



SESAR U-Space Workshop



20 April 2017, the Hague





THE GLOBAL UTM ASSOCIATION: Industry-Driven Innovation for UAV Airspace Management

PRESENTED BY

Jonathan Evans | @UTM_Aero

Co-President, Skyward | Board President,
GUTMA



www.utm.aero

Founding Members



The Global UTM Association

GOAL: Safe and secure integration of drones into national airspace systems

TACTIC: Interoperability Blueprint
System of Systems

- 📄 Architecture
- ✓ Common Protocols
- 👁 International ID



Why Should There Be a Global Standards Body?

- Why are global standards useful?
- Who do global standards benefit?



The Drone Industry Is Booming

TODAY Drones are a heavy-duty tool

- ⚙️ One operator per drone
- 👤 Must fly within visual line of sight
- 👁️ sight
- 💰 Creating efficiencies & revenue streams even at this stage



USE CASE: Bridge Inspections

TODAY:

- Traditional method still used today
- Several workers in a bucket truck
- Relies on human senses

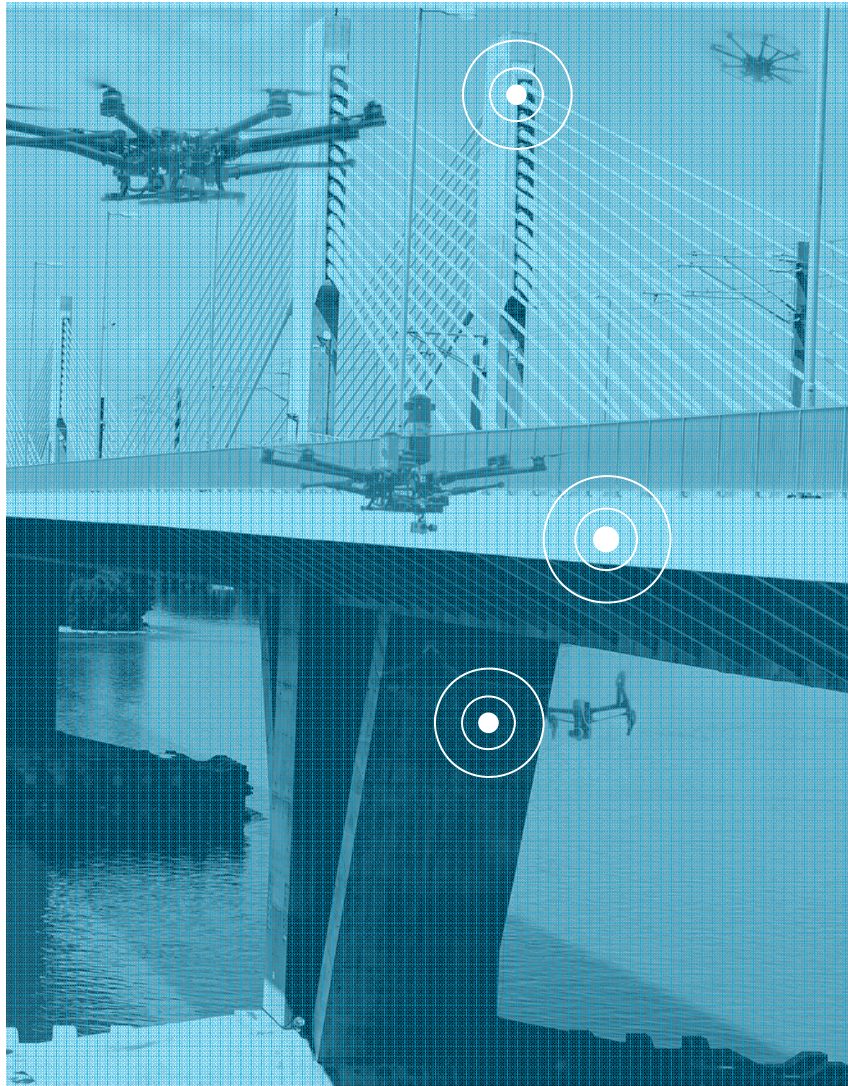
ALSO TODAY:

- More efficient, effective
- One worker & one drone
- Uses sensors to gather data





Operating Across Multiple Jurisdictions



Bridge Inspection in the **Near Future**

- 📶 Autonomous flights
- 📶 Sensors guide the drone
- 🔄 Widespread adoption
- 🌐 Simplified access to multiple jurisdictions

Drones Are Poised to Transform the Economy

But first, we must address two standardization challenges:

1. How all the technologies communicate among each other
2. How to harmonize our regulatory approaches with the technology



Harmonizing Means Integrating



1. **Airspace regulations**
2. **Wireless network infrastructure**
3. **Aerial robots, payloads, software**

Unmanned Traffic Management Is a System of Systems

Providing the blueprint for drones to interact on an international airspace network

- Common languages
- Social contract
- IP addresses of the sky



UTM Enables a Global **NETWORK** of Aerial Robots

Common protocols will allow drones to connect across:

- Information space
- Regulatory jurisdictions
- Technologies
- Market demands



The Global UAS Traffic Management Association

GOAL: Safe and secure integration of drones into national airspace systems

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- 🏗 Architecture
- ✅ Common Protocols
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Our Members



GUTMA's First Three Working Groups

- **Overall Architecture**
Whitepaper publication
next week!
- **Data Exchange**
Open Source Project
in progress
- **Registration Identification**
Launched in April



Let's Be Clear

Regulators create the rules

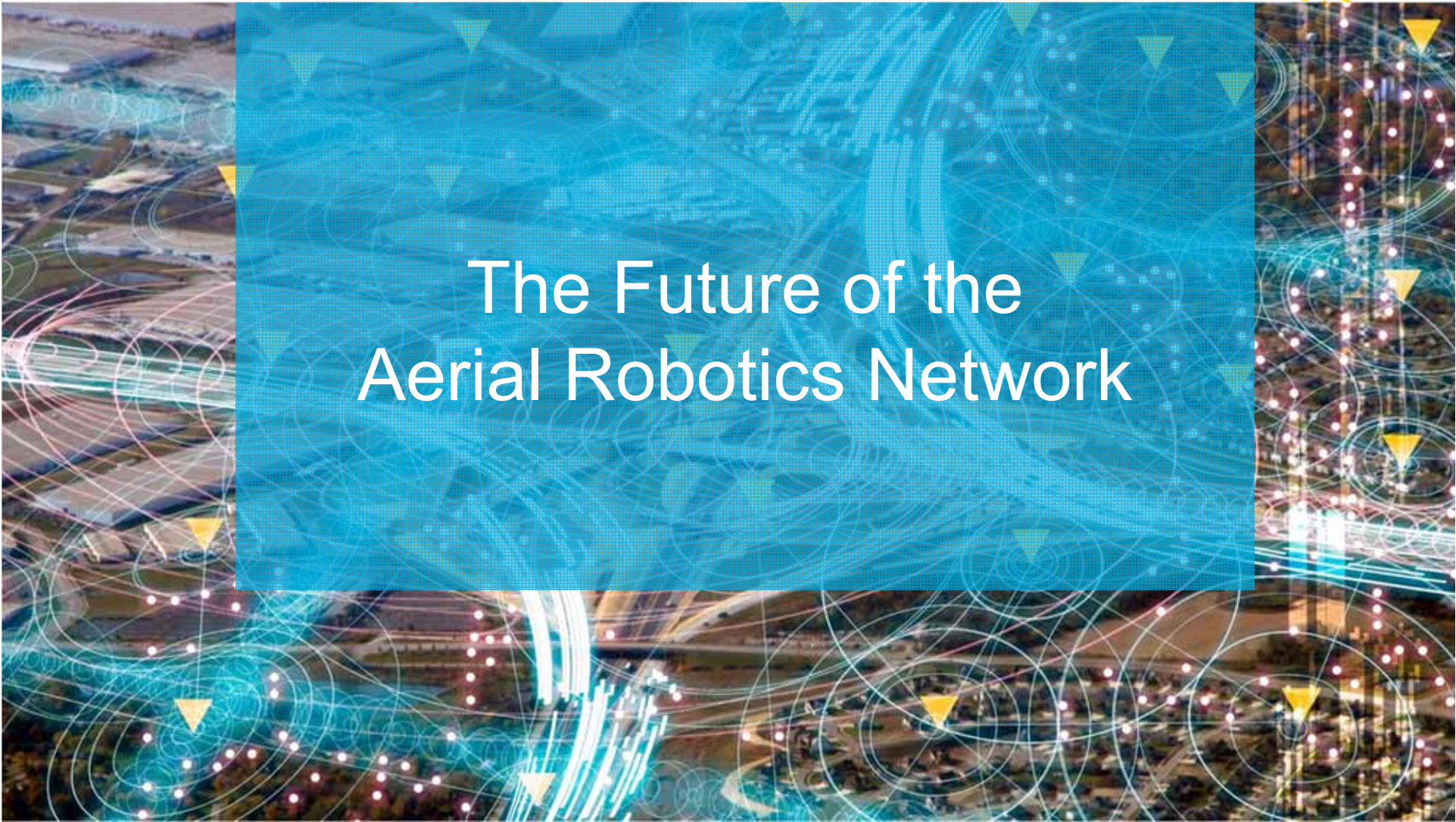


Regulators can use industry-driven approaches as they define regulations





Bridge Inspection in
5-10 years



The Future of the Aerial Robotics Network

AUDIENCE QUESTIONS

Contact

Global UTM Association

EPFL Innovation Park, Building C

1015 Lausanne

Switzerland

General inquiries: info@utm.aero

Membership: membership@utm.aero

Press: press@utm.aero





SESAR U-Space Workshop



20 April 2017, the Hague





Opening Remarks



Florian Guillermet, SESAR JU Executive Director

20 April 2017, the Hague

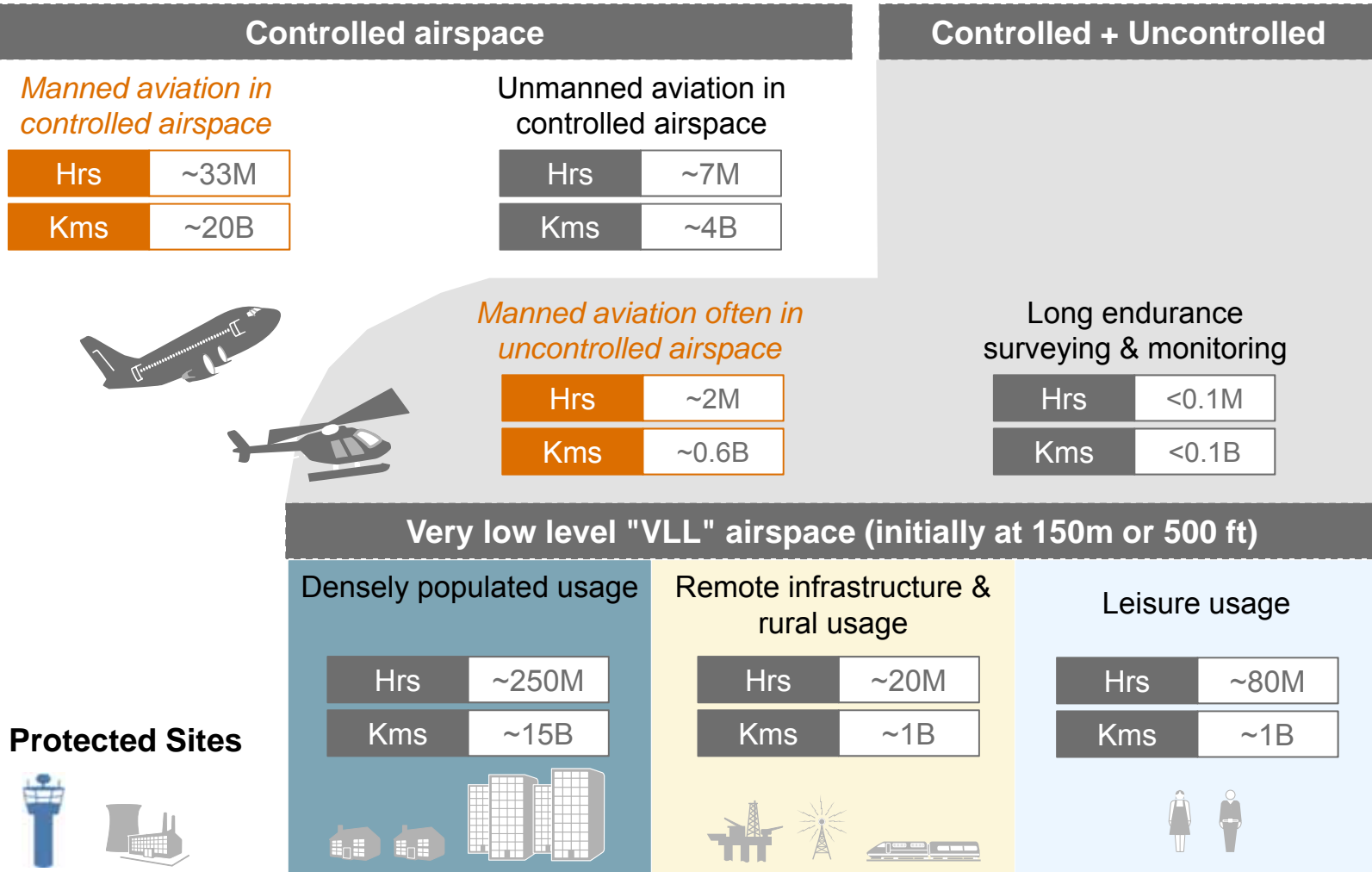


First things first



Thank you !

