

COUNTRY REPORT ON THE USE OF DRONES IN CONSTRUCTION- RELATED ACTIVITIES



**CAMPUS
DES MÉTIERS
ET DES
QUALIFICATIONS
D'EXCELLENCE**

**Habitat, énergies renouvelables
et éco-construction
Occitanie**

FRANCE 2022

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I- OVERVIEW (AT NATIONAL LEVEL)

Regulations (Standard Operating Conditions) and RPA operator qualification requirements / Pilot certifications needed

In France, the government produced texts regulating the air traffic of drones before Europe addressed the issue. Thus, French regulations currently coexist with the national application of European texts that have since been enacted (see below).

National legal corpus :

- Civil Aviation Code
- Code of transport

Registration

[Immat decree]: decree n° 2019-247 of March 27, 2019 relating to the registration of unmanned aircraft and amending the civil aviation code

[Arrêté immat]: Order of July 28, 2015, as amended, on the nationality and registration marks, the identity plate and the registration certificate of aircraft

Operation of unmanned aircraft

[Scé]: Order of December 3, 2020 on the definition of national standard scenarios and setting the conditions applicable to missions of civil aircraft without crew on board excluded from the scope of Regulation (EU) 2018/1139.

[Esp] : Order of 3 December 2020 on the use of airspace by aircraft without crew on board.

Law " Drones

Law No. 2016-1428 of October 24, 2016 on the reinforcement of the safety of the use of civil drones

Registration of aircraft

[Decree Enr]: decree n° 2018-882 of October 11, 2018 relating to the registration of civil aircraft operating without crew on board

[Enr Order]: order of October 19, 2018 on the registration of civil aircraft operating without a crew on board

Training of remote pilots

[For] : Order of 18 May 2018 on the requirements applicable to remote pilots who use civil aircraft operating without a person on board for purposes other than leisure

Warning lights and electronic or digital warnings

[Decree No. 2019-1114 of 30 October 2019 for the application of Article L. 34-9-2 of the Post and Electronic Communications Code

[Signaling Order]: Order of December 27, 2019 defining the technical characteristics of electronic and light signalling devices for aircraft operating without a person on board

Notice

[Decree notice]: Decree no. 2019-348 of 19 April 2019 on the information notice relating to the use of aircraft operating without a person on board

[Order notice]: order of April 19, 2019 on the content of the information notice provided with the packaging of civil aircraft circulating without a person on board and their spare parts

Sanctions

[Sanc]: decree no. 2019-1253 of November 28, 2019 on the criminal penalties applicable in the event of breaches of the safety obligations provided for the use of civil drones circulating without a person on board.

DGAC: The rules are grouped and studied by the Direction Générale de l'Aviation Civile, which issues authorizations, certifications, and flight restrictions through its various directorates.

<https://www.ecologie.gouv.fr/direction-generale-laviation-civile-dgac>

DSAC: The respect of international and national rules is the responsibility of the Direction de la Sécurité de l'Aviation Civile. Supervision and certification body, in particular for pilots.

SIA : The documentation is provided by the Aeronautical Information Service. Its website includes airworthiness (NOTAM, weather, flight plan...) and regulations.

<https://www.sia.aviation-civile.gouv.fr/>

Legal corpus of the single European flying area:



Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency

Since January 1, 2021, two European regulations apply in France because its airspace is part of the Single European Sky (and by transcription of the texts):

- Regulation (EU) 2019/947
- Regulation (EU) 2019/945

A revision in September 2022 integrates the changes introduced by :

Commission Implementing Regulation (EU) 2022/425 amending Commission Implementing Regulation (EU) 2019/947 as regards the postponement of the transition dates for the use of certain drones in the "open" category and the application dates of certain standard scenarios.

Decision ED 2022/002/R amending Decision ED 2019/021/R on "geographical areas", operational authorization forms in the "specific" category, a procedure and forms for cross-border operations, standard scenarios, the syllabus of training modules for remote pilots in the "specific" category, and a new predefined risk assessment.

The rules are consolidated and reviewed by the European Aviation Safety Agency EASA.

EXEMPTION: Not concerned are those whose use is limited to the following case: operation in the open category AND maximum mass of the UAS less than 250g AND impact energy of the UAS less than 80 joules AND UAS not equipped with a sensor that can collect personal data (unless it is a toy compliant with the directive 2009/48/EC)

We use cameras, so no exemption!

RPA operator qualification requirements / Pilot certifications needed

The main points that concern pilots in relation to the construction and training sector (drones taking pictures, sometimes heavy, having to operate in all areas, students in training) are the following:

There are three categories of flights, in summary:

Open category: low risk as much for people as for other aerial operations, flight in view of the drone from the pilot, mass less than 25kg, two sub-categories (A1 and A3) with simple pilot exams. No remote electronic identification if the drone weighs less than 800g.

Specific Category: moderate risk, out of sight flight, unlimited weight possible, electronic identification emission, cargo transport. Declaration or possibly request for flight authorization, French scenarios (S1, S2, S3), and soon European standards (STS01 and STS02). Pilot certified in theory and practice by a more advanced examination.

Certified category: high risk, transport of dangerous materials, people, dangerous tools... specific file of authorization request to be sent to the DGAC.

Vocabulary: "operator" and "exploitation" (RPA operator)

Flying a drone is often called in the regulations an "operation".

Operators are the legal entities (persons or companies) that own drones and use them. The pilots, who are employees, are themselves operators when they fly the drone and therefore bear the responsibility for the flight. A drone operation is the fact of using a drone, even for a simple flight.

Training of pilots - certifications: see end of document « TRAINING

Specific training and licensing for RPAS pilots”

- The ERASMUS+ Drones4VET program, if recognized by the authorities, could be a basis for certification for training.

Operator responsibility

In order to practice professionally, the operator must

- Declare his activity on the web portal administered by the DGAC: AlphaTango
- Write a European MANEX (formerly MAP "Manuel d'Activités Particulières", a little lighter): describing the modalities of implementation of his regulatory obligations; keep this document up to date.
- To write the Cerfa 12546: declaration of aerial photography and cinematography activity (if envisaged, which is the case for our civil engineering activity)
- To have an insurance RCA " Civil Aeronautical Risk ".
- Register your drones on AlphaTango
- Affix on the drones a rectangular plate of operator
- For drones over 800g to 25 kg, add the registration number UAS-FR-XXX
- Check the qualifications of the pilots according to the category of flight envisaged

- Maintain the flight qualifications of the pilots by continuous training or a follow-up of the missions in lieu of continuous training
- Ensure the airworthiness of the UAVs (condition, maintenance, compliance with changing standards)
- Monitor regulations

Before operating a mission, the operator must ensure compliance with the regulations of 17 December 2015:

- Prepare his mission beforehand (specific form recommended)
- If necessary, request a protocol with a civil or military aeronautical platform:
 - o Declare your flights to the competent local prefecture in a populated area or a place open to the public
 - o Declare your flights in S2 (out of sight) or if visual flight at more than 50 meters in a military training area
- Take note of the aeronautical documentation in force: NOTAM "Messages to airmen" and SUP AIP "Supplement to aeronautical information publications" as well as the weather.

In the open category, the operator does not have to make any declaration for his flights, he only has to respect the rules of the subcategories of the open category.

In the specific category, the operator must declare his flights but they are not subject to authorization if he respects one of the three conditions:

- operate according to a national standard scenario S1, S2 or S3
- OR operate in accordance with a European standard scenario STS-01 or STS-02 (not yet applicable in France before 2024)
- OR to hold a light UAS operator certificate (LUC) see below.

