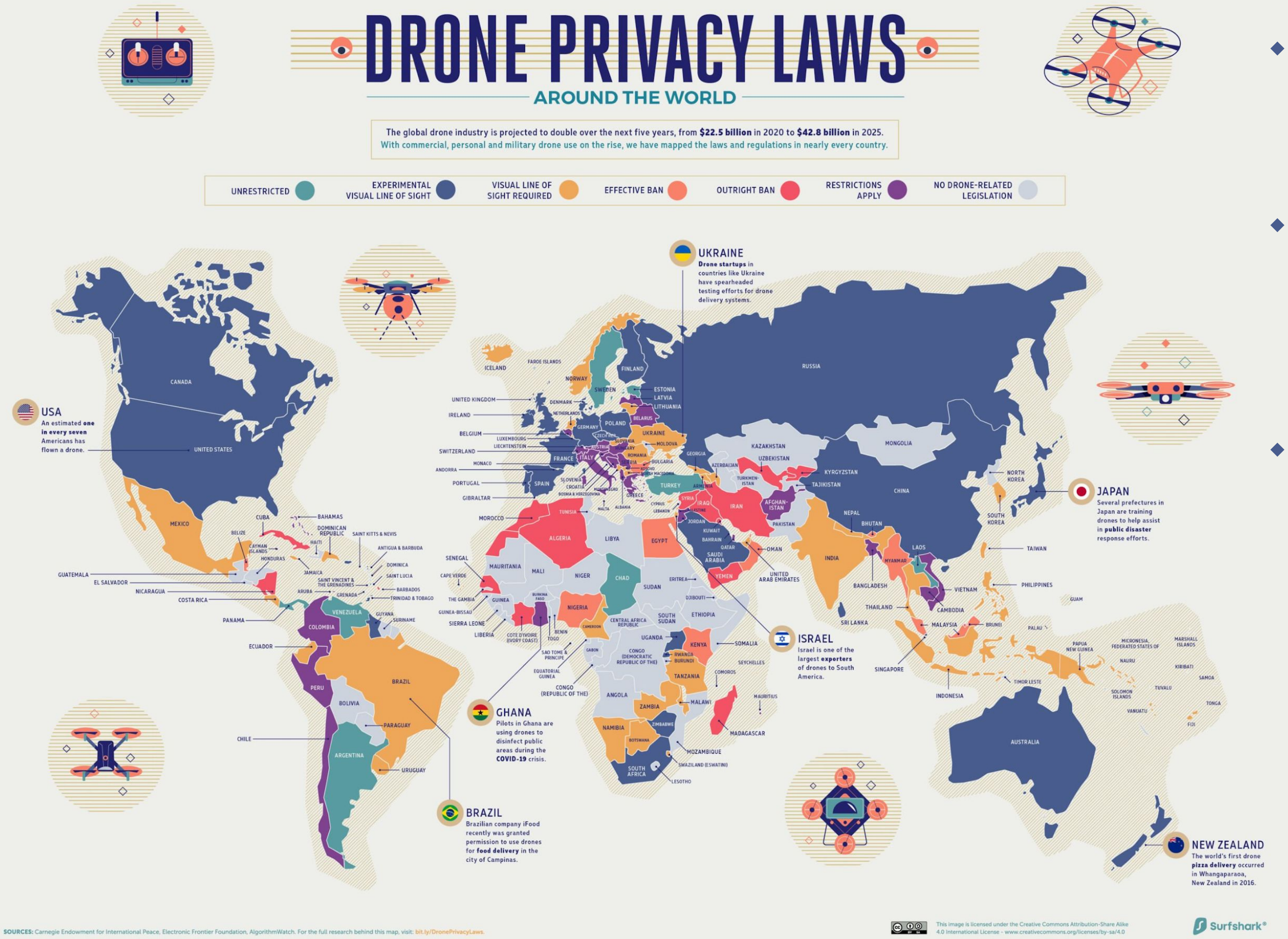
An Overview of Drone & EVTOL Regulations

PRESCOUTER

June 2021

Drone Regulations



- **A MAJOR DRAWBACK FOR DRONE OPERATORS IN ALMOST ALL COUNTRIES IS TO FOLLOW THE "LINE OF SIGHT RULE" WHICH LIMITS DRONE APPLICATIONS AND USE.**

- According to the latest drone numbers, 70.5% of registered U.S. drones are recreational, but these proportions may soon decline in favor of commercial uses. Civilian drones, as of December 2020, are allowed to fly over populated areas, a step towards fulfilling their potential in package delivery.

