



**GLOBAL
ACCESS**

**LAYING THE BASIS FOR
A COMMON UNDERSTANDING OF
THE GLOBAL NON-MILITARY RPAS MARKET
(Commercial & Non-Commercial)**

Professional Market Sectors

Aerial Work Sectors

Flight Mission Purposes

Explanation of Terms

Payloads

**Examples of Flight Operations &
Purposes per Aerial Work Sector**



Background & Objective



Rules & Regulations

With an ever-increasing number of States bringing out operational rules or regulations, the non-military remotely piloted aircraft systems (RPAS) market is growing substantially. This is very clearly the case in Europe, where the following 28 European Union (EU) countries now have an RPAS regulation in place, or where a regulation is about to be published:

Austria	Belgium	Bulgaria
Croatia	Cyprus	Czech Rep.
Denmark	Estonia	Finland
France	Germany	Greece
Ireland	Italy	Latvia
Lithuania	Luxembourg	Malta
Netherlands	Norway	Poland
Portugal	Romania	Slovak Rep.
Slovenia	Spain	Sweden
UK		

Note: Switzerland does not have a RPAS regulation, but a significant amount of commercial & non-commercial RPAS activity takes place under «adapted» model aircraft rules [Guidance for an Authorisation for Low Level Operation of RPAS (GALLO)].

Certificated Operators

The steadily increasing number of nationally approved or authorized (jointly referred to as certificated) commercial RPAS operators in Europe is a positive sign of the European commercial RPAS market development. However, it should be noted that the criteria used to define a certificated commercial RPAS operator vary greatly from country to country.

According to the figures at our disposal (and our best estimates), there are 11 473 certificated civil RPAS operators (companies commercially operating RPAS) in Europe (Dec. 2016), namely:

Austria (198)	Belgium (200 ^{est.})	Cyprus (2)
Czech Rep. (24)	Denmark (575)	Finland (33)
France (2500)	Germany (750 ^{est.})	Ireland (30)
Italy (965)	Netherlands (102)	Norway (300)
Poland (2000)	Spain (1800)	Sweden (244)
Switzerland (150 ^{est.})	UK (1600)	

Note: The quantity of certificated RPAS operators is indicated between brackets.

Disparity

Currently, there is large degree of disparity in the following RPAS-related fields between EU States:

- Rules & regulations (*which often exist only in the national language*);
- Data protection and privacy rules (*if they exist*);
- Pilot training (syllabus) & qualification (licence);
- Flight school qualification;

- Operator qualification (licence).

Consequently, there is an absence of mutual recognition of RPAS-related rules and regulations, pilot licences, and operator licences between EU States, which makes it extremely complicated and expensive for a commercial RPAS operator registered in one of the EU States to operate in another.

The DroneRules Project

The DroneRules project (www.dronerules.eu), which is being co-funded by the EU, is developing a comprehensive web site which will become the reference web portal for current & future RPAS operators in the EU (+ Norway and Switzerland).

The purpose of this portal will be to increase awareness and facilitate understanding with commercial RPAS operators of the legal environment and constraints in relation to light RPAS operations (safety, privacy and data protection, insurance, etc.); there will also be a specific information for non-commercial operators (incl. hobbyists).

The DroneRules project will contribute to facilitating the understanding of the access to the European market for commercial operators intending to use RPAS in their home country, or in other EU countries; it will also showcase the opportunities for economic and job market growth that RPAS represent for entrepreneurs and Small & Medium-sized Enterprises (SMEs).

General Awareness Creation

In this context, as well as in light of the necessary general awareness creation efforts that now have to be undertaken, this paper proposes an identification and classification of the non-military (civil) RPAS market.

This document proposes:

- A segmentation of the non-military RPAS market in 22 aerial work sectors;
- The distinction between commercial and non-commercial RPAS flight operations performed in these market sectors
- The flight mission purposes that can take place during commercial and non-commercial flight operations.
- The explanation the indicated flight mission purposes.

As the flight mission purpose defines the payload required to conduct it, and in order to be complete, payloads are split into 2 categories:

- Imaging payloads
 - Non-Imaging payloads
- and examples in both categories are indicated.

