** How to ensure a light-handed but effective regulatory approach that is able to keep up with evolving technology?
- **Which role for Air Traffic Control?** Where can drones fly and where not? Which rules of the air, which air traffic control procedures?
- **Enforcement** – can new rules for drones help to enforce existing regulation on privacy and security on the national and local level?

1. Which regulatory approach?

How to ensure a light-handed but effective regulatory approach that is able to keep up with evolving technology

Definitions

The regulation of drones is in many ways new ground, and the discussion showed that there is still a lot of ambiguity in the use of terms. The terms drones, RPAS (Remotely Piloted Aircraft System), UAS (Unmanned Aircraft System), and UAV (Unmanned Aerial Vehicle) were used interchangeably, and part of the discussion revolved around the very question of which terms to use when referring to what type of device and operation. For most it seemed clear that the term "drone" generally refers to all types of unmanned aircraft. The term "RPAS" was often used during the discussion when referring to larger drones that are not for recreational use. The term RPAS can be misleading as it suggests the existence of a pilot. There are, however, also fully autonomous systems and furthermore the role of the pilot of a drone is yet to be precisely defined. RPAS can be considered a subset of UAS, which is the broader term the Federal Aviation Administration (FAA) commonly uses. On the EU level the term RPAS is widely used (such as in the Riga declaration) for all type of drones that are not completely autonomous.

This ambiguity shows that, in spite of the existence of some definitions, these are not well established in the used language and clearly different connotations exist. Some associate large "aircraft" types when they speak of drones while others associate it with small toy like devices. It was also noted that the term drone carries a certain negative connotation as it is associated with military drones.

Definitions play a major role also in a wider sense as several important questions have to be clarified in order to have consistent regulation. For example: what is an aircraft? Is every drone an aircraft? What is a pilot? Is every drone operator a pilot? These are some very basic concepts in aviation regulation and as drone regulation is forming they may need to be redefined.

Categorization

The most important aspect of future drone regulation will be the categorization, which is related to the discussion on definition. The European Aviation Safety Agency (EASA) proposed three categories based on the different levels of risk posed by the different types of drones[1] . Which risk is actually posed by which type of operation will be defined according to reports by Member States. The EASA concept defines some basic rules for the categories, as illustrated in Figure 1.

While the EASA approach was overall very well received it became clear that further differentiation is needed and that many new challenges will arise when the details of the categories have to be defined. The suggested categorization can only be considered a "first step". Yet it is important that regulators categorize in a way that is intuitive and accepted by all stakeholders. This could be achieved by the EASA approach as it is

