Present and Future of Civilian RPAS
Preliminary conclusions
of an International Conference
Paris, 13-14 November 2014

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Plan

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1: Introduction (1)

- The Air and Space Academy (AAE) and the Association Aéronautique et Astronautique de France (3AF) organized jointly a 2-day Conference on :
  - Present and Future of Civilian RPAS
- The event took place on 13-14 November 2014, at the French DGAC (Directorate General of Civil Aviation) Headquarters, in Paris.
- 280 attendees in Paris, and 90 people in Toulouse through video transmission.
- European and American civil aviation authorities were represented.
- Proceedings of the Conference including conclusions and recommendations will be published.

1: Introduction (2)

- **Aims of the Conference** :
  - Civilian Drones, or Remotely Piloted Aircraft Systems (RPAS) are one of the most dynamic areas in civil aviation to-day : number of agreed operators growing rapidly in Europe.
  - Conference addressed a wide range of stakeholders : users, manufacturers, operators, research organisations, public authorities, regulatory services, all those interested in the social issues raised by this new activity.
  - Goal : to bring together key actors to confront ant enrich viewpoints, identify areas needing improvement, and actions required.

1: Introduction (3)

- the programme of the conference was divided into 7 parts :
  - 1 : Main types of civilian RPAS, State of the art
  - 2 : Stakeholders 'viewpoint
  - 3 : Public expectations and regulations
  - 4 : Risk management, degraded modes, technical means and procedures
  - 5 : Users 'expectations
  - 6 : Potential market
  - 7 : Round table
- 3 papers in each part 1 to 6 plus 4 opening speeches
- Round table : 10 participants

2: Present situation of the civilian RPAS sector (1)

- The current **boom** in the area of civilian drones is creating a new, dynamic industrial sector, with a high potential for generating growth and creating jobs, especially for small and medium enterprises.
- The **European Commission** has published in 2014 a communication COM(2014)207: "A new era for aviation: Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner“.
- Due to their lightness, flexibility and ease of operation, RPAS provide higher performance and quality than current means (helicopters, light aircraft, satellites), obtaining **more and better results**, often at **less expense**.

2: Present situation of the civilian RPAS sector(2)

- **Civilian drones market** – 90% of which is made up of video taking for the moment – evolving towards the supply of sophisticated data and diagnostic means for a variety of areas such as:
  - Surveillance of linear infrastructures (railways, oil and gas pipelines, power lines ...),
  - agriculture and environment,
  - mapping and monitoring of construction sites, quarries, mines, ...
  - diagnosis of the state of buildings, infrastructures and architectural sites.
- This developing market essentially consists of **supplying data and services** : end customers are mainly interested in processed results that can be exploited immediately and effectively.

2: Present situation of the civilian RPAS sector (3)

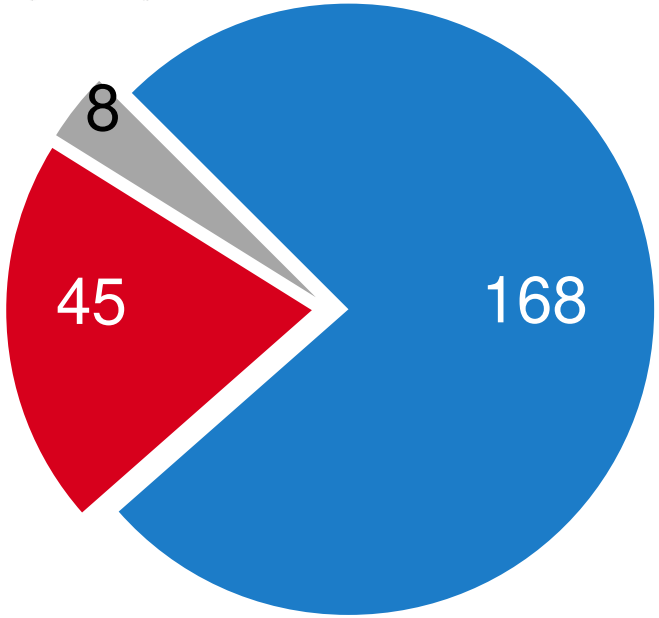
- In **France** (as an example):
  - The commercial applications with RPAS are legally authorized in France since April 2012.
  - End 2014, the sector employs about 3,000 people, mostly in small and medium enterprises (above 1000 registered operators).
  - turnover estimated at between 50 and 100 million euros and a strong growth of 25-30% per year.
  - In average, each operator uses 3 RPAS ; the great majority of them are multirotor weighing less than 5 Kg.
  - Acquisition costs : between 1K Eu and 200 K per drone, plus sensors (digital cameras, lidars, bolometers, multispectral scanners..)

