# Lessons learned in implementing U-Space in Finland

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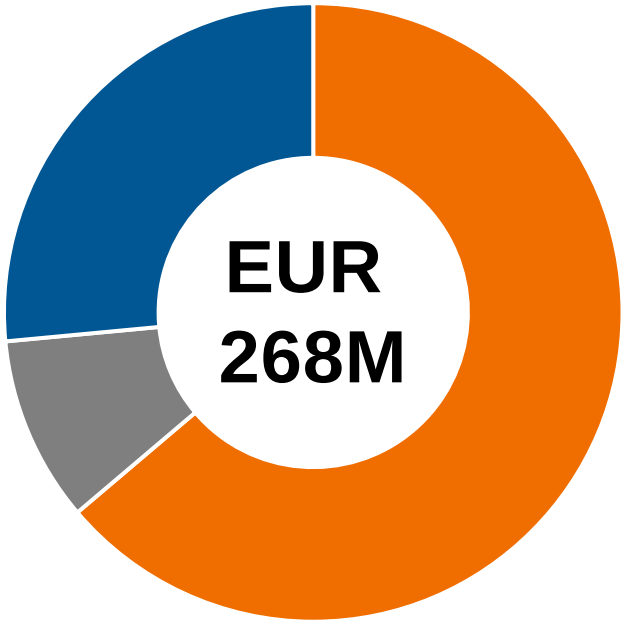
# VTT today