1. See EASA's "Concept of operations for Drones", and the 7th Florence Air Forum's summary of presentations

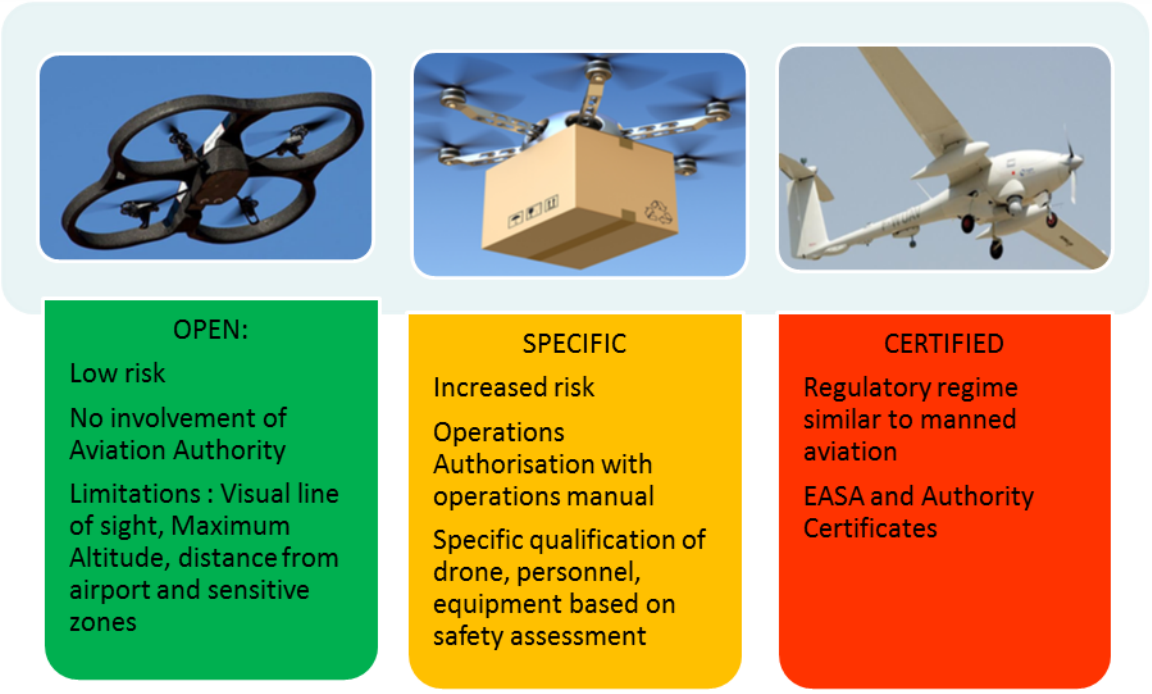


Figure 1. Three categories for drones as proposed by EASA, Source: EASA

relatively simple and may structure the discourse in a way that it becomes a "self-fulfilling prophecy".

The discussions at the Forum addressed all categories. The open category will see the most rapid increase in numbers (one large drone producers is expecting to sell 1 mil drones by the end of the year), because drones in this category are becoming more affordable and attract many new recreational users.

There is a huge variety of types of drones differing substantially in weight and range in all categories allowing various types of operations. The requirement of the open category to operate "within line of sight" excludes most thinkable commercial uses. Therefore also the specific category was of major concern in the discussion. Some concrete examples for possible commercial drone operations were discussed with regard to the necessary regulatory conditions that would allow such operations. Regulation for drone-based delivery services for instance should achieve two things: firstly establish a specific altitude layer for commercial, autonomous, drone flights, and secondly define technical and organizational prerequisites to pass areas with a population density beyond five persons per hectare.

The American approach

Parts of the discussion focused on comparing the US and the EU approach to drone regulation. Even though regulation is still forming on both sides of the Atlantic, differences in the respective approaches are visible. Some described these differences in a way that EASA applies a risk based approach whereas the FAA's approach is more operation focused. Yet there were different views. The categorization of EASA derives directly from the risks associated with certain types of drones, whereas the American approach firstly distinguishes between recreational and professional use. Nevertheless both sides describe their approaches as both "risk based" and "operation centered". Some advocated that Europe should follow the American approach more closely in order to achieve a maximum level of harmonization on the global level. Others considered the American approach too restrictive and too close to the traditional aviation approach which could be harmful for the growth of the emerging drone sector. However the "educational approach" of FAA found a lot of support: FAA is conducting a "know before you fly" campaign reaching out to the general public to inform about important rules on safe operations for recreational drone users.

Regulation and technology

On a principle level the "chicken and egg problem" of technology and regulation was a recurring theme in the discussions. One view was that "if technology is right regulation is light": this reflects the expectations of some Air Navigation Service Providers (ANSPs) to have the necessary safety requirements included in the drones in an automated way (thanks to technological solutions) making detailed operational regulation unnecessary. Regulators are in a difficult situation with regard to technology: on the one hand, regulation is urgently needed as the market for drones is already rapidly developing and in need of rules that provide for safety. On the other hand, technology is evolving rapidly and regulation that is considered appropriate at present may become redundant or harmful for the industry already in the near future.

The actors

A large range of actors and institutions are involved in the regulation of drones. At the Forum a lot of attention was dedicated to some of them with regard to their future role.

