



# Flying high – Why Switzerland for drone technology

**GZA Webinar – June 12, 2019 at 12 pm EDT / 9 am PDT / 6 pm CEST**



"Switzerland is the Silicon Valley of robotics"

**Chris Anderson**  
CEO & Founder  
3DR

# Greater Zurich Area – concentrated technology excellence in Europe's most stable environment

## Oracle Labs Zurich

- Multiple research projects with ETH since 2012
- Framework agreement est. in 2014
- Oracle Labs started in 2014 close to ETH
- > 15 people and growing
- Focus: data analytics, big data, programming languages

## IBM Research Zurich

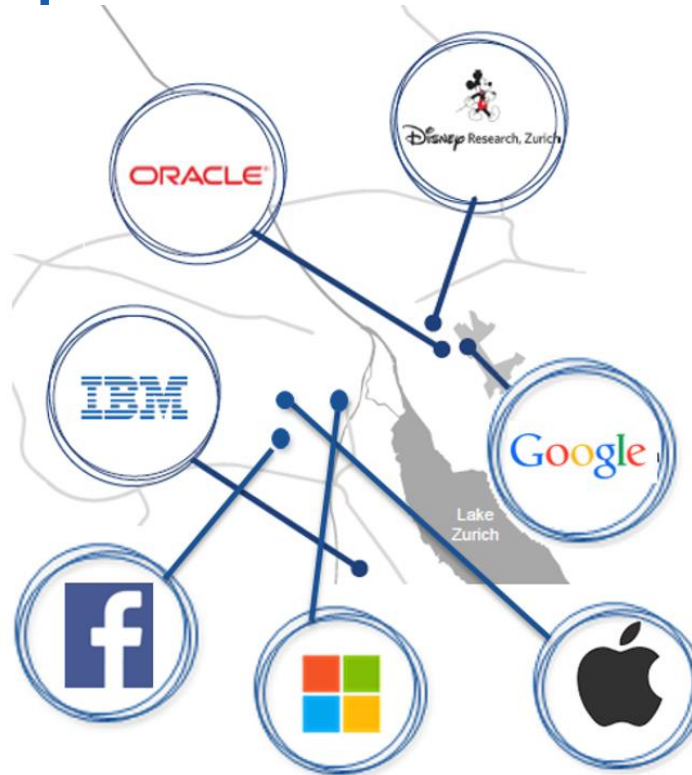
- Binnig and Rohrer Nanotechnology Center established in 2011
- 950 m<sup>2</sup> cleanroom space
- Location of ETH research groups in the Center
- Focus: nanoscience, photonics

## Facebook/ETH Labs

- Project Santa Cruz: 2018 expansion of R&D teams and offices
- Joint development of next generation Oculus core technology
- Acquisition of ETH/Wyss Center's "Zurich Eye" spin-off
- > 35 developers, and rapid growth
- Focus: virtual und mixed reality

## Microsoft Research: Mixed Reality & AI Lab

- Multiple research projects with ETH since 2008
- Headed by ETH Prof. Marc Pollefeys
- > 15 people and growing
- Focus: Computer Vision (HoloLens) AI, mixed reality, system technologies for data security
- Outlook: New "Swiss joint research Center" in 2019



## Disney Research Zurich

- Est. 1992, ETH collaboration since 2010
- Directed by ETH Prof. Markus Gross
- 13 joint PhD students with ETH, >60 ICT specialists
- ~200 joint papers, >100 patents
- Focus: computer graphics, 3D animation and face modelling, video of the future

## Google Research Labs Zurich

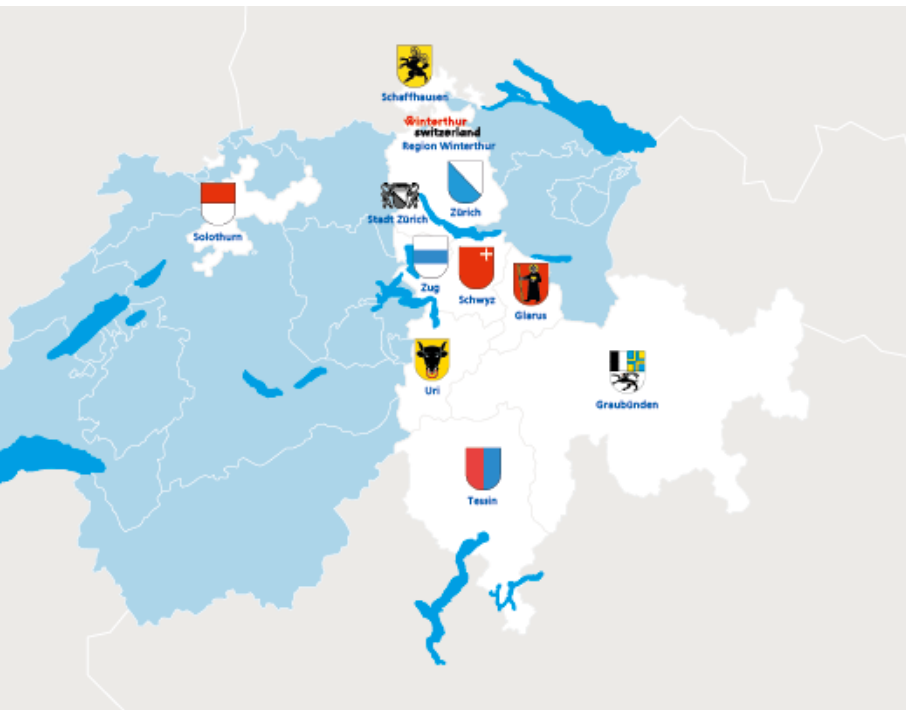
- Biggest engineering and R&D hub outside the US, est. 2016
- Multiple research projects with div. universities
- 2018: expansion to Europaallee
- > 2000 empl. from 75 countries
- Outlook: 5'000 people until 2021
- Focus: AI, machine learning and perception, algorithms

## Apple Inc.

- Acquisition of FaceShift, ETH Spin-off in 2015
- Since then continuation of close collaboration with ETH
- Focus: perception, machine vision & deep learning