In conclusion there is a section indicating the following for each of the 22 aerial work sectors:

- The type of operator (commercial; non-commercial; corporate; governmental)
- The operation's location (outdoor; indoor)
- Aerial work sub-sectors
- Examples for each aerial work sub-sector

The objective of this holistic approach is to, within the context of the Global Access Initiative, lay the basis for a common understanding of the civil RPAS market and its potential, in such a way, that it is comprehensible to all.



The Non-Military RPAS Market (Commercial & Non-Commercial)



Preamble

The intent of this document is to propose a methodology to identify and classify the non-military RPAS market.

This document proposes a segmentation of the non-military RPAS market sectors, the commercial and non-commercial RPAS flight operations performed in these market sectors, as well as terms (& explanation) for each of the indicated flight mission purposes. As the flight mission purpose defines the payload required to conduct it, and in order to be complete, a high level categorization of payloads is also proposed.

The objective is to lay the basis for a common understanding of the civil RPAS market and its potential, in such a way that it is comprehensible to all.

Professional RPAS Market Sectors

The market sectors in which non-military RPAS applications (commercial & non-commercial) currently take place, or probably will take place in the future, are (in alphabetical order):

Agriculture, Fishery/Pisciculture, Forestry
Audio-Visual Production, Advertising, Arts
Cinema & TV Industry
Construction & Real Estate
Environmental Protection & Conservation
Heritage & Historical Monument Management
Humanitarian Relief
Industrial Applications
Insurance (<i>Accident & Claim Investigation</i>)
Maintenance
Mining & Exploration
News Gathering & Broadcasting
Policy Compliance & Obtaining Legal Proof
Requirements Expressed by Private Citizens
Public Safety
Public Security & Law Enforcement
Research & Science
Utility Companies (<i>Public & Private</i>)
Flight Training/Instruction
Other Miscellaneous - Test/Experimental - Demonstration - Ferry/Positioning - Air Show/Racing
Transport
Leisure Use - Flying Toys - Recreational - Model Aircraft

RPAS Flight Operations (Aerial Work)

Non-military RPAS flight operations fall into two categories:

- Commercial: Flights carried out by companies for paying customers.
- Non-Commercial: Flights carried out by companies or organisations without external financial compensation from customers.

Non-commercial operations include Corporate Operations,

which should be understood as: Flights carried out by companies or organisations to meet their own internal requirements.

RPAS Flight Mission Purposes

The flight mission purposes of commercial and non-commercial flight operations can be categorized as follows:

Advertising	Deterring	Dispensing
Cinema & TV	Exploration	Identification
Inspection	Localisation	Mapping
Manipulation	Measuring	Monitoring
News Gathering	Observation	Patrolling
Policy Compliance	Relief Flight	Research
Search & Rescue	Sensing	Special Purpose
Spotting	Spraying	Surveying
Testing	Tracking	Transport
Video	Water Bombing	

Explanation of Terms

Advertising: Towing publicity banners, skywriting, airships with publicity in or on them.

Broadcasting: Distribution of video via television to a dispersed audience.

Cinema & TV: Production of aerial film/video footage for the production of films, documentaries, advertisements/video clips, or news broadcasting.

Deterring: Flight operation with the purpose to chase animals (e.g. birds) from specific sites.

Dispensing: Aerial distribution of solids (e.g. fertiliser, granulates, pamphlets, pellets, seeds, other).

Exploration: The act of searching the earth's surface and sub-surface with the intent of finding minerals, oil, etc.

Identification: The process of recognizing as being a certain person or thing or activity.

Inspection: Examination with the intent to find faults, errors, problems, malfunctions or specific phenomena.

Localisation: Supplying the geographical coordinates of activities, faults, errors, malfunctions, equipment, structures, persons, livestock or specific phenomena.

Manipulation: The modification of a direction or position, or the displacement, of an inert object.

Measurement: The process of measuring using a particular standard.

Mapping: Process of creating a diagrammatic representation (incl. 3D modelling).

Monitoring: Observation on a regular basis over a period of time.

Observation: Examination of an activity, person, group, area or phenomena.

Patrolling: Searching for a specific activity, person, group or phenomena.

Photography: Aerial use of still cameras to capture images.

