

Urban Air Mobility – the new dimension in city planning





CONSULTANCY FOCUSED ON UNMANNED AVIATION

EUROPEAN LEADING UNMANNED AVIATION
ADVISORY AND EXPERT COMPANY

Some references

European projects

Large U-space demonstration in Gulf of Finland

Status: Ongoing



GOF USPACE is very large U-space demonstration. The total budget for this demonstration is 3,3M€ where SESAR JU has funded 1,6M€. This demonstration has 19 consortium members from Finland, Estonia, and other EU countries. In this project, our partner Frequentia developed Flight Information Management System (FIMS) to share UTM and managed aviation flight information data between UTM Providers (Altitude Angel, Airmap and Unifly). We are honored that our work recognized by SESAR JU by selecting our architecture as one of the third reference architecture. FIMS was tested by eight different demonstrations. We did demonstrations in the city of Tallinn with police and border guard where three drone operators were flying inside the Controlled Airspace of Tallinn airport. In Helsinki, we did the same kind of demonstration in the park of the Viinamökin. In Helsinki, the police were participated in the demonstration to remotely identify five drone operators. In sea a delight to announce that with Fleetonomy and Airmap we exceed level 3 of U-space. Polos created the no-flight zone and both Fleetonomy's drones landed autonomously. During this demonstration, we also did the international logistic flight from Estonia to Finland with full situational awareness of the airspace, the last demonstration was with Volocopter, the air taxi flight in Helsinki International Airport, where air taxi created flight plan in Unifly's UTM and the flight plan was accepted by ATCO via Airmap UTM system.

5GDRONES - Developing KPI's for 5G Network to ensure good connectivity with drones

Status: Ongoing



5GIDrones aim is to trial several UAV use-cases covering eMBB, URLLC, and mMTC 5G services, and to validate 5G KPIs for supporting such challenging use-cases. The project will drive the UAV verticals and 5G networks to a win-win position, on one hand by showing that 5G is able to guarantee UAV vertical KPIs, and on the other hand by demonstrating that 5G can support challenging use-cases that put pressure on network resources, such as low-latency and reliable communication, massive number of connections and high bandwidth requirements, simultaneously. 5GIDrones will build on top of the 5G facilities provided by the ICT-17 projects and a number of support sites while identifying and developing the missing components to trial UAV use-cases. The project will feature Network Slicing as the key component to simultaneously run the three types of UAV services on the same 5G infrastructure (including the RAN, backhaul, and Core), demonstrating that each UAV application runs independently and does not affect the performance of other UAV applications, while covering different 5G services. While considering verticals will be the main users of 5GIDrones, the project will build a software layer to automate the run of trials that exposes a high level API to request the execution of a trial according to the scenario defined by the vertical, while enforcing the trial's scenario using the API exposed by the 5G facility, as well as the 5GIDrones enables API deployed at the facility. Thus, 5GIDrones will enable abstracting all the low-level details to run the trials for a vertical and aims at validating 5G KPIs to support several UAV use-cases via trials using a 5G shared infrastructure, showing that 5G supports the performance requirements of UAVs with several simultaneous UAV applications with different characteristics (eMBB, URLLC and mMTC). Using the obtained results, 5GIDrones will allow the UAV association to make recommendations for further improvements on 5G.



National projects

Aviapolis drone logistic

Status: Ended



Aviapolis is the most rapidly growing area in Finland. Aviapolis offers a job for 35,000 employees, and new jobs in the coming years are estimated to be over 15,000. Drone logistics is a rapidly evolving solution, and there are appearing new companies specialized in drone deliveries. Recent studies claim that drone logistics with an electric propulsion system for delivering less than 2kg payload is more carbon-neutral than delivering the same size of the parcel by electric car. Aviapolis drone logistics was a part of a larger Aviapolis project in Vantaa city. The goal was to demonstrate drone logistics services, develop a simulator tool, and publish a guide book for city planning and architects. The project also explored charging networks and landing pads for drone logistics. The project was funded by Smart & Clean Foundation has been funded by this project.

NEXT STEPS: Although this project has ended, the work is continuing with drone logistics and to promote scalable drone business in an urban environment. Companies looking at new ways to deliver a parcel for customers, please contact us.

Download DRONE GUIDE FOR CITIES
currently available only in Finnish



Drone business acceleration project in Pohjois-Pohjanmaa area

Status: Ongoing



In this workshop series, the goal is to finetune current drone services in the Pohjois-Pohjanmaa region to match with participated customers' needs. This project has three workshops and various analysis between workshops to first understand the customer's needs and current services of local drone partners. From these analysis, we define together with partners and customers the required development needs to match customer's expectations.

This project is done together with the Oulu university of applied science.

Company-specific projects

Long range UAV for remote sensing large areas

Status: Ended



Long range UAV for remote sensing demonstration tested the use of large, 100kg UAV with 8 hour operation time for remote sensing. During this demonstration, UAV was operated in Finnish south-east archipelago for sea dog counting, in Evo area for remote sensing of 3000 hectares with the Multispectral sensor and in Nummela for remote sensing crops with multispectral sensor. During this demonstration, UAV was operated from different airports in Kumlinge, Nummela and Vesivehmaa. UAV was operated in active airports among manned aviation.