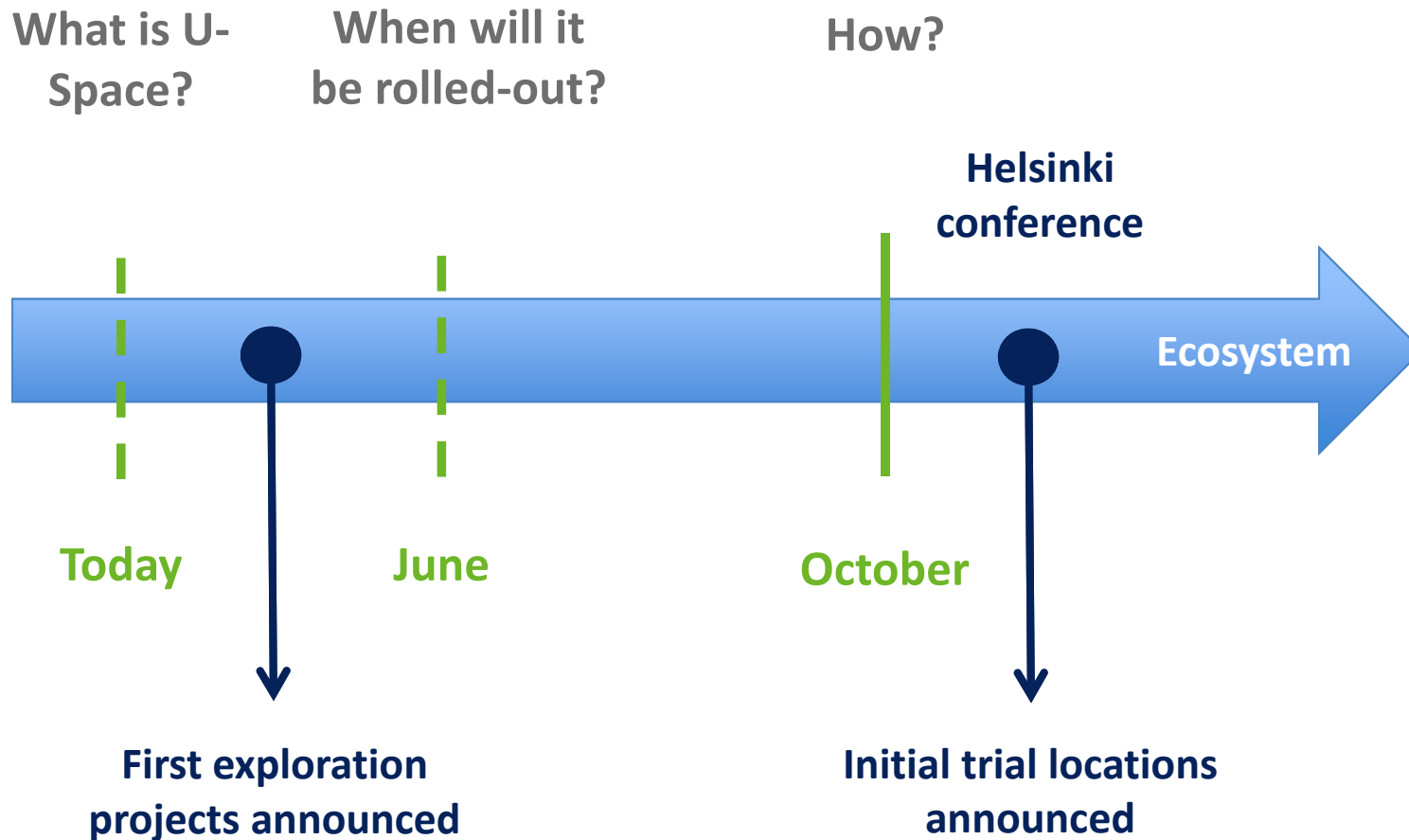
Drones will be part of our future



Not working in isolation



Our journey in 2017



Two objectives for today



Hear from you if

1. You now understand better what “U-Space” is (and isn’t!)
2. We have been “radical enough” in our approach

... before we move on with the next stage of our activities

Wishing you a good workshop ...





SESAR U-Space Workshop

The U-Space Vision



Julie Ibalot, Master Planning Expert, SESAR JU
Ludovic Legros, Programme Manager, SESAR JU

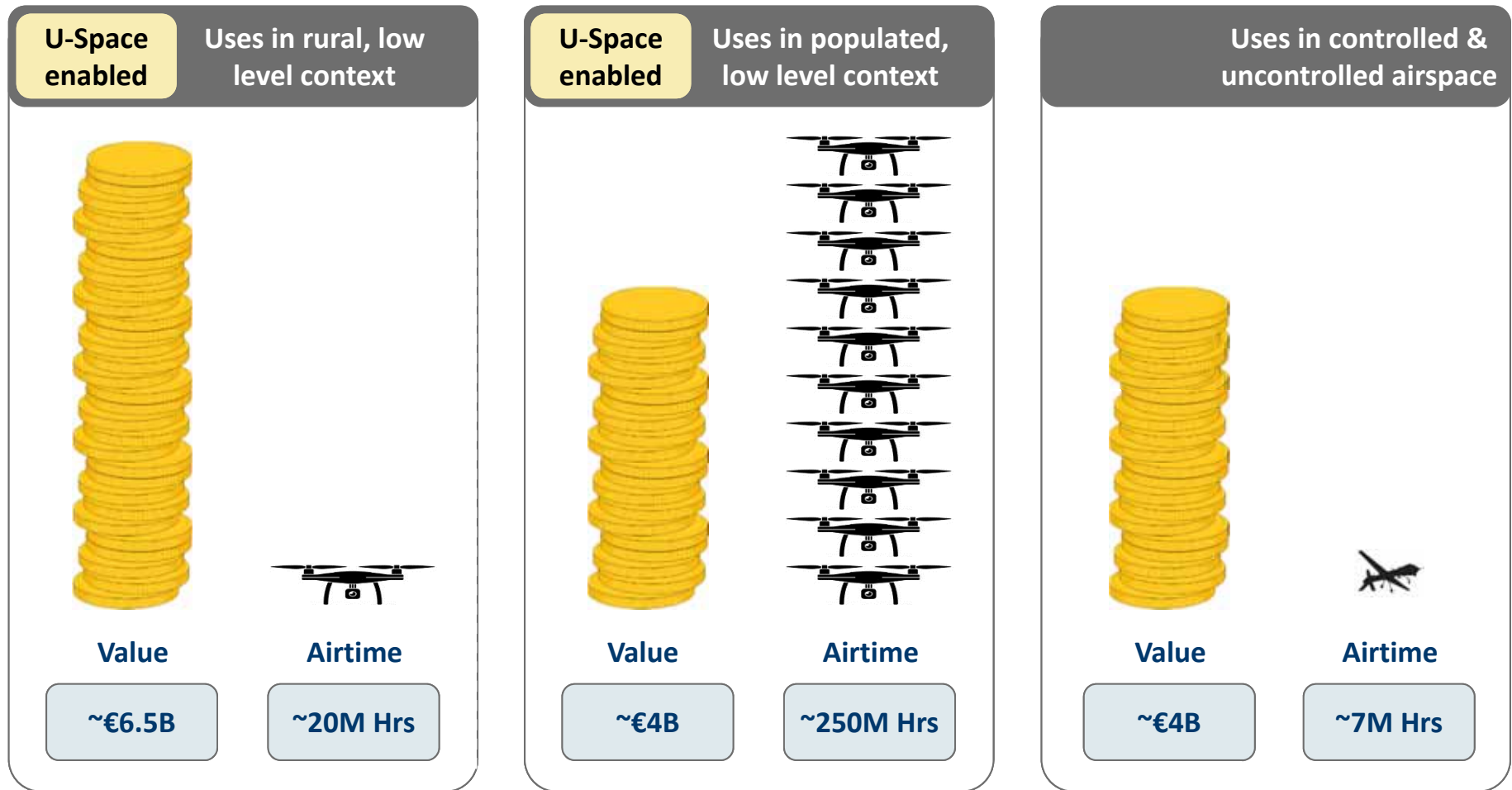
The Hague, 20th April 2017.





Why U-Space?