Relief Flight: Flight carried out for humanitarian purposes to carry relief supplies such as food, clothing, shelter, medical and other items during or after an emergency and/or disaster.

Research: Systematic investigation with the purpose to discover facts through scientific study.

Search & Rescue: Looking for missing persons.

Security: A combination of measures and human & material resources intended to safeguard against unlawful acts

Sensing: Looking for & analysing or defining the geographical coordinates of phenomena & transmitting or registering them.

Skywriting: Flight carried out to create an aerial written message using smoke generated on the aircraft involved. A computer can generate the master plan and electronic signals can control the smoke output.

Special Purpose: Flights serving a specific purpose [e.g. communication relay; (tethered) aerial electricity generation]

Spotting: Looking for an activity, object, person, group or phenomena & registering their geographical coordinates.

Spraying: The process of spreading liquid substances [e.g. insecticide, fertiliser]

Surveillance: Close observation of an activity, person, group, area or phenomena.

Surveying: Detailed inspection of a geo-referenced section of the earth's surface (incl. structures) with the purpose to study or measure altitudes, angles, distances, phenomena & structures flown over, and recording them.

Testing: Ascertaining a capability or correct functioning.

Tracking: The process of following something or someone.

Transport: Flight carried out for the carriage & delivery of goods or persons.

Validation: Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

Video: Production of aerial video for purposes other than indicated above.

Water Bombing: Flight carried out to discharge liquid on a fire with the intent to extinguish it or stop it from spreading.

RPAS Payloads

Payload Elements on a remotely piloted aircraft (RPA) that are not necessary for flight, but are carried for the purpose of fulfilling specific mission objectives.

Imaging Elements on a RPA that permit the capture of imagery (and in some cases tracking) and the recording or transmission of such data.

Imaging payloads (gimballed & non-gimballed) include the following:

- Digital Photo Camera (bracket-mounted)
- Electric-Optical (EO) - Infrared (IR)
- Near Infrared - Corona Effect Imager
- Light Detection & Ranging (LiDAR)
- Flash LiDAR - Hyperspectral
- Laser Scanner - Light Intensification
- Linescanner - Multispectral
- Multi Layer Laser - Radar
- Solid State Photon Counter
- Synthetic Aperture Radar

Non-Imaging Elements on an RPA that permit the capture of non-imagery data and the recording or transmission of such data (e.g. sensors in the following domains: atmospheric, audio, frequency, laser, locational, mineral content, meteorological, moving target indicator, particle analysis, phenomena analysis, radiation analysis), as well as elements permitting:

- a) Communication relay;
- b) Data recording;
- c) Dispensing & spraying systems;
- d) Emergency beacon detection;
- e) Manipulating/robotic arm;
- f) Spotlight;
- g) Water bombing system.

Examples - Aerial Work Sectors Commercial & Non-Commercial

Agriculture, Fishery/Pisciculture, Forestry

Operators	Commercial Corporate
Location	Outdoor & Indoor
Sub-Sectors	Agriculture
Deterent	[e.g. protecting high value crops from birds]
Dispensing	[e.g. fertiliser pellets, pollination agents, seeding, useful insects]
Identification	[e.g. disease, insects/parasites]

Inspection [e.g. conformity with agricultural policy; crop growth vigor; crop health; crop maturity; crop yield; disease; parasites; seedling growth density; soil erosion; soil moisture requirement; water leaks (irrigation piping); weed growth; wildlife/pest impact]

Inspection Meteorological damage impact & mapping (*drought, hail, icing, lightning, rain, snow, temperature, tornados, wind*)

Inspection Post Natural Disaster (*drainage, earth quake, flooding, forest fire, hurricane, mud/land slide, tornado, tsunami, volcano eruption*)

Localisation [e.g. very young animals, bird nestings (plow planning); crop disease; insects/parasites; livestock; soil erosion; weed growth; where to fertilise; where to use insecticide; wildlife]

Mapping [e.g. field delineation; hydrogrammetric; irrigation control; parasite control; pest control; selective fertilising; selective harvesting; selective insecticide spraying; selective irrigation; soil density & composition; weed control]

