UTM/ATM Integration-Challenges/Lessons Learned from U-Space GOF project

Presented to: ATIEC 2019
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California
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Agenda

• Frequentis Drones Solutions
• U-Space GOF Project
• Flight Information Management System (FIMS)
• Challenges
• Lessons Learned
• Conclusion
Frequentis Drones Solutions

- **Drone Management**
  - Flight Information Management System (FIMS)
    - Drone Registration and Identification
    - Flight Plan Management
    - Flight Plan Data Fusion
    - Safety Nets
  - Air Situation Display

- **Drone Detection and Incident Handling**
  - Flight Information Management System (FIMS)
    - Integration with existing Infrastructure and Sensors
    - Surveillance Data Fusion
  - Incident Management System
SESAR U-Space Demonstrations

U-space demo coverage

U-space
# U-Space Demo Coverage

<table>
<thead>
<tr>
<th>Project</th>
<th>Country</th>
<th>Environment</th>
<th>Area survey</th>
<th>Parcel delivery</th>
<th>Linear survey</th>
<th>Point survey</th>
<th>UAM</th>
<th>Leisure</th>
<th>Emergency / SAR</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIODE</td>
<td>Rural - Urban - Airport</td>
<td>Agriculture - Archaeo - Road traffic</td>
<td>Ad-hoc</td>
<td>Electricity rail</td>
<td>- On airport - Photography</td>
<td>n/a</td>
<td>Yes</td>
<td>- Firefighting - SAR</td>
<td>- Manned a/c - ATC - V21</td>
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<tr>
<td>DOMUS</td>
<td>Rural - Urban - Maritime - Airport</td>
<td>Terrain - Construction - Road traffic - Maritime patrol</td>
<td>Medical - Urgent delivery</td>
<td>n/a</td>
<td>- 3D modelling - Building inspection</td>
<td>n/a</td>
<td>Yes</td>
<td>- Firefighting - Road traffic accident</td>
<td>- Manned a/c - ATC - V21</td>
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<tr>
<td>EuroDRONE</td>
<td>Urban - Airport</td>
<td>No</td>
<td>Commercial</td>
<td>Long distance utility</td>
<td>- On airport</td>
<td>n/a</td>
<td>Yes</td>
<td>n/a</td>
<td>- V2V - V21 - ATC</td>
<td></td>
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<tr>
<td>GCF</td>
<td>Urban - Maritime - Forestry - Airport</td>
<td>- Drone fleet management - International parcel delivery</td>
<td>Long-range sensory data collection 100km+</td>
<td>- Drone fleet management</td>
<td>Air taxi from airport to city centre</td>
<td>Yes</td>
<td>- Maritime traffic surveillance - SAR - Police</td>
<td>- Manned a/c - ATC</td>
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<td></td>
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<tr>
<td>SAFIR</td>
<td>Urban - Airport</td>
<td>Inspection for Port Authorities</td>
<td>Commercial - Medical</td>
<td>Oil spill - High tension line</td>
<td>- Line incident intervention and Pyrox inspection</td>
<td>n/a</td>
<td>Yes</td>
<td>- Port inspection on criminal offenses</td>
<td>- Manned a/c - ATC - V2V - V21</td>
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<tr>
<td>VUTURA</td>
<td>Rural - Urban</td>
<td>Agriculture</td>
<td>Commercial</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Yes</td>
<td>- Drone interception - Firefighting - Police</td>
<td>- Manned a/c - ATC</td>
<td></td>
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<tr>
<td>MEDSAFE</td>
<td>Rural - Urban</td>
<td>Agriculture</td>
<td>Commercial</td>
<td>n/a</td>
<td>- On airport - Security surveillance</td>
<td>n/a</td>
<td>Yes</td>
<td>- Police</td>
<td>- ATC - V2V - V21</td>
<td></td>
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<tr>
<td>PODIUM</td>
<td>Rural - Urban - Airport</td>
<td>Agriculture</td>
<td>Commercial - Urgent delivery</td>
<td>n/a</td>
<td>- On airport - Security surveillance</td>
<td>n/a</td>
<td>Yes</td>
<td>- Police - SAR</td>
<td>- Manned a/c - ATC</td>
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<td>SAFEDROME</td>
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<td>Agriculture - Drone fleet management</td>
<td>Commercial</td>
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<td>- Drone fleet management</td>
<td>n/a</td>
<td>Yes</td>
<td>n/a</td>
<td>- Manned a/c - ATC - V2V - V21</td>
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</tbody>
</table>
# GOF Project Partners

