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# Summary

- Involvement of the French Aerospace Competitiveness Clusters in the UAV Environment
- ✓ What are we talking about ?
- ✓ French and European Regulations
- Examples of UAV Applications in Various Areas of Economy
- ✓ Potential Needs/Well-founded Questions about UAV Applications
- ✓ Next Challenges/Main Collaborative R&D Projects Requested



Specifics & Common WGs

#### Involvement of the French Aerospace Competitiveness Clusters In the UAV Environment

- Members of the French Civilian Drone Council (Civilian Professionnal UAV/RPAS)
  - Technical Committee # 1 : Operations, Regulations & Uses
  - Technical Committee # 2 : Technologies & Safety
  - Technical Committee # 3 : Support & Promotion of the Industry
- Cooperate through the 'Comité Drones Inter-pôles 'with Dedicated Clusters and Test Ranges
- ASTech Paris Region Member of UVS International
- Aerospace Valley Member of EACP (European Aerospace Cluster Partnership)



## What are we talking about?

- A Remotely Piloted Aircraft System (RPAS), with Nobody on Board, Professional, Class 'Specific' (EC), for no Military Operation
  - ✓ A Vehicle: Fix Wing, Rotating, Counter-Rotative, Quadri, Hexo or Octocopter, and so on
  - Its Payload (A Mission System): Power Supply, Sensor(s), Data Link, Airworthiness Card, and so on
  - A Control Ground Station
  - A Command & Control System (C2)
  - ✓ A Remoted Pilot/Its Training
- Technologies, Data Processing & Diagnostics
- An Evolutive Legislation for an increased Safety and Security
- Well-founded questions about the UAV/RPAS Applications







#### What are we talking about ? (Cont'd)

- ✤ A Mean for:
  - Inspection of Difficult to reach Areas
  - Preventive Maintenance Planning
  - ✓ Access to Areas that pose Health and Safety Risks to Humans
  - ✓ Fast Response Time
  - Quick on Site Deployment of Inspection Systems
  - Reduced Downtime, and so on
- A Mean making Use of Innovative Technologies (Few Examples):
  - Photogrammetry: The Science of making reliable measurements by the use of Photographs and especially Aerial Photographs
  - Aerial Thermography: Technology to register the Thermal losses by Infra-red
  - LiDAR (Light Detection And Ranging): Tehnology of Teledetection by Laser
  - ✓ NDVI (Normalized Difference Vegetation Index) Cartography: To monitor the Cultivations and their Produces
  - Aerial Footage & 3D Maps



## The Current French Regulation (For Civil UAV/RPAS)

Two Orders (Not Applicable to Indoor Operations, Free Balloons, Kites, Rockets, ...)

Arrêté du 17 décembre 2015 relatif à l'utilisation de l'espace aérien, modifié le 30 mars 2017 Arrêté du 17 décembre 2015 relatif à la conception, aux conditions d'emploi et aux capacités requises pour les télépilotes

#### Use of Airspace

Design, Operational Conditions, Competencies

https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000031679868&dateTexte=20170413 https://www.legifrance.gouv.fr/eli/arrete/2015/12/17DEVA1528542A/jo/texte





## The Current French Regulation (Cont<sup>d</sup>)

#### Aerial Works : Operational Limitations



- ✓ Technical Requirements on UAV depending on the Scenario
- Prior Notification required in Populated Areas
- Prior Authorization required in Controlled Airspace or Restricted Areas
- ✓ Away from Aerodromes
- Specific Operations and Experimentations subject to a Case by Case Risk based Analysis
- ✓ A Handbook is Available on Line



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#### Security Issues: Law 2016-1428