Measurement [e.g. slope angles; hygrometric; volumetric]
Monitoring [farm equipment; machinery & facilities; livestock]
Spraying [e.g. fertilizer; insecticide/pesticide; water]
Tracking Livestock

Fishery/Pisciculture

Localisation Fish schools, algae
Monitoring Fish pens, oyster farms, algae proliferation
Inspection Meteorological damage impact (*icing, lightning, temperature, storms*)

Inspection Ecological impact

Forestry

Localisation [e.g. tree disease]
Identification [e.g. disease, insects/parasites]
Inspection [e.g. conformity with agricultural policy; tree growth vigor; tree health; tree maturity; disease; parasites; seedling growth density; soil erosion; soil moisture requirement; water leaks (irrigation piping); weed growth; wildlife/pest impact]

Inspection Meteorological damage impact & mapping (*drought, hail, icing, lightning, rain, snow, temperature, tornados, wind*)

Inspection Post Natural Disaster (*drainage, earth quake, flooding, forest fire, hurricane, mud/land slide, tornado, tsunami, volcano eruption*)

Localisation [e.g. animal/bird nestings (harvest planning); tree disease; insects/parasites; soil erosion; where to use insecticide; wildlife]

Mapping [e.g. tree growth delineation; hydrogrammetric; irrigation control; parasite control; pest control; selective harvesting; selective insecticide spraying; selective irrigation]

Measurement [e.g. slope angles; hygrometric; volumetric]
Monitoring [farm equipment; machinery & facilities; livestock]
Spraying [e.g. fertilizer; insecticide/pesticide; water]
Tracking Livestock

Audio-Visual Production, Advertising, Arts

Operators Commercial Corporate
Location Outdoor & Indoor Tethered & Non-tethered
Sub-Sectors **Audio-Visual Production**
Cinema & TV [e.g. athlete performance training/evaluation]
Cinema & TV [e.g. special effects]
Cinema & TV [e.g. public rallies, sporting events; rock concerts]

Advertising

Advertising Advertisement production (indoor & outdoor)
Skywriting

Artistic Expression

Aerial Flight Spectacles
Sky Painting

Construction & Real Estate

Operators Commercial Corporate

Location Outdoor
Mission Purposes
 Advertising
 Deterent [e.g. avoiding birds to nest on construction sites]
 Mapping [e.g. 3D modelling; construction planning; construction reporting]
 Measuring [construction planning; construction reporting; topographic survey]
 Patrolling [e.g. perimetric security]
 Photography [e.g. real estate agencies]

Environmental (Protection & Conservation)

Operators Commercial Non-Commercial
 - Public Authorities
 - Corporate

Location Outdoor
Mission Purposes
 Inspection [e.g. biodiversity; coastal erosion; invasive animal species detection; invasive plant species detection; pollution impact];
 Monitoring [e.g. aerial pollution; ecosystem impact; glacier; iceberg; ice cap; maritime ice flow; maritime pollution; salt water seepage; terrestrial pollution]
 Patrolling [e.g. wildlife conservation]
 Sensing [e.g. algae proliferation; atmospheric measurements]
 Spraying [e.g. insect control]
 Tracking [e.g. wildlife counting]

Heritage & Historical Monuments

Operators Commercial Non-Commercial
 - Public Authorities
 - Corporate

Location Outdoor & Indoor
Mission Purposes
 Inspection [e.g. site or monument erosion]
 Mapping [e.g. historical site; 3D modelling of historical building or structure]
 Measuring [e.g. pollution impact]
 Monitoring [e.g. evaluating environmental impact]
 Patrolling [e.g. search for & discovery of archeology sites]
 Photography
 Surveying [e.g. pre- & post restauration]
 Video

Humanitarian Relief

Operators Non-Commercial
 - Public Authorities
 - Private [e.g. Red Cross; Red Crescent]
 - NGO (Non-Governmental Organisation)

Location Outdoor & Indoor
Mission Purposes
 Inspection Post Natural Disaster [*earth quake, flooding, forest fire, hurricane, mud/land slide, tornado, tsunami, volcano eruption*]
 Localisation [e.g. injured persons; missing persons]
 Mapping [e.g. 3D modelling; reconstruction planning]
 Relief Flight
 Search & Rescue
 Spotting [e.g. searching for boats with illegal immigrants]