Ultrahack Drone Tournament in Helsinki - Airboss for safety operations

Status: Ended



Ultrahack Oy arranged a Drone tournament in Helsinki with 20 sponsors. This tournament had several challenges from identifying and sampling hazardous chemicals to Fly High and Back. Robots.expert ensured safe operations in each challenge. Our Airboss service included required safety assessments, safety training, permissions, and onsite safety arrangements. Some of the flight operations were done near populated areas, and some in unpopulated areas. Fly High and Back challenge we got permissions to fly as high as 12 000m. Airboss-service helps organizations who plan to make trials, high safety operations to minimize the risks related to drone operations.



Robots Expert has authored a 40-page Drone Guidebook for Cities (in Finnish)

Drooniopas kaupungeille
Skaalautuvan drooniliiketoiminnan mahdollistamiseksi kaupungeissa

Available soon in www.ril.fi

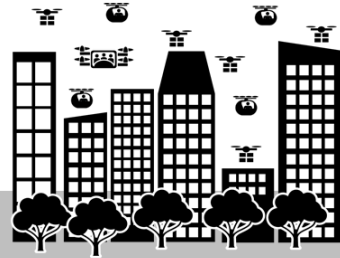
OUR SERVICES



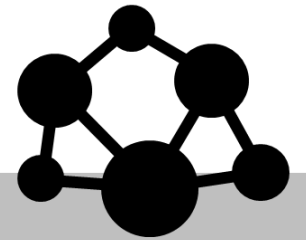
Services for drone operators and events



Drone enabled competitiveness for industries

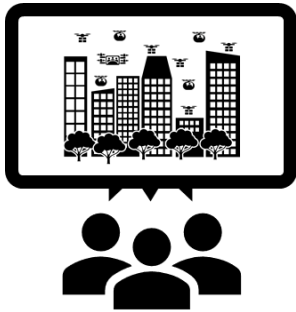


Urban Air Mobility advisory



Projects to promote scalable drone business in Europe

URBAN AIR MOBILITY ADVISORY SERVICES



UAM workshop for
city stakeholders



City planning and
design to enable UAM



Corridor and
Zonation planning

Introduction to UAM

Expert



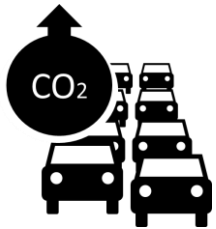
Urbanisation puts pressure on transportation infrastructure



In 2018, 55% of the global population (72% in Finland) lives in urban areas – a figure that is projected to rise to 68% by 2050



Peak-hour traffic congestion and land sprawl drives building of new urban infra. In the EU, traffic congestion costs ~ €100 billion a year.



Transportation as a whole needs to dramatically reduce carbon-dependency and use infrastructure more effectively



Air taxis (electrical VTOLs), electrical aircraft and unmanned aerial vehicles (UAS) is an important part of new smart mobility solutions



Urban Air Mobility is the capability to enable scalable drone services in urban environments by integrating it as a part of Smart Mobility and Smart Cities



Urban Air Mobility in big cities
Mostly discussions around air taxis

But UAM is much more

The urban air mobility is expected to be used for several operations



Humanitarian missions



Weather monitoring



Ground traffic assessment



Emergency medical services



News gathering



Package delivery



Rescue operations



Passenger transport

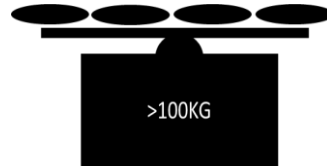
Typical UAM use cases



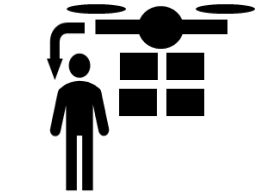
Air taxis



Air Busses



Heavy logistics



Parcel delivery



Surveillance



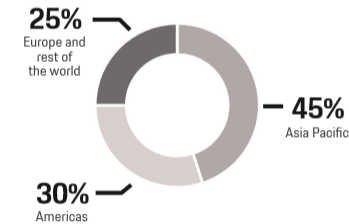
Other use cases
e.g. temporal Mobile Cellular node