Summary of standard flight scenarios

open category

the open category flight consists in respecting all the rules below, and it allows not to have to declare its flights. Attention, for the professionals, it is necessary to "prepare its mission beforehand" thus to write a flight sheet (for example place, geo-cage settings, name of the owner and authorization, type of mission, pilot, drone used, weather...).

common prescriptions :

- o Low risk
- o Drone always in view of the pilot
- o Drone of more than 800g registered on the AlphaTango portal
- o Maximum altitude 120m/ground and +15m above very high buildings
- o Out of the public domain in built-up areas
- o If flight in built-up area: only above a private plot with owner's authorization and without risk of falling on a neighboring plot or the public domain ($dist = V.e(2h/g)$ or 2.5m at 1m/s)

and 30m high, 3m at 2m/s and 30m/ground V [m/s] horizontal speed of the drone, h [m] height/ground, g=9.81)

- o With implementation of a geo-cage of limitation of evolution programmed in the drone so that it does not leave the perimeter of the subcategory: geovigilance
- o Outside built-up areas: respect of the altitude and flight restrictions map published on the website www.geoportail.gouv.fr
- o Respect of the flight restrictions issued by the DSAC in the form of NOTAM or other
- o Night flights are prohibited
- o Dumping, spraying, transport of dangerous goods prohibited
- o Minimum age 14 years
- o Drone certified in European class C1 to C4 from January 1st 2024. Currently (September 2022) no drone is sold with a class certification
- o Drone without class but respecting weight and equipment criteria
- o Flying from a moving vehicle is not prohibited but not recommended because it is impossible to monitor the airspace at 360°.
- o Anti-fall parachute not mandatory whatever the weight (the parachute is only required in specific category S3 scenario)
- o Professional operator: no obligation to declare his flights
- o Professional operator: operator number stuck on the drone on a label of at least 5 x 3

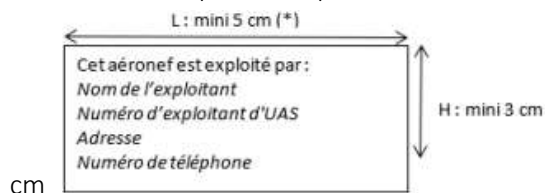


Table of specificities by subcategory, in addition to the above rules according to the type of flight

Subcategory open	pilot	Drone without european class	Drone european class certified	flight
Subcategory A1	CO A1/A3	prohibited	weight < 900g and class C1	Close to people but not to gatherings
Subcategory A1 limited Up to january 2024	CO A1/A3	weight < 500g	/	Close to people but not to gatherings
Subcategory A2	CO A1/A3 + exam A2 (=BAPD)	prohibited	weight < 4kg and class C2 Emission of the identifier if weight > 800g	At 30m from people. At 5m if low speed system
Subcategory A2 limited Up to january 2024	CO A1/A3 + exam A2 (=BAPD)	weight < 2kg Emission of the identifier if mass > 800g	/	At 50m from people.
Subcategory A3	CO A1/A3	weight < 25kg class C3 ou C4 without european class from 2024 amateur construction Emission of the identifier if weight > 800g		At 150m from people and residential, industrial, commercial and recreational areas

Specific category

All flights that do not meet the criteria of the open category fall into the specific category.

To make things easier, the French rule applicable until December 2023 provides for three "scenarios" that need only to be respected in order not to have to request a flight permit. For professionals, it is necessary to "prepare the mission in advance", i.e. to draw up a flight sheet (e.g. location, geo-cage settings, name of the owner and authorisation, type of mission, pilot, drone used, weather conditions, etc.).

Common prescriptions:

- o "Moderate" risk (high risk: certified category, therefore authorization)
- o Maximum altitude 120m/ground and +15m above very high buildings
- o Drone of more than 800g: emission of an identifier specific to the drone coded by the manufacturer, registered on the AlphaTango portal and AlphaTango UAS-FR-number identification label stuck on the drone (in addition to that of the operator); warning light only for night flights (thus useless here because prohibited in S1-S2-S3). Drones weighing less than 800g can be voluntarily registered, which is useful for teaching purposes. WARNING: from 2024 onwards, a European type signal will also have to be issued... the two signals have not yet been split into one...)
- o Drone with a mass of more than 25kg or a dimension of more than 3m: forbidden, see specific regulations (out of subject here)
- o Drone with a design, maintenance and user manual
- o Drone equipped with a fail-safe emergency landing system in the event of a control link failure
- o Safety by cutting propulsion from the control regardless of weight, but the parachute is only mandatory in certain cases detailed in the scenarios
- o With the implementation of a geo-cage of limitation of evolution programmed in the drone control so that it does not leave the perimeter of the scenario: geo-vigilance
- o Height measurement by barometric sensor
- o NO overflight of third parties (people not involved in the mission) for all scenarios, which is quite difficult to achieve in scenario S3 which authorises flight in populated areas: one immediately finds oneself in an "out of scenario" situation and therefore requires authorisation. Passers-by in the street of a report are not considered as participants in the mission, unlike our students who are following a flight course.
- o Securing an area on the ground under the flight of the drones where third parties (people not involved in the flight mission) cannot enter

- o Outside built-up areas (within 50m) or gatherings of people (within 150m); respect the altitude and flight restriction map published on the www.geoportail.gouv.fr website and the ICAO-VFR maps
- o 30m from motorways, expressways and railways
- o Respect of flight restrictions issued by the DSAC in the form of NOTAM or other
- o Night flight is prohibited
- o If piloting with virtual goggles "in immersion" (first person vision FPV): another person must see the drone and is responsible
- o Dumping, spraying, transport of dangerous goods prohibited
- o Minimum age 16 years
- o Drone certified in European class C1 to C4 from 1 January 2024. Currently (September 2022) no drone is sold with a class certification
- o Drone with no class but meeting weight and equipment criteria
- o Piloted flight from a moving vehicle prohibited except from a boat
- o Parachute not required regardless of weight (parachute only required in specific category S3 scenario)
- o Professional operator :
 - o Mandatory declaration of his activity and the scenarios envisaged, with the drones used, renewable every 24 months
 - o Drafting and updating of a MANNEX
 - o Training and periodical verification of pilots' skills
 - o Each year in January, the operator operating according to the national standard scenarios must declare to the DSAC the number of flight hours performed according to the scenarios considered AND make a summary of the problems encountered and the measures taken to remedy them.
- o Documents required at the place of flight :
 - o Drone operator registration receipt with mention of the declared scenario(s) in specific category
 - o Acknowledgement of receipt of the operator's activity declaration
 - o Certificate of design of the drone
 - o The updated MANNEX
 - o The pilot's certificates: CATT or CAPD and his identity document
 - o Authorisation to take pictures or other necessary authorisations from the DGAC

Professional flight: operator's number stuck on the drone on a label of at least 5 x 3 cm IN ADDITION TO THE DRONE NUMBER IF REGISTERED (>800g or voluntary)

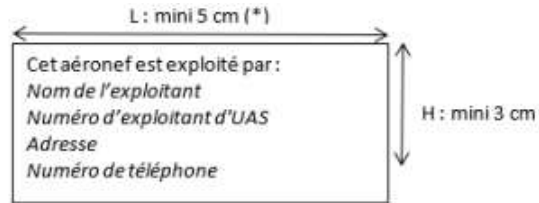


Table of specific scenarios whose rules complement the general requirements :

French scénario	Populated area	drone	Distance to pilot	Drone in pilot's view	Maximum flight Volume – third party exclusion zone ZET
S1	No	25kg max No homologation	200m	yes	Area around the drone, moving with it, radius $10m < V \cdot e(2h/g) < 30m$ if drone < 2kg without parachute et height < 50m Or if drone < 8kg with parachute without height limit if weight > 8kg : 30m without réduction
S2	non	25kg max under 50m height 2kg max if height > 50m Recording of the parameters of the last 20 minutes of flight Cartography showing the position of the drone Engine shutdown independent of the remote control DSAC approval	1000m	Possibly not but notified on AlphaTango (between D-2 and D at 4am)	Fixed, all-flight zone of 30m around the entire projection of the entire flight area
S3	Yes, but without an overflight by a person outside the mission	8kg max (Except if captive) Push-pull rescue, engine shutdown, independent, audible warning, checkable before Approval required if weight > 2kg	100m	Oui	Area around the drone, moving with it, radius $10m < V \cdot e(2h/g)$ Et < 30m si weight < 4kg over 4kg the formula has no limit

European harmonisation: Standard scenarios STS-01 and STS-02 and European UAV classes C1 to C6

Although published and therefore soon applicable, the STS are aviation safety rules, not public safety rules, so they are complemented by French public safety rules (800g rule, exclusion of third parties...)