Significant value at stake for Europe

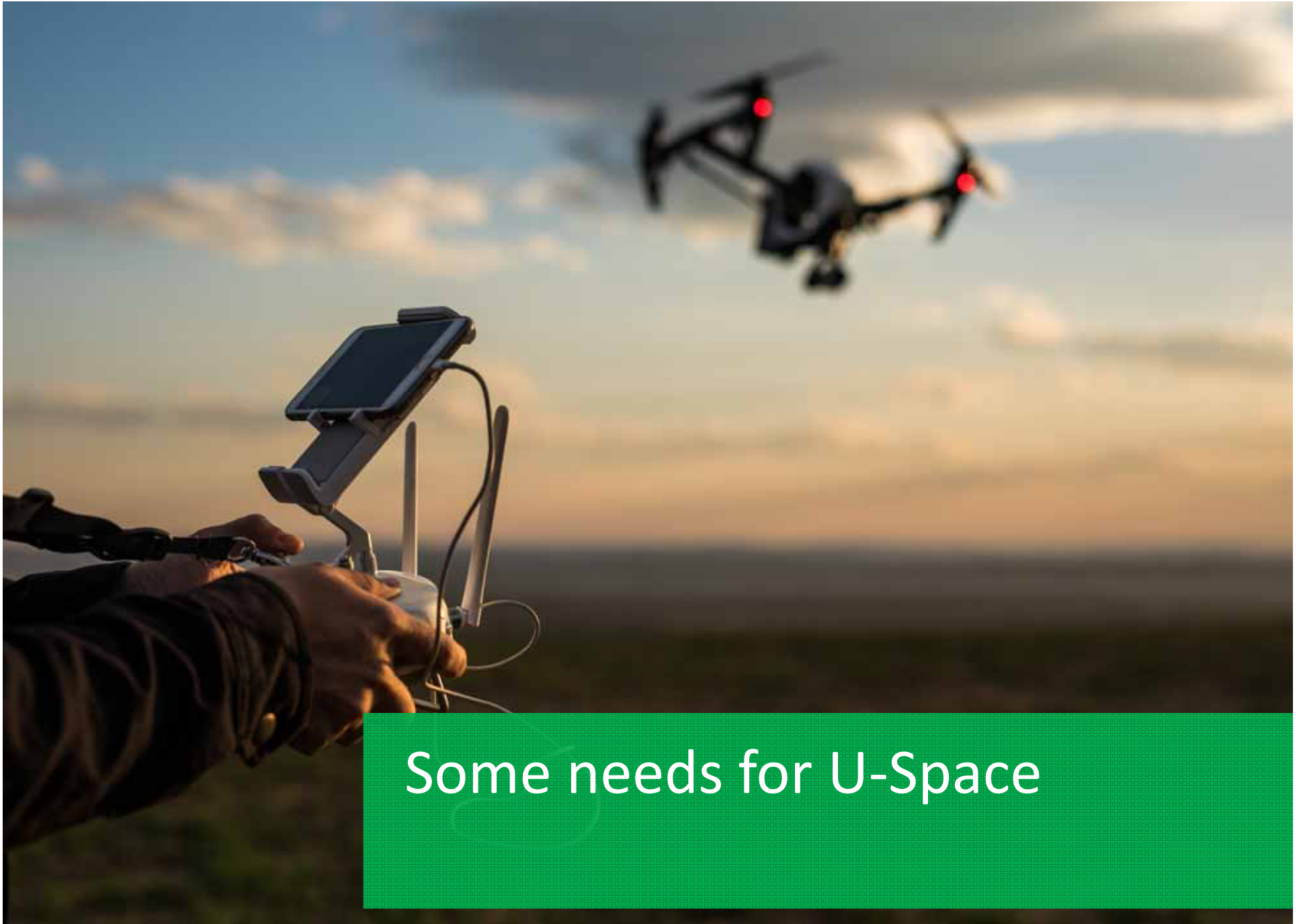


70% of the value can only be fully unlocked with U-Space

Europe must act now



**5 years window
of opportunity**
before other
regions in the
world likely
complete most
critical activities

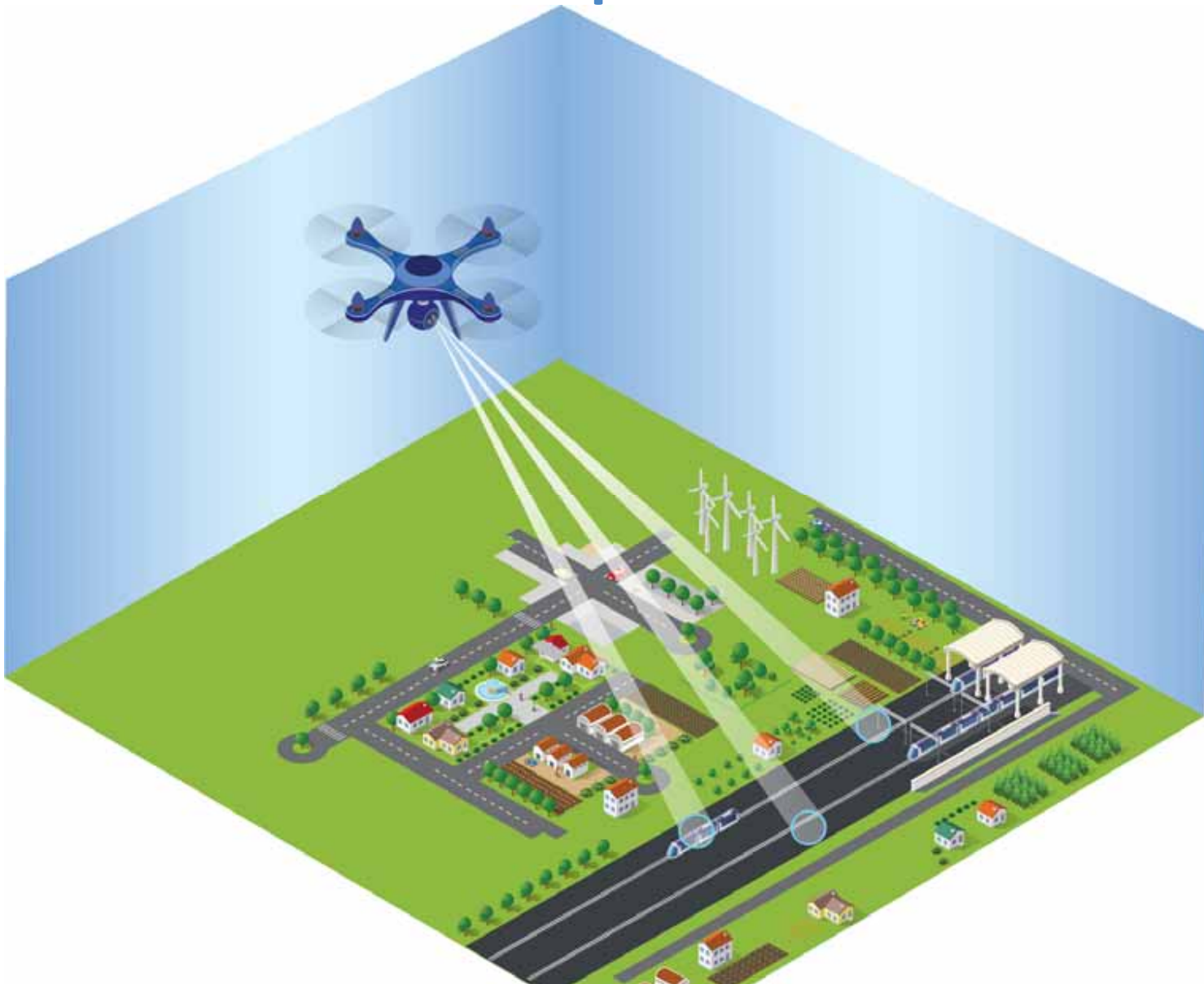


Some needs for U-Space

Mapping and surveying



Infrastructure Inspection



Delivery of medical assets





What is U-Space?

U-Space is ...



*“U-Space is a set of **new services** and specific procedures designed to support safe, efficient and secure access to airspace **for large numbers of drones**.*

*These services rely on a high level of **digitalisation and automation** of functions, whether they are on board the drone itself, or are part of the ground-based environment.*

*U-Space provides what is needed to enable and support **routine drone operations**, as well as a clear and effective interface to manned aviation, ATM/ANS service providers and authorities.”*

Source: A blueprint for U-Space, draft version 0.9

U-Space

All operating environment

All types of airspace

All kinds of missions

All categories of drones

All drone users

U-Space is a set of services



How does U-Space operate?

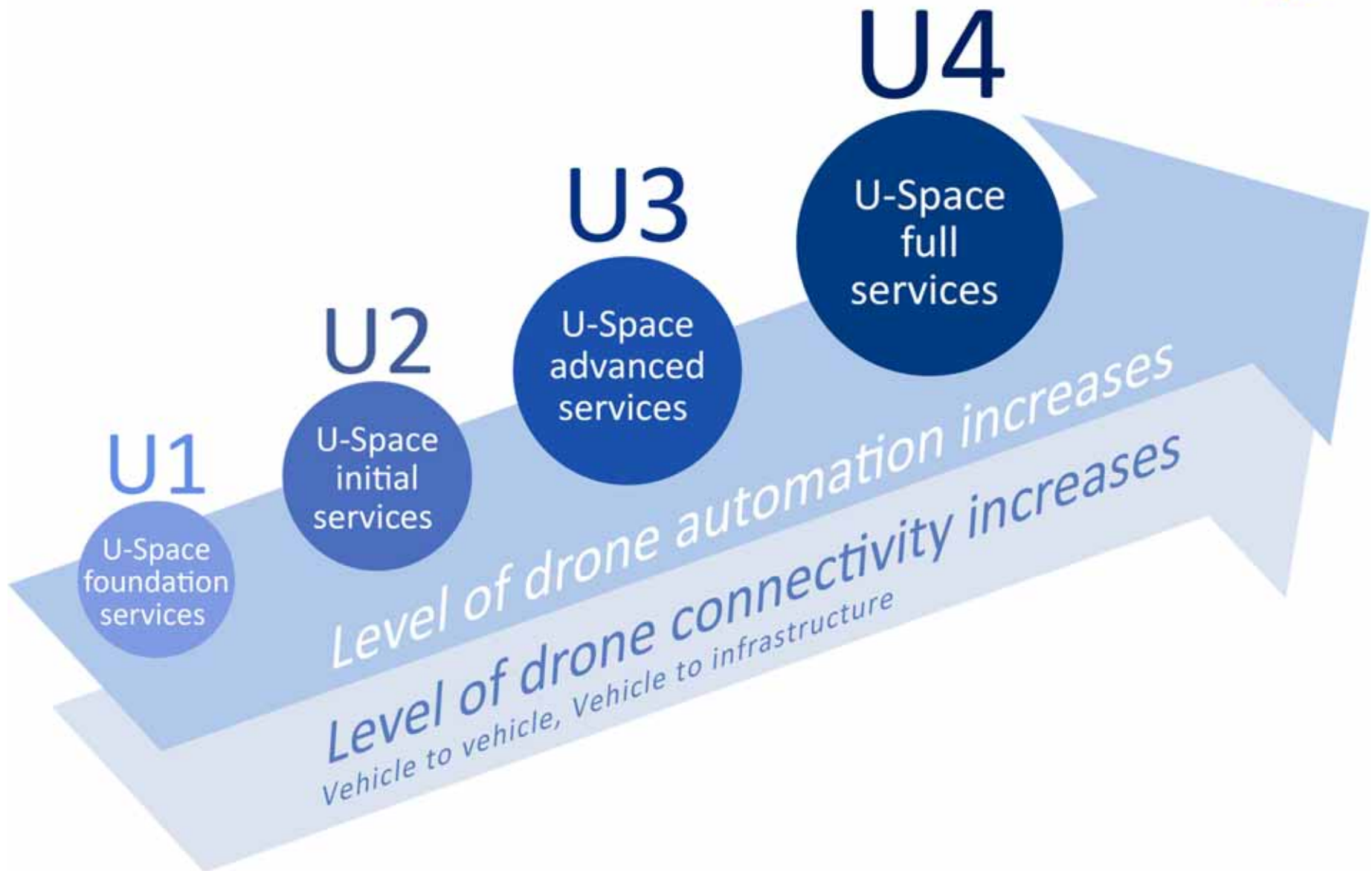




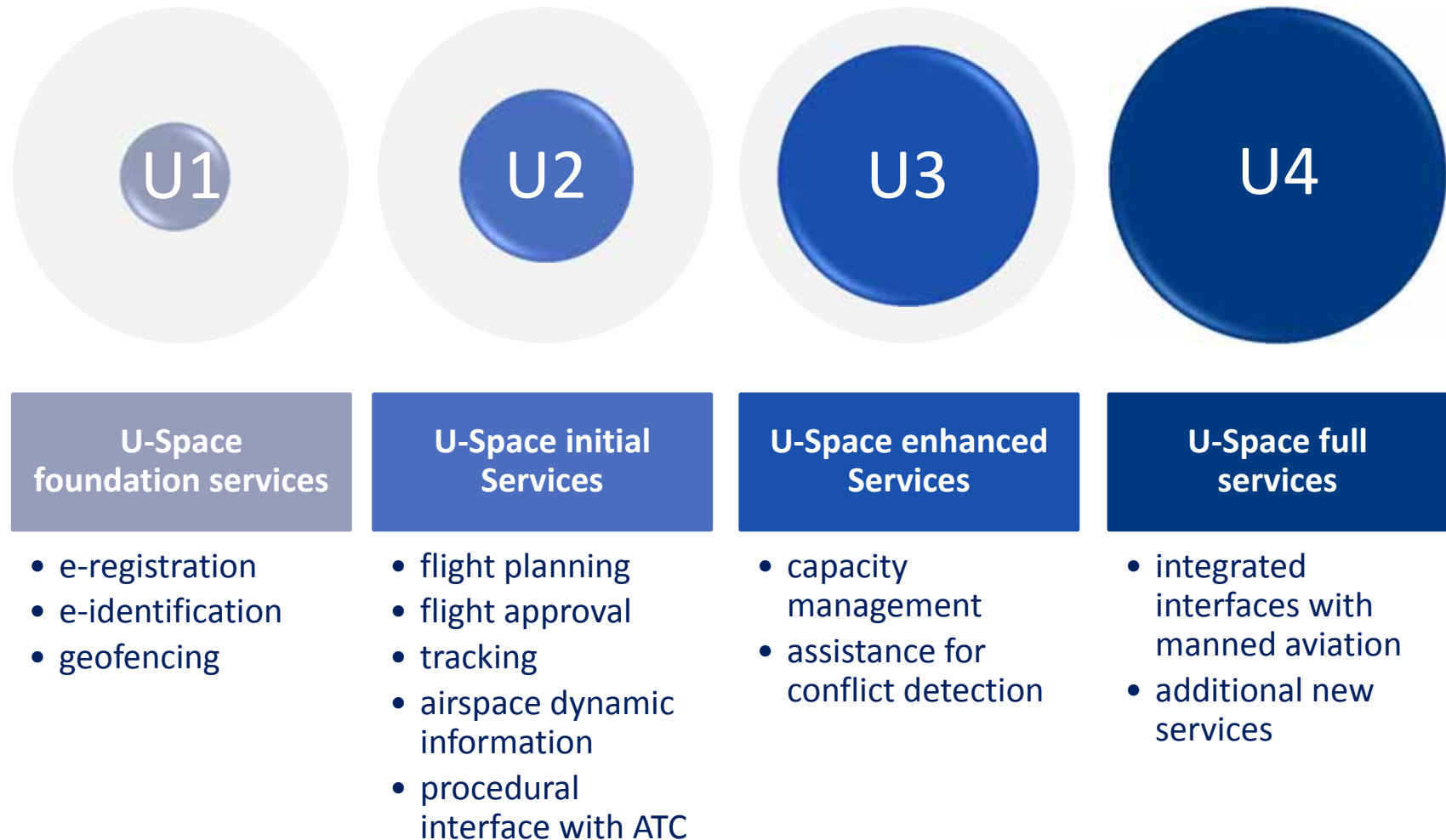


How will U-Space be roll-out?