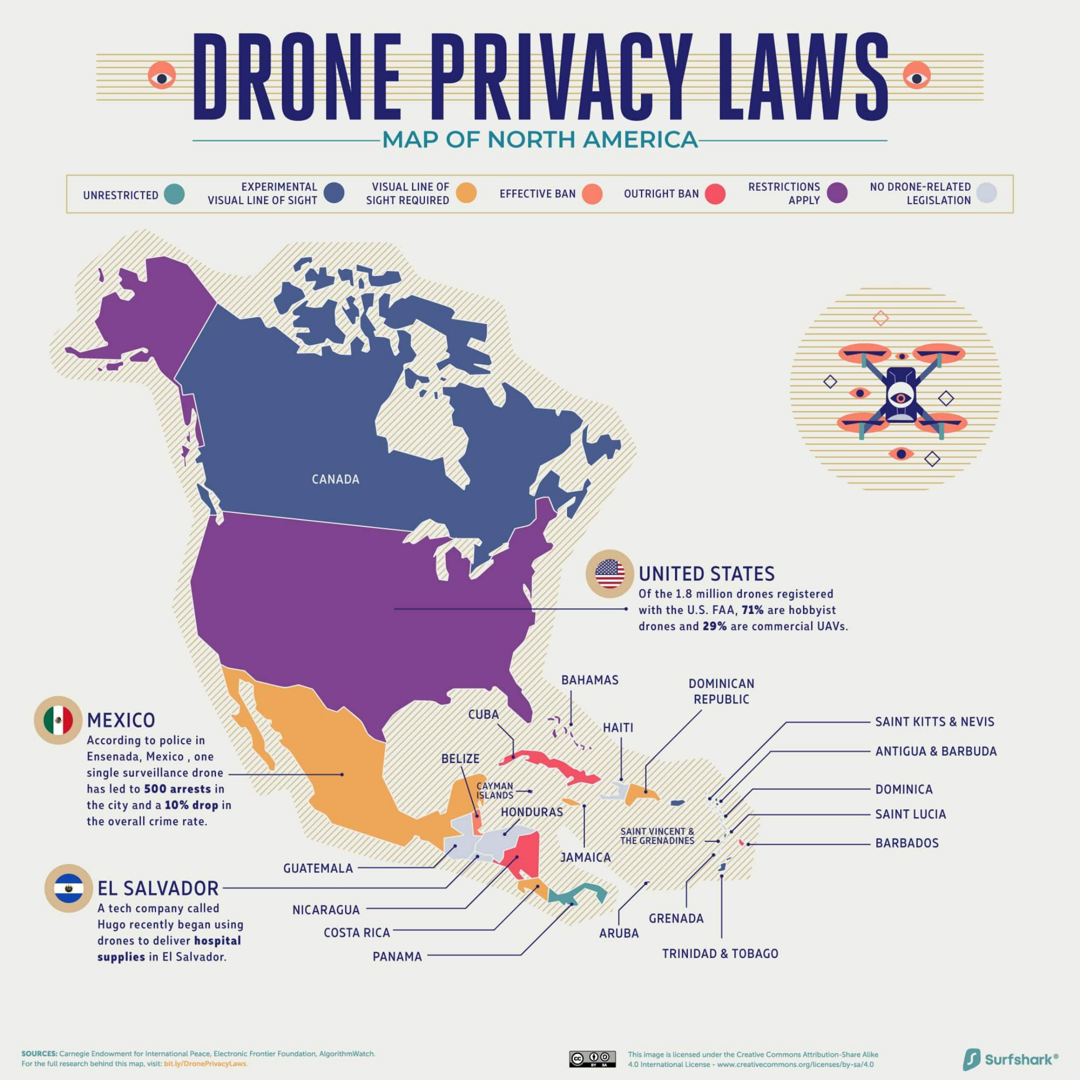
- Meanwhile, countries like Mexico are beginning to rely on drones for other applications, such as to combat crime, with good results so far. The People's Republic of China (PRC) currently lacks comprehensive laws or administrative regulations regarding drones at the national level.