FÉDÉRATION PROFESSIONNELLE DU DRONE CIVIL

Une majorité de voilures tournantes

Voilures fixes (avions)

Ballons



Voilures tournantes

Une société possède en moyenne **3 drones.**

(Oct. 13)

Inspection du viaduc de Millau

2: Present situation of the civilian RPAS sector (4)

- *Several Countries have published national regulations authorizing commercial applications of small RPAS:*
  - ***EU**: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, Spain, Sweden, United Kingdom*
  - ***Europe non-EU**: Norway, Switzerland*
  - ***Outside Europe**: Australia, Canada, Israel, Japan*
  - *Theses lists are based on information's publicly available on Internet*
- ***USA:***
  - *Public operations are authorized but are submitted to the deliverance by the FAA of a COA (certificate of waiver or Authorization) under strict conditions*
  - *The commercial applications of RPAS are authorized only for video taking flights, and are submitted to the deliverance of a COA*
  - *Six test sites have been selected by the FAA where research experiments will be carried-out.*
  - *A proposed new regulation has been published recently for commercial applications of small RPAS, and is submitted to a public consultation.*

3: Barriers to development (1)

- The main obstacles to development were highlighted in two surveys, one conducted by the European Commission in October 2014 and the other prior to the conference in Sept/Oct. 2014:
  - **Safety** is crucial**:** Need to protect populations and assets on the ground and manned aircraft flying in the airspace.
  - **Security** must be ensured and any offenders punished: for instance, intentional incursion in prohibited air space; or intentional jamming of control-command links.
  - **Privacy** of citizens must be protected.

3: Barriers to development (2)

- **Responsibilities** as regards **privacy**, **security** (ill-intentioned act) and **safety** (accident) must be clear, which means defining rules and a legal framework.
- **Feedback from experience:** this is essential in order to establish a climate of confidence (authority, customer, insurance companies, investors).
- **Technologies** should be developed in order to facilitate the insertion of civilian drones into non segregated airspace.

4: RPAS Safety (1)

- Major threats and risks:
  - **Collision with ground**: risk of fatal accident with overflown population
  - **Mid-air collision** with manned aircraft : risk of fatal accident for crew and passengers
  - **Loss of control-command** communication link: mission interruption, return to base, risk of collision with ground or mid-air during return flight
  - **Loss of navigation** information: mission interruption, risk of uncontrolled landing
  - **System failures** : mission interruption, risk of uncontrolled landing

4: RPAS Safety (2)

- Risk Mitigation Measures :
  - **Collision with ground**: flights above ground populations forbidden or strictly limited
  - **Mid-air collision** with manned aircraft: maximum height of flight 500 ft AGL; flights in view of the remote pilot; flights beyond line-of-sight restricted to very small RPAS; R and D on sense and avoid systems (SESAR)
  - **Loss of control-command** communication link: autonomous go-around
  - **Loss of navigation** information: autonomous or controlled safe landing
  - **System failures** : autonomous or controlled safe landing when feasible

4: RPAS Safety (3)