Size, growth and distribution of world eVTOL passenger market until 2035

Market size

Year	2025	2030	2035
In billion USD	1	4	21
eVTOL units	500	2,000	15,000

Regional split 2035



Total addressable market

Theoretically achievable market with fully established infrastructure



SOURCE: Porsche Consulting

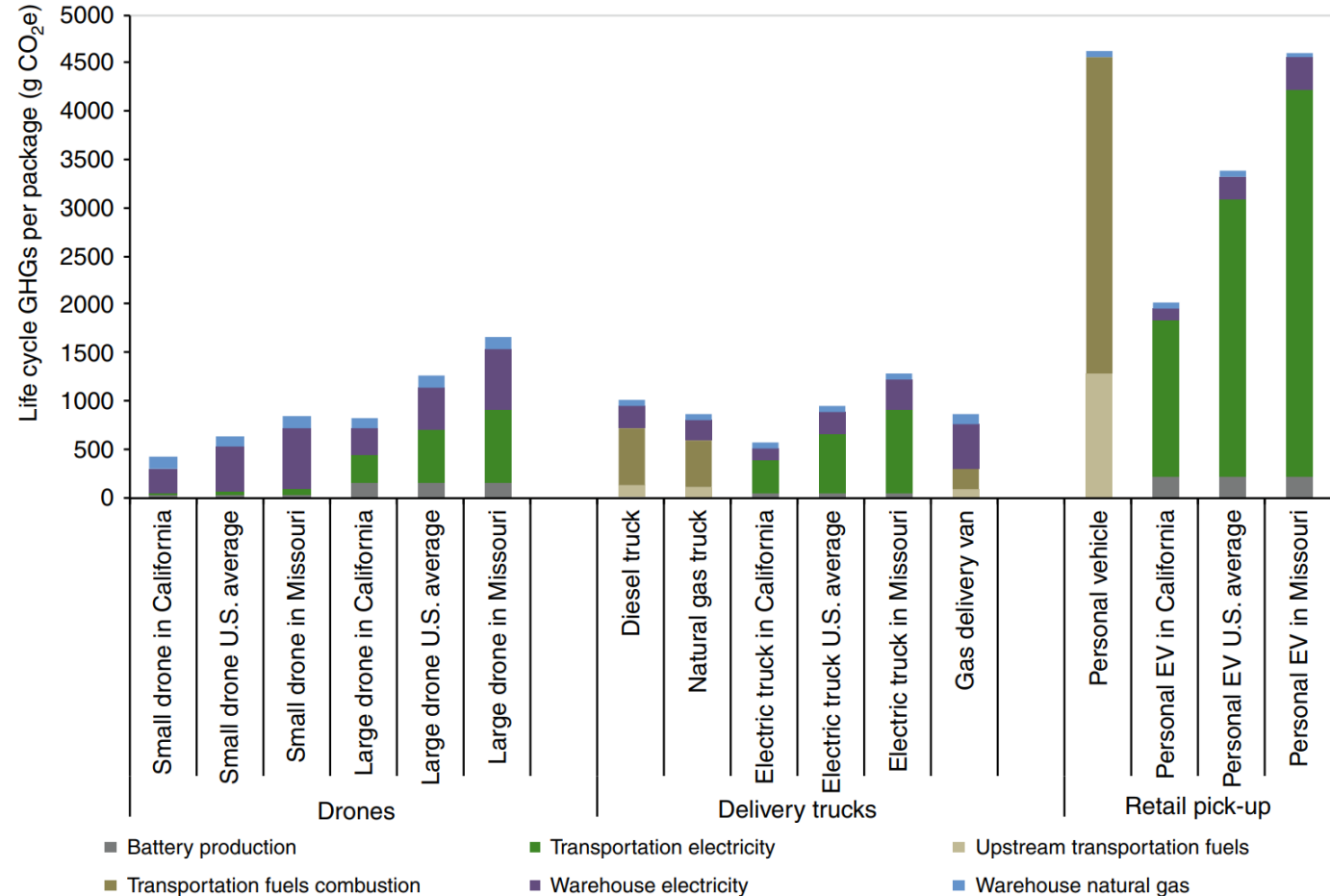
Drone logistics is one key UAM application promising to cut CO₂ emissions

The (US based) analysis focuses on the final delivery of the package, after the package is delivered to the regional warehouse.

Small quadcopter drones have lower lifecycle GHG emissions than conventional delivery trucks powered by diesel, gasoline or natural gas, and electric vehicle (EV) trucks.

...but nothing beats walking or taking the bike...

Comparison of life-cycle greenhouse gas emissions per package



New harmonized drone legislation in Europe



OPEN:

Low risk
No involvement of
Aviation Authority
Limitations : Visual line
of sight, Maximum
Altitude, distance from
airport and sensitive
zones

No Notification or
Permit

SPECIFIC

Increased risk
Operations
Authorisation with
operations manual
Specific qualification of
drone, personnel,
equipment based on
safety assessment

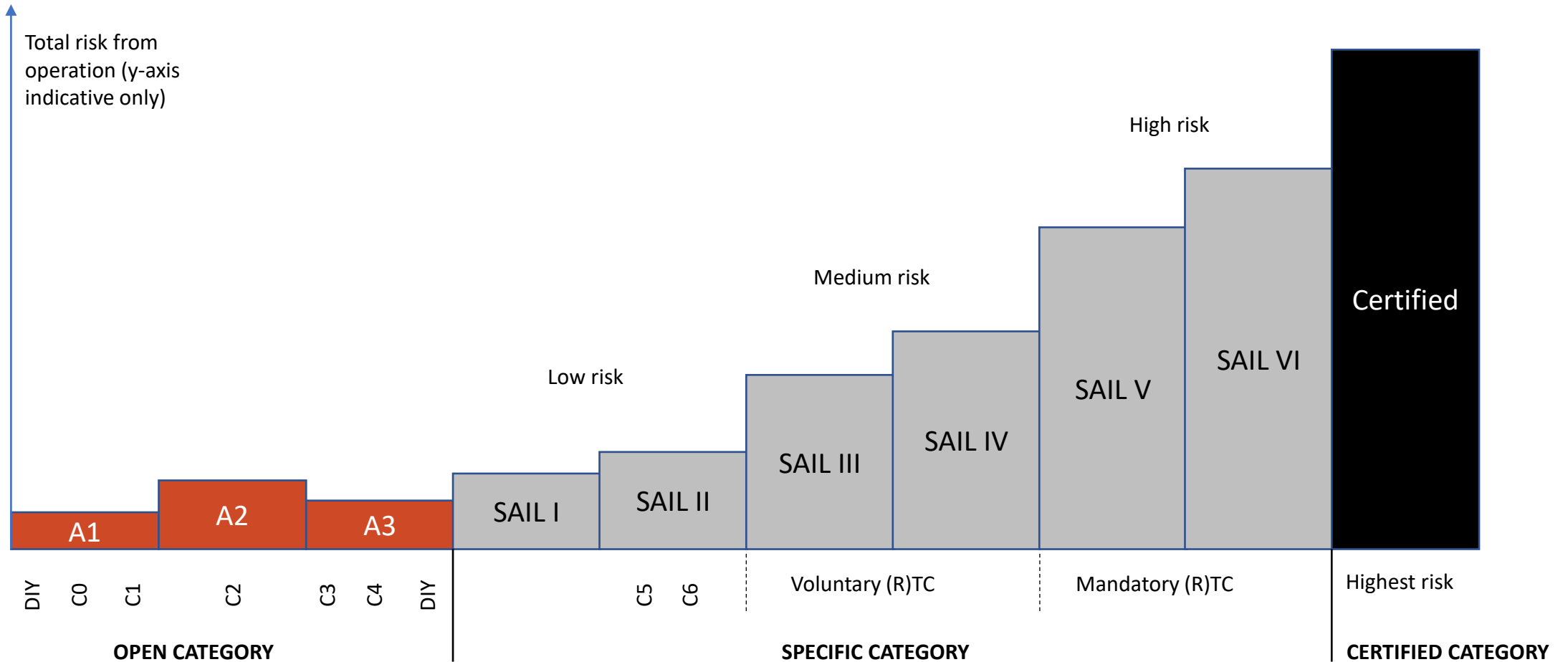
Notification or
Permit required!