Services, automation, connectivity



What could be the services?



By 2019?



Operational



U-Space foundation services

- e-registration
- e-identification
- geofencing

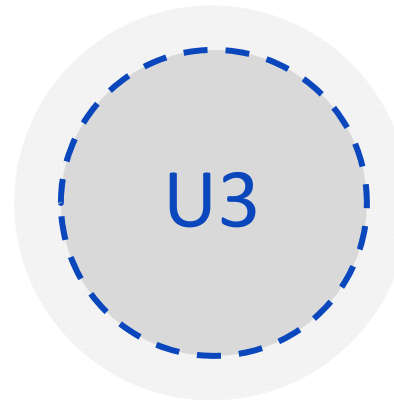
Demo



U-Space initial Services

- flight planning
- flight approval
- tracking
- airspace dynamic information
- procedural interface with ATC

Exploration



U-Space enhanced Services

- capacity management
- assistance for conflict detection.



U-Space full services

- integrated interfaces with manned aviation
- additional new services



Thank you very much
for your attention!





Creating the EU drone ecosystem

Matthew Baldwin, Deputy Director-General, DG MOVE, European Commission

20 April 2017, the Hague



Panel discussion: is our vision future proof?



Benoit Curdy,
Global UTM Association



Andrew Charlton,
Drone Alliance Europe



Christian Struwe,
Drone Manufacturer Alliance Europe



Peter van Blyenburgh,
UVS International

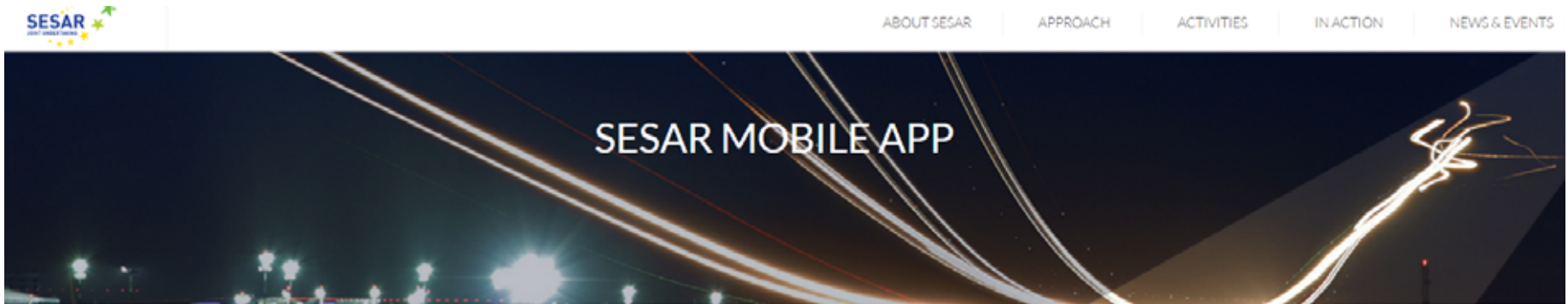
Moderated by Koen De Vos, Senior Expert, European Commission DG MOVE



NETWORKING LUNCH



Have your say on the SESAR mobile app



The SESAR mobile application will help you stay up to date with the latest activities at various events organised by the SESAR JU and even on a daily basis.

The app includes several interactive features such as, the possibility of personalising your own agenda during SESAR JU events, chatting with SESAR stakeholders, interactivity polls, surveys and much, much more.

The mobile app will also allow us to provide you with last minute announcements, changes, and important information during the event.

Get started today by downloading the app!

[App Store](#)

[Google Play](#)

[HTML 5](#)

In case you experience any problem with downloading/accessing the mobile app, contact us.



Connected drones

20 April 2017, the Hague

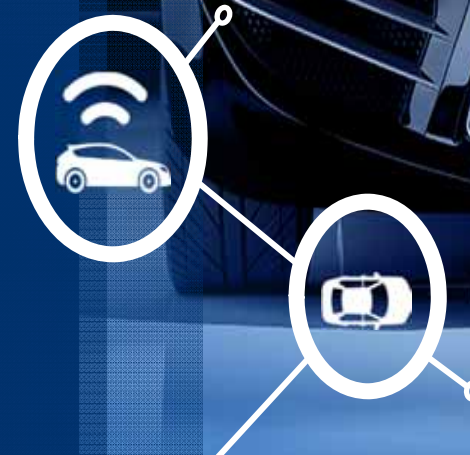


Disruptive technologies— Flying Robots

CLARA OTERO

Director Systems Innovations
NXP Semiconductors

SESAR U Space workshop
Den Haag, April 20th , 2017



Safe & Secure Mobility – 90% Innovation Through Electronics

Seamlessly Connected
Mobility Experience



One hour per
day in the vehicle
Enjoying Life

ADAS Towards
Self-Driving



1.3M global road fatalities
every year
Saving Lives

Energy
Efficiency



US mandates 163 grams / mile
and 54.5 MPG by 2025
Reducing CO₂

From Automotive to Safe & Secure Mobility

More than doubling the semi content per vehicle

 SENSE

 THINK

 ACT

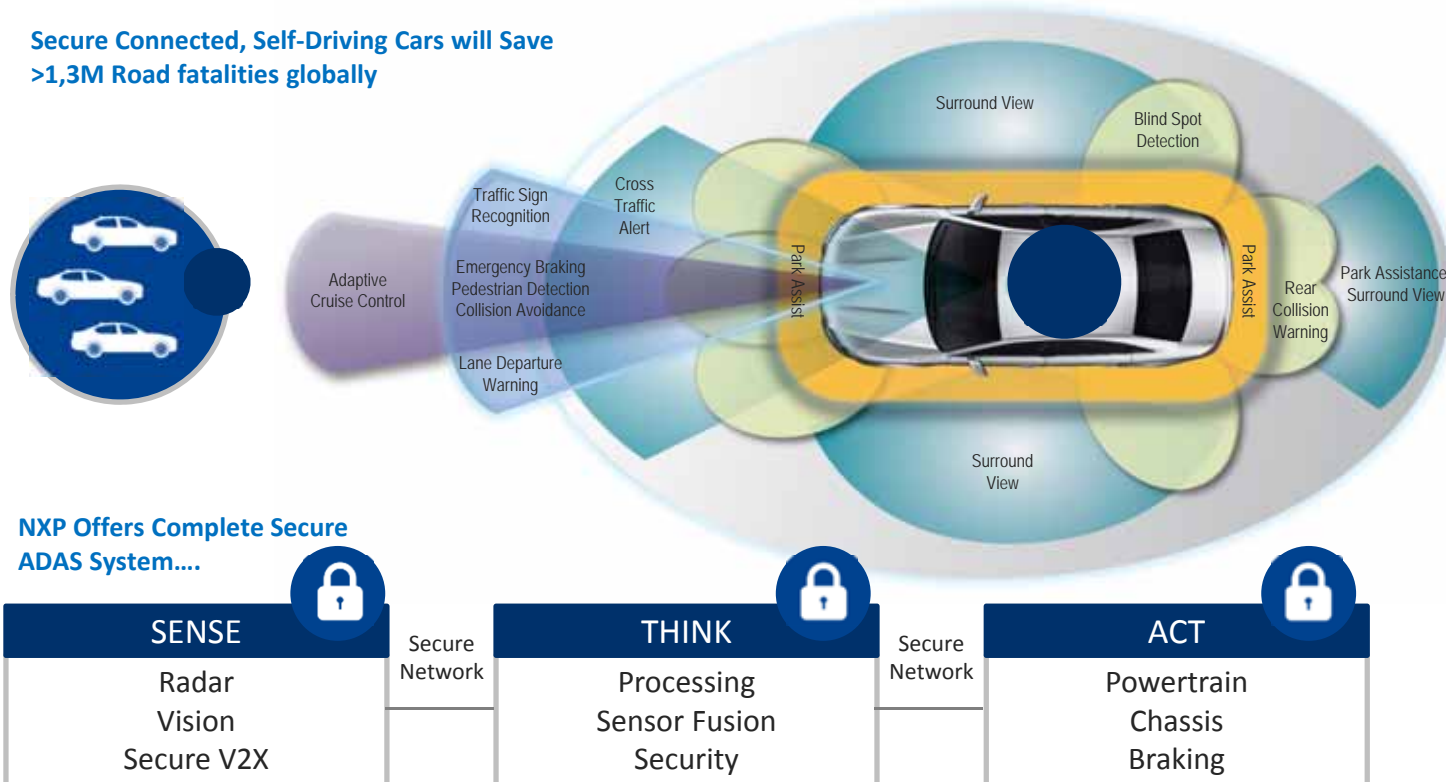


Tomorrow:
Self-Driving
Robots with end-
to-end Services



ENABLING THE SECURE CONNECTED CAR

Secure Connected, Self-Driving Cars will Save
>1,3M Road fatalities globally



Connected UAV Cooperation, Autonomy, Sense and avoid technologies



VEHICLE-TO-EVERYTHING (V2X) COMMUNICATIONS

BASED ON IEEE802.11p standard



INTELLIGENT TRANSPORT SYSTEMS (ITS)

Avoiding road accidents

Improving traffic flow / CO₂

Enabling autonomous driving

IEEE802.11p is derived
from IEEE802.11a/g (today's
WiFi standard in computing)



VEHICLE-TO-EVERYTHING

USE CASE EXAMPLES



Typical V2V

Hazardous location warning

Slow vehicle warning

Stationary vehicle warning

Emergency brake light

Emergency vehicle warning

Motorcycle approaching indication

Typical V2I / I2V

Probe Vehicle (Floating Car) Data

Signal traffic light phase and time

Road works warning

In-vehicle signage



Emergency Electronic Brake Warning



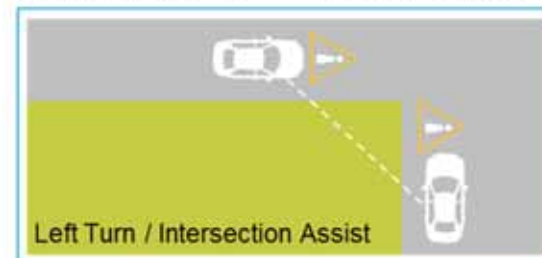
Do Not Pass Warning



Hazardous Location



Emergency Vehicle



Left Turn / Intersection Assist

Cooperation: Dedicated Short Range Communication

802.11p + Security



RELIABLE dedicated communication up to 3 KM

MULTIPLE Communication links at once.

Super light weight “Anti Collision Transponder”.

Best receiver sensitivity also for

- Non-Line-of-Sight and Mobility conditions (differential speeds up to 500km/h)
- line of sight range up to 3 KM

Software defined radio supporting over the air updates as well as global standards

Automotive quality



APPLICATIONS:

- REAL TIME Video transmission up to 3 KM
- SECURE Remote Control of the UAV (avoiding unauthorized access)
Low latency direct communication 802.11p
- Drone to Person communication
“Selfie Drone” follows me at specified altitude & distance and makes movies of me while I am windsurfing etc.
- UAV authentication to local authorities via secure V2X & SMX
avoid UAV misuse by terrorists at a public events/ in cities to carry explosives.

SECURING V2X COMMUNICATIONS



SECURITY

**WAS THE MESSAGE NOT MODIFIED?
DID IT REALLY ORIGINATE FROM CAR A?
CAN I TRUST CAR A?**

CAR AND MESSAGE AUTHENTICATION REQUIRED TO
PREVENT TRAFFIC DISRUPTION OR IMPERSONATION



Seeing around
corners



Emergency
Vehicle
Warning

PRIVACY:

CAN OTHERS TRACK ME WHILE DRIVING?