# Greater Zurich Area Ltd (GZA) – a successful public-private partnership

## Public members

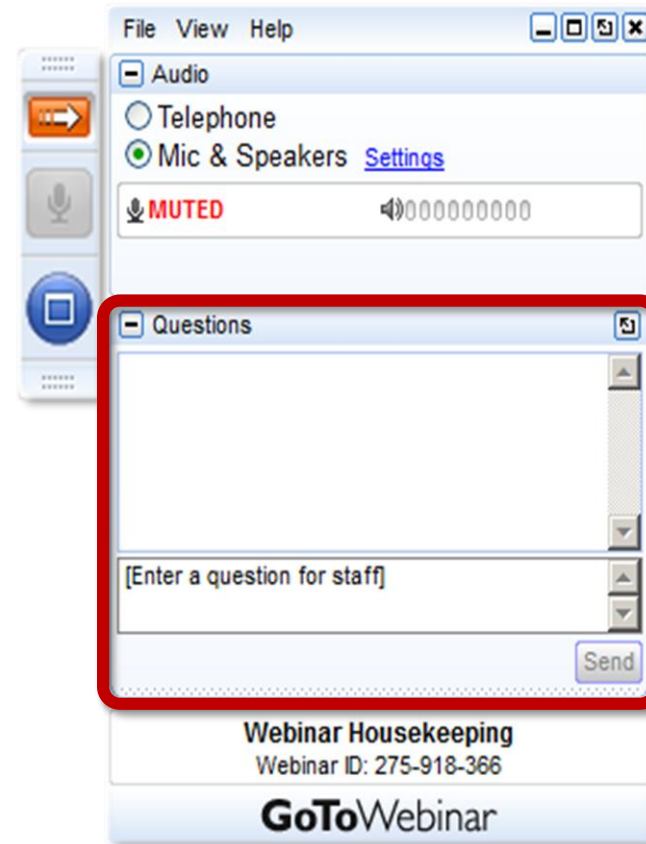
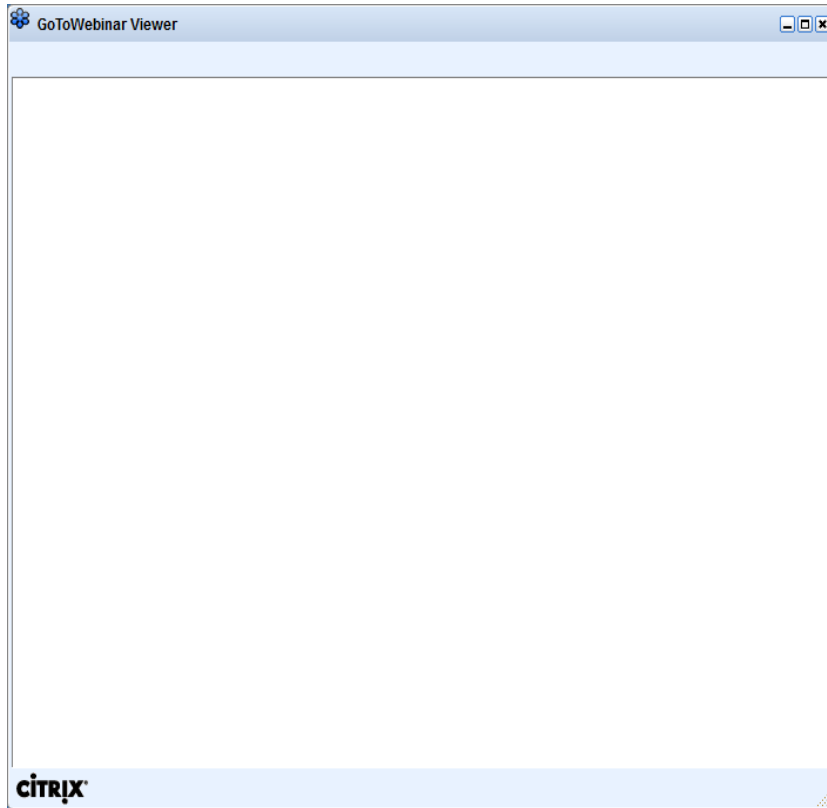


## Partners from science and business





# Webinar housekeeping



All webinar recordings available on: [greaterzuricharea.com/webinars](http://greaterzuricharea.com/webinars)