CERTIFIED

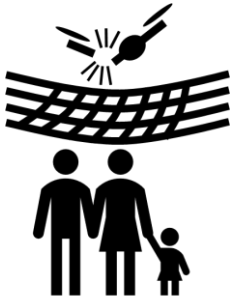
Regulatory regime
similar to manned
aviation
EASA and Authority
Certificates

2023 →

Each operation category is divided into mission types based on the associated risk



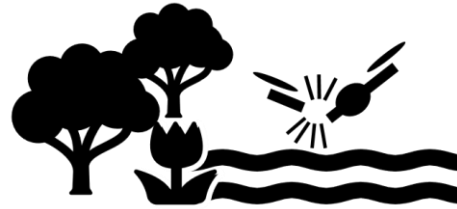
The key to public acceptance is safety



Shelter landing pads



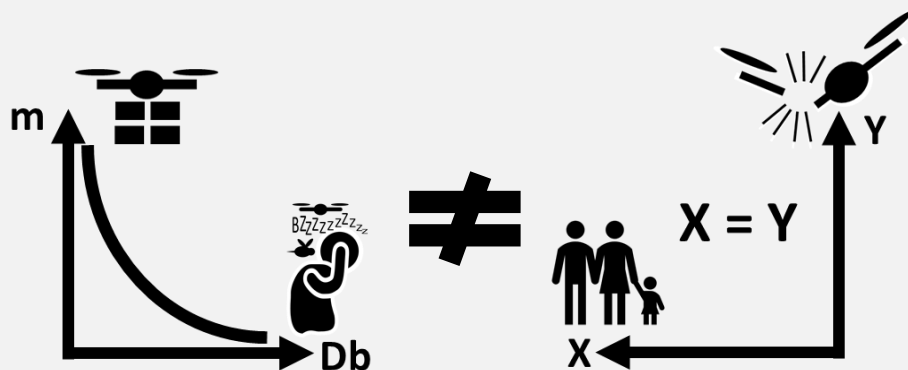
Pre-plan emergency landing sites



Fly over unpopulated areas as much as possible

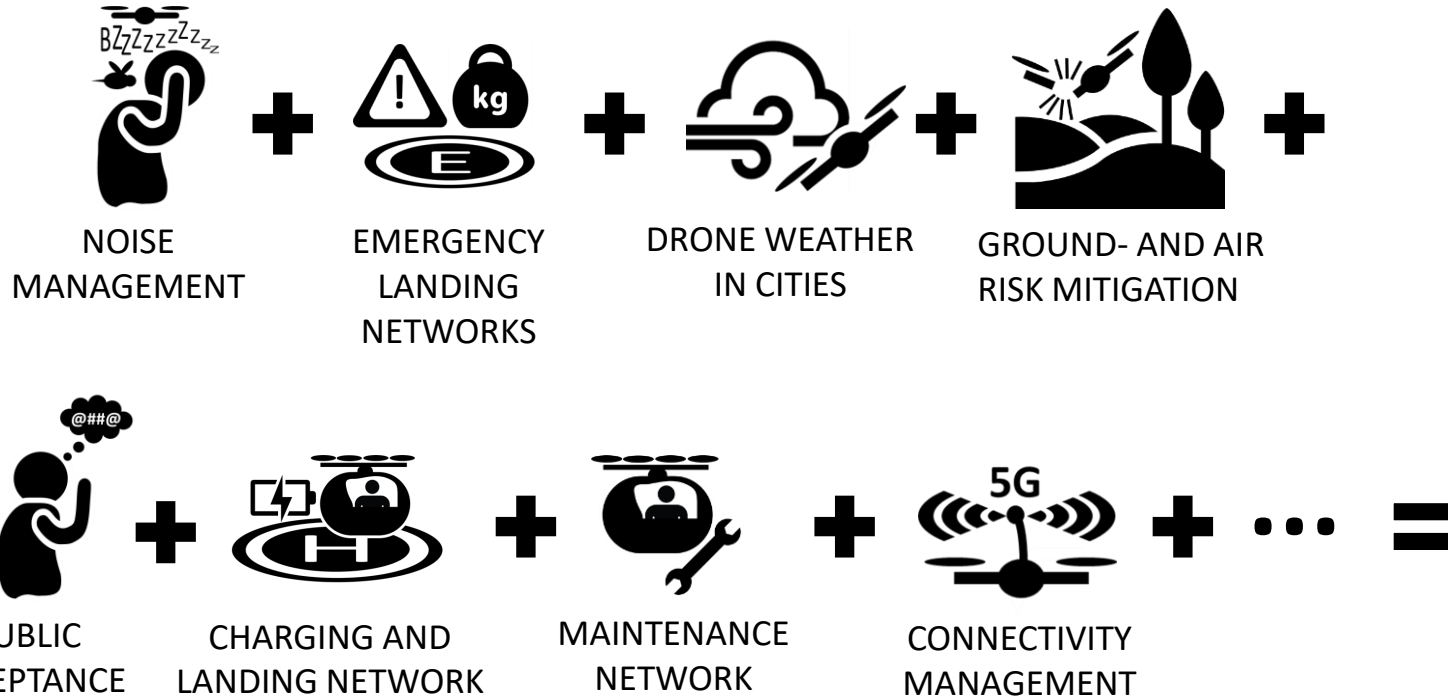


Use natural shelters – e.g. trees