HIGH DEGREE OF ANONYMITY (IDENTITY HIDING)
REQUIRED TO PREVENT TRACKING



Hazard
Warning

SECURING V2X COMMUNICATIONS

MESSAGE AUTHENTICATION VIA DIGITAL SIGNATURES



Authentication via digital signature

Based on

Hash function → unique identifier for message

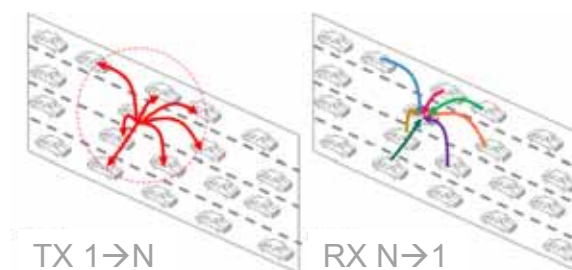
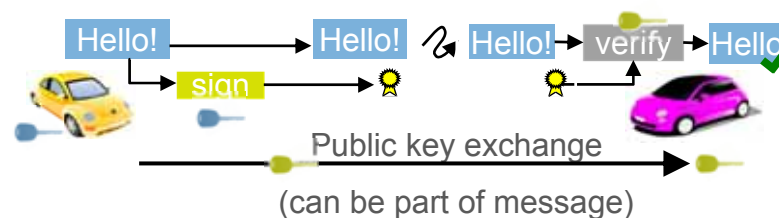
Public-key crypto - two keys (private/ public)

IEEE (US) & ETSI (EU) standards mandate
Elliptic Curve Digital Signature Algorithm

RSA signatures too long

Comparable security strength of

RSA3072b ~ ECC256b ~ AES128b



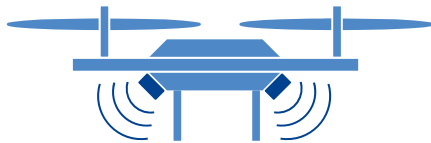
	TX	RX
Operation	Signature generation	Signature verification
Rate	Low: $\leq 20 / s$	High: 400-1000 / s
Security level	High: protection of private keys (car identity)	Modest: only non-secret data

Sense and Avoid: Radar

Stamp size Radar Sensors



- Collision Avoidance
 - Buildings
 - Wires
 - Other Drones
 - Birds
- Measuring altitude
- Typically 1-3 Radars per drone



Note: permission of FAA & FCC pending on use of 76-81GHz spectrum by UAV's

Dolphin one-chip Radar Frontend as key component in Drone Radars

- Small size
- Low weight
- Low power consumption

Prototype available at InnoSenT

Sense and avoid: Vision systems



One SW Platform from Smart Sensors to Fusion Unit

Safe. Secure. Reliable.

- mC Families with true automotive reliability
- High Performance/Power, and True Safety
- Guaranteed Security and Connected Network
- Ecosystem of SW and Tools (mCAL-Linux-Safe OS)



Thermal and visible imaging

UAV

Security and safety



GEOFENCING TECHNOLOGY

A geofence is a virtual boundary around a real-world geographical area (e.g. airport). Rules to avoid no-flying zones.

1. Receiving of trusted geofencing data
2. Safety: GPS (global positioning system) or RFID (radio frequency identification) to enforce a given geo-fence

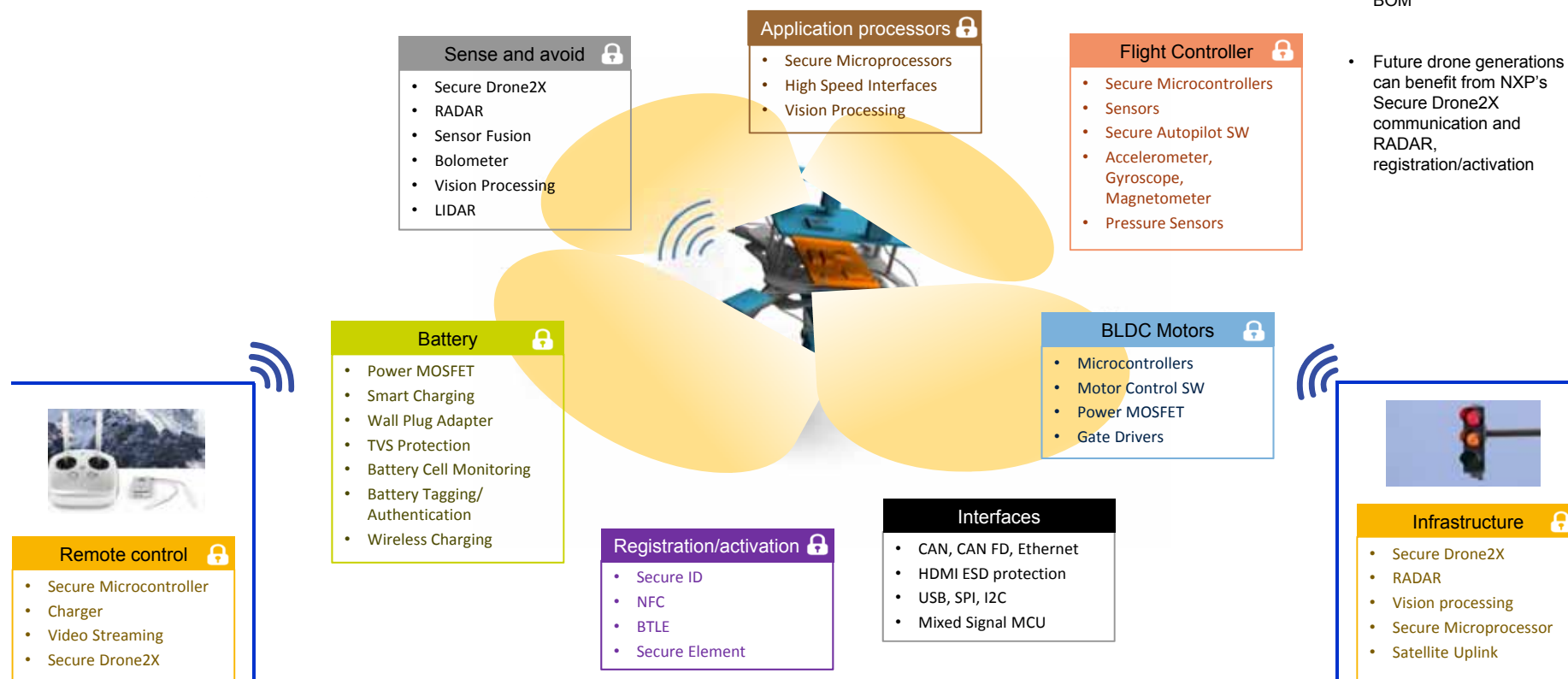


Source: Synergy World

- ⇒ **Required: joint definition of**
1. **Unique UAV-ID for Authentication of UAV in the cloud**
 2. **Trusted Geo-fencing Data (Encrypted Data)**
 3. **Secure Data Upload: Secure Communication between UAV and (national) Server**
 4. **Central flight log**

Summary NXP Technologies for UAV

UAVs can be fully powered by NXP



Comments

- Current portfolio fits very well with current Drone BOM
- Future drone generations can benefit from NXP's Secure Drone2X communication and RADAR, registration/activation

www.nxp.com/UAV



Summary

Connected UAV require state of the art technologies

- Autonomy: Radar, V2X communication, Vision, Sensor fusion, IR, high accuracy positioning.
- Security: Registration, authentication
- Safety: Geofencing, limp home, Safe operational
- Privacy: Video encryption, privacy preserving video analysis.



*Thank
You*

www.nxp.com/UAV

Mobile networks for safe integration of Unmanned Aerial Vehicles (UAV) in the airspace