**171 M€** Turnover (parent 160 M€)

**26 M€** Other operating income

**71 M€** Government grant

**2,049**
employees

**36%**
of Finnish innovations have links with VTT's competences

**44%**
of turnover from abroad*

**363**
patent families

**VTT**
is under the state ownership steering of the Ministry of Economic Affairs and Employment



*VTT Group 2018

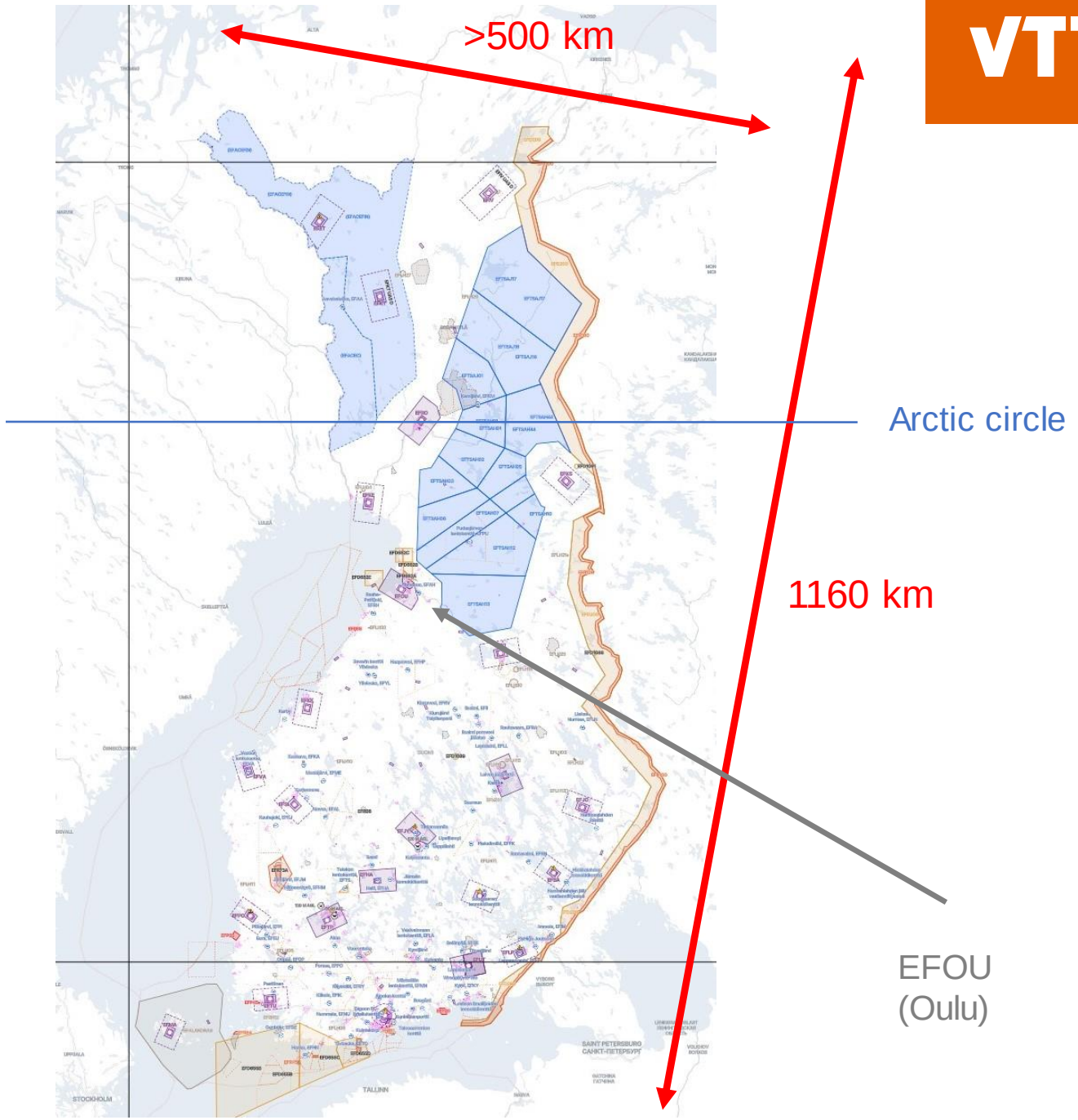
# Contents

- Finnish UAV research & demonstrator landscape
- Autonomous intelligent multi-purpose drone enabled business in evolving U-Space environment (Drolo)
- Lessons learned and to be learned along the way

- Goal: show challenges and learnings for players that start with U-Space from the ground up

# UAV research & demonstrator landscape in Finland

# Finland



# Finnish stance in UAV & UAM & UTM

- UAV offers huge potential for developing innovative civil applications in a wide variety of sectors that benefit the society and will contribute to creating new business and jobs
- By and large, Finland actively contributes to the development of a drone ecosystem supporting the emergence of this promising sector
- In addition to national activities, heavily leaning on UAV development globally
- Up to now, no large scale implementations or demonstrators of U-Space / UTM
  - one smaller scale one with single user company, food logistics in a smallish area

# Research landscape

- European & international
  - AiRMOUR (H2020, a few words on this later)
  - Flying Forward 2020 (H2020 sibling)
  - 5G Drones (H2020)
  - GOF & GOF 2.0 (SESAR)
  - Hyfliers (H2020), Nordic Drone Initiative, etc.
- Nationally funded
  - Drolo (Business Finland, more later)
  - FUAVE (Academy of Finland)
  - RoboMesh (Academy of Finland)
  - VED, SURE, CityLog, etc. etc.
- Foci including drone ecosystems, 5G, cross-border, eVTOL, logistics, U-Space, ground infra, autonomy, propulsion tech, business models, education, etc.
- Involved are businesses, academia & RTOs, administrations and cities

# Expanding mobility into the third dimension – the airspace

AIRMOUR

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101006601

# Why AiRMOUR?

## Cities will have a major role in UAM – along with civil aviation administration and national transport authorities

## Emergency Medical Services (EMS) will be likely first adopters of eVTOL

AiRMOUR

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101006601

# AiRMOUR in a nutshell

- Enabling sustainable AiR MObility in URrban contexts via use cases in emergency and medical services
- AiRMOUR is a Horizon 2020 RIA supporting Urban Air Mobility
- Running 1.1.2021 – 31.12.2023
- 13 partners from 6 countries, with a total EU funding of 6M€
- Lead partner VTT Technical Research Centre of Finland Ltd.
- Demonstrations in three cities: Stavanger (NO), Helsinki (FI), Kassel (DE)
- Simulations in three cities: Luxembourg, Stockholm and Dubai
- 10+ Replicator cities
- Strong international and European support: NASA, JUIDA (Japan UAS Industrial Development Association), Dubai Future Foundation, EASA, Eurocontrol, EIT KIC Urban Mobility, European cities UIC$^2$, etc.