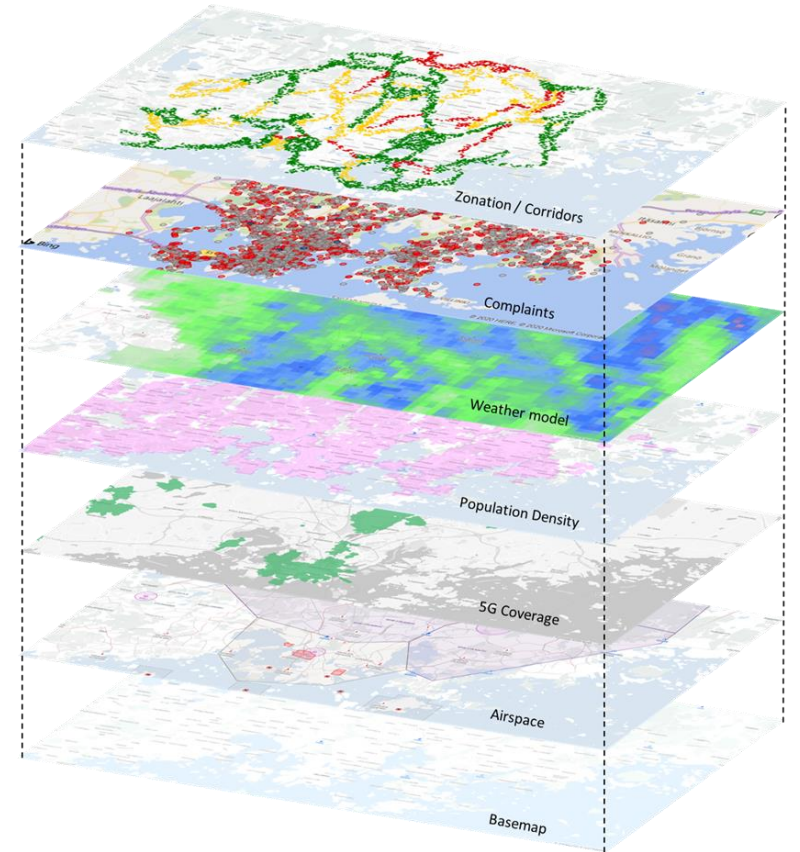


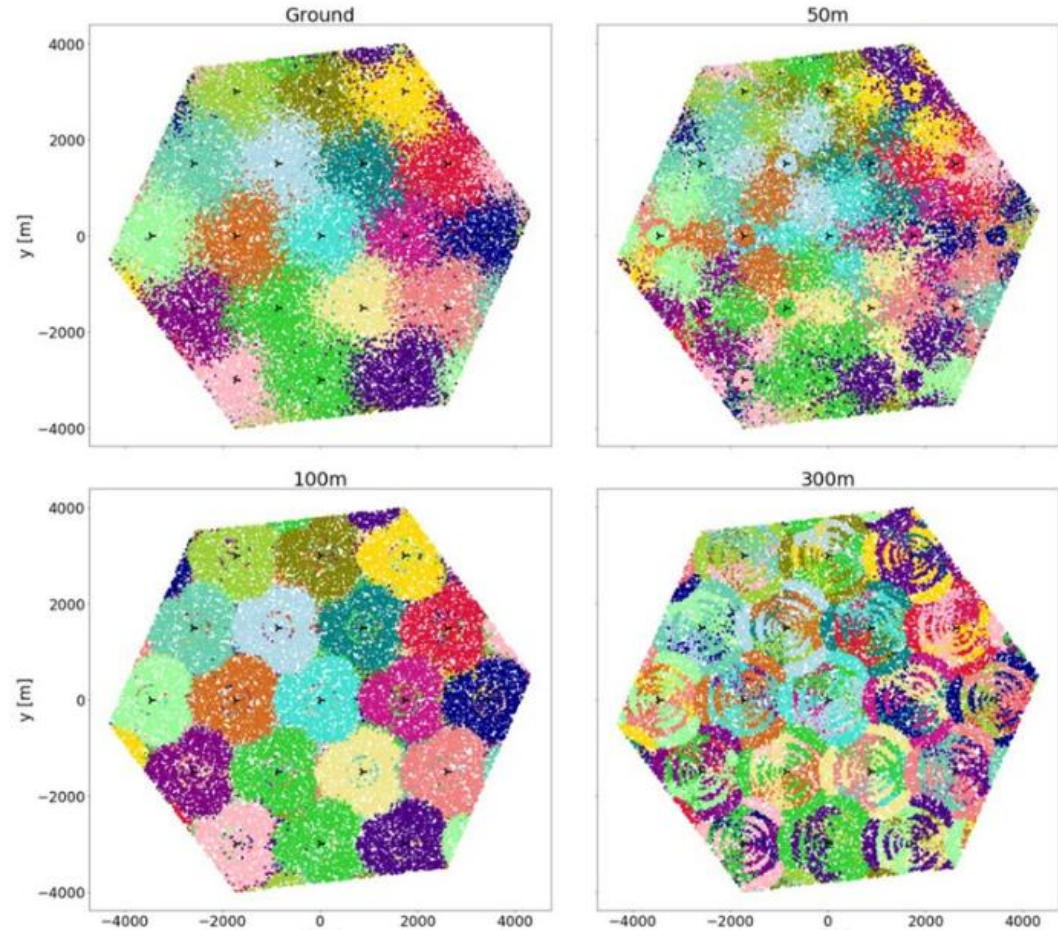
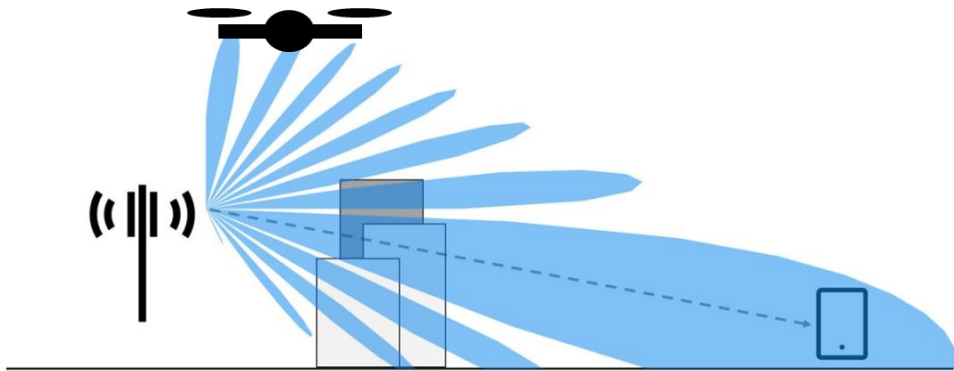
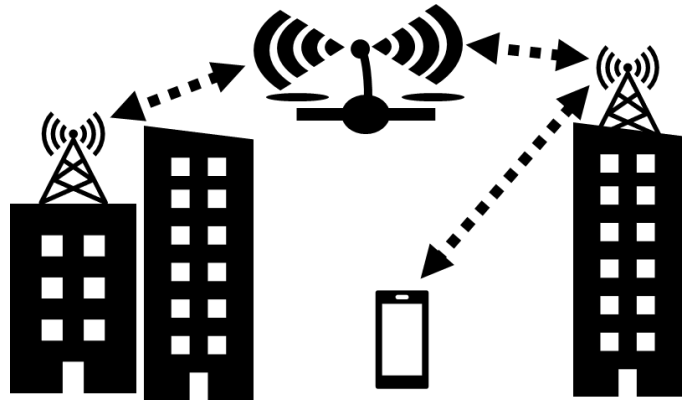
Conflict: The higher the drone flies, the less the noise pollution. But the higher the drone flies, the longer the distance must be to uninvolved people. Less noise = more difficult to find appropriate routes to maintain ground risk buffers

...but there are many boundary conditions

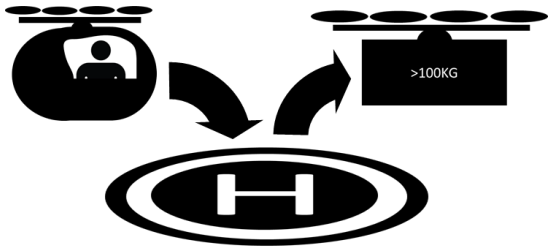


CORRIDOR AND ZONATION MANAGEMENT





Business growth is accelerated by available infrastructure, such as prepared landing sites



Vertiports for air taxis and heavy logistic



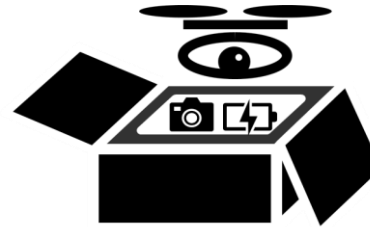
Heavy load charging



Emergency landing pads for heavy drones



Landing pads with standardized charging



Proprietary landing pads with charging and sensor exchange



Emergency landing pads for lighter drones

eVTOL
vertiport

VOLOCOPTER
IN COLLABORATION WITH
Skyports



U-space is a set of digital services supporting safe, efficient and secure access to airspace for large numbers of drones