Drone users: Firstly drone users in general may be a factor that other stakeholders and regulators still need to get used to. It was stressed several times that it is important to remember that drone users will generally not be part of the "aviation community":

- They do not have the same safety and compliance focus as for instance airline operators.
- They may generally not have any knowledge about aviation or the rules of the air.
- Given the wide and uncontrolled availability of drones there may be drone users that have malevolent intentions or intentionally break rules.
- They require more flexibility: pre-approved flight paths and orders by ATM may not be appropriate for their operations.

EASA: The discussion on drone regulation will have an impact on EASA also because the EASA basic regulation is currently under revision. The discussion showed that EASA will play a new role in the future. It is not clear to what extent EASA will be in charge of drones, yet it is likely that its mandate will be extended to include all types of drones. Regulating this sector means a new perspective for the agency: the consultation among drone stakeholders that EASA has just carried out required it for the first time to seek the opinion of non-aviation specialist. In order to get wider range of responses EASA for the first time carried out the consultation in several EU languages.

The European Parliament: A novelty in the law making procedures was pointed out in the discussion with regard to the role of the European Parliament. It has so far been quite well established in EU aviation regulation that EASA informs the Commission, which then proposes regulation. Furthermore Commission and EASA (and the Council) take on a strong role in the implementation phase. This may be to some extend different for drone regulation: In part because of the new comitology procedures[2] and in part because of the higher political saliency of the drone issue there will probably be a stronger involvement of the European Parliament.

This requires looking even more closely at the issues that are relevant for the public in particular data protection, privacy and security. It was recalled that these questions cannot simply be dealt with during the implementation.

Standardization bodies: Drone regulation will be characterized by the current trend towards performance based regulation. This shift means that EASA will reduce the importance of guidance material (also called soft law) defining procedures and minimum means of compliance. Instead regulation will make more reference to standards agreed by standardization bodies such as EUROCAE.

SESAR Joint Undertaking: Research and Development is absolutely crucial as drones are in need of technologies to make their operations safe. Many called for more funding for R&D for drone

2. Parliament will have a very limited role in the implementation phase, which is a further incentive to be active in the adoption of the regulation (http://easa.europa.eu/faq/18997).

Will Unmanned Vehicles modernise Air Traffic Management?

Marc Baumgartner, SESAR and EASA coordinator IFATCA and air traffic controller in Geneva
Dr. Anthony Smoker, IFATCA and Human Factors and System Safety graduate tutor at Lund University

The proliferation of civil drones poses new challenges for civil society. Privacy, security and safety aspects create a unique and urgent need for regulators to become aware and possibly active in this new domain. Drones offer the potential for new services in aviation and also reach far beyond aviation. They are developing into a new field of aviation that bears prospects for growth both in manufacturing and service provision as well as fields of practise beyond these. The innovation that drones have the potential to unleash comes in large part from a community that has no knowledge or understanding of the rites, rituals and history of aviation. What aviation assumes is a given in terms of safety is not with this community. The business models of drone start-ups will be different from those existing in aviation. The appetite for, and understanding of risk will be different.

The myriad of possible applications and uses of unmanned flying vehicles will affect our daily lives much more than we currently most probably can imagine. From drones operating at sub-orbital heights making internet access permanently available in remote areas of the globe, to remote maintenance work, all facets of our current society will be affected.

This new feature of our digital society poses a challenge to manned aviation and some spectacular near misses/near encounters have already occurred around busy airports in both the US and Europe according to reports by eye-witnesses. The regulator's task to create a sensible and efficient regulatory framework to guarantee the safety of the manned and, for the most part, commercial aviation is a daunting one. The approach chosen by the European Commission and the FAA is interesting to observe. It could be best described as exclusion and segregation as well as managed integration, according to the different type of operations. By creating so-called 'no drone zones' or segregated areas a protected environment is being created for manned aviation.