AiRMOUR

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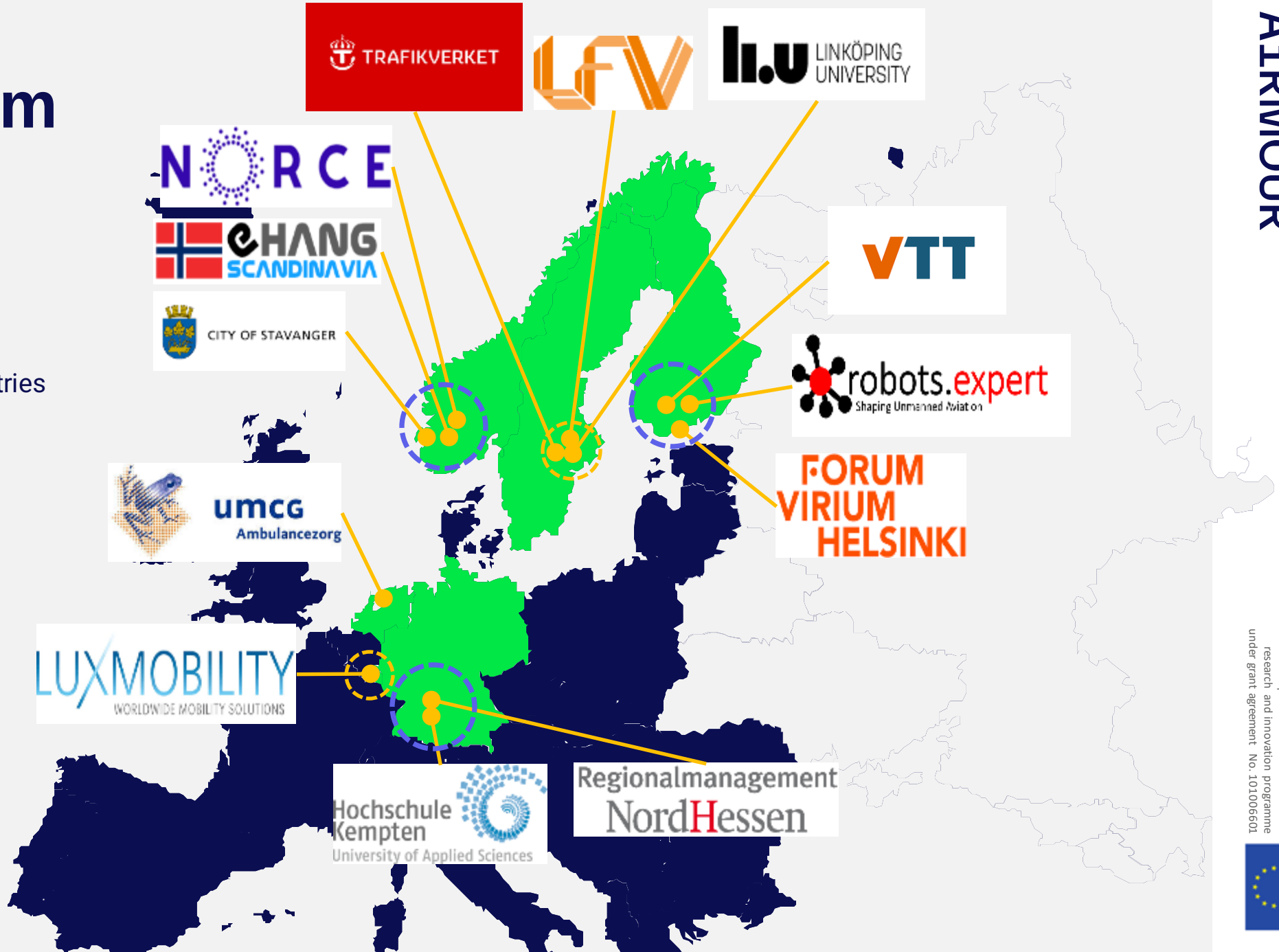
# Consortium

Partnership countries

Test flights / Simulations

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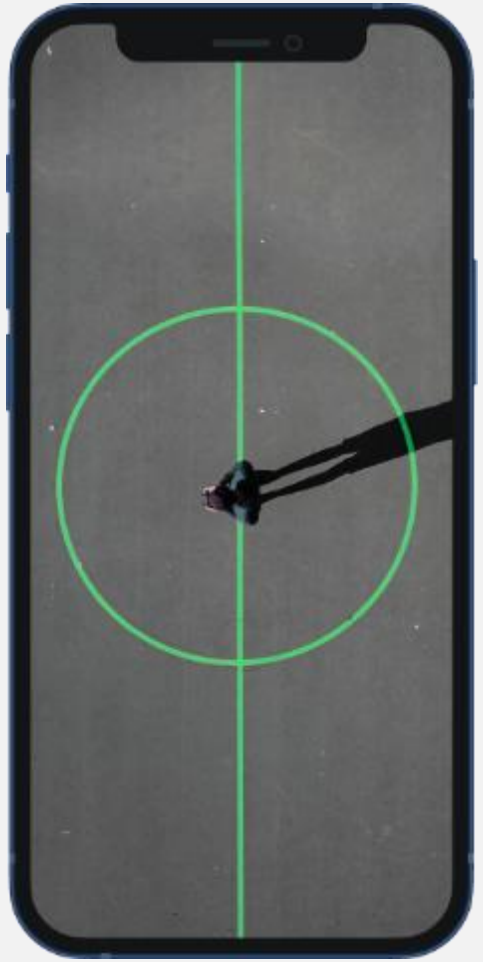

# Approach

### Research

- Safety
- Security
- Regulations
- User acceptance
- Sustainability – ecologic, economic, societal

### Validate

- Simulations
- Live validation test flights for unmanned and eVTOL EMS

### Spread

- Leverage findings into UAM Toolbox
- Cities up to speed
- Stakeholder engagement
- Public outreach
- Supplement transportation system as a new mode

AIRMOUR

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# Global outreach





**+ 10+ replicators, research collaboration, etc.**

AiRMOUR

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# Main output of AiRMOUR

## The UAM Toolbox for aviation and urban authorities, validated in real-life settings

- **UAM Guidebook for cities,** operators and other stakeholders
- **UAM GIS tool for urban planners**
- **UAM Training programme** and masterclasses
- N/B: no UTM, but…

**City and region involvement - this is an integral lesson**

**Will need to be heavily involved (are in Drolo & AiRMOUR)**

**Huge differences e.g. in understanding, knowledge levels, aspirations, imagined end-states and generally the possibilities & limitations of UAV**

**Varying setup of relevant decision-making bodies**

**Now coordinating directly to the relevant EASA WG**

AiRMOUR

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# DROLO

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DROLO

"Investigate and demonstrate the U-Space integration into and interplay with ATM CTR. Develop various other technological and economical aspects, such as business viability, hydrogen propulsion and 5G connectivity."