These scenarios will be declarative, just like the current French scenarios. It will be necessary to use EC drones under Regulation 2019/945 with a class certification. These new standard scenarios can be used from 2 December 2021, the French scenarios will still be valid until 2 December 2023 (for the time being).

- Scenario STS-01: "covers direct visual operations (VLOS) with a Class C5 (CE marked) UAS at a maximum height of 120m above a ground controlled area in a manned environment.

- Scenario STS-02: "covers operations that can be conducted out of sight (BVLOS), with the unmanned aircraft at a maximum distance of 2 km from the remote pilot and with airspace observers present, at a maximum height of 120 m over a ground controlled area in a low population density environment, with a Class C6 (CE marked) UAS."

There is no longer a difference between recreational and professional flights, each flight depends on the class of the drone. We remain in OPEN with C1 to C4 drones and then in STS with C5 and C6. From 1 January 2023, all newly built drones will have to meet the new requirements of European legislation. Each drone will be marked with a pictogram indicating its class in addition to the separate CE marking.

Definition of European classes (summary):

Drone classes range from C0 to C6. The higher the number, the higher the risk of using the drone.

C0 : Open category A1/A3. This category authorises the overflight of people (except for grouping).

Maximum weight 250 g

Maximum altitude 120 m

Visual flight only

C1 : Open category A1/A3, overflight of persons tolerated with explicit written agreement.

Maximum weight 900 g

Maximum altitude 120 m

Visual flight only

C2 : Open category A2/A3, flight distance to people of at least 5 m in slow mode and 30 m in standard mode



Maximum weight 4 kg

Maximum altitude 120 m

Visual flight only

C3 : Category Open A3, flight at least 150 m from populated, commercial, industrial or recreational areas

Maximum weight 25 kg

Maximum altitude 120 m

Visual flight only

C4 : Category Open A3, flight at least 150 m from populated, commercial, industrial or recreational areas

Maximum weight 25 kg

Maximum altitude 120 m

No automatic control systems

Visual flight only

C5 : Category Specific, drone intended for flight according to the STS-01 scenario

Slow flight mode (maximum 5 m/s)

Geo-vigilance system

Control tools for: flight height, engine shutdown system, etc.

C6 : Category Specific, drone intended for flight according to the STS-02 scenario

Slow flight mode (maximum 5 m/s)

Geo-vigilance system

Tools to control: geographical position, speed, height, horizontal and vertical boundary crossing indication, etc.

NOTE: Overflying private property: rights of the owner

With regard to the issue of overflying private property, Article L. 6211-3 of the Transport Code stipulates that "the right of an aircraft to overfly private property may not be exercised in such a way as to interfere with the exercise of the owner's right".

It is therefore up to the operator to assess, before the flight, whether it is likely to "hinder the exercise of the owner's right", for example in the case of very low-level flying, and in case of doubt to contact the owner and obtain authorisation or non-opposition.

Training Organisation

Any UAS operator can become a practical training organisation for student telepilots, customers (in the case of a school) or employees (in the case of an operator providing basic practical training to its telepilots). Since practical training flights in standard scenarios constitute activities in the Specific category, the training organisation must be a UAS operator that has declared itself according to the scenarios for which it provides training.

Its MANEX must specify that training is part of its activities and define the specific measures taken to ensure the safety of training flights. In particular, the instructor must be a remote pilot already authorised for the scenarios under consideration and must have his own control system or, failing that, must be able to access the control system at any time and under conditions which maintain flight safety.

The methods (training programme, progress booklet) and means (material and human) used to provide basic or additional practical training are also described in the operator's MANEX.

Progress booklet

The organisation providing the basic practical training must fill in a progress booklet.

The progress logbook is used to monitor and document the acquisition of practical skills. It contains detailed and regular progress reports from the trainers, including assessments to evaluate progress. It is signed by the student telepilot at the end of each training cycle. It is archived for five years. A copy is given to the telepilot on request.

Penalties

The following is punishable by imprisonment and a heavy fine

- using a drone in conditions that do not comply with the rules laid down to ensure safety
- for a remote pilot, to have a drone fly over an area of French territory in violation of a flight ban, through clumsiness or negligence
- to voluntarily infringe on the privacy of others:
 - by capturing, recording or transmitting, without the consent of the author, words spoken in private or confidentiality;
 - by fixing, recording or transmitting, without the consent of the latter, the image of a person in a private place.

The following is punishable by a fine:

- for the remote pilot of a drone weighing 800g or more,
- use a drone without having obtained the theoretical aptitude certificate and the training follow-up certificate (or the aptitude certificate for the functions of remote pilots);
- not being able to present these documents immediately in the event of an inspection
- not being able to present these documents within 5 days
- for the owner of a drone weighing 800g or more, to allow his drone to be used: without having registered it;
- by having provided, at the time of registration, inaccurate information on the characteristics of the aircraft or on the identity of the owner(s);
- without having affixed the registration number to the aircraft;
- without having equipped its drone with the electronic or digital reporting device.

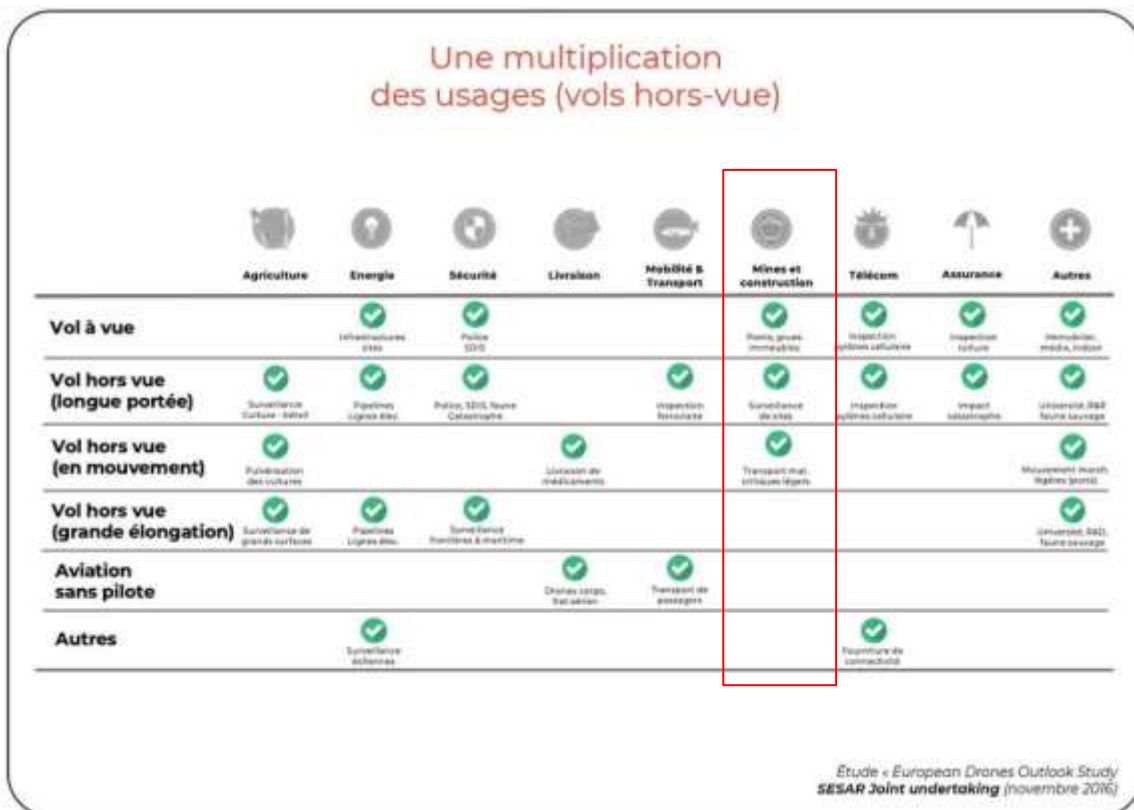
Strategic plan for the development of RPAs/drones in the country. Priorities