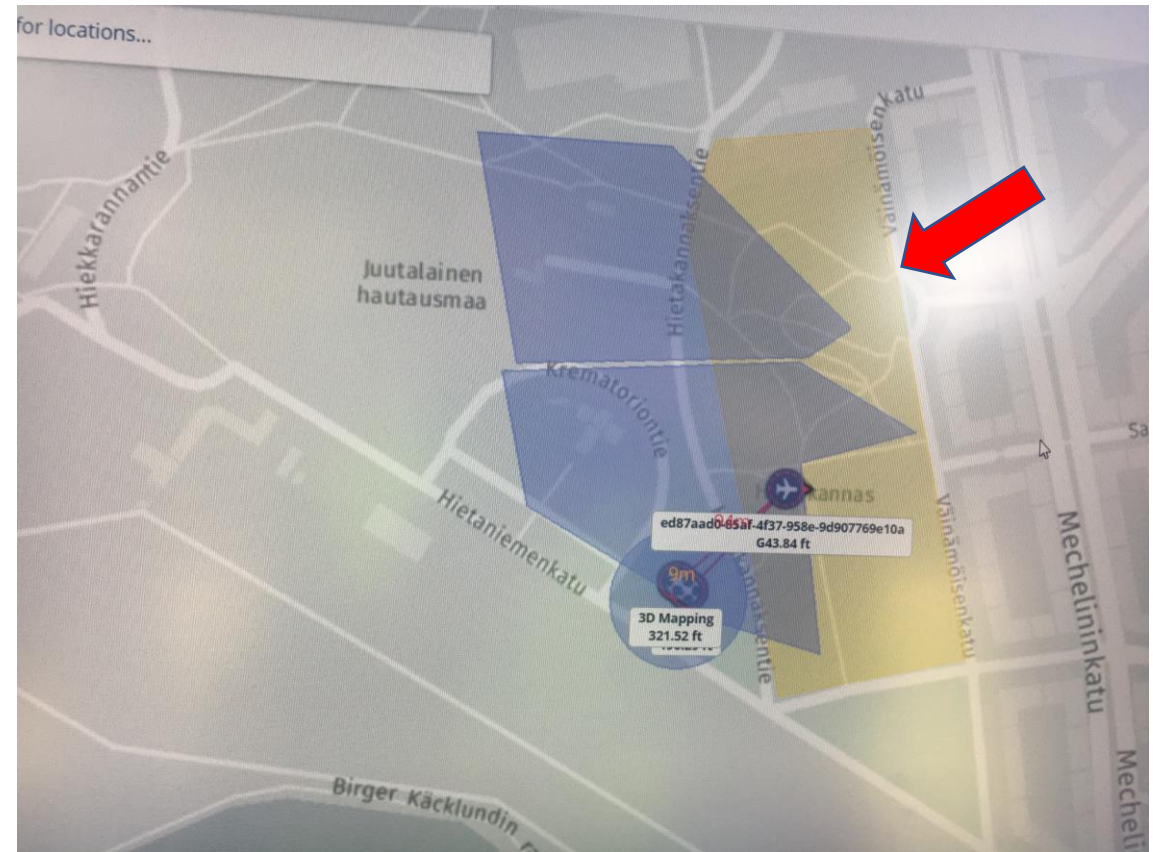
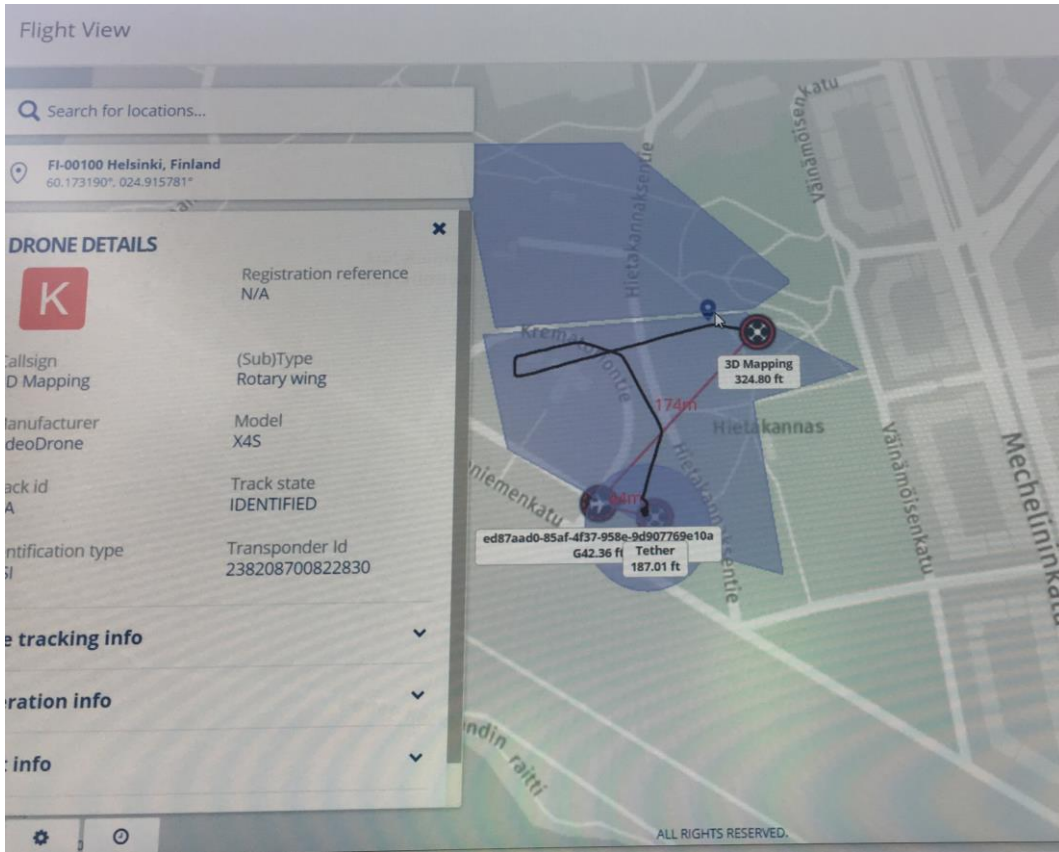
“U-space is an enabling framework designed to facilitate any kind of routine mission, in all classes of airspace and all types of environment - even the most congested - while addressing an appropriate interface with manned aviation and air traffic control.”