Michiel Dirven

Head of Customer Business Team

Nokia





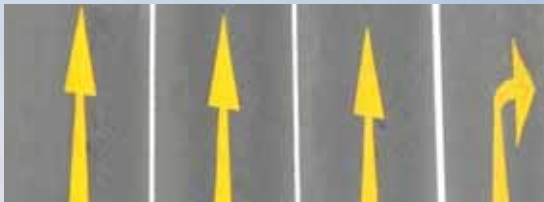
RAILWAYS



POWER UTILITIES



PUBLIC SAFETY



HIGHWAYS



OIL & GAS



STATE & LOCAL AUTHORITIES



AIRPORTS



DEFENSE

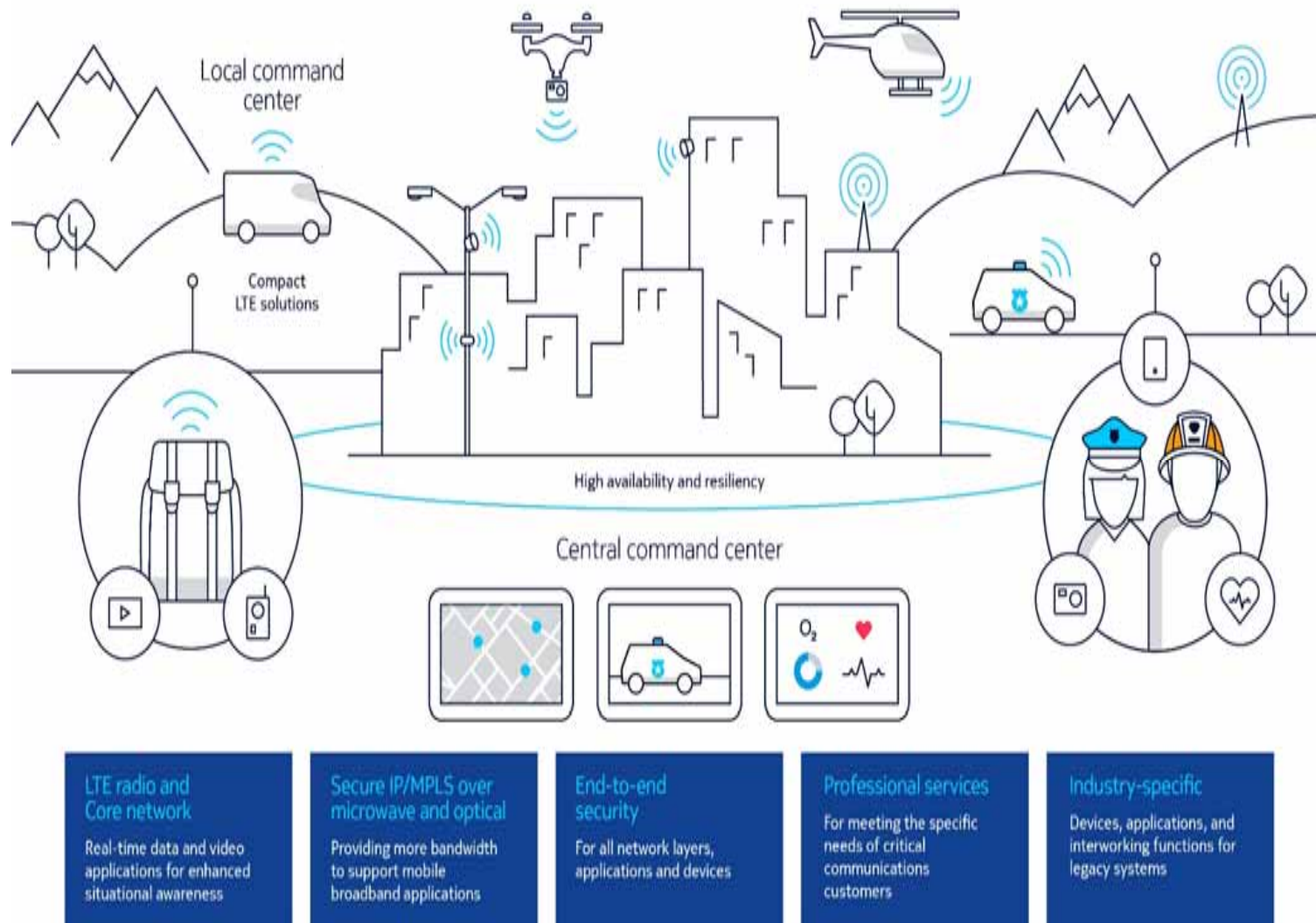
TRANSPORTATION

ENERGY

PUBLIC SECTOR

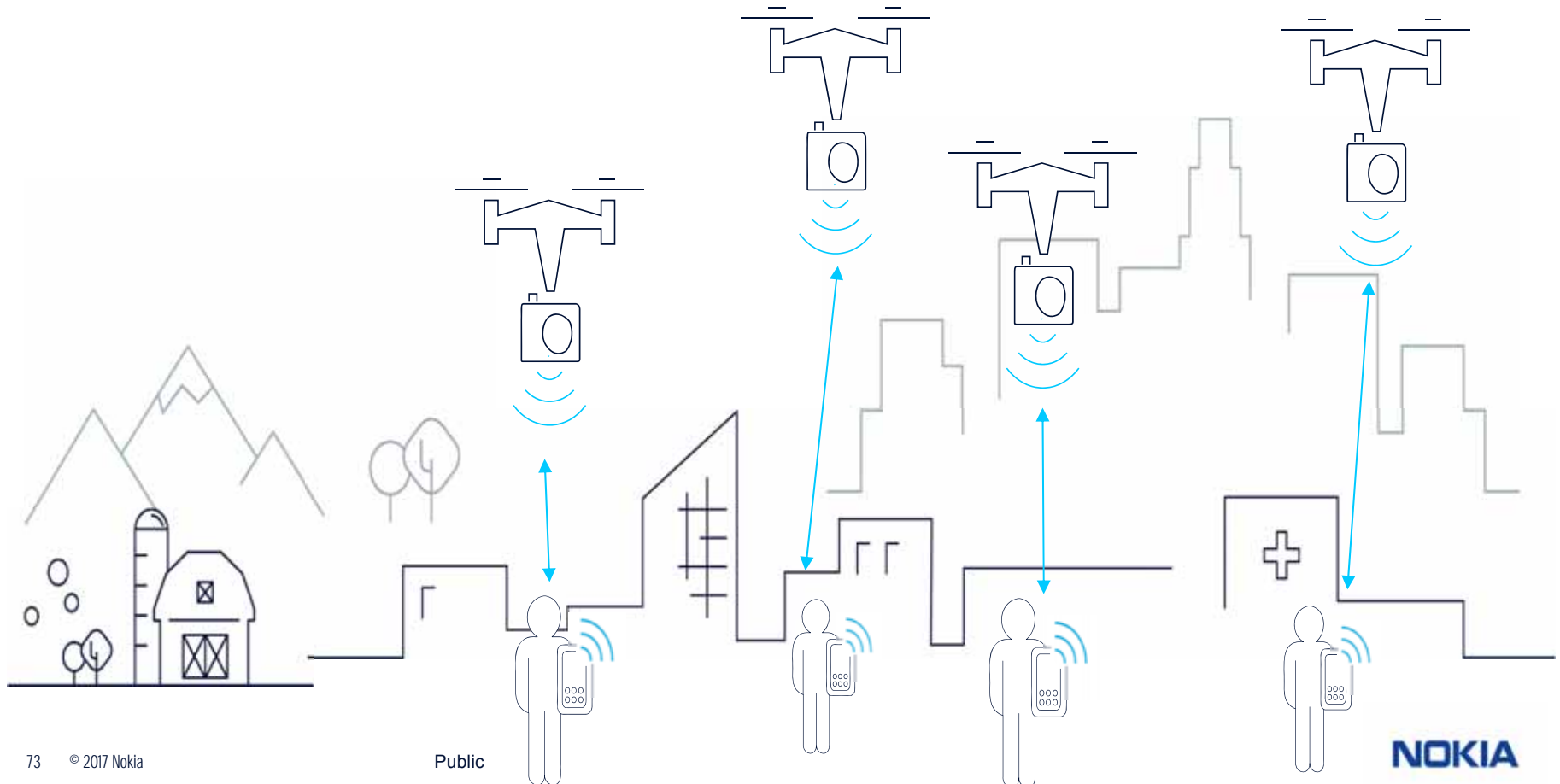
Providing mission and business critical services

Networking solutions for all components



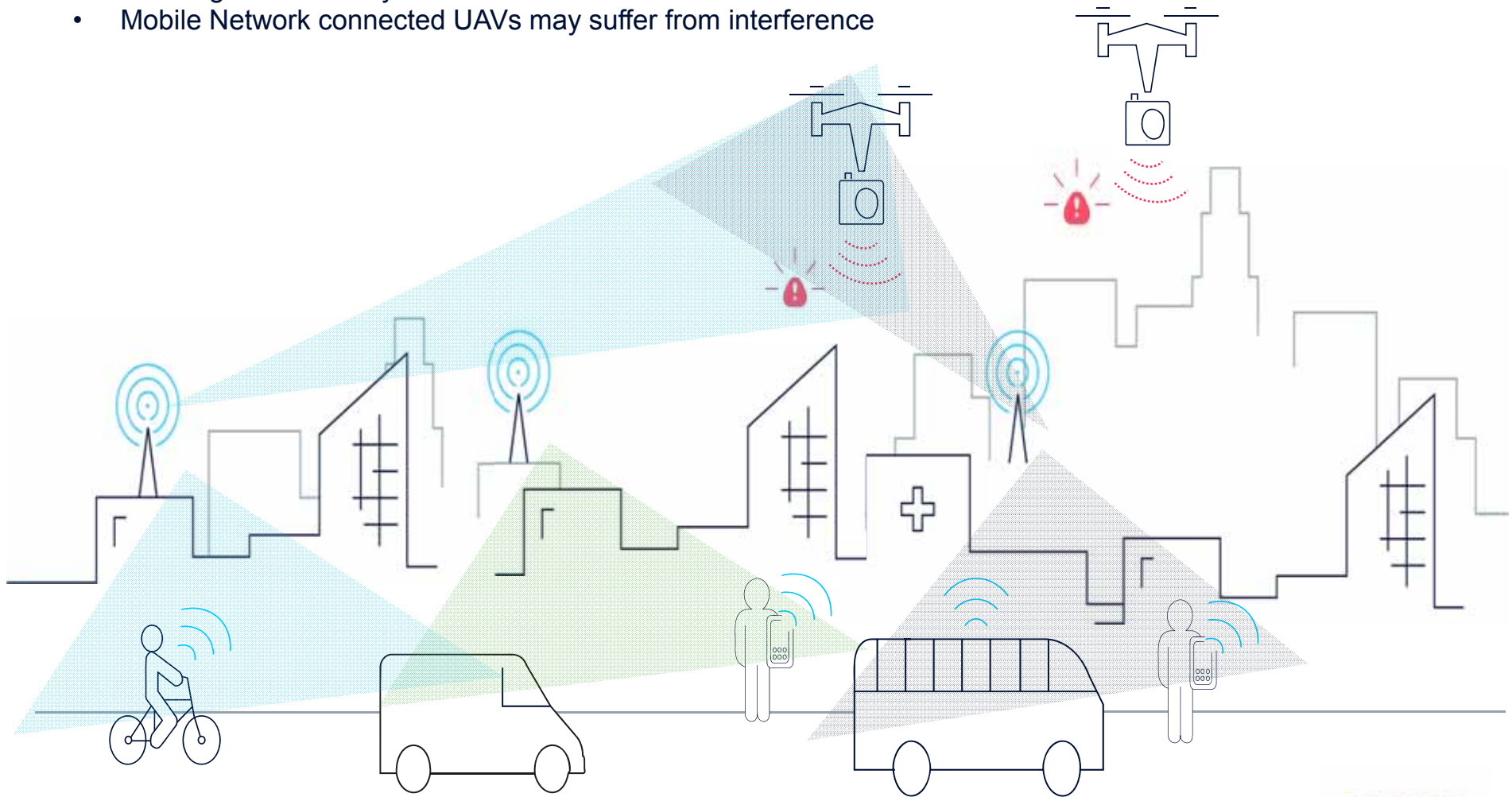
Today UAVs are operated manually

- Pilot controls UAV manually via peer2peer radio link
- UAVs are not connected to the Internet
- UAVs position cannot be monitored remotely
- UAVs cannot exchange data towards cloud resources
- No centralized intelligence



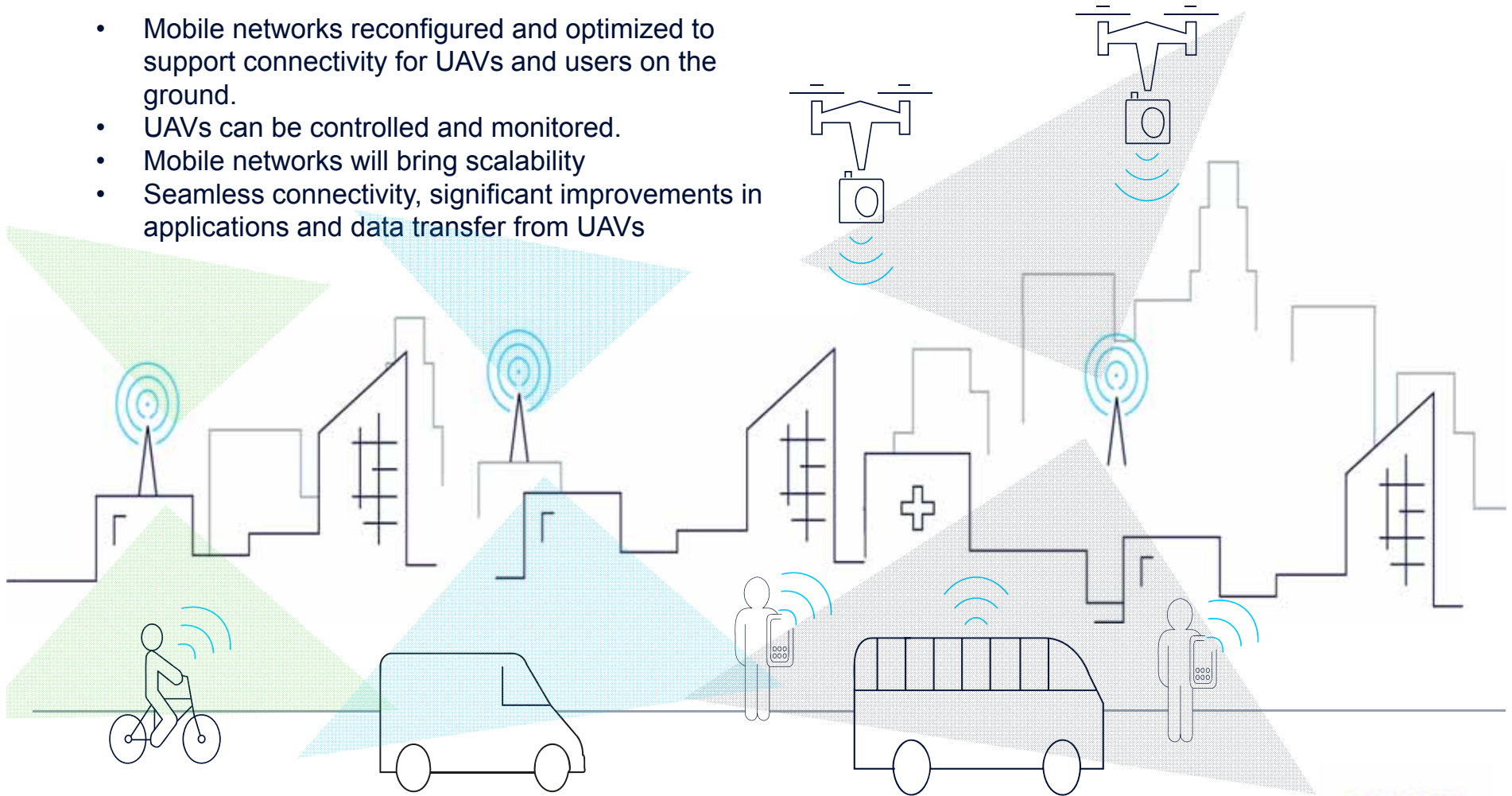
Today mobile networks are not optimized for UAVs

- Networks are deployed for ground-level coverage – 1,5 m above a ground
- Coverage and mobility are limited in altitude
- Mobile Network connected UAVs may suffer from interference



Targets for mobile network design to enable connected Unmanned Aerial Vehicles (UAV)

- Mobile networks reconfigured and optimized to support connectivity for UAVs and users on the ground.
- UAVs can be controlled and monitored.
- Mobile networks will bring scalability
- Seamless connectivity, significant improvements in applications and data transfer from UAVs