Categories of Ban

CATEGORIES OF RESTRICTIONS FROM DIFFERENT REGULATORY BODIES GLOBALLY INCLUDE:

- Outright ban
- Effective ban
- Visual line of sight required
- Pilots need to be able to see the drones at all times and must usually obtain a license or permit
- Experimental visual line of sight
- Pilots can let the drone fly outside their field of vision e.g., during a race

- Previous restrictions apply
- Drones need to be registered, and/or additional observers are required
- Unrestricted
- When drones are flown around private property and airports, and under 500 feet (150 meters)



North America

While the bulk of countries around the world require drone pilots to be able to see the UAV at all times, 33% of countries in North America allow for **experimental drone flights beyond the line of sight**, the largest share of any continent and far above the 22% global average.

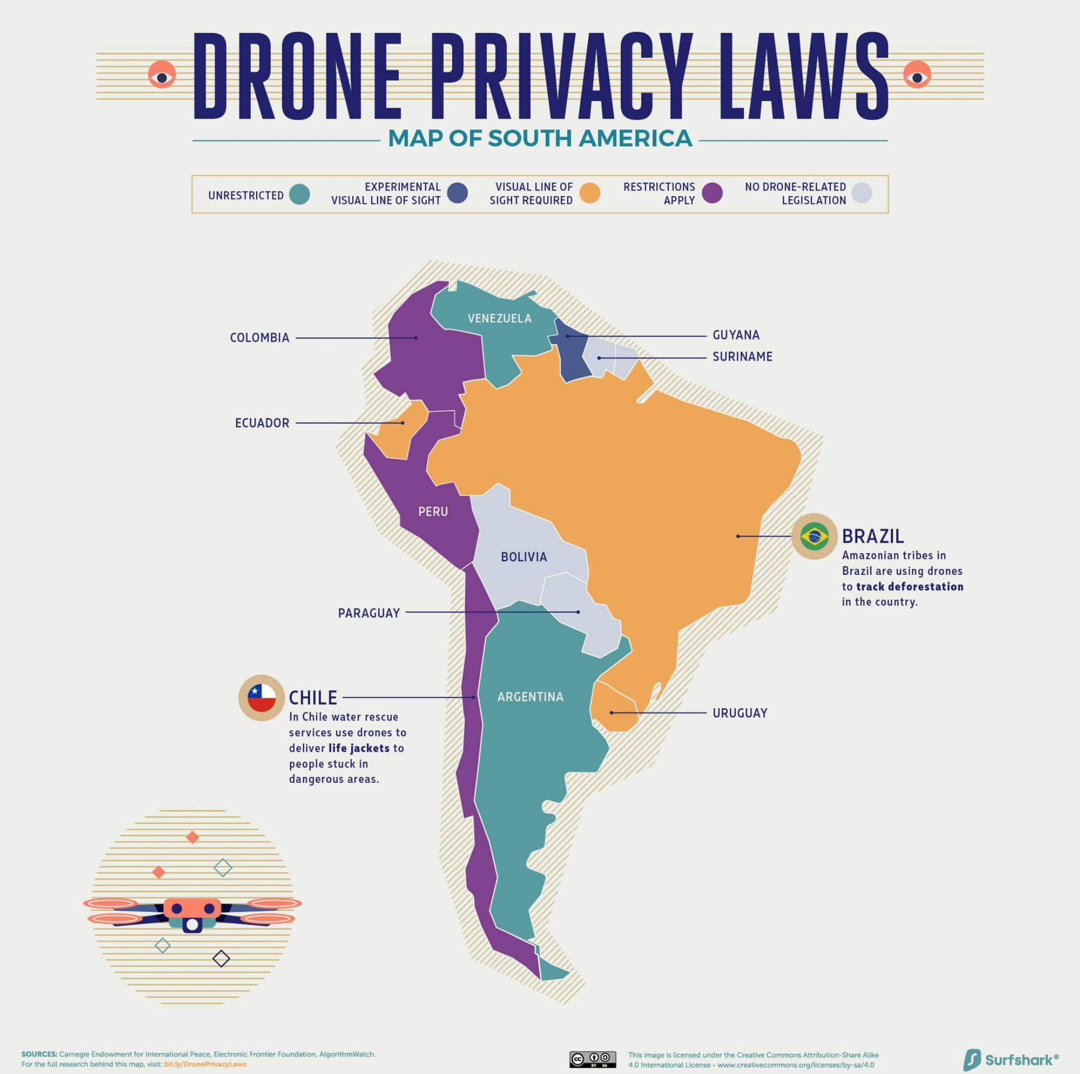
Countries with experimental drone legislation include Canada, the Cayman Islands, Antigua and Barbuda, and other small Caribbean nations.