"Drolo is linked to European regulatory development so that U-Space services can be piloted, tested and launched in Finland among the first."

2 years c.a. 8 M€
11 partners + ecosystem
U-Space demonstrator
Drone business development
Drone technology RDI
Concept RDI

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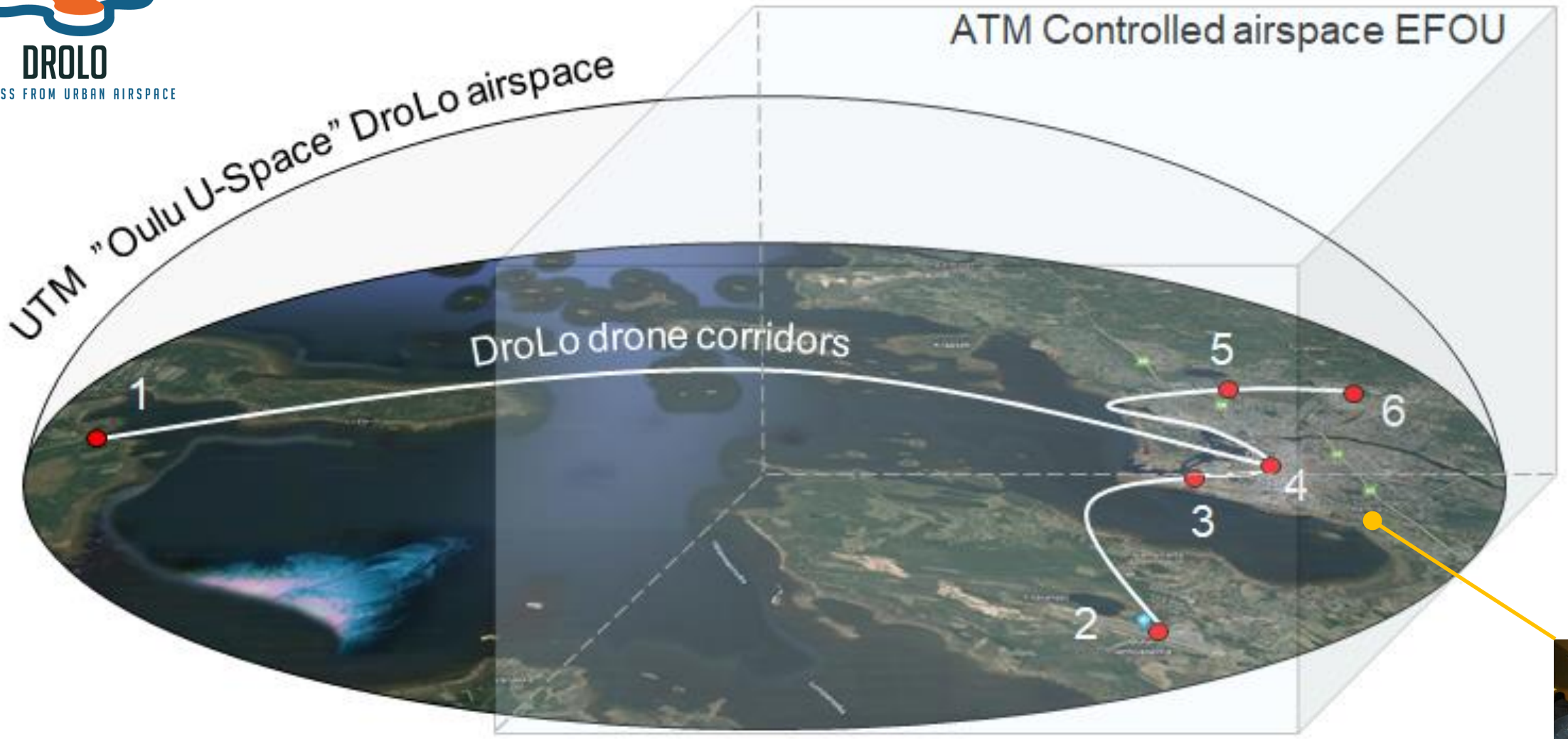



1. Hailuoto
2. Airport
3. Harbour
4. Oulu City centre
5. Technology campus
6. Rusko 5G test site

# Schedule

Project start

Consortium agreement

Steering group (every 4 months)

Define, design, implement, validate | Test flight activity (to archipelago etc.)

UTM vendor?