- ✓ Implemented in France in July 2018 Detailed Decrees currently in Progress
- International Standards should be Defined
- ✓ Web Registration for all UAVs from 800 g (or Below), Official Registration over 25 Kg
- Remote Pilot to be educated and to follow approved Training, Licence needed for some UAVs Operations (Risk based Approach)
- Information towards all Drones' Users (Leaflet)
- ✓ Devices consisting of Lights, Electronics and Sound for all Drones above 800 g
- Geo Limitation Systems (Max Ceiling, Max RPAS Distance, No-Drone Zones and so on) on-Board for all Drones above 800 g (or Below). Exemption for Specific Operations



#### New Potential French Scenario

Scenario S0 for Use in One's Own Right



Use only above Grounds, Sites or Works, inside a Volume all in One Block, of which the Structure monitoring the Flight :

#### Is the Owner or the Operator or the Co-operator

Or

Possess, for a Mission of Public Utility, a Service or an Occupation Permit, or a Concession granted by a Public Authority

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UAV/RPAS with a Geo-limitation Function and of Maximal Mass of 4 Kg No Third Party on the Ground



## The UAV at the Conquest of the Economy

- ✓ Aerial Pictures for Medias, Real Estate Marketing, Insurance Cy...
- Lifesaving
- Inspection of Power-supply Network
- Security, Safety
- Agriculture
- Constructions / Civil Engineering / Geometers Evaluations
- Checks and Inspection of High Value Assets, Industrial Sites, Buildings...
- Protection of the Environment
- ✓ **Ground Studies** (Mining Sites, Open Quarries, Archaeology)
- Miscellaneous (Outdoor & Indoor Operations)

Impossible to be Exhaustive : more than 200 Types of Missions expected !



### Aeríal Píctures for Medías, Real Estate Marketíng, Insurance Cíes...



The Sporting Dailies (Tour de France Cycling)

'Wild Horses of the Camargue' (Drone Pictures for the C. Turner's Movie)



Real Estate Marketing (To Harness the Beauty of the Real Estate and its Environment 'To see Something in Another Light') (Drone Immobilier)





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Insurance Companies (Damages Evaluation)





## Lifesaving (Life Protection Emergency Response)



Delivery of Blood Samples (From Lab to Hospital)





Drone equipped with a Detector of Avalanche Victim (To Set-up the Rescue)



Talkie Walkie to quickly warn a person difficult to reach

#### Dropping of a connected Life-Buoy by a Drone





The Fire Brigade (To Set-up the Rescue)









## Inspection of Power-supply Network

**ErDF/Enedis** 'Be Reactive, Independant' 'Setting-up an UAV/RPAS is Simple'



Detection of a Failing Isolator in a circuitry of 20 kV





EDF (Thermal Depot) Identification of Hot Points on an Operating Transformer Station (Thermographic Checking)



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#### Security / Safety

Mapping and **Detection of Failures** SNCF Failure Inspection (Hermes Project) To Help the Firemen

Coordination of a Fleet of Heterogeneous UAVs



Where to place the Fire-Brigades ?

Survey : Presence of Trains, Vehicles. Secure the Acquisitions

Firefighting Ressources Management





## Security / Safety (Cont'd)

Help the National Police Forces (I.e : RAID in France : Search, Assistance, Intervention, Dissuasion with a casing RPAS)



Fire Survey over an Industrial Site





GRTGaz Detect a Potential Leakage of Gas In a Difficult Environment



Counter Overflights over Sensitive Sites (I.e : a UAV spreads a Net to capture the malevolent Vehicle)



#### Agriculture (Precision Farming)

Detect the Adventitious, the Diseases of the Vegetation, the Chlorophyl Rate, the Hydrous Stress, and so on

**Cultivation Analysis** 



Digital Processing of Pictures of NDVI Type (Normalized Difference Vegetation Index)



**Biomass Cards** and of Nitrogen Preconization







### Constructions / Civil Engineering / Geometers Evaluation



Following-up a Construction (Drone Corp)





Inspection of Bridges, Viaducs...