# Today's speakers



**Kevin Sartori**

Co-Founder  
Auterion

kevin@auterion.com

Master in Robotics from ETH Zurich  
MBA from UC Berkeley

Career: Pixhawk team at ETH Zurich,  
Boston Consulting Group, 3D Robotics

**Andreas Lamprecht**  
Chief Technology Officer  
Aimap

andreas@airmap.com

PhD in Automotive Engineering from  
Technical University of Chemnitz

Career: Audi



# The Greater Zurich Area as a global center for drone technology

Kevin Sartori, Co-Founder @ Auterion



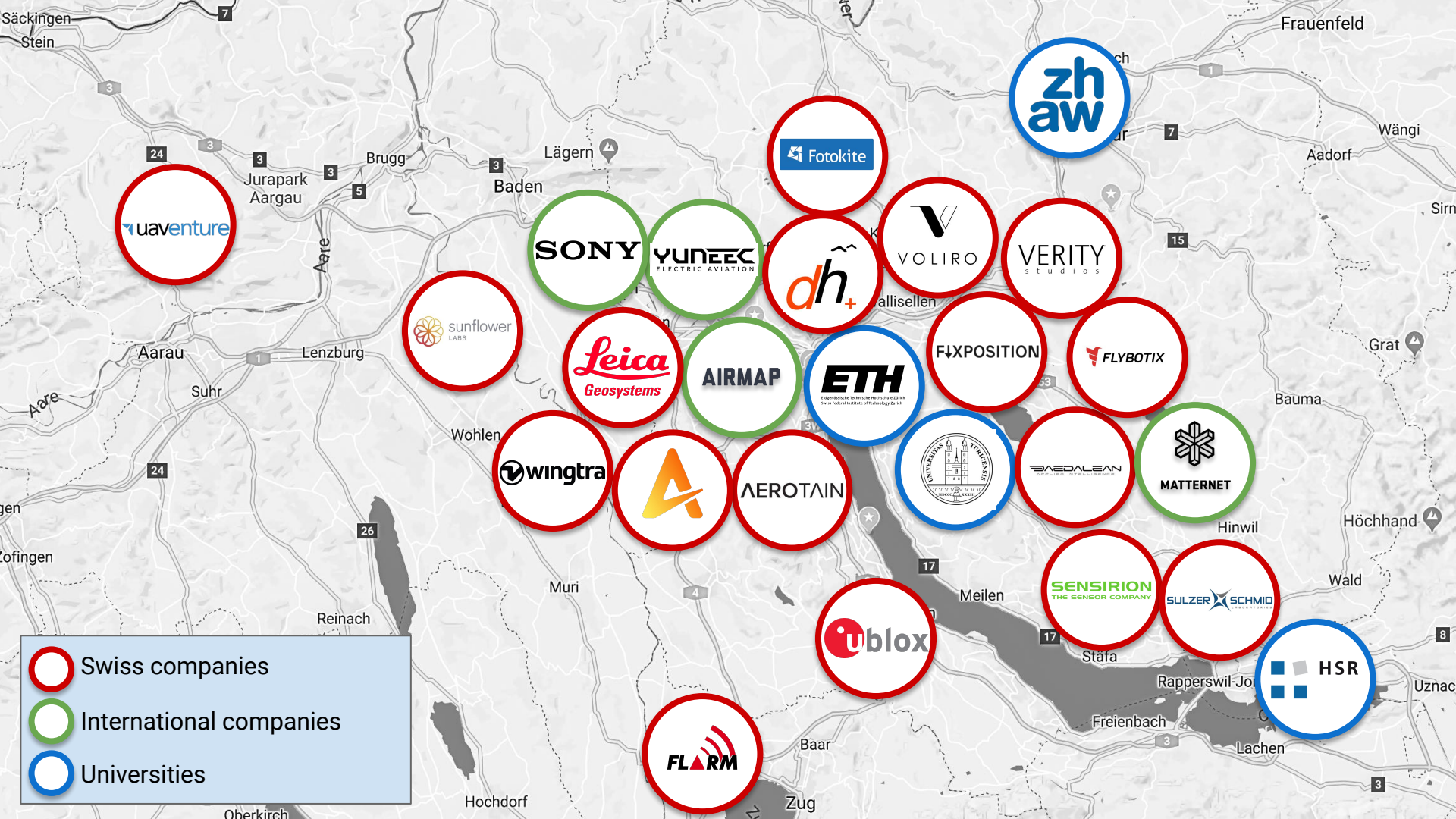
# What is a technology ecosystem?

A technology ecosystem is an interconnected, self reinforcing, and interdependent network of various actors that combine to create innovative products and services in tech.

## **It includes:**

- Established companies with product in the market
- Startups bringing new innovating products to market
- Suppliers of components, parts, and technology
- Leading research
- Talent pool
- Regulatory framework





# Factors that facilitate the foundation of drone startups and attract international players

## 1 World class education

**ETH** Zürich



**zhaw**



**HSR**  
HOCHSCHULE FÜR TECHNIK  
RAPPERSWIL

## 2 Internal competition



Autonomous Systems Lab



Computer Vision  
and Geometry Lab



ÉCOLE POLYTECHNIQUE  
FÉDÉRALE DE LAUSANNE

## 3 Talent pool



## 4 Support for founders

**ieLab**  
Innovation and  
Entrepreneurship Lab

**>>venture>>**  
Companies for Tomorrow



Translating  
Science into Life

**VENTURE  
KICK**



## 5 Progressive regulations



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra  
Swiss Confederation

Bundesamt für Zivilluftfahrt BAZL  
Office fédéral de l'aviation civile OFAC  
Ufficio federale dell'aviazione civile UFAC  
Federal Office of Civil Aviation FOCA



## 6 Birthplace of PX4



## 4 Infrastructure to support founders

1. Organizations supporting founders mature and adapt to their needs:
  - Increased awareness for product-market fit
  - Accelerators at Universities
2. Growing VC network
  - With Lakestar and Index Ventures, Switzerland is home to two of the most successful European VCs
  - Investments tripled in the last 5 years (to CHF 1.2B in 2018 / 43% in Zurich)
  - Size of rounds triples in last 4 years (median of CHF 11M in 2018)
3. More focus on software products by founders
4. Slowly the ecosystem starts to become self-reinforcing

## 6 The key component: PX4, the Linux for drones

YUNEEK



YUNEEK



IMPOSSIBLE  
AEROSPACE



UAV



FREEFLY



NXP



DHL



amazon  
Prime Air



QUALCOMM



INSPIRED FLIGHT



TEAL



SONY



sentera



VERTICAL  
Technologies



ALT1



FlightWave



AIRDOG



wingtra





# On the same mission for a decade



# The largest drone developer summit with over 200 attendees ETH Zurich: June 20-21 2019



[www.dronecode.org/dev-summit-zurich/](http://www.dronecode.org/dev-summit-zurich/)

# If PX4 is Linux, Auterion is Red Hat

Auterion is the largest open source drone software company with 45 employees based in Zurich

Customers include leaders in the space:



GE Aviation



PRECISION-HAWK

IMPOSSIBLE  
AEROSPACE

AV  
AeroVironment™



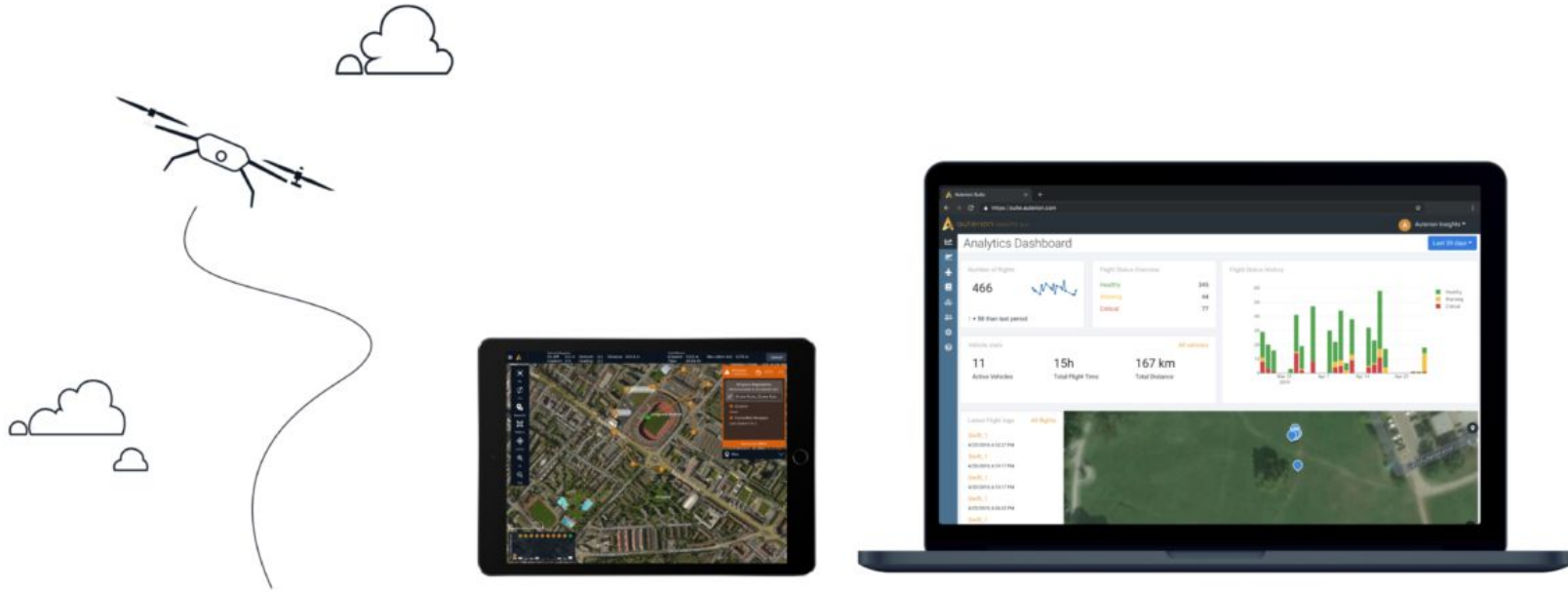
Proud to be recognized as “The Next Global Hot Thing” at the Digital Economy Awards 2018



Auterion has presence in Switzerland and USA, and is backed by top US and European VCs.

Founded by Lorenz Meier, creator of  and  and Kevin Sartori who worked for the largest US drone manufacturer in Silicon Valley

# The operating system for safe and reliable drones





## Takeaways and outlook

- Strong network of manufacturers, tier 1 / tier 2 suppliers, service companies
- The ecosystem has reached a size that makes it self reinforcing
- The PX4 / Auterion are the catalizers in the ecosystem
- Exemplary collaborations between local ecosystem, world class research, and progressive regulators

**Zurich is a leading location for core drone technology and leading companies from the US and China move here to leverage it.**



Thank you!

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# U-space

Airspace Intelligence Services for Safe, Compliance & Efficient Drone Operations

AIRMAP



June 12<sup>th</sup>, 2019  
Andreas Lamprecht  
CTO



# About AirMap

AirMap opens the airspace for drones by building the leading global UTM platform to support a secure & sustainable drone ecosystem.

2015

Year Founded

75+

Staff Worldwide

\$60M

Raised in Venture Capital and Strategic Investment

AIRBUS VENTURES



GENERAL CATALYST

Honeywell



QUALCOMM VENTURES

Rakuten

SONY

TEMASEK

YUNEEC



# Drone technology is evolving quickly to meet growing demand for drones and drone-related services.

## 2015

### RECREATIONAL DRONES

Early adoption of remote helicopters and multirotor for hobby use, including photography.



WE ARE HERE

### ENTERPRISE UAS SERVICES

VLOS Individual & fleet deployment across agriculture, infrastructure, construction, mining, public safety, and more.



### ADVANCED UAS OPERATIONS

Semi-autonomous, BVLOS for standardized drone delivery, long range inspections, surveillance, search and rescue.

### DRONES AS A SERVICE

Connecting end customers to drone enabled services offered by fully autonomous, BVLOS drones. Tap to request a roof inspection, no pilot required.





## 2023

### EVTOLS / UAM

Fully autonomous VTOL\* aircraft equipped to take 1 or more passengers (or freight) to and from their destinations.

\*2018 projections by Uber for a Vertical TakeOff and Landing demo in 2020, with first commercial operation projected for 2023.

# Low-altitude airspace is complex.

TRADITIONAL AIRSPACE   
LOW ALTITUDE AIRSPACE 

Safety, security & compliance assurance are critical to building an ecosystem that enables the responsible use of drones for commercial work.



## WILDFIRES

Cell phone towers, building data, & terrain



## WEATHER

Temperature, precipitation, pressure, cloud cover, & more



## AIRSPACE

Controlled, restricted, & prohibited



## MANNED TRAFFIC

Nearby air traffic



## AIRPORTS

Public, private, heliports, military



## PUBLIC BUILDINGS

Prisons, hospitals, & power plants.