The main challenge is perceived however as the managed integration from an Air Traffic Control perspective. Whereas a full integration of UAs will take a couple of more years if not decades, the "specific" category (as described by EASA) might have to be accommodated in a so-called "mixed environment". This will create a lot of challenges for safety and the risk-assessed manned aviation environment. There will be interesting friction points as the drone users and Air Traffic Management (ATM) learn how to work together. There is no regulatory paradigm onto which to map drones which are autonomous and aviation might be trapped by its own (too narrow) view on regulation.

One of the aspects which could become of significant interest in the current discussion and technological debate could be the fact that drones will start to revolutionize Air Traffic Management through "disruptive technology". 'Disruptive' in the sense that it will review and drive the need to question the way Air Traffic Management has done business to date, specifically with regard to the overall infrastructure. Technology for Air Traffic Management is based on old, fragmented, prototyped and "hardcoded" technology, whereas the institutional framework has moved from government owned to commercialised Air Navigation Service Providers. In the coherence framework a misalignment between the institutions and technology has been highlighted over the last couple of years[1] (Finger and Crettenand, 2013). The European Commission has introduced a performance scheme to regulate the monopolistic Air Traffic Service providers and significant EU Funds have been spent to modernise the current infrastructure. However, this is moving very slowly due to dense global standards and recommended practices published by ICAO that ensure the required global interoperability. The drone world assisting the current Air Traffic Management

1. N. Crettenand and M. Finger. The alignment between institutions and technology in network industries, in Competition and Regulation in Network Industries, vol. 14, num. 4, p. 106-129, 2013

infrastructure might be an emerging novel approach. NASA published a factsheet on Unmanned Aerial System (UAS) Traffic Management (UTM) where it describes how the future of the UAS would be managed in low altitude airspace. Most of the UAS applications with a commercial interest operate at low altitude or very high altitude, areas where mostly no commercial aviation is operating (except maybe in the very close vi N. Crettenand and M. Finger. The alignment between institutions and technology in network industries, in Competition and Regulation in Network Industries, vol. 14, num. 4, p. 106-129, 2013 cinity of the landing and departing runways).

We can imagine today that technology could permit UAS to operate autonomously by using technology thus far unknown to aviation. For example, command and control via GSM network, autonomous and "geofenced" operations providing segregation or separation from each other – but including a form of automatic detect and avoid system. If these operations see the light of day as described in the factsheet[2] of NASA, then there is a good chance that successful trials with such systems (even in a limited area) will produce spin-offs which might be used in a not-too-distant future to provide separation and replace part of the costly ATM infrastructure in a way that has never been seen before. Interesting times ahead!

2. http://utm.arc.nasa.gov/docs/UTM-Fact-Sheet.pdf

related technologies in SESAR. In fact it was pointed out that in the design phase of SESAR the growing importance of drones was not foreseen.

Representatives from small drone manufacturers questioned the strong involvement of traditional aviation stakeholders all together. Because of the disruptiveness of the technology the established stakeholders would slow down innovation. Much like "there would be no electric light today if the regulation of the light bulb industry had been left to the candle makers".

2. Which role for Air Traffic Control?

Where can drones fly and where not? Which rules of the air, which air traffic control procedures?

The role of ANSPs and ATM in drone regulation is an open issue. A point that clearly emerged at the 7th Florence Air Forum was that the challenge from an ATM perspective is principally the integration of unmanned aircraft in the controlled airspace. Smaller drone operations in the open category (e.g. within the uncontrolled airspace) are generally not viewed as directly impacting the business of ANSPs. Yet these can be test cases for systems that can later be deployed also in the controlled airspace, namely airborne detect and avoidance systems and ATM for unmanned aircraft (Unmanned Aerial System Traffic Management - UTM).

ANSPs recognize the importance of allowing drones in controlled airspace, as the current limitation to the Visual Line Of Sight (VLOS) does not allow most commercial operations. However, this seems to be a technological challenge, rather than a regulatory one. ANSP envisage a step by step approach: first airspace segregation for drones needs to be established. This will be based on the VLOS rule or on pilot mitigation through a remote station in the beginning. Later this should be possible in a fully automated way.