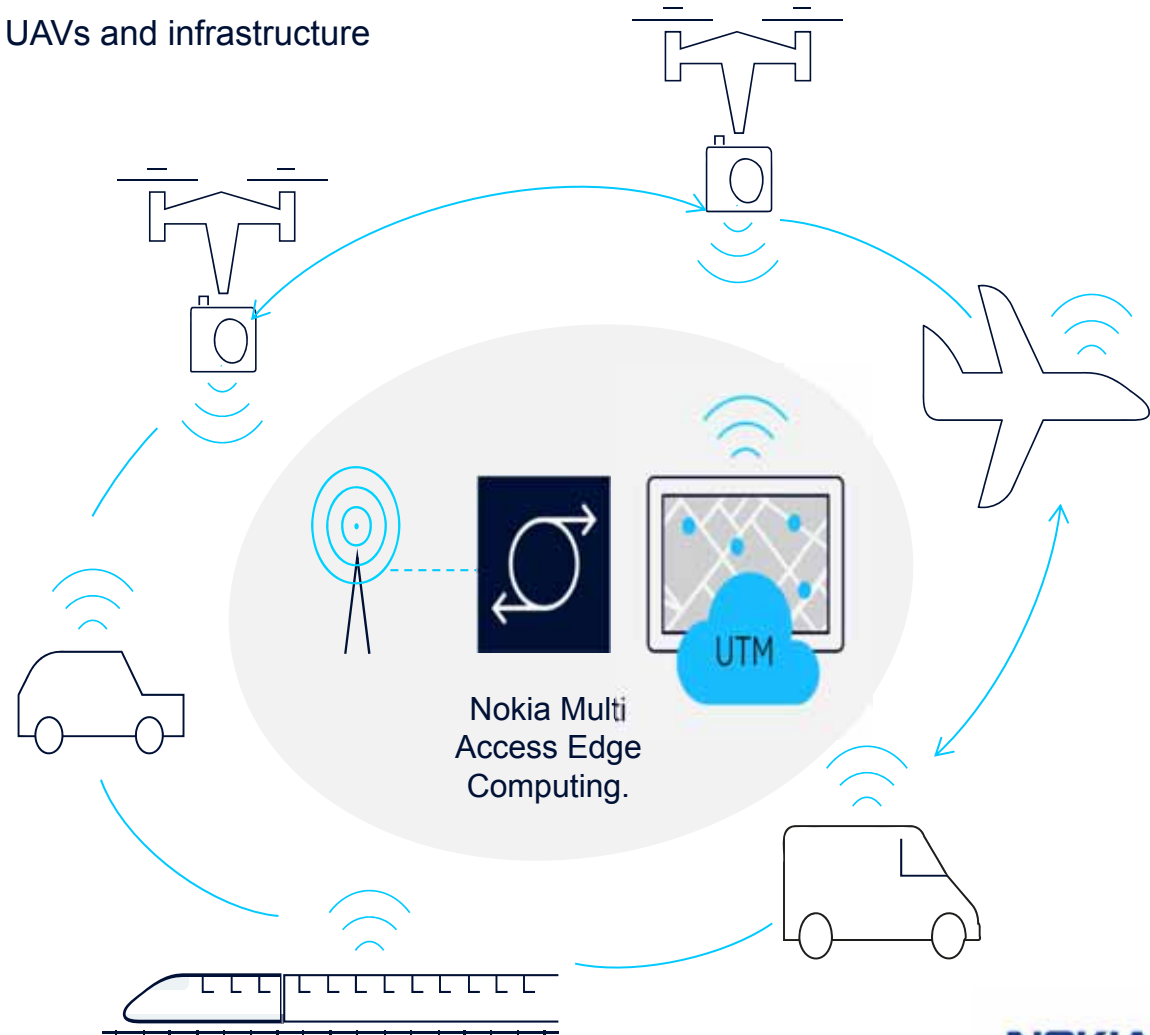


Nokia Multi Access Edge Computing (MEC) enables UAV Control and beyond

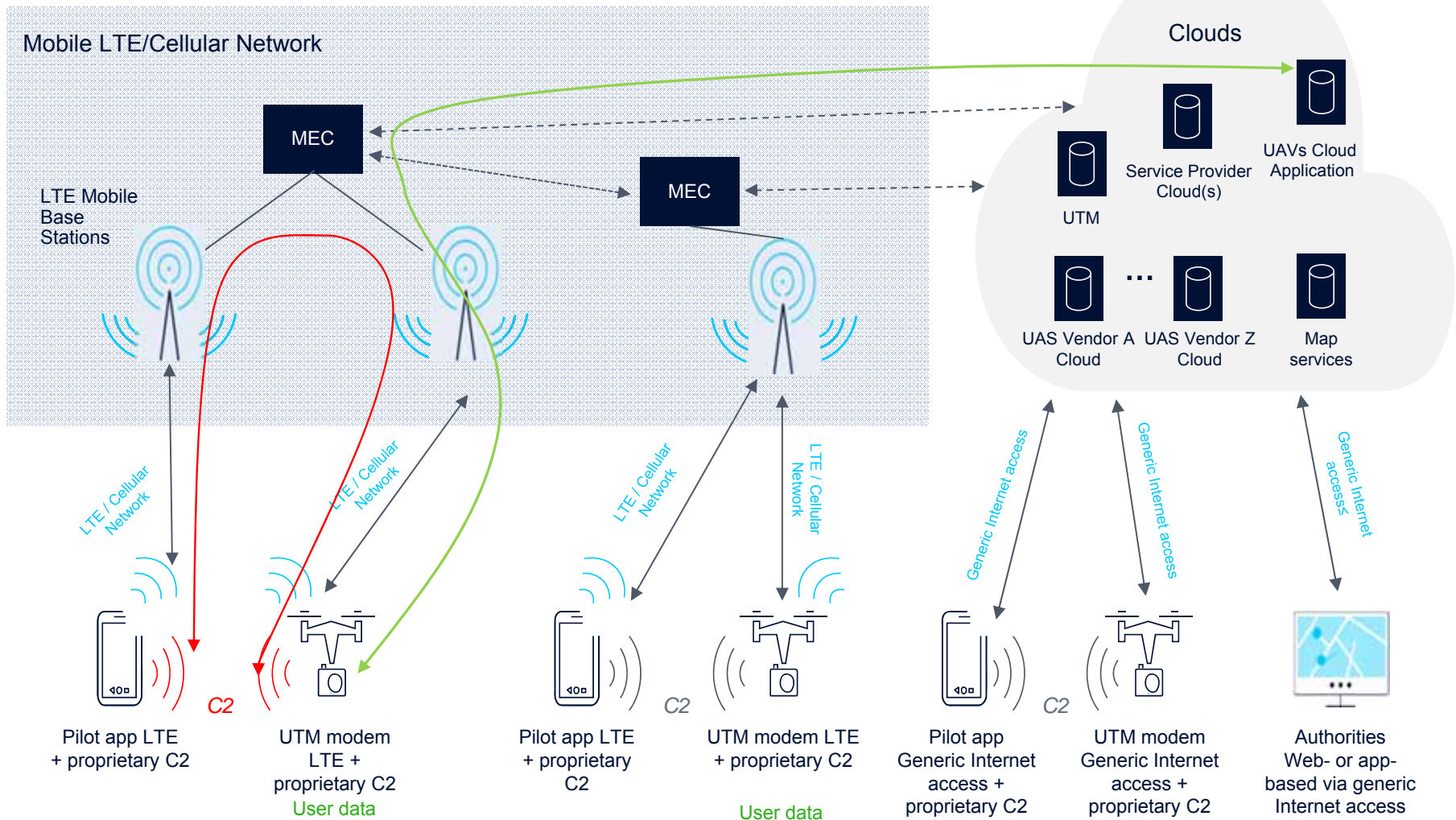
Low latency communications between UAVs and infrastructure

Nokia Multi Access Edge Computing

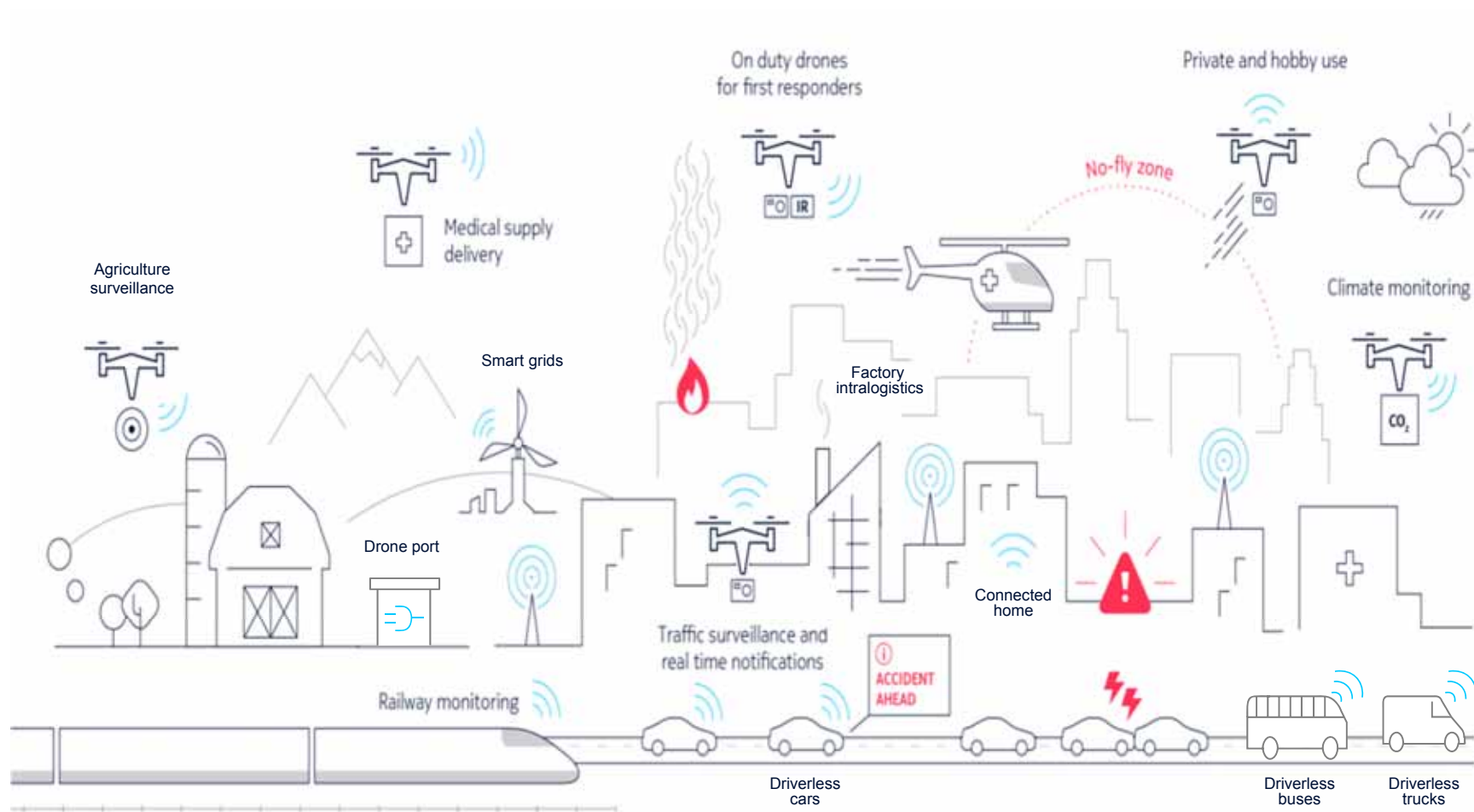
- Vehicle to anything (V2X) communication
- Low latency communication
- Data analytics platform
- Video analytics algorithms



UTM Architecture based on Multi Access Edge Computing (MEC)



Connecting society: Internet of Drones is the future



Next-generation network for mission-critical and smart city services

2016: Nokia selected by Dubai government security networks operator Needa



Create safe and smart city for residents and visitors

Applying IoT for emergency services support, e-government, transportation and healthcare

5G-ready, mission-critical network

High-bandwidth voice, video and other data applications for mission-critical services IoT





Drones in SmartCities U-Space

Food for Thought

U-Space Workshop, The Hague, April 20th, 2017

Andreas Lassak, Deutsche Telekom AG



LIFE IS FOR SHARING.

What to talk about...