U-Space setup

Pre-commercial U-Space / UTM | Commercial U-Space

Airport corridor definition

5G network analysis

5G flights

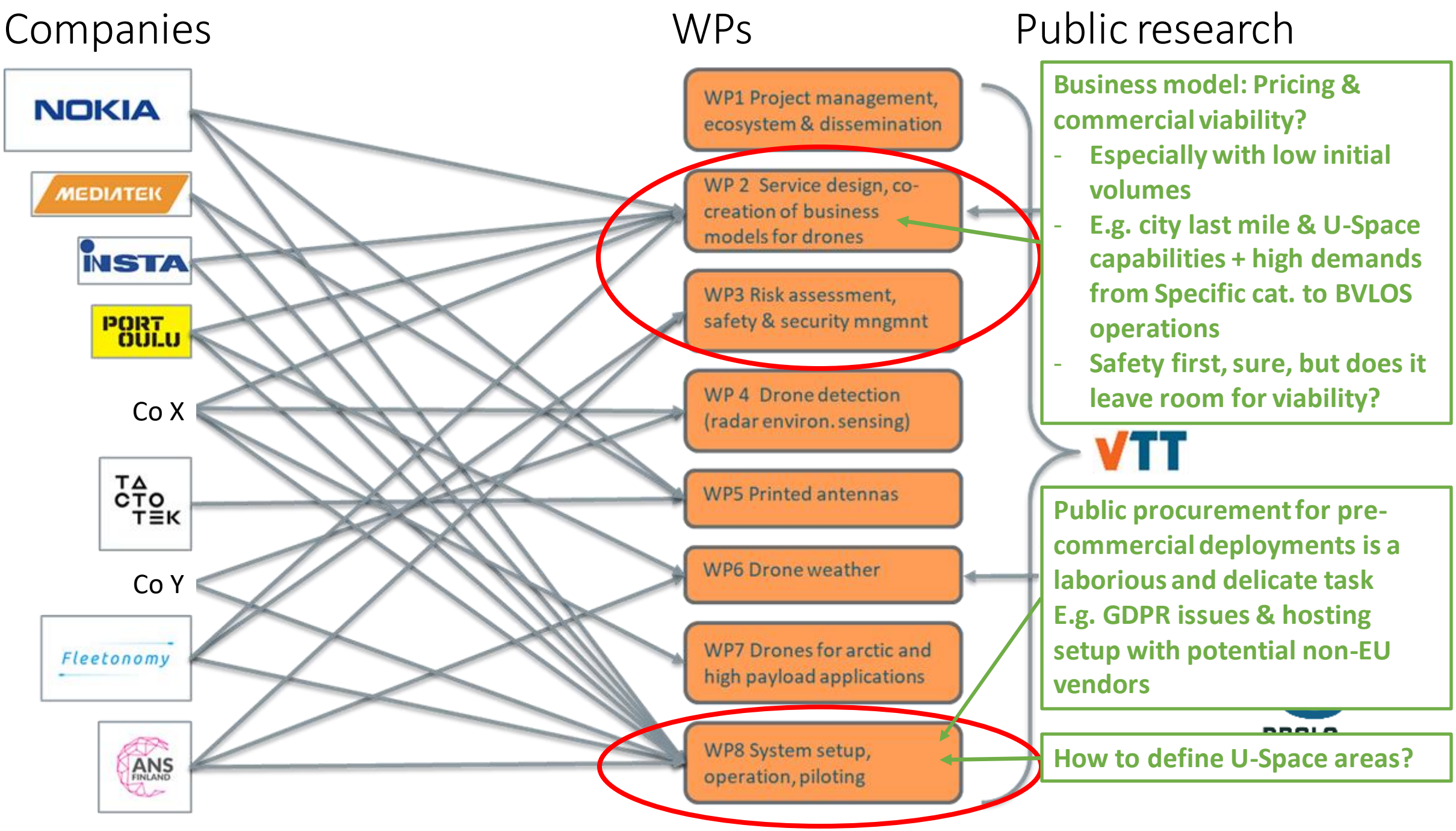
Fuel cell drone

**A lot on USSP operators' plate**

- **Inter-USSP data exchange, CIS was going to be the integration point, will this be feasible?**
- **Methods to convey UAV location data from U-Space to ATM actors**
- **Handover operability between USSPs at country borders, a lot of undefined interfaces and options**

**Banking on the estimated EU legislation schedule**

| 2021 | | | | | | | | | | 2022 | | | | | | | | | | | | 2023 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun |


Companies
WPs
Public research
NOKIA
MEDIATEK
INSTA
PORT OULU
Co X
TACTOTEK
Co Y
Fleetonomy
ANS FINLAND
WP1 Project management, ecosystem & dissemination
WP 2 Service design, co-creation of business models for drones
WP3 Risk assessment, safety & security mngmnt
WP 4 Drone detection (radar environ. sensing)
WP5 Printed antennas
WP6 Drone weather
WP7 Drones for arctic and high payload applications
WP8 System setup, operation, piloting
Business model: Pricing & commercial viability?
- Especially with low initial volumes
- E.g. city last mile & U-Space capabilities + high demands from Specific cat. to BVLOS operations
- Safety first, sure, but does it leave room for viability?
VTT
Public procurement for pre-commercial deployments is a laborious and delicate task
E.g. GDPR issues & hosting setup with potential non-EU vendors
How to define U-Space areas?