The large number of countries allowing experimental drone flights relate to tech companies like Amazon, Walmart, and DHL, which are researching ways to incorporate drones into their delivery infrastructure.

Ten states specifically restrict drone access near critical facilities and infrastructures: Arkansas, Arizona, Delaware, Florida, Louisiana, Nevada, Oklahoma, Oregon, Tennessee, and Texas.

The United States differentiates commercial and recreational drone uses. Both are subject to restrictions, registrations and a strict code of conduct. Additionally, depending on your drone's weight and the state you wish to fly within, different rules may apply.

People do not need permission or a license for drone recreational use in the US (unless you fly within 8.1 km of an airport).



South America

67% of countries with drone-related legislation in South America allow drones to be flown, as long as the aerial vehicle stays within the view of the pilot, the largest share of any continent.

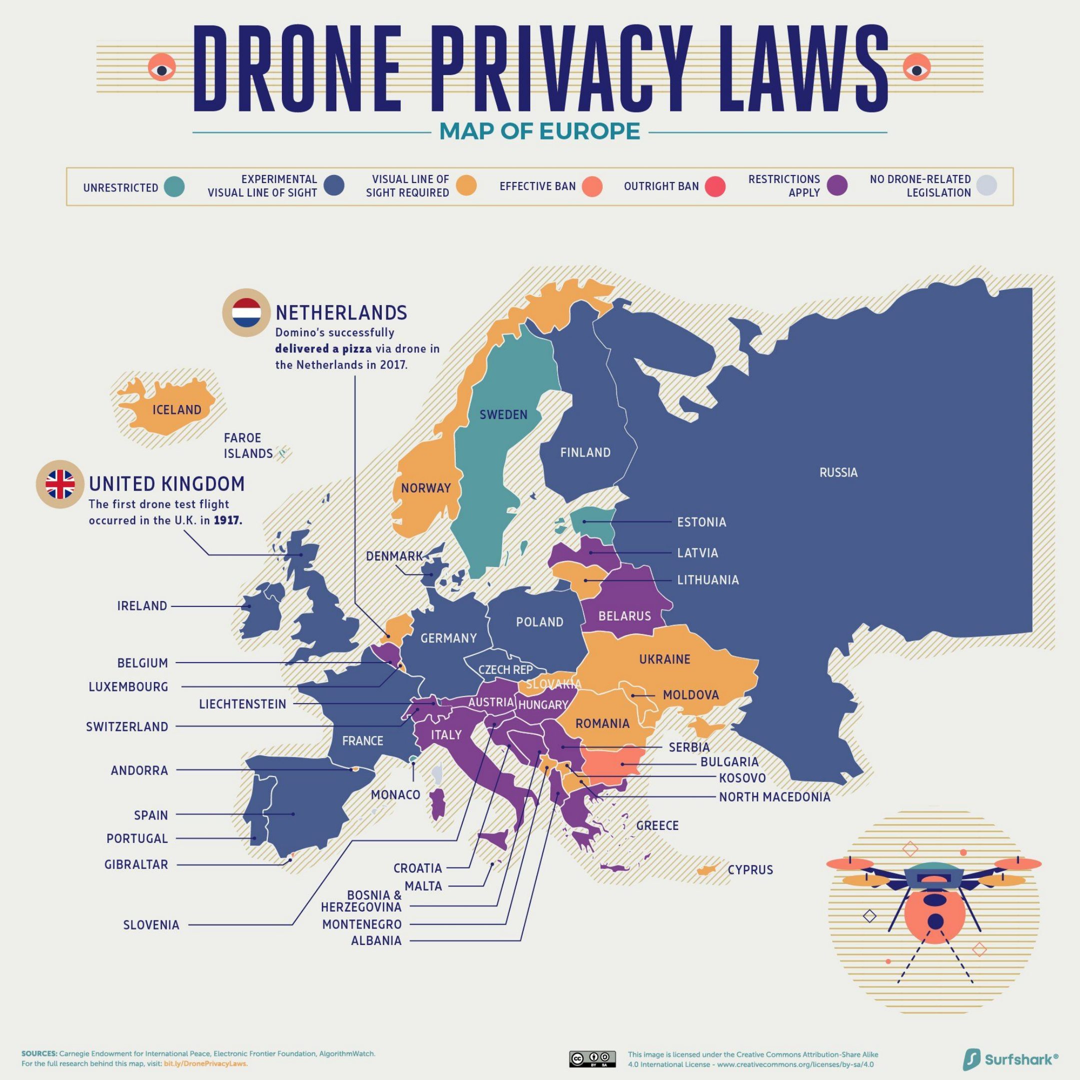
No countries in South America have outright or effective bans on drones.