## TEMP. FLIGHT RESTRICTIONS

Community events, sports games, emergency response, & VIP



## SCHOOLS

Elementary, middle, high, universities & other



## PARKS

National, marine protected areas, city, playgrounds, stadiums, & ballfields



## OBSTACLES

Cell phone towers, building data, & terrain

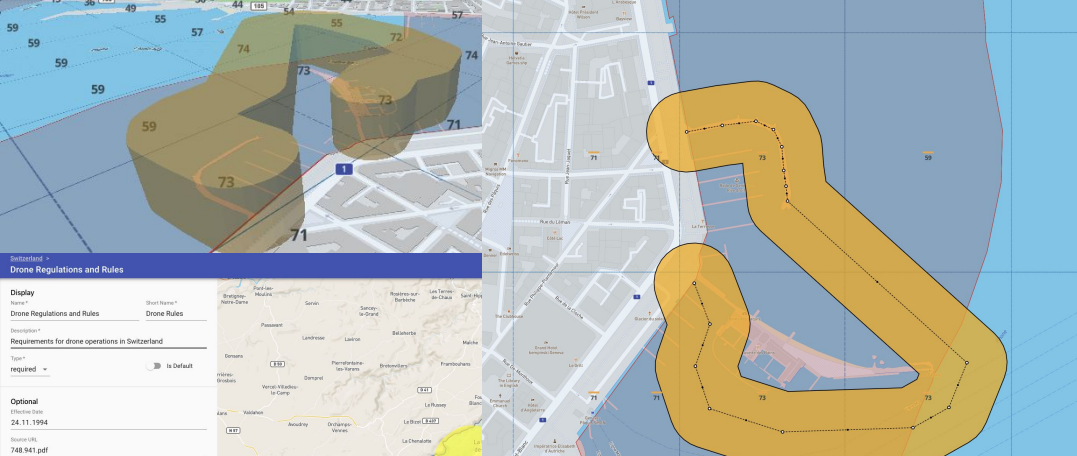
How to tackle this?

# It starts with a Digital Twin of the airspace.

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AirMap represents the past, present, and predicted future state of the airspace in a real time 4D digital cloud.

This airspace intelligence, based on industry standards, combined with value-add services, and global partnerships, makes up the AirMap Platform: a global, robust, and interconnected Unmanned air Traffic Management system.



### Switzerland - Drone Regulations and Rules

Display  
Home  
Drone Regulations and Rules  
Drone Rules

Download  
Requirements for drone operations in Switzerland

Type  
required  
is Default

Optional  
Effective date: 24.11.1994  
Source IRL: 748.941.pdf  
Ordinance Code: 748.941

Search rules

Rules (13)

- Do not drop or spray fertilizers or biocidal products from your drone
- Do not fly drones over a city without liability insurance of at least 1M CHF
- Do not fly in restricted airspace
- Do not fly in prohibited airspace
- Authorization required to fly closer than 5 km from civil or military aerodrome runways
- Authorization required to fly closer than 5 km from civil or military aerodrome runways
- Authorization required to fly closer than 5 km from civil or military aerodrome runways



### Flight Brief

Authorizations  
Authorization Accepted

Rules & Compliance  
Rules needing more information  
Rules you should review  
Rules you are following

Update Plan Submit Plan Close

Authorization Status  
Link to report a pending authorization

Telemetry  
A white outline indicates the aircraft is sending telemetry.

Aircraft Altitude  
Indicates the aircraft's altitude.

True Course  
Icon rotates towards the true course.

Aircraft Type  
Based on the aircraft type.

80m AGL

AirMap/Other Flight  
A blue icon in the top right corner indicates AirMap flight. A white icon in the top right corner indicates all other flights.

PD

< 200 FT AGL MAV UAV

04 MSL

SMO22

Penmar Recreation Center

Penmar Municipal Golf Course

Marine Park

Walgrove Elementary School

Data, lots of data

# Services built on Digital Airspace Twin

Standardisation and Regulation shaping the way usage of airspace is automated

**Geo-Information Service**

Provides data necessary for to meet safety- and operational requirements.

**Rule-Awareness Service**

Provides information about rules to follow in a specific area of operation.

**Risk Assessment Service**

Provides risk-estimates based on flight-route with respect to air- and ground-risk.

**Weather Service**

Provides forecast and real-time weather information to support operations.

**Flight Planning Service**

Prior to flight, arranges intended trajectories for safety, dynamic airspace rules, airspace restrictions and mission needs.

**Geo-fencing and -caging Service**

Keeps UAS inside or outside a designated geofence.

**Digital Logbook Service**

Provides digital logbook for Operators and UAS operations. Documents safety compliance.

**Tracking Service**

Tracks position reports in order for other services to operate.

**Conflict- & Advisory Service**

Provides real-time monitoring and alerting through suggestive information about traffic proximity.

**Conformance Monitoring Service**

Provides real-time alerting on non-conformance on intended operation.

**Dynamic Rerouting Service**

Provides modifications to trajectories to minimize likelihood of airborne conflicts.

**Emergency Management Service**

Nulla porttitor massa id neque aliquam vestibulum morbi blandit. Ut morbi tincidunt.

**Airspace Authorization Service**

Request and manage airspace authorization requests according to operating rules.

**Registration Service**

Allows creation of static and dynamic airspace restrictions.

**Restriction Management Service**

Nulla porttitor massa id neque aliquam vestibulum morbi.

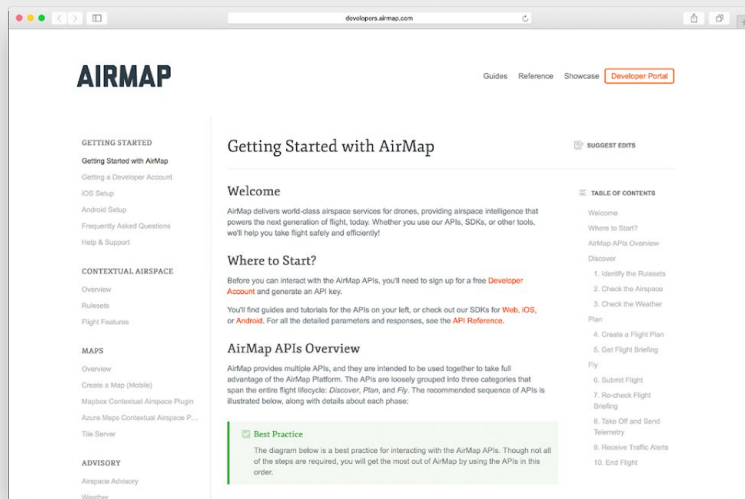
**E-Identification Service**

Provides position-reporting of airborne UAS for purpose of remote-identification.