# Ecosystem Launchpad (led by VTT)

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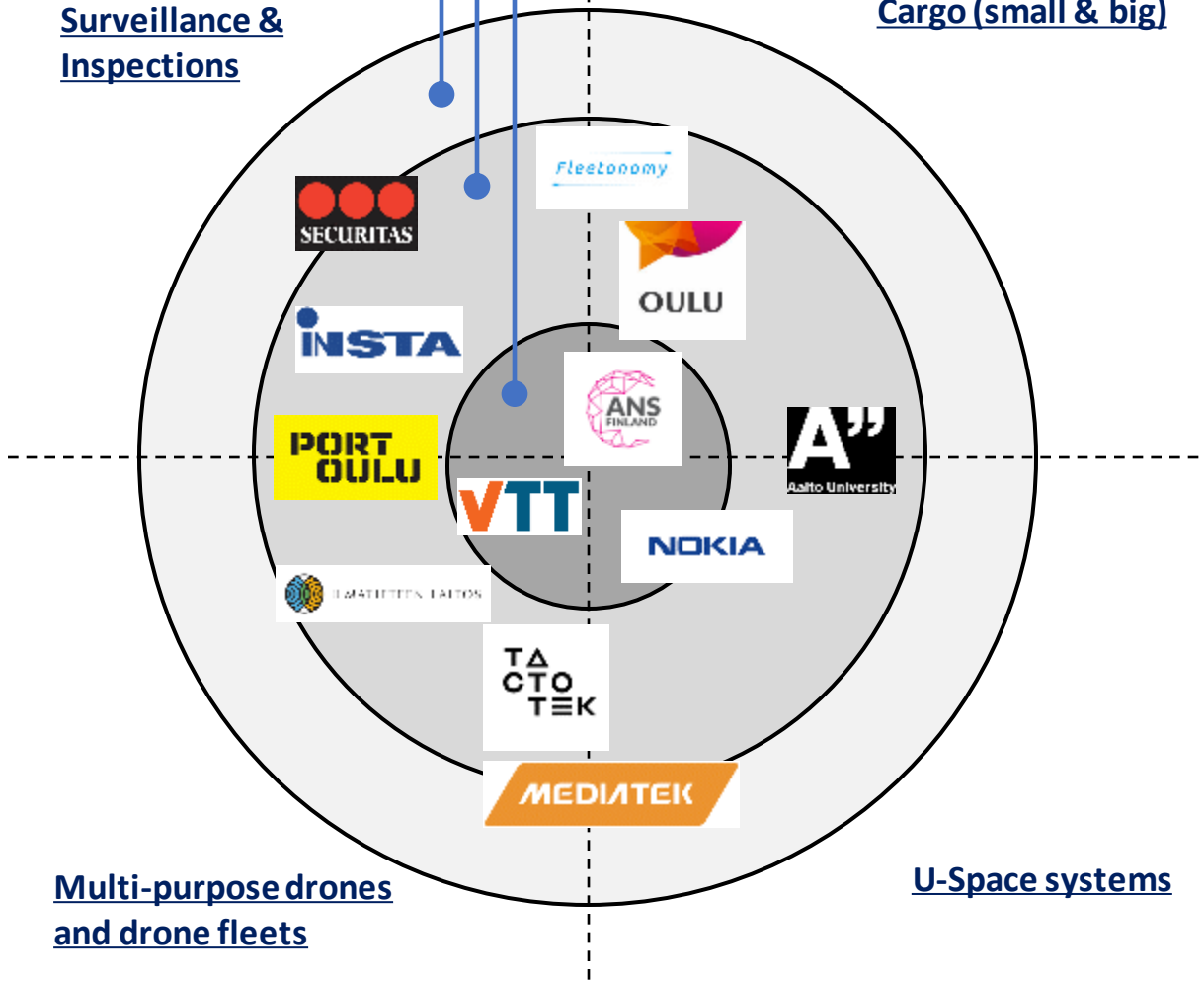
Partners & enablers directly connected to the co-innovation project
Committed partners with ecosystem co-innovation project
Core partners / drivers / business champions