While no countries ban drones, **only one country, Guyana, has provisions that allow for flights beyond the line of sight** - the fewest of any continent.

Other countries in South America have specific drone rules geared toward safety and environmental conservation.

In Peru, for example, drone flights cannot last longer than one hour.

In Ecuador, drones are completely banned on the Galapagos Islands, save for approved scientific usage.



Europe

The European Aviation Safety Agency (EASA) has **recently tightened drone regulations in the EU** and its other member states (Switzerland, Norway, Iceland, and Liechtenstein).

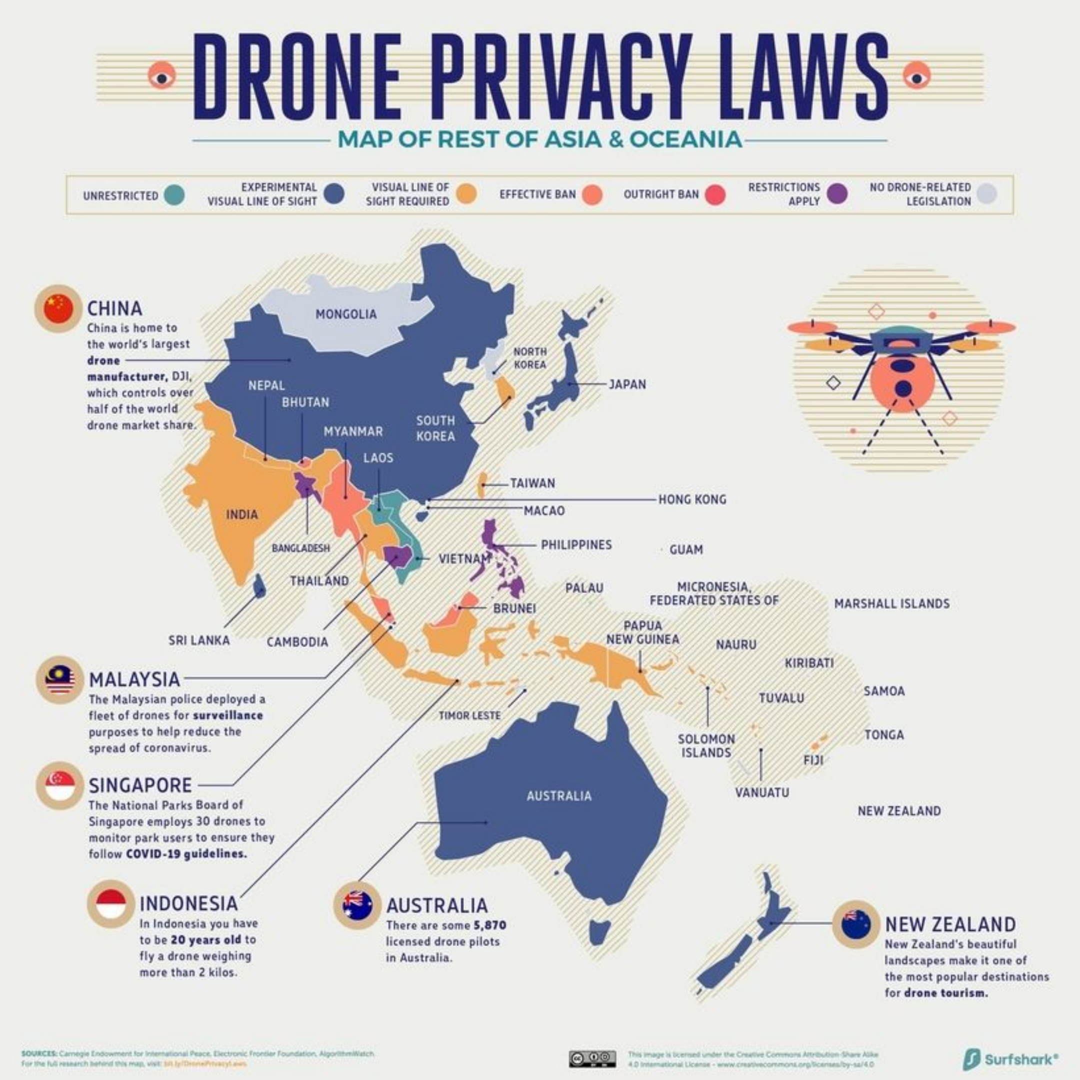
EASA countries can also set their own rules and regulations within these limits.