- Remote Pilot and commercial operator qualifications:
  - **Remote pilots** shall hold a pilot licence theoretical certificate and have successfully followed a practical training, under the responsibility of the RPAS operator; for BLOS flights (scenario S4), a full private pilot licence is required with a minimum experience.
  - **RPAS commercial operators** shall be registered by the civil aviation authority; to do so, they must prepare and deliver to the authority a manual detailing the operational procedures that are applied by the remote pilots.
  - A revision of the current French regulation is under preparation and should improve the remote pilot qualification requirements for LOS operations;

5: Regulatory Framework (1)

- In order to ensure safety, **regulations** must be developed : EU Member States are competent for regulating RPAS with a maximum mass less than 150 kg – above, the European Aviation Safety Agency is competent.
- In **France** the existing regulations date back to 2012 and cover four operational scenarios (S1 to S4): they apply to light RPAS (<25 kg), only one of them may exceed a distance of 1 km from the remote pilot.
- It is important that these existing regulations, which should be completed and improved, remain flexible, adaptable and proportionate to the risks arising from the weight + scenario combination.

5: Regulatory Framework (2)

- The European Commission has published COM(2014)207 aimed at addressing the different barriers to development, proposing to undertake the following actions:
  - **Examine the regulatory conditions to integrate RPAS into non-segregated airspace,** from 2016, and request EASA to develop the future rules, in relation with the JARUS group of civil aviation authorities
  - Ensure that the necessary R & D support to develop contributing technologies for the integration into the airspace are taken into account by **SESAR 2020**
  - Ensure that **security** aspects are covered in the operations of RPAS
  - Assess how to protect **citizen's fundamental rights** (privacy, personal data)
  - Assess **third-party liability and insurances** aspects et propose regulatory measures
  - Support the development of the **RPAS market** by means of H2020 and COSME programmes, ensuring the participation of SMEs

5: Regulatory Framework (3)

- **1. Very low level** operations below VFR altitudes for manned aviation: i.e. not to exceed 500 ft. above ground level; they comprise:
  - **A. Visual line of sight (VLOS)** in a range such that the remote pilot maintains direct unaided visual contact with the remotely piloted aircraft;
  - **B. Extended Visual Line of Sight (E-VLOS)** where the pilot is supported by one or more; observers, in which the crew maintains direct unaided visual contact with the RPAS;
  - **C. Beyond VLOS (B-VLOS)** where the operations are also below 500 ft, but beyond visual line of sight requiring additional technological support.
- **2. RPAS operations in VFR or IFR**, above 500 ft. and above minimum flight altitudes; they comprise:
  - **A. IFR (or VFR)** operations in radio line-of-sight (RLOS) of the pilot in non-segregated airspace where manned aviation is present. The key capability of **'detect and avoid' (D&A)** is required in relation to cooperative and non-cooperative nearby traffic;
  - **B. IFR (or VFR)** operations beyond radio line-of-sight (BRLOS) operations, when the RPAS can no longer be in direct radio contact with the pilot and therefore wider range communication (COM) services (including via satellite) are necessary.

5: Regulatory Framework (4)

5: Regulatory Framework (5)

- The **FAA** has received instructions from the US authorities to draw up a roadmap, with the goal of establishing a regulation enabling the flight of RPAS. The FAA has recently published a NPRM concerning a proposed regulation for the small RPAS (less than 25 kg).
- **ICAO** has created a RPAS panel to review and develop new standards and best practices for RPAS integration in the non-segregated airspace in terms of airworthiness, "command and control", the frequency spectrum, "sense and avoid", the qualification of remote operators (licenses), operations and integration into air traffic.

6: Conclusions

- The integration of RPAS into the non-segregated airspace is a condition for the development of civil applications.
- It is essential to increase the R and D effort, for developing new technologies making possible the safe integration of RPAS within the non-segregated airspace.
- The integration of RPAS within the non-segregated airspace requires dedicated frequency bands for the C2 links.
- A specific training of the remote pilots should be defined taking into account the specificities of RPAS.
- The national regulations within EU should be harmonized, and aligned as far as possible with the future ICAO SARPS.