Committed enablers of DroLo project implementation

FINAVIA
Traffic Management Finland
HaiLuoto
elisa
Yliopiston Apteekki



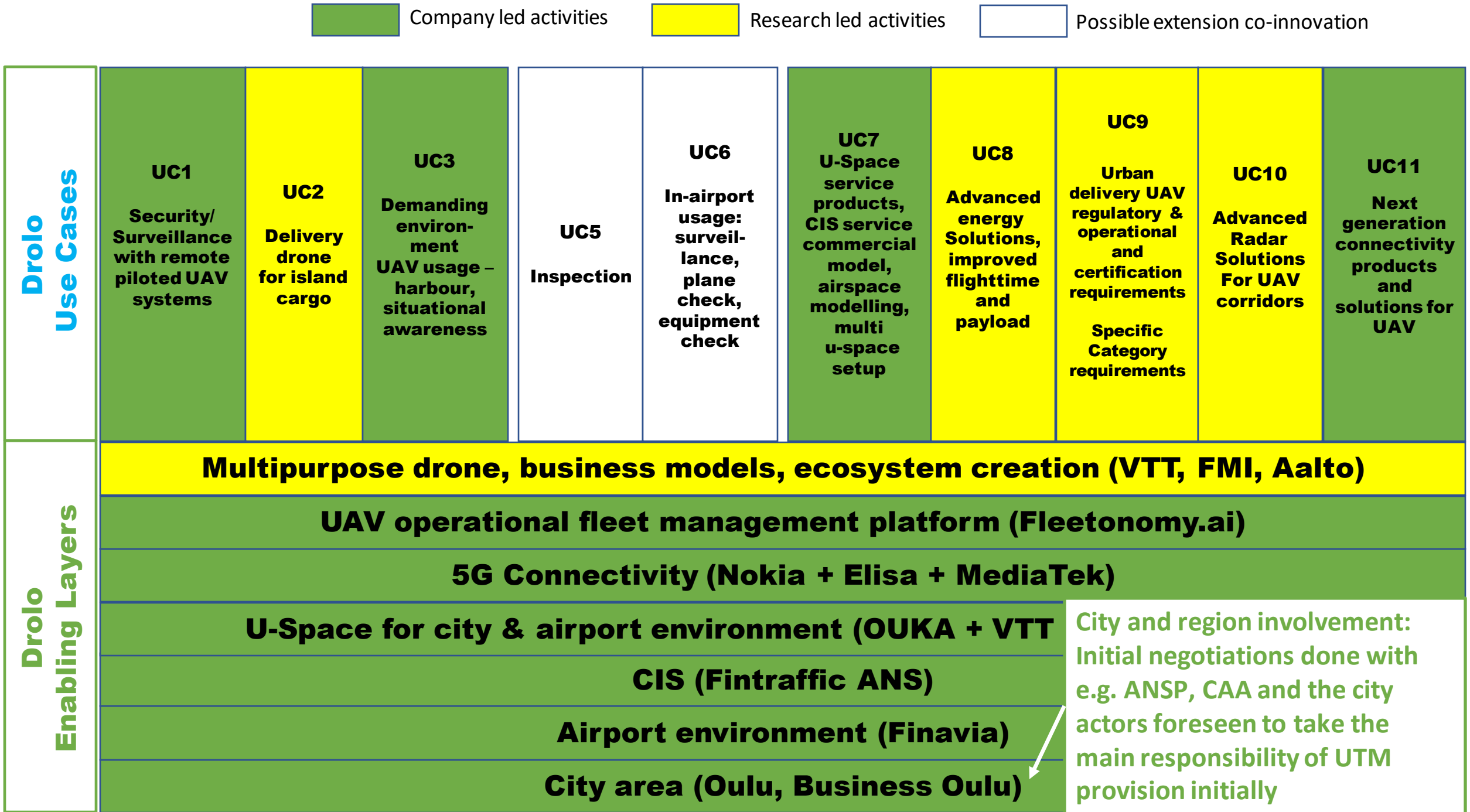

Subcontractors, co-creation partners and other stakeholders & enablers that have already been contacted

robots.expert
MATKAHUOLTO
SKYDATA
UNIFLY
FinnHEMS
Wing
NODEON
posti
LÄHITAPIOLA
SOLITA
AVIAMAPS
TRAFICOM
futurice
Rumble Tools
Pyhtää Redstone Aero
AVARTEK
POLIISI
Pohjois-Pohjanmaan voimaa
oulunenergia.fi
storaenso

Examples of some foreseen subcontractors, co-creation partners and other stakeholders & enablers that will be contacted immediately at project & ecosystem start

Cities & regions!

Telia
SATAMA
DB SCHENKER
DHL
SILO.AI
Metsä
WÄRTSILÄ
SITOWISE
VAISALA
...etc, etc...