No strategic plan has been established for the development of RPAs, but the intrinsic reliability of the aircraft should allow the use of UAVs and the performance of these missions in complete safety within a few years. The main current difficulties identified still concern :

- The safety and quality of the telecommunications to be established between the drone and the ground control station;
- The autonomy of the UAV in flight through the capacity of the autopilot card to manage air risks (detection of moving objects in the airspace and real-time recalculation of trajectories).

Projections by institutional bodies

According to the study "Perspective de développement de la filière du drone civil à l'export" written by the DGE, the DGAC (Direction Générale de l'Aviation Civile) and the PIPAME on 5 June 2017, more than 70% of professional drone flights should be carried out by 2024 off-view. This study is supported by the "European Drones Outlook Study" of the SESAR Joint undertaking published in November 2016. This study estimates the European market at 400,000 drones (100,000 drones in France) by 2035, 70% of which will carry out out-of-sight flights.





DGAC development plan January 2020

- Invent the professional civil drones of the future (transport of people and goods)
- Open the way to the current industrial use of aircraft (without pilot on board in particular) in complete safety (flight over populated areas)
- Creation of an air traffic management system for drones (U-space planned for 2023):
 - o Registration of operators, drones
 - o Management of flight authorisations
 - o Management of conflict risks (between drones) or access to sensitive areas (geofencing)
- Harmonisation of regulations at European level



Government agencies with jurisdiction over RPAs

Direction générale de l'aviation civile (DGAC), to guarantee the safety and security of air transport by placing the logic of sustainable development at the heart of its action.

Fédération professionnelle du drone civil (FPDC), to defend and represent the interests of a professional sector, to structure a national network and to become the reference interlocutor for the public authorities.

Direction de la sûreté de l'aviation civile (DSAC), to monitor the manufacture and maintenance of aircraft, in application of European regulations. It issues, for France, approvals for maintenance organisations, airworthiness certificates for aircraft and mechanics' licences.

Directorate of Air Transport (DTA), to ensure the functions of air transport regulator. It is the contact point for airlines, airports and their customers. As a partner of manufacturers and operators, the DGAC contributes to the activity of the aviation industry.

The Directorate of Air Navigation Services (DSNA) is the leading air navigation operator in Europe. As such, it has operational responsibility for air traffic control in French airspace, in metropolitan France and overseas.

General Directorate for Enterprises (DGE) to design and implement public policies contributing to the development of enterprises. Its action is at the heart of the government's projects for the country's economic transformation.

Interministerial Pole of Prospective and Anticipation of Economic Change (PIPAME)

Key figures

In 2014, for the French industry, the turnover was more than 50 million euros excluding recreational drones. At the end of 2014, France had 3,000 jobs in the professional drone sector.

In August 2015, there were 40 French drone manufacturers

In 2016, the French Civil Aviation Authority (DGAC) estimated that there were between 150,000 and 200,000 recreational drones in France, 98% of which were micro-drones (mass less than 2 kg). The turnover of the professional drone market in France amounted to €160 million in 2016, and has been growing every year by 20 to 30% since 2012.

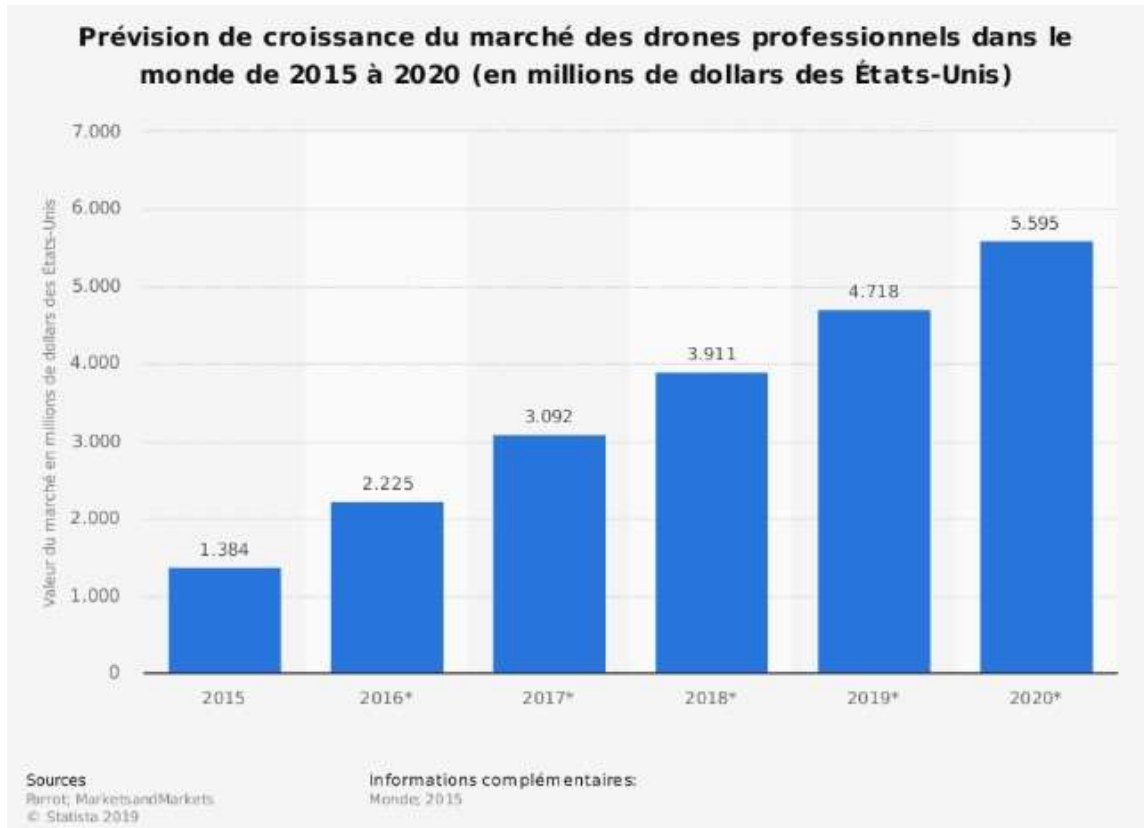
In 2017, according to the DGAC, 500,000 leisure drones were sold in France in 2017. A business volume of 200 million euros.

In 2018 - Civil drone in France is represented by 7415 companies officially registered on the DGAC list as drone operators.