...and much more to come...

# Available via APIs and SDKs

AirMap Developer Program enables native integration of services into UAS



**C++ (MAC, IOS, ANDROID, LINUX, WEB)**  
Dronecode-compatible Platform-SDK enables authentication, access to flight- and airspace features



**WEB**  
JS-SDK for authentication and display of maps



**IOS / Android**  
Swift- and Android SDK for easy creation of apps utilizing full AirMap UTM Services



**Direct API**  
APIs (REST/GRPC) for direct access to static and real-time information from UTM services.

Sign-up here:  
<https://developers.airmap.com>



# AirMap UTM customers solutions

CHALLENGE



## Airspace Authorities

### FIMS &

#### National Registry

- AIM, ARM, Air Traffic
- Airspaces distribution
- USP's connections

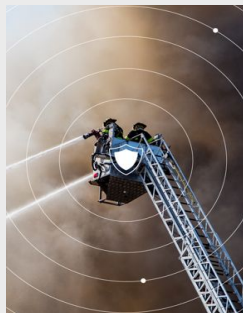
### UAS Traffic Management Solutions

#### UTM Control Center:

- Authorizations
- Monitoring
- Communications
- Deconflictions

### Airspace Awareness Solutions

- Public Awareness application
- Public Remote ID application



## Public Safety Authorities

### Public Authority Apps

- Authority Remote ID
- Authority Registry Access
- Public information app

### UAS Airspace Management

#### UTM Control Center:

- Temporary Restrictions
- Airspace Access Clearances
- Monitoring
- Communications

### UAS Flight Services

(See Enterprise)



## Enterprises

### UAS Operations Management

#### Enterprise UAS Operations Center:

- Fleet registrations
- Procedural workflow
- Operations management
- Operation conformance
- Mission data & audit

### UAS A Management

#### Enterprise UTM Control Center:

- Facility maps & rulesets
- Airspace Notifications / Clearance
- Monitoring

### UAS Flight Services

AirMap USS / USP SDK & APIs



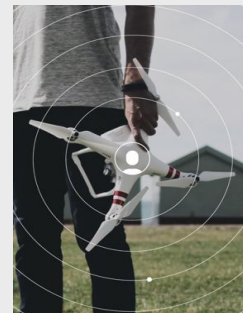
## UAS Developers & Solutions Providers

### UAS Application Integration

- AirMap Developer Portal
- AirMap SDK / API integration
- AirMap Developer support

### UAS Flight services

- AirMap USS / USP SDK & APIs



## Operators (Pilots)

### AirMap Pilot Applications

- AirMap for Drones
- AirMap pilot web app

AIRMAP

Challenge

# So why Switzerland?

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Not part of EU, small market-share on global scale, cost of labour is rather expensive, but it has huge upside (see next slide).

Regulation is being implemented worldwide to ensure the safety and compliance of drone use in low-altitude airspace.

The massive potential for unmanned aircraft hinges on an overhaul of the global air navigation system to ensure safety, compliance, and efficiency at scale.

# AirMap UTM products for airspace authorities & other competent authorities



## Swiss U-space Implementation Program

### FOCA-initiated Implementation Program

Government is coordinating implementation group consisting of Regulator, ANSP, Technology-Providers, Drone-Service-Providers, Drone-Manufacturers, UTM-services Providers.

Advocating for risk-based and open UTM-marketplace on global level.

<https://www.bazl.admin.ch/bazl/en/home/good-to-know/drones-and-aircraft-models/u-space.html>



## SORA

### Risk-based performance authorizations

Switzerland is Home of SORA, regulators are willing to invest into technology and innovation to learn and enable the future. Standard-scenarios are available, and complexity of operations have no limit (provided they are safe).

<https://www.bazl.admin.ch/bazl/en/home/good-to-know/drones-and-aircraft-models/permits-for-the-operation-of-drones-without-direct-eye-contact-o.html>



## skyguide

### Swiss ANSP embraces U-space

Seen as a welcome and needed digital disruption, skyguide is actively working on enabling U-space and the services provider to

<https://www.skyguide.ch/en/company/innovation/swiss-u-space/>



## Drone Industry

### Huge ecosystem, innovating at global scale

Auterion, senseFly, Flyability, Verity Studios, Dronistics, Meteomatics, REGA, Sunflower Labs, Eclectic Wingtra, Pix4d, Drone Harmony, Leica, Fotokite, Yuneec, EWATT, Windshape, FLARM, Involi, swisscom, Rigitex,

...and many more!

<https://droneindustry.ch/swiss-digital-aviation-industry-map/>

## Case Study

# Swiss U-space

**CHALLENGE:**

Drones are appearing in Switzerland's skies, and skyguide, the country's air navigation service provider, wants to be ready for them. It sought a disruptive technology for managing drone traffic and empowering the growing Swiss drone community.

**SOLUTION:**

Skyguide deployed AirMap UTM, a service platform for drones, to develop and deploy a nationwide drone traffic management system for Switzerland.

**IMPACT:**

Today, Swiss U-space supports regular BVLOS operations with awareness, authorization, and traffic deconfliction services.

In March 2019, skyguide, AirMap, and FOCA published the Swiss U-space ConOps to share key learnings and best practices with the global aviation community to further promote an open and competitive drone economy.