In order for it to be conceivable that drones fly in controlled airspace, onboard technology has to be able to replicate the capabilities of a human pilot. This is necessary in order to comply with the "rules of the air" – which apply to manned and unmanned aircraft alike according to International Civil Aviation Organization (ICAO) rules.

For drones in the open category there is currently no role for ATC. It was commonly agreed that that ANSPs have no business in controlling this airspace. Yet the future needs for systems could offer them business

opportunities. The financing and business model of "air traffic management for drones" remains an open question: under the current system traditional airspace users finance the activities of ANSPs through their route charges. It is unlikely that drone users will accept to pay such fees to operate their devices. On the other hand, current airspace users might not be willing to bear the additional costs necessary to cover new ANSPs' operations related to drones.

From the discussion it emerged that finding a way to cope with the massive increase in drones in the open category will be the first priority for the regulator. Dealing with the specific category will emerge in the medium run. In the longer run also the drones in the certified category will be a bigger issue as, for example, governments intend to use these drones more often in the future for non-military purposes.

Drone operations near airports

Another important issue is drone traffic in controlled traffic regions (CTR) near airports. Air traffic at all heights in these regions needs clearance from Air Traffic Control (ATC) and all aircraft are required to carry a radio transponder to receive directions from ATC. This means that currently drone operations are forbidden in CTR. On the one hand, there is a challenge with regard to the safety risk by the foreseeable increase in small drone operations (in spite of the ban) in these areas. On the other hand, there were several remarks and examples presenting drone operations in this airspace that could be useful thus posing the question whether ways should be explored to allow them in the future. Examples included Airlines wanting to use drones to inspect their fleet on airports.

It was mentioned that in the US the National Aeronautics and Space Administration (NASA) is developing systems for ATM of drones flying at low altitudes. Such technology is crucial to manage drone traffic in the open category in the future and possibly to allow them in CTR. Some recommended increasing the research dedicated to this topic in the EU within the SESAR2020 program.

The technological developments in ATM triggered by the increase in drones are significant: at the forum also ANSPs conceded that it is at least conceivable that on the long run drones will fundamentally change their business, if not make large parts of it redundant. The way forward for making drones safe to fly in controlled airspace relies on making systems operational that allow for fully automated separation of air traffic. Such systems would still rely on a functioning infrastructure but would be independent from air traffic controllers. Once such a system "feeds back" into classic ATC it will unfold the potential of a disruptive technology.

What level of risk?

The primary goal of ATM is safety. A fundamental part of the discussion therefore addressed which safety risks were actually posed by drones and which reaction would be appropriate.

Pilots and representatives from Civil Aviation mostly took the stance that it was premature to take a relaxed view about any risks posed by drones. In this view no decision should be taken based on a risk assessment that is barely an estimate. Instead, risks need to be assessed in a structured way using the established methodology. In this context it was called for the development of reporting methodology to have a European view on the number of safety relevant incidents involving drones. The US are already reporting these, and some saw the numbers alarming as about 765 possible encounters were reported over a period of 9 months. It was warned that no compromise to proper risk assessment should be made in the interest of supporting the development of the sector.

The other view was that the ambiguity of terms in the debate currently prevents a realistic look at risks. Traditional aviation stakeholders tend to have bigger drones flying at higher altitudes in mind when in fact very small devices flying at very low altitudes are the ones making up the most important market segment at the moment. These are in danger of falling under strict regulation that is not appropriate to the risk they actually pose. In general the "civil aviation notion of

The ALIAS project: using the Legal Case to address the legal risks of automation

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Some of the issues debated at the 7th Florence Air Forum, "Regulating Drones", in particular liabilities pertaining to the use of drones, and the impact of drones on ATM, have been addressed by ALIAS II, a project on liability issues and automation in ATM, financed as part of Work Package E in the SESAR Programme.