By 2024, the global civil drone market could be worth 1.42 billion euros and it is estimated that the sector will create 10,000 jobs in France by 2025 compared to 2014.

The number of registered professional drones (i.e. weighing more than 800 grams) is growing steadily: 9,582, 13,647 and 15,946 respectively between 2017 and 2019. These civil aircraft are owned by approximately 8,500 professional drone operators (manufacturers, training organisations, industrialists, service providers).

The annual growth rate observed has therefore been 29.6% over the last few years. This surge confirms the study of 20 June 2020 conducted by SVP, which estimates the annual growth of the professional civil drone market at 27.2% between 2018 and 2024.



France ranks 3rd in the world (source DGAC January 2020) for the number of users of remotely piloted aircraft.

In France: the turnover of the professional drone market amounted to €200 million in 2017, €160 million in 2016, with an increase of 20 to 30% since 2012. It will reach €700 million in 2020 (with the creation of 150,000 manufacturer and operator jobs combined).

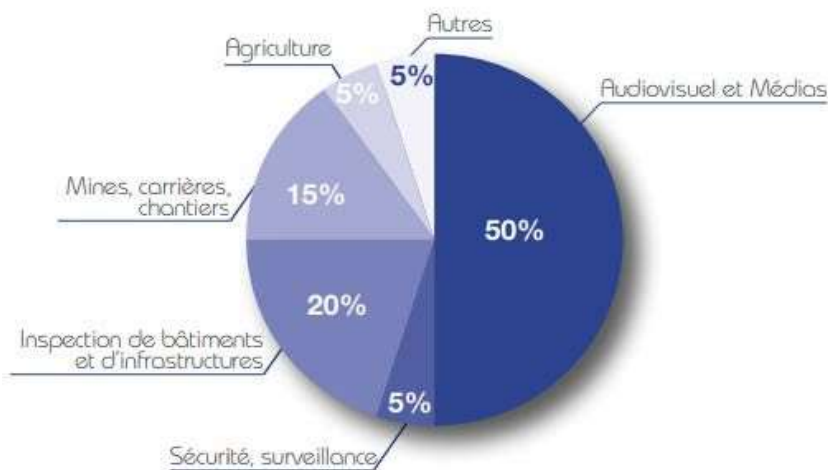
In 2018, the activity in France was broken down into :

- 110,000 flight hours for the media and communication sector:
 - Information and media: film shooting
 - Photography
 - Advertising
 - leisure, communications
- and 60,000 flight hours for the construction and civil engineering sector:
 - Real estate: inspection, BIM modelling
 - Civil engineering: public works; monitoring and inspection of engineering structures, industrial sites, buildings, bridges, dams; mapping and volume calculation (cubing)

- Infrastructure and networks: monitoring and inspection of transport and energy networks (railways, electricity networks, pipelines, oil and gas pipelines), industrial management of mining and oil industry sites (excluding transport networks);
- Telecommunication mobile relay antenna: inspection

(sources DXAC/NO, Direction de la Sécurité de l'Aviation Civile, Direction Générale de l'Aviation

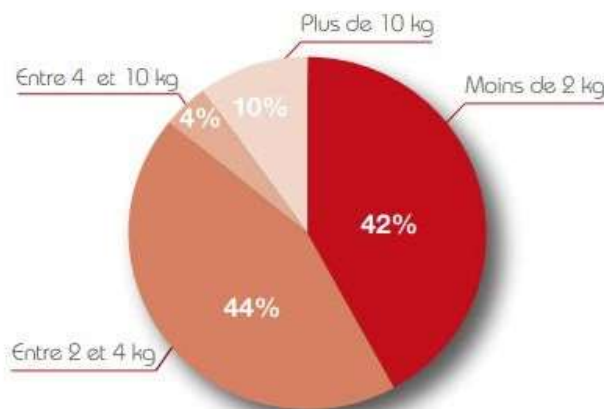
Activités des drones professionnels en France



Civile)

(source : Fédération professionnelle du drone civil – FPDC

Répartition des drones professionnels en France en fonction de leur masse



The French Civil Aviation Authority (DGAC) estimates that there are between 150,000 and 200,000 recreational drones in France, 98% of which are micro-drones (mass less than 2 kg) (in 2016).



MAJOR GROUPS LISTED AS CIVIL DRONE OPERATORS IN FRANCE

- Energy: Technical inspection in high-risk areas: offshore platforms, methane tankers, nuclear power plants, mapping of radiation levels Cerap, Areva, Total
- Environment, construction and public works Underwater pollution control, air quality measurements, art inspection, building pathologies, improved management of large construction sites Groupe Monnoyeur
- Renewable energies Wind turbine maintenance and rapid intervention at height, dam inspection, detection of defective photovoltaic cells EDF Energies Nouvelles, Alstom
- Heavy industry: Observation of Seveso sites, detection of thermal and chemical leaks, pollution measurement, monitoring of sensitive installations ArcelorMittal
- Mining and quarrying: 3D imaging to evaluate extracted ore stocks, contour surveys to monitor the progress of Lafarge operations
- Networks: Observation of railways, high-voltage power line networks, pipelines and gas pipelines; recognition of incidents and malicious acts EDF, GRTgaz, ERDF, RTE, SNCF, RFF

II- INDUSTRY OVERVIEW

Focus → Related activities linked to RPAs

SECURITY

- o Surveillance and civil security professions (law enforcement)
- o Military (reconnaissance, surveillance, intervention)
- o Fire fighting (thermal inspection, locating people in danger)
- o Intervention in difficult environments (mountains)

ENERGY

Photogrammetry and thermal inspection on :

- o Power lines,
- o Dams
- o Solar panels
- o Offshore platforms
- o Wind turbines
- o Nuclear power plants

AGRICULTURE

Multispectral imaging (colour shades) for vegetation diagnosis :

- o Nitrogen levels
- o Moisture levels
- o Biomass
- o Water status
- o Plant stress
- o Chlorophyll content

ENVIRONNEMENT

1. o The aim is the protection of biodiversity:
2. o Movement of animal populations
3. o Monitoring of parks
4. o Monitoring the general condition of trees
5. o Forest mapping



o Monitoring the evolution of forestry

AQUATICS (MARITIME)

Underwater drones for inspection of underwater flora and fauna, fish farming

COMMERCIAL

Drone delivery (Amazon US)

Developments

POTENTIALLY LONG-ENDURANCE UAV SYSTEMS CERTIFIED FOR INTEGRATION INTO AIR TRAFFIC AND PROLONGED OVERFLIGHT OF POPULATIONS.

The applications of this type would be primarily surveillance operations requiring high altitude evolutions, in complementary use of other surveillance tools such as satellites (border surveillance, fight against illegal fishing, observation of large farms).

Because of the high altitude of operation, the sensors used must have high performance.

French sensor manufacturers would then have the opportunity to invest in the development of these missing technological bricks dedicated to the carriage on a low mass UAV (need for lightness and compactness); The evolutionary altitude of these systems also implies taking into account the problem of integration in the airspace, and therefore a need for certification of all the systems (aircraft, on-board systems, operators, pilots)

HIGH RELIABILITY UAV SYSTEMS FOR SPECIFIC APPLICATIONS.

In the field of building inspection, for example, developments are carried out in urban environments but remain limited to the immediate vicinity (about 1.5 metres) of the inspected object. If the drone (light - about 2 kg) has an on-board geofencing device that prevents it from moving away from the building in question, the safety requirements should not be as strict as for a drone intended for flying over crowds. There are currently no national or European civil standards for assessing the safety of a drone system.