## Supporting Authorities
- Finnish CAA
- Estonian CAA

## Program Management
- Frequentis
- EANS
- Robot Expert

## ANSP
- EANS
- ANS Finland

## FIMS provider
- Frequentis

## Governmental Users
- Police of Helsinki
- Police & Border Guard Estonia

## U-space Service Provider
- Airmap
- Altitude Angel
- Unifly

## Commercial UAV operators
- Aviatec
- BV Drone
- Robot Expert
- Fleetonomy
- Hepta Airborne
- Video Drone
- Volocopter
GOF - Project at a glance

Flight Information Management System (FIMS)

- Integration of UTM and ATM systems
- Cross-agency / country drone (UAV) information exchange
- Accessibility of a Common operational picture
- Enable Joint Operations / authority collaboration

UAV use-case demonstrations

- Urban drone fleet ops in Helsinki with Police intervention
- Model flyers, general aviation and drones sharing same airspace
- Maritime SAR exercise with helicopters in Gulf of Finland
- International parcel delivery between Finland and Estonia
- Urban drone fleet ops in Tallinn in controlled airspace
- Inspection flights in forestry
- Urban Air Mobility flight at Helsinki-Vantaa airport
FIMS at the core of interoperability

- Serves and Integrates multiple UTM Service Providers (USP) – creates a liberal market regime
- Supports standard protocols based on SWIM principles to connect UTM services from several USP’s to FIMS
- Provides real-time situational awareness to all airspace users – supports privileged access
- Supports FIMS to FIMS connections enabling cross-border and FIR to FIR operations
- Enables the integration of additional COTS UTM components, e.g. precision weather, 3D mobile coverage charts, dynamic charts on aggregation of people
MosaiX SWIM – Digital Data Platform

Security Gateway

API Manager / Billing

Messaging

Service Registry
Visual Data Mediator
Identity Provider
Data Storage

Weather
Flight Planning
Airspace
Surveillance

ATM Services

Airspace Reservation
Flight Operation
Drone ID & Registry
Telemetry

UTM Services

MosaiX SWIM

Monitoring & Logging
Challenges

- Safety – Operations in Controlled Airspace (CTR), airports & large cities, manned & unmanned
- Large consortium - partner different in interest, size and capabilities
- Building on existing products with little to no development – different APIs and runtime behaviour
- Demanding trials, both for operators and infrastructure partners
- Schedule – 6-7 months from first partner meeting to first trial
Lessons learned

- FIMS is a key enabler for a successful integration of UTM/ATM
- Standardized protocols reduce integration effort when integrating different UTM vendors
- Conversion between UTM and ATM environments works but ATM standards need to evolve to meet the UTM needs
  - FIXM geometry in ATM vs. complex 3D volumes in UTM
  - IWXXM weather in ATM vs. Hyperlocal weather information & Wind LIDAR in UTM
- Conversion needs to be standardized (i.e. ICAO)
- Affordable, reliable and secure telemetry “position” data link is the bottleneck
  - ADS-B not designed for thousands of UAVs in a small area, FLARM is proprietary, 5G initially won’t cover all areas
Conclusion

• UTM/ATM Integration is today one of the best use case for SWIM
• FIMS architecture was successfully validated with multiple USPs across borders in a large geographical area
• FIMS will support SESAR with the design and standardization of the future ATM/UTM architecture
• FIMS will be used for drone detection in future validation projects