The main research outcome of ALIAS II is the Legal Case, a methodological tool intended to support the integration of automated technologies into complex systems, particularly in ATM. Its purpose is to address liability issues arising from the interaction between humans and automated tools, ensuring that these issues are clearly identified and dealt with at the right stage in the design, development, and deployment process.

During ALIAS II research, the Legal Case has been validated through two test applications: one application concerned collision avoidance systems (ACAS X), the other one RPAS. The purpose of these applications was to implement, test and improve the process of the application of the Legal Case.

Concerning RPAS, a user group of major aviation experts involved in RPAS was set up, including engineers, manufacturers, insurers, human factors experts, safety experts, policy makers, and pilots, while legal experts from the project acted as moderators.

The Legal Case supported the assessment of the legal risk, i.e., the risk of incurring in liabilities and other legal problems and obstacles, related to various activities and operations involving RPAS. The purpose of the exercise was to help all stakeholder, in particular manufacturers, RPAS operators and insurers on the one hand to design better insurance policies, contractual agreements, and proposal to regulators, and on the other hand to develop best practices for the development and use of RPAS.

The ALIAS research on drones also debated some of the issues identified in the Florence Air Forum, such as the integration of drones in the European airspace and into the existing system of aviation safety, and the role of navigation service providers in such processes. ALIAS focused in particular, on technological innovation, and on issues pertaining to automated management of aspects of drone's behaviour.

Among the measures suggested are the following: the detailed specification of remote pilot's tasks and responsibilities in the operational manual, the standardization and certification of the remote piloting as professional activity, the definition of official and publicly available register of remote pilots who are entitled to fly RPAS. Concerning manufacturers, the measures included: the definition of standards and best practices for the RPAS manufacturers, the definition of clear and detailed contractual arrangements between RPAS manufacturer and RPAS components manufacturers, and between manufacturers and operators, especially as concerns warranties.

Suggestions to the policy makers included: the definition of a clear legal and regulatory framework also for light RPAS, establishing the roles and responsibilities not only of the RPAS operator, RPAS manufacturer and remote pilot, but also of other stakeholders involved, such as the service providers, training organizations and certifications/ accreditation bodies; the provision of a mandatory insurance for RPAS operators, raising the minimal insurance coverage for third party liability; the establishment of a single RPAS registry, providing clear rules to make RPAS identifiable.

risk" may not be appropriate for these products. The criticism also addressed that drones may at some point bring safety benefits for example by allowing missions in disaster areas.

One of the big challenges still ahead will be to build "safety cases" for the different types of drone operations (e.g providing a structured argument based on evidence that a certain operation is safe – a common practice for the introduction of new devices in transport and other sectors). As safety cases have to be drafted from scratch this will mean a significant research work requiring the collaboration of all actors that are part of the aviation system. Also on this point opinions diverged with regard to the disruptive effects of the new technology. The current ATM system relies on many technological elements that will lose their relevance in the future if new ATM technology is deployed (as foreseen also by SESAR2020): many fundamental components such as radio control and flight areas are contrasting with a long term vision of highly automated system based on onboard technology rather than ground infrastructure. In such an environment the safety case for a product would look very different than in the current environment.

3. Enforcement

Can new rules for drones help to enforce existing regulation on privacy and security on the national and local level?

Drone regulation differs significantly from aviation regulation. One of the most important differences relates to the enforcement of rules. Many of the goals of drone regulation (security, privacy) are outside the scope of aviation authorities. Local Police however face constraints when making sure rules on drones are properly applied.

Several concrete issues on the local level were discussed at the Forum. Examples of drones flying over crucial infrastructure such as nuclear power plants and of drones approaching politicians or other public figures were discussed. These showed that drones create a gap in the capability of the state to offer protection for its citizens.