In the current context of energy efficiency, the building inspection market presents real opportunities for the French drone industry, which has skills in topography, thermography, 3D modelling and BIM (Building Information Modeling). Certain technological expectations also seem to emerge from this sector, such as ultra-precise geopositioning devices (in the centimetre range) like GPS RTK (Real Time Kinematics). These technological needs could therefore constitute relevant orientations for the French players.

DRONE SYSTEMS WITH WIDE DISTRIBUTION FOR MASS PROFESSIONAL USE.

This scenario envisages the democratisation of the professional use of drones intended for mass use. Unlike the long-endurance drone described above, these machines can be piloted by any user and fly at a height of less than 150 metres. Sold on a large scale, these vectors have a lower level of technical expertise than solutions developed for a specific business expertise. Their fields of application are extremely varied but still demanding.

From a security point of view, scenario 3 seems to be the most prone to the occurrence of technical and human incidents, which would negatively impact the whole ecosystem. The implementation of security devices such as geofencing is therefore essential.

Sector statistics and challenges

THE GLOBAL MARKET

The civil drone market is a rapidly emerging market. The many factors that need to be taken into account in order to quantify the extent of its development potential make it very difficult to estimate figures, as demonstrated by the disagreement between the many studies published on the subject.

These forecasts are based on various key development factors, such as the completion of regulations on the integration of drones in airspace, financing to facilitate the acquisition of drones by buyers, or an insurance system to cover disputes. However, these factors are all barriers to the development of civil drones, which have not yet found solutions that would allow them to be used in a truly democratic manner. These estimates remain of interest in view of the trends they illustrate, and in particular in relation to the distribution of the market within the various segments of interest. The scarcity of competent pilots, the associated safety and security problems and air traffic management are other factors limiting the growth of the market

THE FRENCH MARKET

France is a forerunner in the field of civil UAVs, thanks in particular to the early introduction of regulations authorising experimentation. The introduction of regulations by the DGAC has in fact been a real engine of growth for the French drone industry

DISTRIBUTION OF CIVIL DRONE APPLICATIONS IN FRANCE IN 2014 AND 2020



BUSINESS OUTLOOK BY CUSTOMER MARKET IN FRANCE

Target market segments	Weight in the civil drone market	Annual sales growth	Example of applications
Leisure	30 %		
Information and medias	30 %	+	
Monitoring and inspection	15 %	++	Monitoring of electricity, gas or railway networks; Visual inspection of buildings and structures; Thermography
Earth and Life Sciences	15 %	+++	Precision agriculture; Mapping; Cubature measurement (quarries)
Civil security	10 %	+	

SEGMENTATION OF THE FRENCH AND EUROPEAN MARKET ACCORDING TO TARGET APPLICATIONS, IN 2020

	Segmentation	France	Europe
Infrastructures/réseaux	35 %	62 M€	385 M€
Génie civil	15 %	27 M€	165 M€
Industries minières et pétrolières	15 %	27 M€	165 M€
Agriculture, forêt, pêche	5 %	9 M€	55 M€
Sécurité civile	5 %	9 M€	55 M€
Sécurité chimique, biologique ou nucléaire	5 %	9 M€	55 M€
Environnement, météorologie, vie sauvage	5 %	9 M€	55 M€
Télécommunications	5 %	9 M€	55 M€
Maintien de l'ordre et sécurité publique	5 %	9 M€	55 M€
Cinéma, photographie, publicité, loisirs, communication	5 %	9 M€	55 M€
Marché accessible total	100 %	179 M€	1 100 M€



SYNTHESIS

The drone industry is still very young and in the process of being structured. Its development is therefore difficult to predict and could require a restructuring of the industry if the achievement of an acceptable level of safety for the use of drones makes their acquisition and operating costs significantly higher than those observed today. At present, the major obstacles to the development of the market lie in its fragmentation into a large number of niches meeting multiple needs and calling on a wide variety of professions. From the point of view of companies, drones raise the issue of adapting to change and introducing new skills.

Key takeaways from the survey (from companies & professionals)

This analysis follows our July/September consultation. It comes after a first analysis and completes it following a re-launch of the consultation.

Response rate, typology

41 responses out of 250 sent.

Three quarters of the responses were from engineering and surveying firms, whereas the initial panel contained about half. Their involvement is greater.

Public works and construction are equally represented at 12% each. This under-representation will require a review of our methodology to bring us closer to the practices of these companies.

There is therefore a greater interest among surveyors than in the rest of the civil engineering profession.

There was no response from specialists in the building envelope sector, although these companies could benefit from an inspection of the roofs to be renovated. It can be assumed that these companies are mainly involved in new construction, so it would be necessary to target companies involved in renovation/repair or insurance experts.

Current uses

Half of the companies indicate that they use an external service provider, but almost 60% have in-house experts, which contradicts the feeling we had during interviews with various companies in the spring. This score of over 100% indicates that some companies have in-house experts and also use external service providers, so a lot of work. The use of the specialist indicates an occasional and non-routine use of the drone, which is not yet a "work instrument", but rather a complementary tool for these companies. The use of the drone is increasing in the companies in the panel, to the point of having invested internally. Perhaps the service providers are overwhelmed or incompetent for the specific demands of the construction industry, forcing companies to have their own specialists.

This idea is reflected in the response on the number of people involved: 35% have no users, and 55% have 1 to 4. So a small, highly specialised team

Only 9% of companies use drones intensively, and 47% use them occasionally. This is still an improvement on our initial results from early 2022, when usage was mostly rare. Currently 35% use them rarely and 16% never use them. There is still a lot of room for improvement and certainly some information work to be done.

There are also interesting responses on the type of current use: the main use is for surveying (92%), and 30% also do site monitoring and communication (sample shots). Multiple responses exceed 100%. There is, however, a new use in site monitoring that we discovered during our interviews prior to the survey and which deserves to be trained.

Surprisingly, for all the other proposed uses there are only one or two user companies. We lack responses in the building envelope sector for roof analysis. The drone is however of great help in this case for renovation, both in diagnosis and costing, but these companies are rather conservative according to the discussions we had with trainers in the field. Here again, training and information work is necessary. Another possibility was proposed: quality control and assurance, an important issue in which the drone has a direct application, was again chosen by only one company.

In the more detailed tasks, topography is used as much to model the terrain digitally in order to produce topographic plans for structures as to determine volumes and surfaces (for processing, in quarries, in public works, etc.). Orthophotos are well used (one third of respondents), which may cover other uses such as site monitoring, which is neglected (10%), as well as the inspection of structures (13%), and there is room for development in this area.

The simple taking of photos and videos is highlighted, but as this is the basis of the work (the drone takes photos which are assembled to form a digital terrain model DTM), we do not know if the respondents only take photos or films, it is necessary to bring it closer to the 10% who do site monitoring and the 3% who practice thermal imaging. On this last theme we lack specialised companies.

3D modelling of structures (exterior/interior) is progressing with 26% of responses. The famous "digital duplicate" of existing buildings with a view to their conservation is beginning to emerge and the drone is particularly well placed to complete scans and enable the model to be assembled in BIM.

The current uses of drones in construction are mainly carried out by surveyors, or the surveying departments of large companies. The predominance of topographic surveying bears witness to this. The fact that many surveyors responded compared to other generalist or non-survey companies does not really distort the results, as the panel of companies surveyed does not give them the majority. The other companies lacked interest in the subject and did not bother to respond despite being re-solicited. We can see here that the use of drones by companies has considerable room for improvement, at least in the interest it should arouse. Construction companies are anchored in traditions and habits, and novelty is often perceived as a source of uncertainty and reduced profitability (through the use of resources that are not directly productive). This is true of BIM, which is struggling to establish itself in France, and also of the drone.