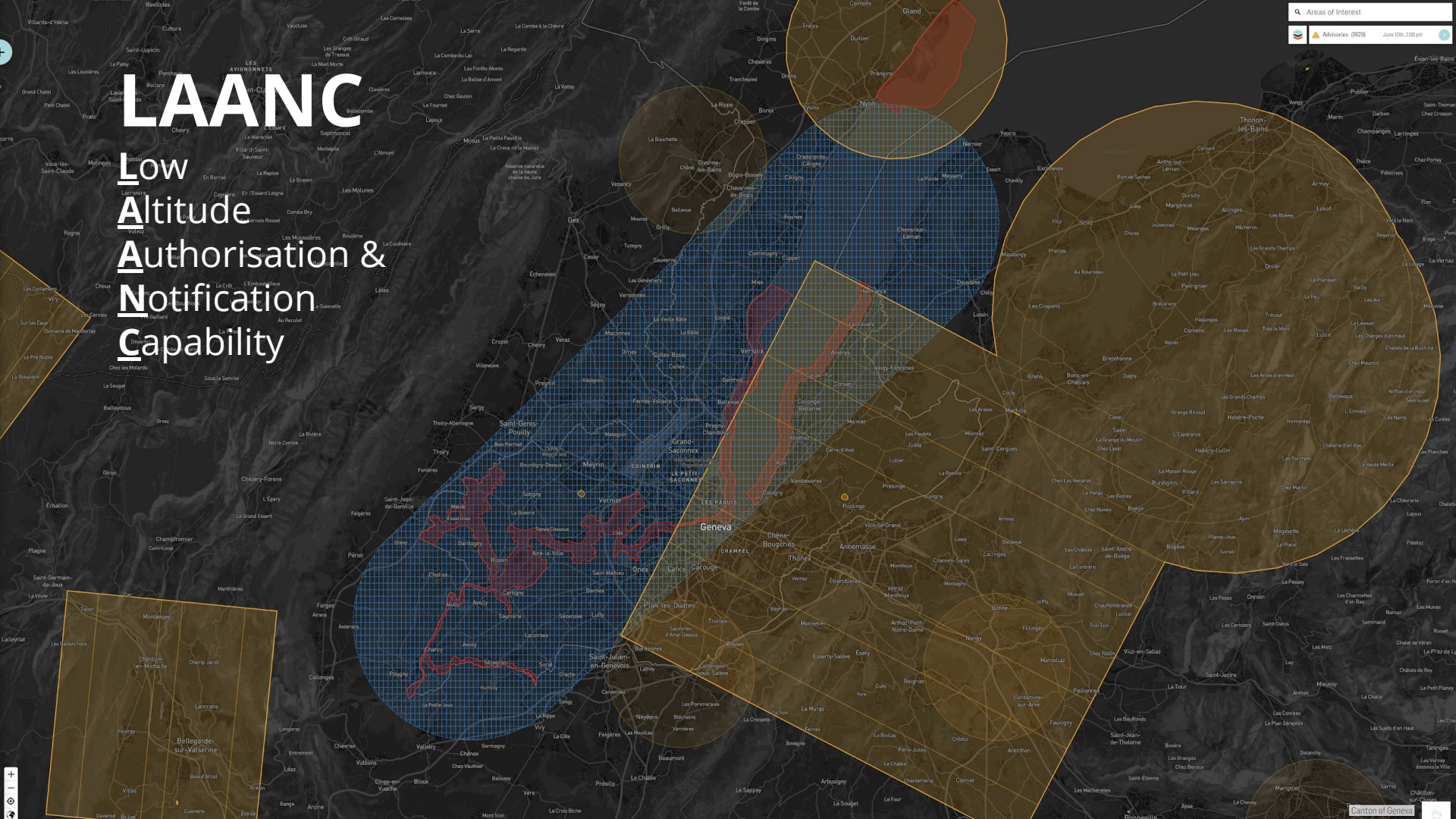
[LEARN MORE →](#)