Drone pilots in Latvia, for example, are required to wear an identifying piece of clothing, such as a hat or a shirt.

In Austria, pilots are required to get a license if the drone weighs more than about half a pound and flies above 98 feet.

In the Netherlands, Domino's delivered Pizza with drones in 2017.

The new *European regulatory framework* takes a risk-based approach, classifying each technology into three separate categories: Open, Specific, and Certified.



China and APAC

According to China's national aviation authority, the Civil Aviation Administration of China (CAAC), flying a drone is legal in China.

Any drone that weighs over 250 grams (0.55 pounds) must be registered with the CAAC.

Any drone weighing 7 kilograms (15 pounds) to 116 kilograms (256 pounds) requires a license from the CAAC.

All drones flown for commercial use require a license from the CAAC.

Any drone weighing over 116 kilograms (256 pounds) requires a pilot's license and UAV certification for operation.

A regulation proposal on drone administration was put forward for public consultation by the State Council and the PRC Central Military Commission in January 2018 — **the "Interim Administrative Measures on the Operation of Unmanned Aircrafts (Proposed Draft)" — but has not yet come into force**.

EVTOL Regulations

FAA Federal Aviation Administration

FAA guidelines are yet to be completed. However, the FAA is expected to soon publish special conditions for certification of electric propulsion units (EPUs) and high-voltage architecture, two of the missing pieces of certification material.

EASA European Aviation Safety Agency

Means of Compliance by EASA for EVTOL can be found here. There is currently a lack of consistency in regulatory standards for electric vertical takeoff and landing (eVTOL) aircraft. Another area that could have difficulty with consensus standards and is essential for eVTOLs is batteries.

DIFFERENT APPROACHES EXIST BETWEEN THE UNITED STATES (FAA) AND EUROPE (EASA).

- The FAA plans primarily to use the inherent flexibility of Part 23, Amendment 64, so no new regulations are required. EASA, on the other hand, has taken the opposite approach of building a whole new regulatory framework from scratch.
- The latest document further illustrates a growing gap between the FAA and EASA, not just on approach to certifying eVTOLs, but on safety standards as well, one source within the industry told *Avionics International*.

The following page illustrates these differences in detail.