The two are similar in two respects: employees have to be trained in a new practice, and expensive hardware/software has to be purchased. The potential time saving is not directly visible enough and the low profitability of the sector makes us cautious. It is up to us to convince.

Future uses

The two uses that stand out are topography with 54% of development wishes and 3D modelling of structures with 50% (several answers possible). The proportions already seen for current uses remain the same, and are therefore consolidated.

On the other hand, a sector that is still not very prominent in current uses emerges in the wishes for the future: the inspection of structures, with 31% of respondents who see this as an interesting use.

58% of respondents believe that drones will become more important in their activities in the future, compared with 30% who do not "believe" in them and 12% who are undecided. It will still be necessary to convince and train newcomers so that companies no longer see drones as toys or even as an additional administrative and IT burden.

Second to last is surveillance, with 15%, bearing in mind that the construction industry is very prone to theft and damage to materials. This use is somewhat fantasised because a drone has a very short autonomy (20 minutes), so apart from a rapid intervention to a place where an intrusion has been detected, to identify criminals and report their movements, there is no permanent surveillance.

We were surprised to find that only 4% of respondents considered construction site monitoring as a future use. However, it seems to us that a scheduled drone flight of a few minutes every day is more efficient and accurate in terms of site progress than a fixed shot (often from the crane) because there will be fewer masks and the possibility of supplementing with specific manually controlled views, and the use of 3D.

The main advantages perceived by the future use of drones (several answers possible) are risk mitigation (41%) and time saving (60%). Increased productivity is, with 46% of respondents putting it first, a very important criterion in the professional use of drones in mapping for the construction industry. This last criterion is found in the criterion of increased efficiency and savings (30%). Next comes better data acquisition (39%), which is a logical result of the use in quarry quantity surveys, large-scale land surveys or remote monitoring.

The variety of items proposed shows a good distribution of interest in the professional use of drones in civil engineering in general, with a strong emphasis on its most widespread current use: topography. Other uses, such as site monitoring, modelling of structures or parts of structures with a view to their conservation, or direct intervention, must be anticipated by the trainers, because even if companies are currently waiting for these topics, they will be very demanding when the skills are presented to them, with the attendant productivity gains.

Drones training

Half of the respondents answered "neutral" to the question of the difficulty of finding employees capable of working with drones. This corresponds to the proportion of companies that do not have any user employees (55% said they had 1-4 drone employees). The following figures shed light on the reality of recruitment difficulties: only 11% found it "easy" to recruit for this skill, and nobody found it "very easy".

It appears that a high proportion of companies have difficulties (32%) or major difficulties (8% very difficult and 3% extremely difficult) in finding suitable drone profiles for the construction sector. This should encourage us to continue our training programme and to expand it.

On the causes of the lack of candidates, two reasons clearly stand out: a lack of specific training in the students' curriculum (57%) and a lack of exposure of students to drones during their training (50%). This result is higher than at the beginning of the consultation, and we are faced with a growing concern among companies about learning skills related to drones.

This invites reflection on the training courses in which piloting and image processing should really be taught (BTS, BUT, engineers) and on the courses in which the possibilities of drones should be shown (architects, engineers, landscape architects, developers, etc.) so that the use of this technology can be considered as soon as possible.

Next in the list of causes of the lack of candidates are institutional problems: for 30% of respondents, the education system is adapting too slowly to this technology and the changes it brings; 17% see this as the consequence of a lack of investment on the part of institutions, and 10% point to the lack of trainers, while 13% point to the inadequacy of equipment in training centres. We are encouraged to move faster. We cannot ask companies to always train their employees themselves in technologies that are no longer new. Curricula are the contracts that bind teachers and the world of work, in the case of drones they are not revised fast enough or not open enough, and most probably in many other fast moving sectors.

Finally 17% feel that companies themselves are fearful of drone technology, it intimidates them. It is possible that here again the lack of information, of professionally targeted advertising, the "toy" image of photo drones is to blame. And let's not talk about the natural inertia of the construction industry (comparable to the difficulties of deploying BIM...).

On the solutions to be provided, the response bars on the company side are almost all equal (knowing about drones, informing about professional prospects, cooperating) around 28 to 38%. On the training side, the respondents are more vehement: they need to :

- Implement standardised training (53%)
- Improve the training of trainers (34%)
- Invest in training centre equipment (25%)

The end of the questionnaire provides an opportunity to make some developments: most companies only "more or less agree" with the fact that new regulations would improve the use of drones... we can see here the traditional mistrust of professionals with regard to anything that

regulates their activity. If the question had instead highlighted the fact that these new regulations are clearer, uniform in Europe, and designed to promote professional use by avoiding the anarchic proliferation of recreational flights by untrained users, the rate of support would have been higher.

88% agree that cooperation between training institutions, industry and other stakeholders will reduce the gap between the existing training offer and the real needs of the sector. This speaks for itself, we are encouraged to develop our programme.

General conclusion on the survey

The survey confirms the validity of the ERASMUS+ initiative to develop a standardised training programme in the construction sector:

- The usefulness of drones is recognised
- Drones bring productivity gains
- The employees of construction companies are under-informed and this is blocking development
- It is difficult to recruit construction+drone profiles
- The companies concerned are demanding graduates trained to uniform and recognised standards
- Drone Training programmes do not adequately meet the demand in the construction sector.

It is also important to note, by broadening the debate, that European regulations on drones have been in place for a short time (3 years) but that each country is still in a period of transition between local regulations (if they exist) and the application of European texts. A common programme for the various countries would therefore enable better understanding between companies on good practices, better employability of personnel and, ultimately, general progress of the construction industry towards digitisation.

III- TRAINING

Specific training and licensing for RPAS pilots

- Basic training open category A1/A3 (CO A1/A3): register on the "ALPHA TANGO" website <https://alphanango.aviation-civile.gouv.fr>, follow an online training (video slideshow), then answer 40 random questions directly related to the training. You have to answer just 75% of the questions, but if you fail, you can repeat the questionnaire indefinitely (the questions change each time, but some of them are repeated). Valid for 5 years.

- Complementary examination open category A2 (CO A2): after having trained oneself to fly (thus in category A3), one must learn (in a training centre or on one's own) aeronautical meteorology, drone flight performance, risk mitigation and pass an official DGAC examination of 30 questions with a 75% success rate. (an online exam is in preparation). https://www.ecologie.gouv.fr/exploitation-drones-en-categorie-ouverte#scroll-nav_5

NB: this specific exam is often confused with the CATT (below) and not always offered, it is better to take the CATT (or CATPD) directly but it is harder.

- BAPD brevet d'aptitude au pilotage des drones: this document is the "licence" that indicates the pilot's ability to fly in open category A1, A2, A3. To be requested at the end of the first self-training (A1/A3) and/or A2 training and to be presented in case of control. (Equivalences are possible for holders of ULM, aeroplane, helicopter or foreign certificates who can demonstrate their practical experience of UAV piloting).

- Theoretical aptitude certificate of telepilot (CATT) to fly in specific category French scenarios S1, S2, S3 or theoretical aptitude certificate of drone pilot (CATPD) to fly in European scenario STS01 or STS02: more advanced training, close to the theoretical examination of ULM pilot (air spaces, rules of the air, operation of the drones, rules of exploitation, access to aeronautical information...) then examination of 1:30 hour in an official DGAC centre of 60 questions with a rate of success of 75%. This is not enough on its own: you must also follow a practical training course (see below). https://www.ecologie.gouv.fr/examens-theoriques-ulm-iulm-telepilote-lapl-et-ppl-et-h-bpl#scroll-nav_4

- Attestation de suivi de formation pratique ou attestation d'aptitude aux fonctions de télépilote (AAFT) : delivered by a training organisation (a declared operator for the scenarios he teaches, and as a teacher in his MAP or MANNEX) under his responsibility, and for certain scenarios only (S1 to S5). Completes the CATT to fly as a professional.