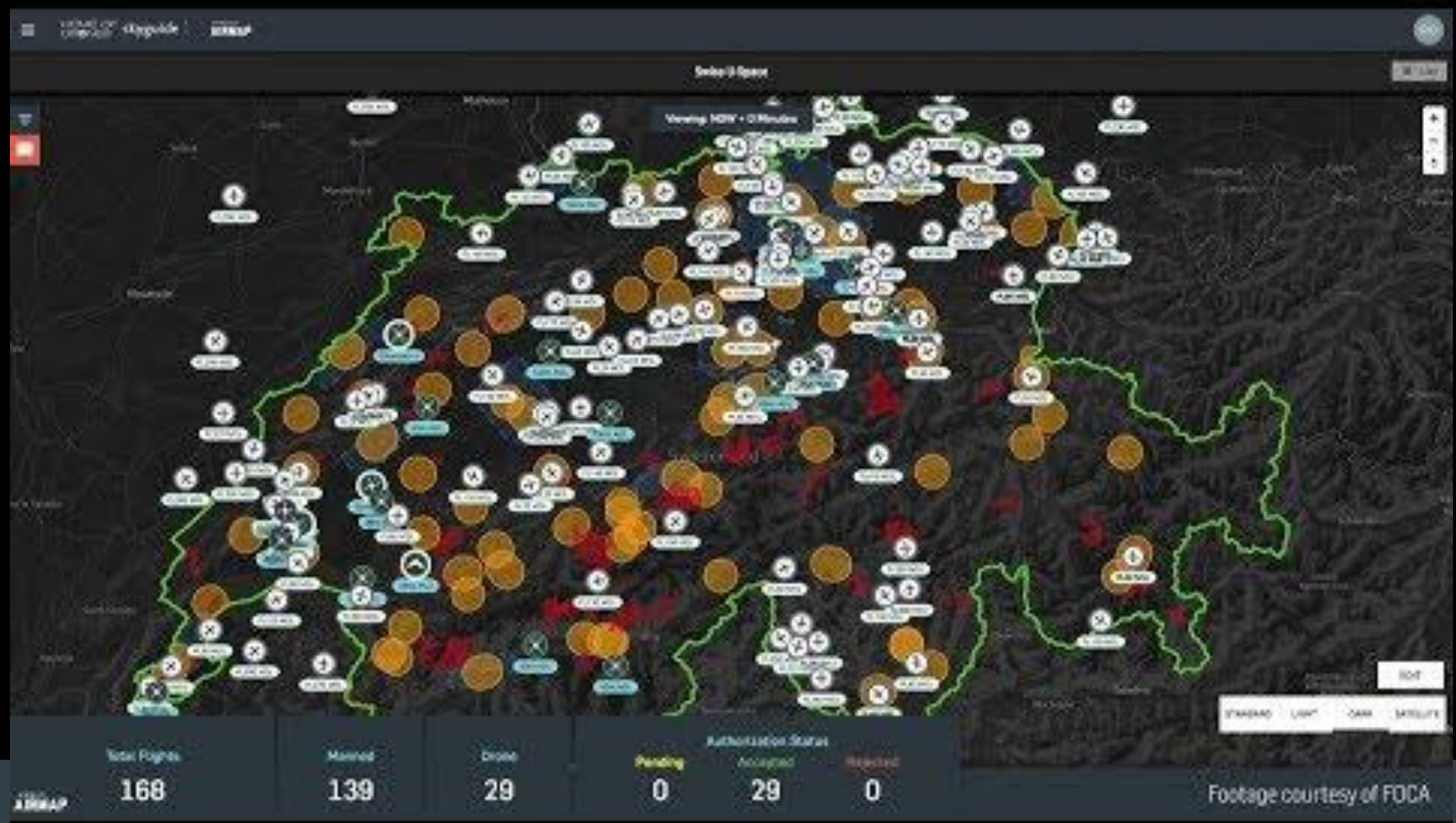


# LAANC

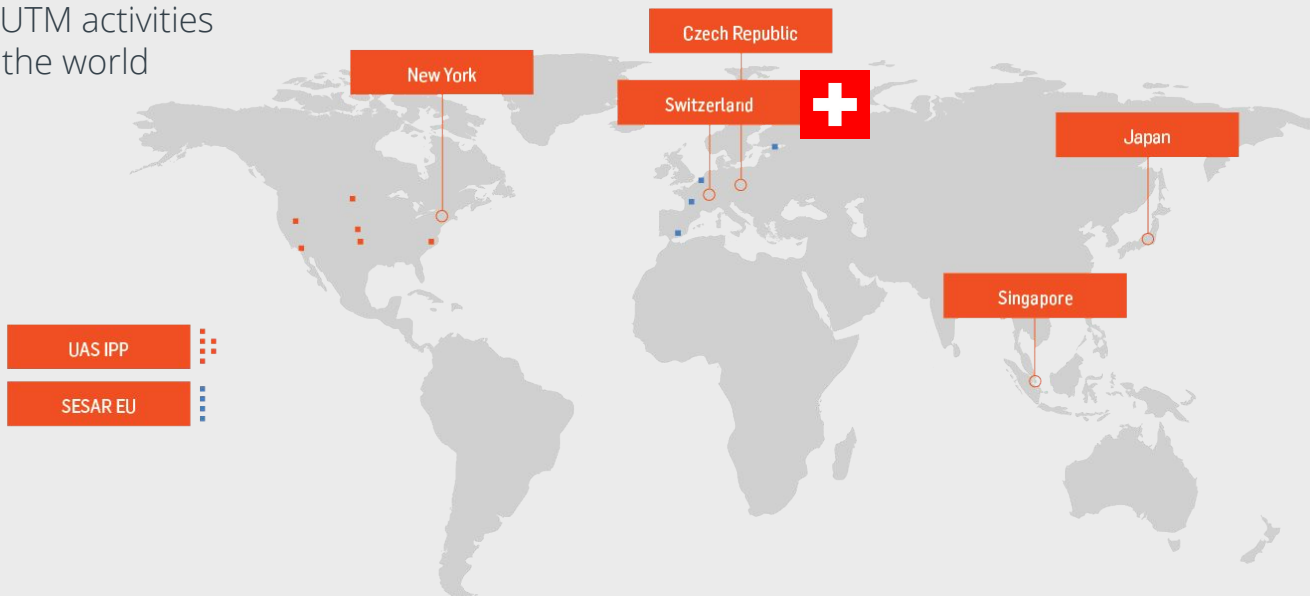
Low  
Altitude  
Authorisation &  
Notification  
Capability







## AirMap UTM activities around the world



### AMERICAS

#### United States (LAANC USS)

45,000+ LAANC authorizations processed in 2018

#### City of San Diego (UAS IPP)

Public Safety, Package / Medical Delivery, & Border Security

#### City of Reno (UAS IPP)

Package Delivery

#### North Dakota (UAS IPP)

BVLOS, Night Operations, & Flights Over People

#### Kansas (UAS IPP)

Precision Agriculture & Infrastructure Inspection

#### Choctaw Nation (UAS IPP)

Package Delivery, Herd Management, & Counter-UAS

#### North Carolina (UAS IPP)

Package Delivery & Disaster Response

#### New York (NUAIR Alliance)

Testing of America's first 50-mile drone corridor for BVLOS operations with NUAIR Alliance

### EMEA

#### Switzerland (U-space)

Nationwide deployment of Swiss U-space with skyguide, U-space Integration with Government and other partners.

#### Czech Republic (U-space)

UTM services deployment around Prague's Václav Havel Airport with ANS CR

#### Spain (SESAR JU)

DOMUS (Demonstration of Multiple U-space Suppliers)

#### France (SESAR JU)

GEOSAFE (Geofencing for Safe and Autonomous Flight in Europe)

#### Netherlands (SESAR JU)

VUTURA (Validation of U-Space Tests in Urban and Rural Areas)

#### Gulf of Finland (SESAR JU)

U-space capabilities for urban, maritime, forestry and airport environments

### APAC

#### Singapore (Future Flight Consortium)

Research project exploring BVLOS drone operations for a variety of commercial uses

#### Japan (Rakuten AirMap)

Joint venture with Rakuten to launch Japan's first UTM platform



A close-up photograph of a dark, textured wooden surface, possibly a plank or a piece of furniture. The wood grain is prominent, showing various shades of brown and black. In the center-right of the image, the letters 'Q&A' are placed on the surface. The letters are made of a light-colored, porous material, likely cork, and have a slightly irregular, handcrafted appearance. The 'Q' is on the left, followed by an ampersand '&', and then the letter 'A' on the right. The lighting is soft, creating subtle shadows and highlighting the textures of both the wood and the letters.

Q&A

# Greater Zurich Area – concentrated technology excellence in Europe's most stable environment

Do you have a question? We'd like to hear from you.  
Give us a call or send us a message and we'll be in touch shortly.

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Switzerland: +41 44 254 59 59

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