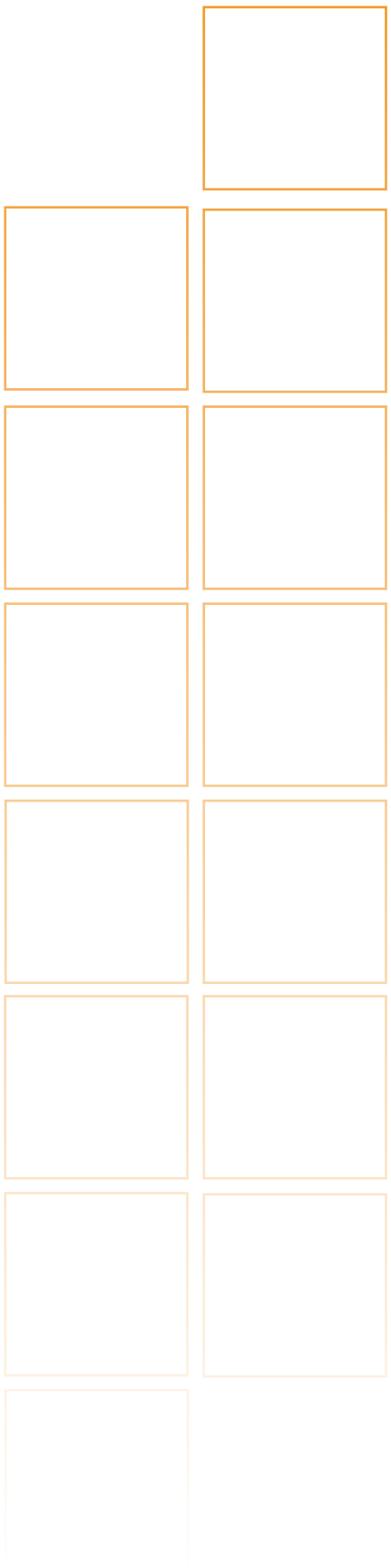
Furthermore the ground based safety risks posed by drones may actually exceed the air risks. Risks are for instance posed by possible accidents resulting from interference with road traffic. Several examples illustrating the threats for security and privacy were mentioned in the discussion.

Is technology the key to rule enforcement?

Especially in the open category solutions built into the devices can make more specific rules for enforcement unnecessary. Namely the proposal was made to require drones for recreational use to have an inbuilt geo fencing feature which would prevent them from entering restricted airspace and from flying above a certain altitude. Furthermore there should be requirements on cyber security as currently most drones are not sufficiently protected against interference from third parties. Automated Detect and Avoidance systems were also discussed as well as UTM systems and electronic identification of drones.

However there are several restrictions. Most importantly most technology is not yet mature enough to be deployed on a large scale. In the immediate short run enforcing drone rules will be the task of police officers that will need better tools to carry out their tasks. The example was made that it is very challenging to tell with the naked eye whether or not a drone is flying too high.

Technological solutions to prevent drone users from breaking the rules would need to ensure that the systems are protected against fraud. Also products need to be controlled and certified. Once a certain feature becomes safety relevant control mechanisms need to be established that allow for a sufficient compliance on the side of the producers (that may produce outside the EU). A parallel was drawn to tachographs that are required for all trucks in the European Union to enforce driving time regulations. These devices are built in a way that makes it possible for police officers to recognize whether the system has



been manipulated. For drones it is currently not in the picture how police would enforce such rules for drones. Procedures to check whether devices actually comply with directives still need to be established. There was agreement that several basic requirements for the safety of drones (such as air worthiness and minimum standards for cyber security) shall be defined at the European level for all categories of drones.

Drones as a local issue

A proposal that was formulated at the Forum was to generally leave it up to the city or provincial level to decide whether and under which conditions to allow drone operations in their area. This would result in forerunner cities that take the necessary initiatives to allow it and create examples that could be copied by other cities. Once a UTM system becomes available this could actually also be implemented on a local level. A city could develop its own strategy and also address the cost question by requiring drone users to pay for using the airspace. Such infrastructure could be established as part of a smart city strategy.