“As time goes on, the whole aviation environment is expected to evolve into a fully integrated environment supporting manned and unmanned operations in all classes of airspace.”

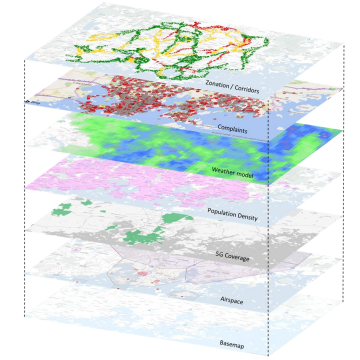
U-space services initially focus on safety and security

U-space phase	U1		U2		U3
Identification and Tracking	Registration Registration assistance	e-identification	Tracking and position reporting	Surveillance data exchange	
Airspace Management	Geo-awareness	Drone Aeronautical information Management	Geo-fence provision (incl. Dynamic Geo-Fencing)		
Mission management		Operation plan preparation	Operation plan processing	Risk Analysis assistance	Dynamic Capacity Management
Conflict Management		Strategic conflict resolution			Tactical conflict resolution
Emergency Management		Emergency Management	Incident / Accident reporting		
Monitoring	Monitoring	Traffic information	Navigation infrastructure monitoring	Communication infrastructure monitoring	Digital Logbook Legal Recording
Environment	Weather information	Geospatial information Population density map	Electromagnetic interface information	Navigation coverage information	Communication coverage information
Interface with ATC		Procedural interface with ATC			Collaborative interface with ATC

GOF demonstrated dynamic geofencing with Helsinki Police – visible to all pilots in real time



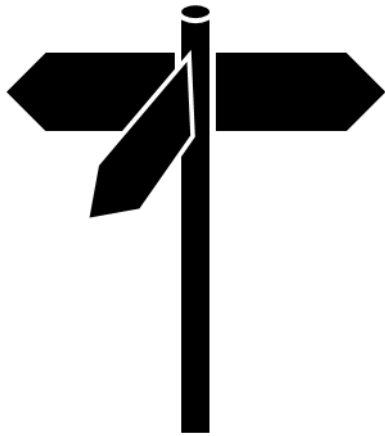
UAM requires additional, supplementary U-space services



U-space phase		U1	U2	U3	Necessary UAM U-space services	
Identification and Tracking	Registration	e-identification	Tracking and position reporting	Surveillance data exchange		
	Registration assistance					
Airspace Management	Geo-awareness	Drone Aeronautical Information Management	Geo-fence provision (incl. Dynamic Geo-Fencing)		Urban airspace zonation	
Mission management		Operation plan preparation	Operation plan processing	Risk Analysis assistance	Dynamic Capacity Management	
						Dynamic ground risk minimising flight route optimisation
						Precision weather
					Wind gradient charts	
Conflict Management		Strategic conflict resolution		Tactical conflict resolution		
Emergency Management		Emergency Management	Incident / Accident reporting		Contingency landing sites & procedures	
Monitoring	Monitoring	Traffic information	Navigation infrastructure monitoring	Communication infrastructure monitoring	Digital Logbook Legal Recording	
Environment	Weather information	Geospatial information	Electromagnetic interference information	Navigation coverage information	Communication coverage information	
						Dynamic aggregation of people maps
		Population density map				Land use maps
					Noise abatement zones	
Interface with ATC		Procedure interface with ATC		Collaborative interface with ATC		

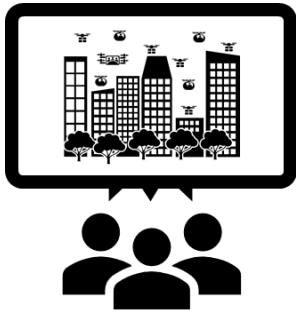


UAM management at the crossroads of aviation, urban building and privacy regulations



- Manned urban aviation regulation
 - Drone regulation
 - ATM regulation
 - U-space regulation (pending)
 - Certified drones / eVTOL (pending)
-
- Construction act
 - Urban planning act
 - Spatial planning regulation
 - Integrated plans
-
- Home privacy legislation
 - GDPR

URBAN AIR MOBILITY ADVISORY SERVICES



UAM workshop for
city stakeholders



City planning and
design to enable UAM



Corridor and
Zonation planning

Summary – Urban Air Mobility is the new dimension in city planning

- Aviation is facing a period of very rapid digitalization, and the advent of U-space
- City stakeholders need new skills and tools to manage Urban Air Mobility
- Investments in shared infrastructure are needed – location, location, location!
- Connectivity is key for safe and effective operations, and 5G is part of the solution
- UAM will need to cut CO₂- and nanoparticle emissions
- Public acceptance will take dialogue and time to build – need to start now



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