Company led activities
Research led activities
Possible extension co-innovation
Drolo Use Cases
UC1 Security/ Surveillance with remote piloted UAV systems
UC2 Delivery drone for island cargo
UC3 Demanding environ-ment UAV usage – harbour, situational awareness
UC5 Inspection
UC6 In-airport usage: surveil-lance, plane check, equipment check
UC7 U-Space service products, CIS service commercial model, airspace modelling, multi u-space setup
UC8 Advanced energy Solutions, improved flighttime and payload
UC9 Urban delivery UAV regulatory & operational and certification requirements Specific Category requirements
UC10 Advanced Radar Solutions For UAV corridors
UC11 Next generation connectivity products and solutions for UAV
Drolo Enabling Layers
Multipurpose drone, business models, ecosystem creation (VTT, FMI, Aalto)
UAV operational fleet management platform (Fleetonomy.ai)
5G Connectivity (Nokia + Elisa + MediaTek)
U-Space for city & airport environment (OUKA + VTT
CIS (Fintraffic ANS)
Airport environment (Finavia)
City area (Oulu, Business Oulu)
City and region involvement: Initial negotiations done with e.g. ANSP, CAA and the city actors foreseen to take the main responsibility of UTM provision initially

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# UTM & CTR challenge

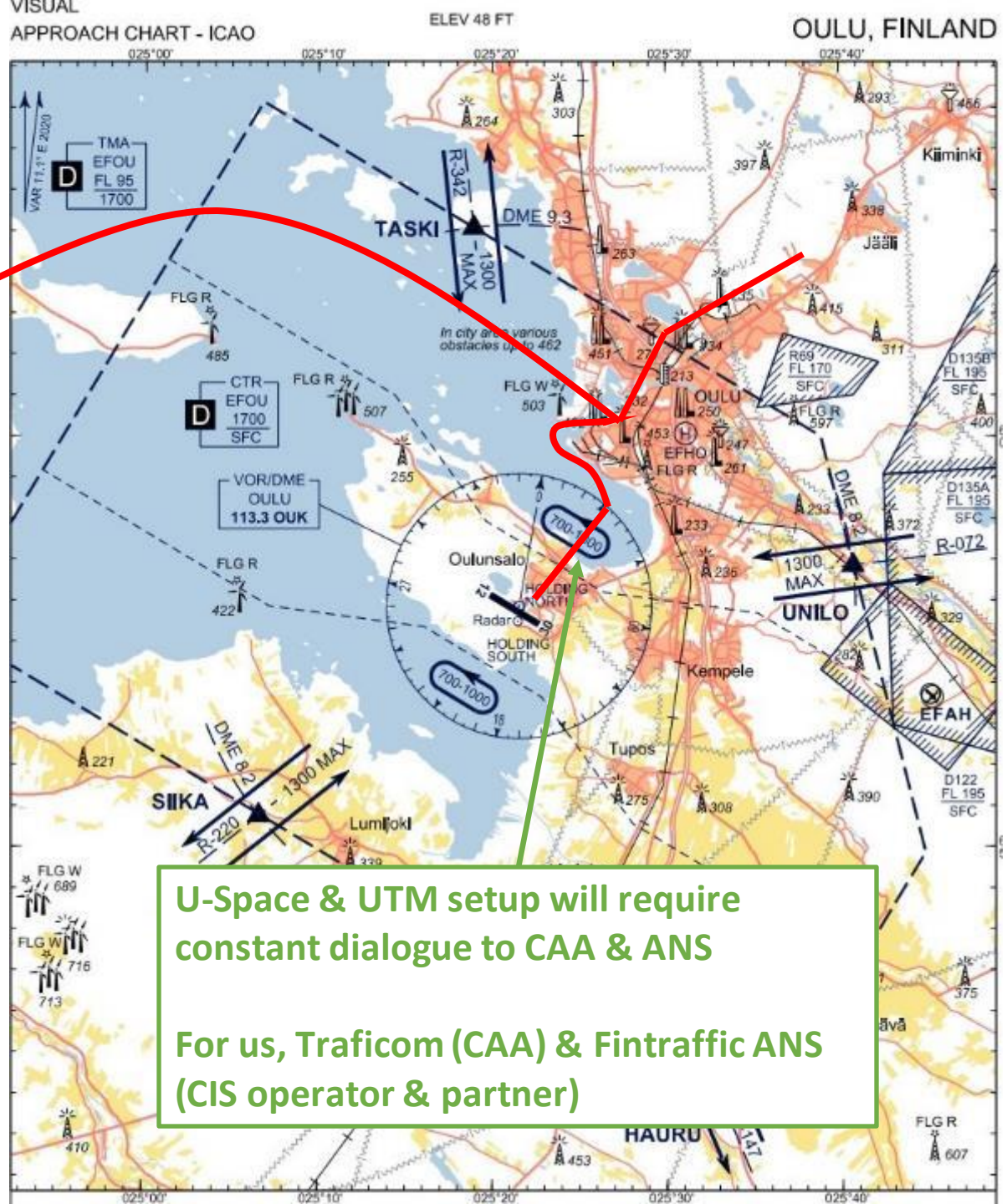
Acknowledgeing that in the end state when operating close to airport, the UAV certification levels must be high (air- and trustworthiness, redundancies, risk levels etc.)

Fintraffic

FINAVIA

VTT

TRAFICOM



# Conclude

- What we or non-aviation experts might wish to learn and benefit from other similar or related activities
- Where we think we might be able to help others

# Thank You!

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