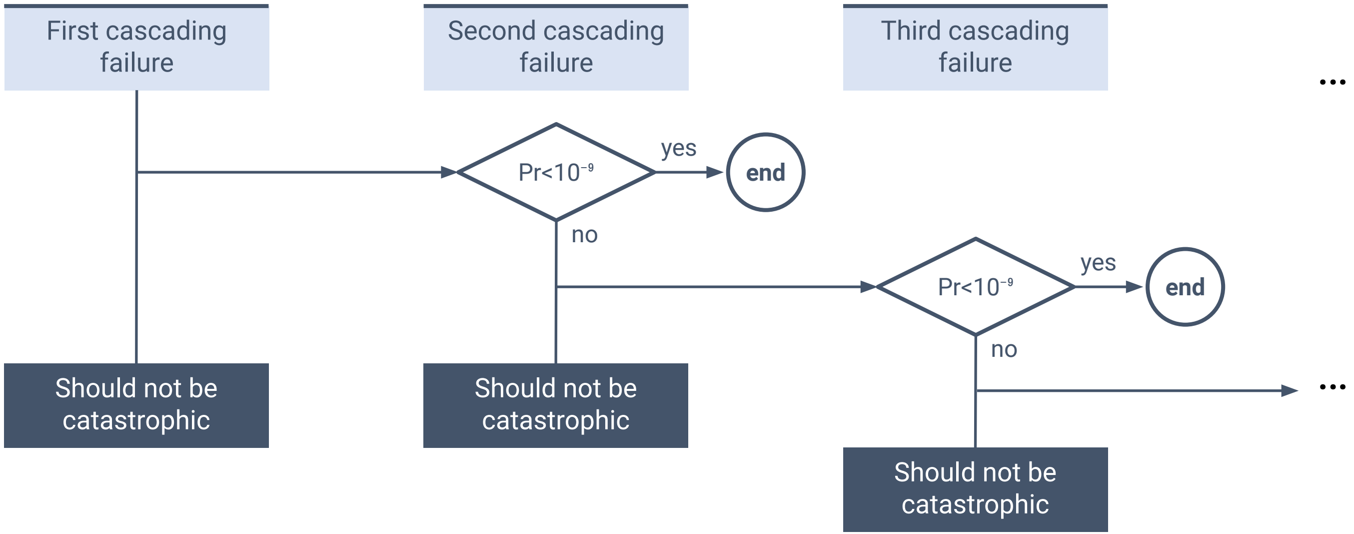
Examples from the EASA Means of Compliance Document

EASA Methodology for the lift/thrust unit cascading failure evaluation

EASA European Aviation Safety Agency

Proposed Means of Compliance with the Special Condition VTOL

Doc. No: MOC SC-VTOL
Issue: 1
Date: 25 May 2020



Pr = overall probability of the n^{th} failure occurring

Examples from the EASA Means of Compliance Document

EASA Safety Objectives per aircraft category and failure condition classification

		Failure Condition Classifications			
	Maximum Passenger Seating Configuration	**Minor**	**Major**	**Hazardous**	**Catastrophic**
Category Enhanced	-	$\leq 10^{-3}$ FDAL D	$\leq 10^{-5}$ FDAL C	$\leq 10^{-7}$ FDAL B	$\leq 10^{-9}$ FDAL A
Category Basic	**7 to 9 Passengers**	$\leq 10^{-3}$ FDAL D	$\leq 10^{-5}$ FDAL C	$\leq 10^{-7}$ FDAL B	$\leq 10^{-9}$ FDAL A
	2 to 6 passengers	$\leq 10^{-5}$ FDAL C	$\leq 10^{-5}$ FDAL C	$\leq 10^{-7}$ FDAL C	$\leq 10^{-8}$ FDAL B
	0 to 1 passenger	$\leq 10^{-3}$ FDAL D	$\leq 10^{-5}$ FDAL C	$\leq 10^{-6}$ FDAL Cx	$\leq 10^{-7}$ FDAL C

[Quantitative safety objectives are expressed per flight hour]

Differences Between FAA & EASA Regulations for EVTOLs

FAA Federal Aviation Administration

Rather than starting off with a one-size-fits-all approach, the provisions of Code 14 of Federal Regulations (CFR) § 21.17 (b) will be used for a more tailored process.
After a detailed evaluation of the concept of operations (conops) for a particular aircraft, the FAA will then stipulate what certification standards must be used, extracted from 14 CFR § 23, 25, 27, 29, 31, 33, and 35.
One potential issue with the FAA's method is how to get **a reciprocal acceptance approval between the authorities**.