Industrial

Operators Commercial Non-Commercial
 - Corporate
Location Outdoor & Indoor Tethered & Non-tethered
Sub-Sectors Communication Infrastructure
 Oil & Gas (offshore) Production Facilities
 Railways
 Also: Construction; Maintenance & Management;
 Mining & Exploration; Utility Companies

Mission Purposes
 Inspection Maintenance-related [e.g. antennae; buildings; chimneys; cooling towers; corrosion; dams; emissions; flare stacks; furnaces & boilers (indoor), offshore facilities/platforms; pipelines (gas, oil, water); powerline cables (corona

effect); powerline surroundings (invasive plant growth); powerline towers; quarries (volumetric) roofs, solar panel farms; structures (other); telephone repeater towers; thermal isolation; wind turbine farms (turbine blades)]
 Post industrial accident

Inspection
 Mapping
 Monitoring [e.g. ecological impact]
 Photography
 Surveillance [e.g. perimetric security]
 Testing [e.g. of aircraft by their manufacturers]
 Validation [e.g. of payloads by their manufacturers]
 Video

Insurance (Claim Investigations)

Operators Commercial Non-Commercial
 - Corporate

Location Outdoor & Indoor
Mission Purposes
 Inspection [e.g. buildings & structures; infrastructure; maritime accident - inshore; maritime accident - offshore; aircraft crash; fire; industrial accident; railway accident; road/highway accident]
 Inspection Meteorological damage impact & mapping [*drought, hail, icing, lightning, rain, snow, temperature, tornados, wind*]
 Inspection Post natural disaster [*drainage, earth quake, flooding, forest fire, hurricane, mud/land slide, tornado, tsunami, volcano eruption*]

Maintenance & Management

Operators Commercial Non-Commercial
 - Corporate
 - Public Authorities

Location Outdoor & Indoor
 The performance of tasks required to ensure the correct functioning and/or safety of an installation, machine, means of transport, system (continuing airworthiness of an aircraft), including any one or combination of overhaul, inspection, replacement, defect rectification, and the embodiment of a modification or repair, e.g. relative to the following:

- | | | |
|--------------------|--------------------|----------------|
| Aircraft (hull) | Antennae | Bridges |
| Buildings | Cable Cars | Canals |
| Chimneys | Cooling Towers | Dams |
| Flare Stalks | Harbours | Holding Tanks |
| Ind. Installations | Infrastructure | Metal Roofs |
| Mines | Offshore Platforms | Pipelines |
| Powerlines | Quarries | Railroads |
| Roads & Highways | Ships | Shipping Locks |
| Ski Slopes | Solar Panel Farms | TeleCom Towers |
| Wind Turbine Farms | | |

Mission Purposes
 Deterent Inspection Mapping Measuring
 Monitoring Photography Surveillance Testing
 Validation Video

Mining & Exploration

Operators Commercial Non-Commercial
 - Corporate

Location Outdoor
Mission Purposes
 Exploration
 Measuring [e.g. Volumetric (gravel, sand pits, quarries)]
 Inspection [e.g. ecological impact; infrastructure; maintenance; perimeter]
 Patrolling

Newsgathering & Broadcasting

Operators Commercial Corporate

Location Outdoor & Indoor
Sub-Sectors Television & Journalism
 Aerial Footage Indoor & outdoor

Cinema & TV Industry
Operators Commercial Corporate

Location Outdoor & Indoor
Cinema & TV [aerial shots (indoor & outdoor)]
Cinema & TV [e.g. special effects]

Policy Compliance (Legal Proof)

Operators Commercial Non-Commercial
- Public authorities
- Corporate

Location Outdoor & Indoor

Mission Purposes

Inspection [e.g. agriculture; emission control; legal matters; treaty compliance]
Validation [e.g. agriculture; emission control; legal matters; treaty compliance]

Requirements Expressed by Private Citizens

Operators Commercial
- Private individual

Location Outdoor & Indoor

Mission Purposes

Inspection [e.g. for insurance claim proof]
Inspection [e.g. thermal isolation of home]
Photography [e.g. birthday party, wedding]
Spraying [e.g. pest control (wasp nests)]
Video [e.g. birthday party, wedding]