Ortho Pictures proposed by ENGIE Lab CRIGEN



## Constructions / Civil Engineering / Geometers Evaluation (Cont d)

Elaborate a Topographical Map by Photogrammetric Survey (By means of Steadying Pieces on the Ground) to marking-out & Cost Reduction to the Benefit of the Buyer



Build-up a Ground Model to set-up Systems in order to Secure the Personal Properties & the Persons against Avalanches & Crumbling risks





Overall Substructure Survey

The French Aerospace Competitiveness Clusters Vision of the UAV Applications in Various Areas of Economy

#### Checks and Inspection of High Value Assets, Industrial Sites, Buildings, and so on



Survey of the Garonne Bank (Chantier de France)



Survey of a Wind-engine



Survey of a Building Site (Vinci, Skydrone)





#### Protection of the Environment

Fly over Forest-clad Mountain Groups, Boggy Sites to find Traces of Pollution or to supervise the Vegetation



Survey of Dykes (DIDRO Project – Cerema)



Fly over a Region to locate Thermal Losses by using the Thermography



Protect the Fauna in Danger





#### Ground Studies (Mining Sites, Open Quarries)

Photographic Surveying or Photographic Grid Layout of Grounds (Air Marine)



Survey of the Cubature



Management of Mines and Quarries



Evaluation of the Depth of the Cutting Front





#### Ground Studies (Archaeology)

Fix Wind UAV for Archaeologic Prospection (AVEM - Aeromapper)



Archaeologic Vestiges Signatures (Photogrammetric Processing)

Orthophoto RBG GSD 3cm









Orthophotos: RVB Imagery, IR Imagery & Thermal IR Imagery



**DRONES IMAGING** 

Orthophoto IR Thermique GSD 18cm



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#### Miscellaneous (Outdoor Operations)



Capital Goods Care

RPAS spraying a Washing Liquid on a Roof

Register Thermal Losses on a Roof





Airrobotics has developed a Turnkey Solution to connect a Port Operations on the Ground and at Sea with Insights from the Sky by a RPAS/UAV



A RPAS/UAV spraying a Product sterilizing Gull Eggs over a Sensitive Site (Sévéso III Class) at Dunkirk - France (Civiv Drone, Cosmopter)<sup>23</sup>



#### Miscellaneous (Indoor Operations)

Operation for One's Own Right



Advanced Indoor Inspection by UAV to reduce Aircraft Inspection Times and enhance Report Quality



**Power Engineering** Catalyst Pipe Inspection



Grotto Inspection

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#### Potential Needs/Well-founded Questions about UAV Applications

- The Events we are living through the current UAV Applications are generally based on Payloads implementing Sensors collecting Datas. Some People are thinking on UAVs/RPASs making use of Tools instead of Sensors (Robotized Arm, and so on). It is Worth thinking over and be ready to respond to this possible Market
- Acceptability of the UAVs/RPASs by the General Public is a True Issue:
  - Sound Effects to be reduced;
  - Risks of Visual Pollution;
  - Affect the Private Life, and so on;

National Authorities are fully aware of these Issues and work with the Industry to come out with Acceptable Solutions



## Next Challenges/Main Collaborative R&D Projects requested

**2017-2020:** Long Range Operations (Linear Surveillance, Mining & Quarrying Operations, and so on)

- Adapt UAVs/RPASs to Missions: Design Long Endurance & Long Range Systems, Detect & Avoid System,...
- On-board Energy Management
- Convert the 'UAV/RPAS Product' into a 'UAV/RPAS System Services'

**2017-2023: Tools & Methodology for Safe & Secured Operations** (Systems, Training, Operation Conditions, and so on)

- Specific Operations Risk Assessment 'SORA' (At System Level)
- Safe & Robust Control & Navigation Systems
- Safety & Security Validation Proofs, Design Tools, Integration, Production
- **2017-2026: UAVs/RPASs Traffic Management** (UTM Global System, Technologies, Services, Regulations, and so on)
  - SORA I Tools & Management Systems
  - Convergent Evolution of the Regulations & the Technologies
  - Operational Concepts, Traffics/Altitudes/Zones Management



Thank you for your Attention

#### Any Question ?