EASA European Aviation Safety Agency

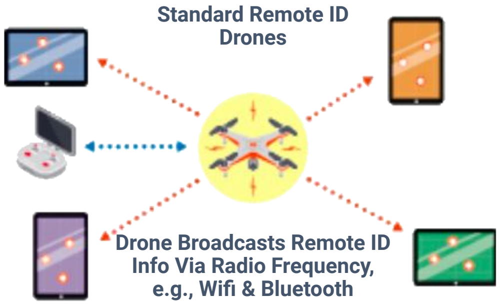
With EASA having a well-defined set of criteria, it should be fairly straightforward to get these transposed and accepted by the FAA, such as is done currently for CS-Very Light Airplanes to 14 CFR § 21.17 (b).
The reverse process to match the various standards for each different 21.17 (b) approval will place a bigger administrative burden on the EASA side.
If the two agencies continue on their current regulatory trajectory, the source expects aircraft developed to meet FAA standards may need significant modifications to achieve the safety specifications required by EASA; conversely, **aircraft that meet EASA's standards may have poorer performance than those the FAA alone approves** to fly.
EASA's new standard has requirements for energy storage crash resistance and dealing with assumed lift/thrush unit failures that include propeller blade fragmentation or complete detachment.

Remote Identification Registration

Remote identification (commonly known as Remote ID) is the standard registration approach for EVTOL globally and describes the capability of an unmanned aircraft in flight to provide certain identification, location, and performance information that people on the ground and other airspace users can receive.

3 WAYS DRONE PILOTS CAN MEET REMOTE ID RULE

DRONE REMOTE IDENTIFICATION



- Remote ID capability is built into the drone
- From takeoff to shutdown, drone broadcasts:
  - Drone ID
  - Drone location and altitude
  - Drone velocity
  - Control station location and elevation
  - Time mark
  - Emergency status

DRONE REMOTE IDENTIFICATION

- Remote ID capability through module attached to drone
- Limited to visual line of sight operations
- From takeoff to shutdown, drone broadcasts:
  - Drone ID
  - Drone location and altitude
  - Drone velocity
  - Takeoff location and elevation
  - Time mark

FAA-RECOGNIZED IDENTIFICATION AREA (FRIA)

- Drones without Remote ID can operate without broadcasting
- Drones without Remote ID must operate within visual line of sight and within the FRIA
- Anyone can fly there, but FRIAs can only be requested by community-based organizations and educational institutions

Authors

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Technical Director

Sofiane leads the high-tech, aerospace & defense, and automotive & logistics practices at PreScouter. For nearly a decade, he has worked with hundreds of F500 and G1000 clients across multiple industries, through which he has developed an expertise in key emerging technologies (such as 5G, IoT, AI/ML, blockchain, energy storage and generation, quantum sensing, and others) and a strong understanding of the associated business ecosystem and drivers pushing these sectors forward (e.g., key players and trends, roadblocks to commercialization, etc). Sofiane's strategic insights have ranged from technical due diligence for acquisition targets to identifying relevant markets for newly developed products based on emerging technologies and assessing market penetration strategies. Sofiane holds a PhD in Materials Science and Engineering from the Georgia Institute of Technology, where his research focused on nanotechnology and energy storage.

Kishore Ravichandran

Researcher

Kishore has a background in industrial engineering and supply chain management and has worked on 100+ projects spanning across multiple verticals. As a business analyst in the IoT (SCM) space, he studies customer requirements to come up with new solutions and develop collaterals based on the research. Apart from that, Kishore holds a Master's Degree in Industrial Engineering and Management in Finland, with a focus toward International Sales and Sourcing. His key areas of specialization include project management, supply chain solutions, and market research. He has also done an exchange program in TU Darmstadt focusing on logistics.

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- DATA ANALYSIS & RECOMMENDATIONS
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- INTERVIEWING COMPANIES & EXPERTS

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