Public Safety

Operators Commercial Non-Commercial
- Public authorities

Location Outdoor & Indoor Tethered & Non-tethered

Sub-Sectors Civil Protection, Critical Installations, Disaster Management, Fire Fighting

Mission Purposes

Deterrent [e.g. Chasing birds away from sites for sanitary reasons]
Inspection [e.g. critical infrastructure (bridges, dams, dikes, piers, tunnels), re-Intervention; post fire; post forest fire; post natural disaster; post industrial disaster]

Mapping
Monitoring Forest Fires - Fire start detection; fire zone]
Observation [e.g. Public gatherings (entertainment; sporting events; political rallies; rock concerts)]

Search & Rescue [e.g. inshore & lakes; mountains; post natural disaster; post industrial disaster]

Transport [e.g. blood, medical supplies]

Public Security & Law Enforcement

Operators Non-Commercial
- Public authorities [Police, Border Guard, Coast Guard, Customs, Forest Guards, Gamekeepers (Anti-Poaching), Judiciary]

Location Outdoor & Indoor Tethered & Non-tethered

Mission Purposes

Analysis	Detection	Classifying
Comms Relay	Identification	Inspection
Localisation	Medical Supply	Monitoring
Observation	Patrolling	Photography
Recognition	Relief Flights	Situ Assessment
Spotting	Surveillance	Tracking
Validation	Video	
Delivery Non-lethal Ordnance		

Research & Science

Operators Commercial Non-Commercial
- Corporate

Location Outdoor

Sub-Sectors

Agriculture	Fishery/Pisciculture	Archeology
Atmospheric	Biology	Botany
Climatology	Earth Sciences	Ecology
Environmental	Geomatics	History
Meteorology	Oceanography	Photogrammetry
Wildlife Conservation		

◆ Multiple flight mission purposes

Utility Companies (Public & Private)

Operators Commercial Non-Commercial
- Corporate
Location Outdoor & Indoor Tethered & Non-tethered
Sub-Sectors

Aerial Electricity Generation	Communication Relay
Construction Planning	Cable Cars
Electricity Plants	Pipelines - Gas
Pipelines - Oil	Pipelines - Water
Powerlines	Railroads
Roads & Highways	Solar Panel Farms
Telephone Repeater Towers	Wind Farms

◆ Multiple flight mission purposes

Flight Training/Instruction

Operators Commercial Non-Commercial
- Corporate
Private Person

Location Outdoor & Indoor

Duo Student instruction by licensed pilot

Solo (Unaided student flight)

Check (Qualification verification of pilot license holder)

Other Miscellaneous (Private & Commercial)

Operators Commercial Non-Commercial
- Corporate

Location Outdoor & Indoor

Test/Experimental (Test & validation of RPA, payloads & sub-systems on an RPA - for company internal assessment purposes)

Demonstration (RPA, payloads & sub-systems on RPA for validation, certification or commercial purposes)

Ferry/Positioning (Delivery flights for the purpose of returning an RPA to base, delivering a new RPA from its place of manufacture to its customer, moving an RPA from one base of operations to another or moving an RPA to or from a maintenance facility for repairs, overhaul or other work)
Outdoor only

Air Show / Race

Transport (Commercial & Non-Commercial)

Operators Commercial Non-Commercial
- Corporate

Location Outdoor

Sub-Sectors

Emergency Supply Delivery	
Freight [outside aircraft: container; suspended bulk (logging)]	
Freight [inside aircraft]	Medical Supply Delivery
Package Delivery	
Persons (e.g. air taxi; ambulance]	Relief Flight

Leisure Use

Operator Private Persons

Location Outdoor & Indoor

Flying Toys
Recreational Flying
Model Aircraft

Editor's Note

This is a living one. It will be added to, modified and improved as time progresses. Each edition will be dated and the most recent edition will be made publically available on:

www.rps-info.com www.rpas-regulations.com
www.rpas-conference.com www.rpas-civops.com

The submission of suggestions for improvement, modification, and additional application examples is encouraged and will be highly appreciated. Submissions should be addressed by email to: Peter van Blijenburgh - pvb@rps-info.com