- Certificate of Professional Qualification CQP (not compulsory): Some state-approved organisations issue CQP's which make it easier to find work as a "dronist", and to get cheaper insurance as a freelancer. This certificate is not compulsory to practice professionally. Most of the time, these certificates are specialised in a theme. For example at the University of Normandy: <https://www.cidn.fr/drone-normandie-innovation/formation-de-telepilote/>

or privately: <https://www.telepilote.org/> or <https://telepilote-academy.fr/>

They are based on the CATT + AAFT (compulsory) and a reinforcement of knowledge on the speciality envisaged (photogrammetry, cinema...)

- QUALIOPi certificate: to be able to professionally train pilots. This is a certification by a state body of the ability to establish a training course. Qualiopi is not a "drone" certification but a verification of teaching skills. It will only be granted to pilots who have passed the CATT and the practical training for the scenarios taught and who can justify a certain experience. Should qualified instructors working in training centres have their centres or themselves certified? This question will have to be decided by the administrative authorities.

- The ERASMUS+ Drones4VET programme, if recognised by the authorities, could be a basis for certification for training.

NOTA BENE aerial photography: You must fill in the Cerfa form n°12546 which authorises the aerial photography activity for 3 years (to be returned at least 15 days before the first flight).

NOTA BENE flight over a populated area: You must request an authorisation on the ALPHATANGO portal or fill in the Cerfa form n° 15476 at the prefecture. Declaration 5 days in advance valid for the days requested (if more than 7 days, specific proofs are required), and for a maximum of 1 month. Each flight must be declared in alphetango afterwards (authorised if there is no response), and the prefecture can still prohibit it exceptionally...

In other cases, the operator must be authorised by the DSAC before starting operations. Deadlines must be respected, which can be up to one month's notice.

For the training of our students

The procedures are no different, it is a drone operation always under the responsibility of the operator, who is the head of the establishment, who delegates to his pilots the right to train apprentices in compliance with categories or scenarios.

The training establishment must declare itself as the operator, and training can only begin once all the formalities have been completed.

The only exception is indoor flying, where the regulations do not apply; we have experimented with this in the gymnasium in order to begin our approach without risk. No other person than the teacher and his students must be in the enclosure.

The teacher-pilots must ensure that the students respect the characteristics of the planned flight: category (open or specific), open sub-category or specific category scenario. He/she bears sole responsibility, as if he/she were flying the aircraft. He must be able to regain control of a flight that "goes wrong" at any time: either by dual control or by direct intervention on the student's control.

This is not different from other school activities, the students are always under the responsibility of the teachers, this should not become an obstacle.



Co-funded by
the European Union

The advantage of an existing training establishment is that it is not obliged to be qualified by an organisation such as QUALIOPI.

Description and comparison of the current training offer

When consulting the training offer, it appears in general that private training organisations concentrate on a specific use of the drone after a training course of handling and theoretical examination:

- General photographic shooting
- Cinematographic filming / reporting
- Specialised security surveillance photography
- Specialised photography for technical surveillance of structures and infrared
- Specialised photography of natural environments
- Photogrammetry / cartography

The regulatory and theoretical part is largely emphasised because a national exam must be passed on this subject by the DGAC and the organisations fear that their trainees will not pass this exam, which is very clear in all the presentations consulted.

Practical training is always discussed in the context of the specific categories, whereas the open category is often sufficient, which is a good way of justifying fairly advanced training in the handling of drones. We have noticed that dual control systems are non-existent, except for heavy drones in courses related to safety or work for the cinema with professional onboard cameras, but this is very exceptional. The shots envisaged are generally taken with drones weighing less than 4kg, including with a professional performance camera.

The duration of the courses is generally at least 5 days, for discovery and simple applications, with 3 days of theory and 2 days of piloting. Passing the CATT (or CAPD) exam is the objective, but not the specialisation.

Once this is done, 2 to 10 days of training are needed to specialise.

The problem is often that the students stop after the first course and manage to improve themselves because of the high cost of the following courses. The cost of acquiring professional hardware and software puts a strain on their budget and they can no longer afford to continue their training.

Finally, and most importantly, there are no professional training standards for the various drone professions. The pilot qualification regulations only provide for flights and safety, and it is then up to each individual to demonstrate their know-how. It is therefore very difficult to compare the offers between the different training centres. Some forums exist, but who knows who writes in them? A competitor, the provider, or real trainees?

A coherent training framework should be proposed, the DRONE4VET project would perhaps be the beginning of a European standardisation of skills certification, as far as the construction sector is concerned.

Key takeaways from the survey (from learners/trainees; maybe trainers?)

1 - Response rate

Low, even among students more concerned with drones (BTS MGTMN with 4 returns out of 15), despite several email requests.

Summary made on 32 responses (higher professional training level) to date.

2 - Level of familiarity with drone technology

A third of the learners are familiar with or have already used a drone, a second third understand how it works without ever having used one, and a final third do not understand its operation well.

Note: 0% say they are very well informed about drones.

3 - Technological applications of drones that interest you the most

Taking photos and/or videos is far ahead with 84% (multiple answers possible), followed by quality control with 22%, preconstruction (and site) planning with 12.5% and 9% for transporting goods.

Note: Risk mitigation on site 0% (despite several possible answers).

4 - Awareness of most in-demand jobs or major new assignments in the construction industry

No to 66

5 - Do you find it difficult to access drone-related training that matches your interests

Not too many opinions as: "Neutral" comes first with 69%, followed by "Quite difficult" with 22% and "easy" with 9%.

6 - In the event of difficulty in accessing drone-related training, reasons given

Firstly, "Lack of specific training programmes" with 36%, followed by "Limited exposure to this type of technology during secondary education or apprenticeship" with 32% and "Insufficient facilities or equipment to provide practical training" with 29%.

7 - Solution envisaged to resolve these difficulties

The majority of respondents (multiple answers) proposed "Setting up standardised training courses corresponding to the various trades in the construction sector" with 53%, followed by "Raising awareness of drone technology and its various applications in construction work" with 50% and in third place "Investing in upgrading training centres" with 37%.

Note: "Improving the training of trainers" and "Disseminating the wide range of employment opportunities offered in the sector" came last in only 20% of cases.

8 - Aspects of training considered most important for effective learning

"Active practice" was favoured in 74% of cases (multiple responses), followed by "Relevant and up-to-date learning content" for 39% of respondents.



Conclusion about the survey:

There is still a great deal of work to be done to develop trainees' knowledge of drones, to make them aware of the new occupations arising from these new technologies so that they can better understand the opportunities now available in the construction sector.

The development of drone practice is favoured by the trainees, as is the introduction of "standardised" training.

CONCLUSIONS

The usefulness of drones in construction is now well understood by professionals, as the survey results and the development of the sector prove. However, the changes in regulations and the large number of rules put off many professionals.

We see illegal use of drones (generally of low weight) due to the absence of operator declaration because of the administrative burden of operation, or due to non-compliance with the category criteria because of ignorance of the latter.

For the time being, the body of regulations has not been stabilised, and the application of the European rules has been delayed because the manufacturers themselves have not been able to certify their drones.

Operators are only just realising that this is aeronautical work and the rules it imposes are far removed from the concerns of construction professionals.

Thus, clear and legible training for employers, which highlights certified skills in relation to the work to be carried out for the flight, for the administration, for the maintenance and for the exploitation of the data, would allow a safe and faster development of the use of drones in construction.

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and others that were not always bookmarked...