Further readings

ALIAS, 2015, Liabilities and Automation in Aviation: The case of RPAS and Collision Avoidance Systems, Conference Website

The ALIAS Conference is an annual event addressing liability and automation in aviation and air traffic management, including the innovation challenges faced by the SESAR Joint Undertaking. This Conference is one of the outputs of an EU funded project aimed at exploring the wide spectrum of the relationship between automation and liability, focusing on Air Traffic Management (ATM) and Aviation). It gathers experts from different disciplines and domains of activity to discuss the many changes in the allocation of liabilities resulting from the use of automation in complex socio-technical systems. This year the Conference addressed "Liabilities and Automation in Aviation: The case of RPAS and Collision Avoidance Systems". The Conference focussed on two technologies of interest in the framework of the future paradigm shift: the new Airborne Collision Avoidance Systems (ACAS X) and the Remotely Piloted Aircraft Systems (RPAS). ALIAS presented the results of the legal analysis conducted on these technologies by means of the Legal Case and the novel methodology developed by the project to address the legal risk of new technologies. The website provides links to videos of the presentations and download of the presentations.

EASA, 2014, Concept of operations for drones - A risk based approach to regulation of unmanned aircraft

EASA's Concept of operations for drones is an important point of reference in the European discussion on drone regulation.

The Concept is aimed at integrating drones into the existing aviation system in a safe and proportionate manner. The integration should foster an innovative and competitive European drone industry, creating jobs and growth, in particular for SMEs. The proposed regulatory framework should set a level of safety and of environmental protection acceptable to the society and offer enough flexibility for the new industry to evolve, innovate and mature. It proposes to establish three categories of operations and their associated regulatory regime: Open, Specific and Certified.

European Parliament, 2015, Report on safe use of remotely piloted aircraft systems (RPAS), commonly known as unmanned aerial vehicles (UAVs), in the field of civil aviation (2014/2243(INI))

The own initiative report illustrates the current view of the European Parliament of the ongoing debate on drone regulation in Europe. It is part of the activities of the European Parliament's transport committee on the drone issue in which the EP will be actively involved.

Florence School of Regulation Transport Area, 2015, 7th Florence Air Forum Summary of presentations

This document offers summaries of the presentations given by the participants of the 7th Florence Air Forum "Regulating Drones - Creating European Regulation that is smart and proportionate". The workshop addressed the discussion questions that were also the basis for this observer:

- How to ensure a light-handed but effective regulatory approach that is able to keep up with evolving technology?
- Where can drones fly and where not? Which rules of the air, which air traffic control procedures?
- Enforcement – can new rules for drones help to enforce existing regulation on privacy and security on the national and local level?

House of Lords, European Union Committee 7th Report of Session 2014-15, Civilian Use of Drones in the EU

The European Union Committee of the British House of Lords scrutinises EU documents in advance of decisions being taken by the British Government. This Report evaluates the plans set out by the European Commission in its Communication in April 2014 to make Europe a global leader in the RPAS industry. It provides context and background information on the drone debate. It covers among others considerations on privacy, data protection, enabling technologies and liability.

NASA, 2015, Factsheet on Unmanned aerial system traffic management (UTM)

The document presents NASA's approach to enabling Civilian Low-Altitude Airspace and Unmanned Aerial System Operations. The UTM system envisaged by NASA would enable safe and efficient low-altitude airspace operations by providing services such as airspace design, corridors, dynamic geofencing, severe weather and wind avoidance, congestion management, terrain avoidance, route planning and re-routing, separation management, sequencing and spacing, and contingency management.

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The Florence School of Regulation (FSR) is a project within the European University Institute (EUI) focusing on regulatory topics. It works closely with the European Commission, and is a growing point of reference for regulatory theory and practice. It covers four areas: Communications and Media, Energy (Electricity and Gas), Transport and Water.

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