SESAR

reTHINK

mySMARTLife

U:CON

Current initiatives Running



Goal

- Drone specific addendum to ATM Master Plan

Ambition

- All kinds of environments⁽¹⁾
- All types of missions
- All types of users⁽²⁾
- VLOS & BVLOS
- Above VLL⁽³⁾

IMPACT

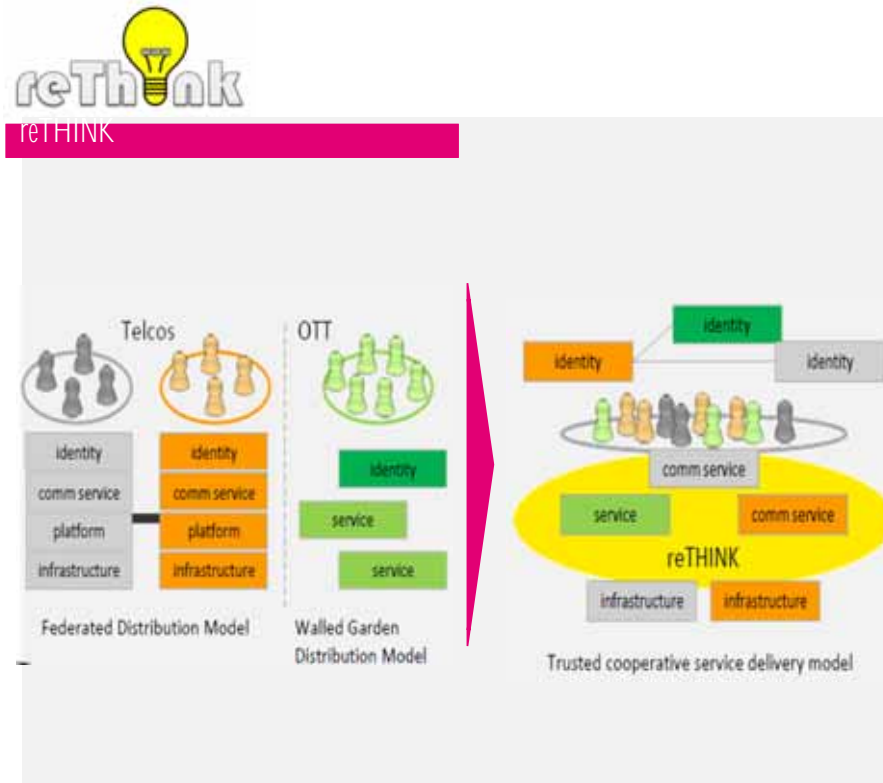
- Disrupt ATM with new technologies
- Open path to broad drone usage
- Make airspace accessible practically for everybody

(1): Urban, Sub Urban, Rural, regardless of the density of population

(2): Civil - especially open and specific categories, Commercial & Leisure, Military, State & Public

(3): Very Low Level

Current initiatives Running



Goal

- Ecosystem for Cross Domain Communication

Ambition

- From Silos to Hyperties⁽¹⁾
- Context related Identities in one Service
- Bring & Manage Own Identities

IMPACT

- Support personal data agnostic business cases
- Emancipated communication of Things and Humans
- Easier cooperation between Things and Humans

(1): Hyperlinked Entities

T · Systems ·

Current initiatives Running

H2020 EU co-funded lighthouse project



reTHINK



Goal

- Transition of EU cities towards a new concept of Smart Life and Smart Economy

Ambition

- Reduce CO2 of cities
- Renewable energy sources
- Environmentally friendly
- Refurbishment of buildings
- Clean transport
- Supporting ICT solutions

IMPACT

- Develop concept of Smart People in „Inclusive Cities“
- Enable Smart Economy

(1): Project Cities: Nantes, Hamburg, Helsinki

Current initiatives Running

A project by



U:CON

U:CON



Goal

- Showcase the connection of drones via standard mobile networks with a UTM-demonstrator by end of 2017.

Ambition

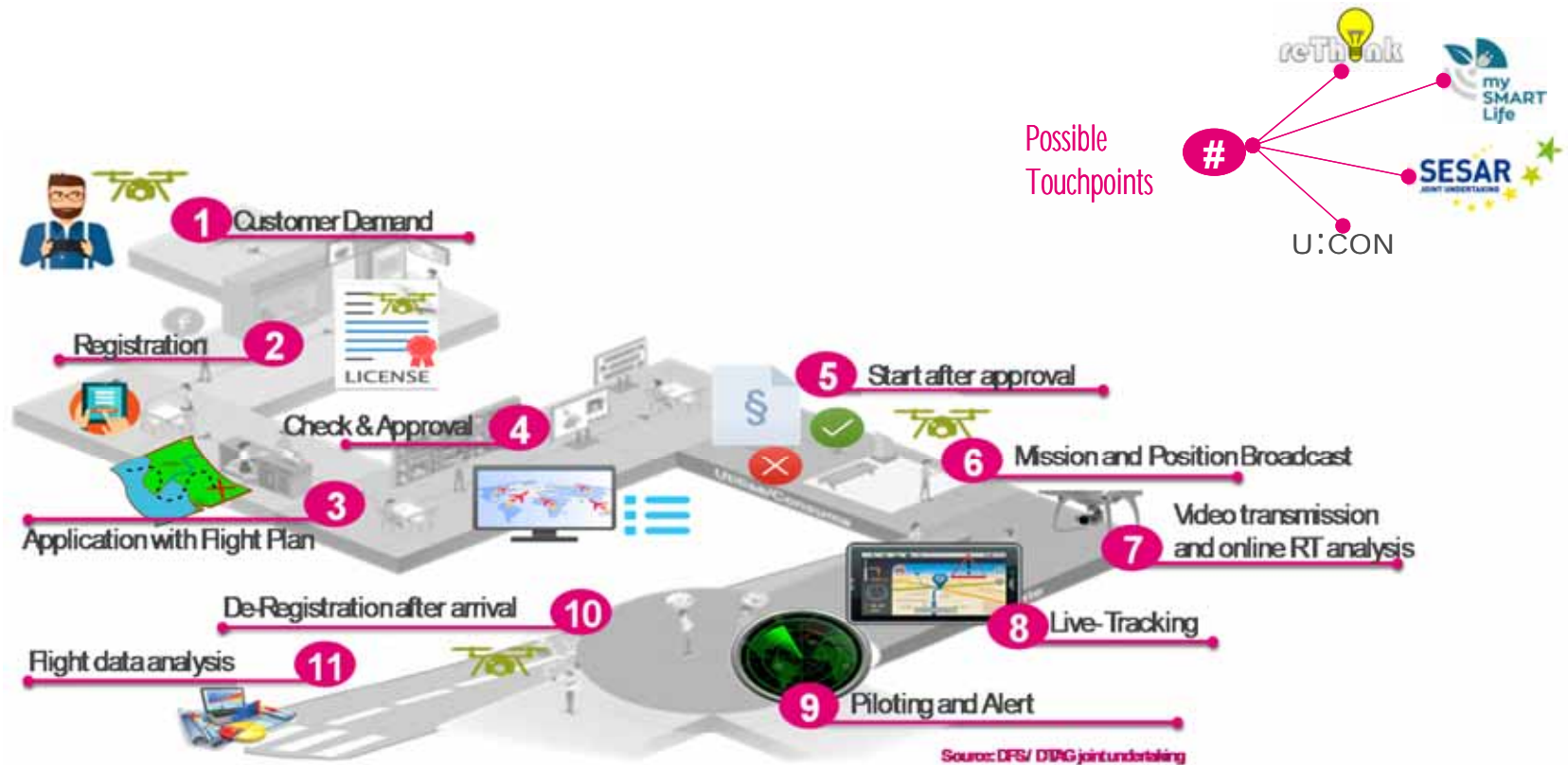
- ConOps development
- System Requirement
- Prioritization of aspects
- Technology
- Partners

IMPACT

- Save integration of drones into airspace
- Economic
- Boost Smart Drone Economy

(1): Project Cities: Nantes, Hamburg, Helsinki

Customer Drone Journey



T Systems

Relevant Smart City Drone Use Cases

Real Time Traffic & Transport Mgt

- Accident clearance and SAR Mission support
- Ad-hoc infrastructure (e.g. Network Nodes or Hyper Lightning Spots)
- Personal public short range transport (Ehang, Airbus..)
- Delivery of goods

Security & Safety

- Fast Crime Scene Clearance
- Risky Area Patrolling
- Suspect Observation
- Smart Home reaction unexpected occasions
(e.g. Intrusion detection -> automatic lift up of observation drone -> online video link to security control center)

Conclusio

All four initiatives...

- Impact social life
- Implement disruptive technologies
- Relate to digital transformation of cities and society
- Generate new businesses with new business models
- Have European relevance

Major Cross Initiative PROs

- Overcome barriers faster
- Enable more investment
- Avoid interface clashes
- Increase level of security already by design
- Increase public acceptance

RECOMMENDATION

Evaluate if a closer cooperation could be beneficial for all parties



Contact
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+49 171 2035966



Connected drones: Q&A

20 April 2017, the Hague





Autonomous drones

20 April 2017, the Hague





DEFENSE & SPACE

SESAR JU U-Space Workshop

URBAN AIR MOBILITY : **FLYING CARS**

Building the future of flight.

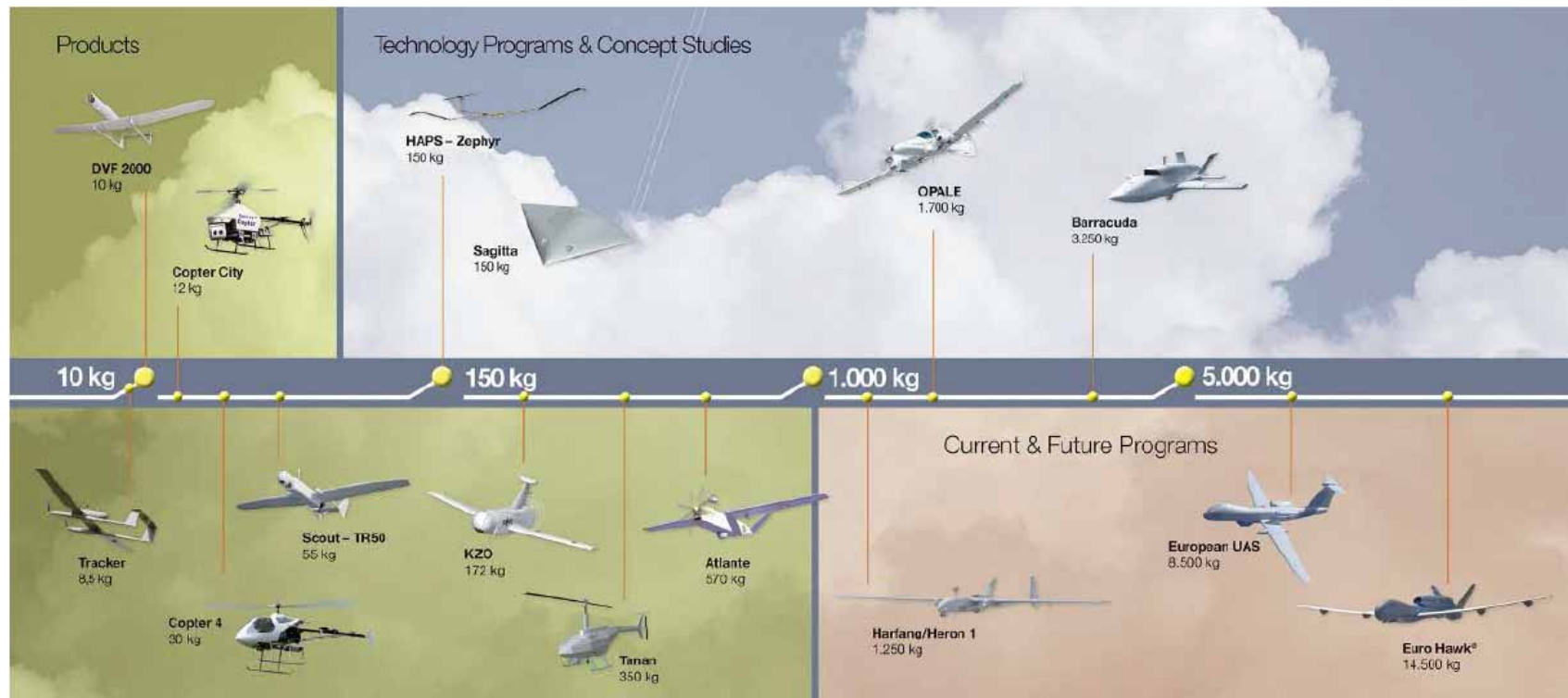
The World Forum, The Hague , Netherlands

April 20th 2017

AIRBUS

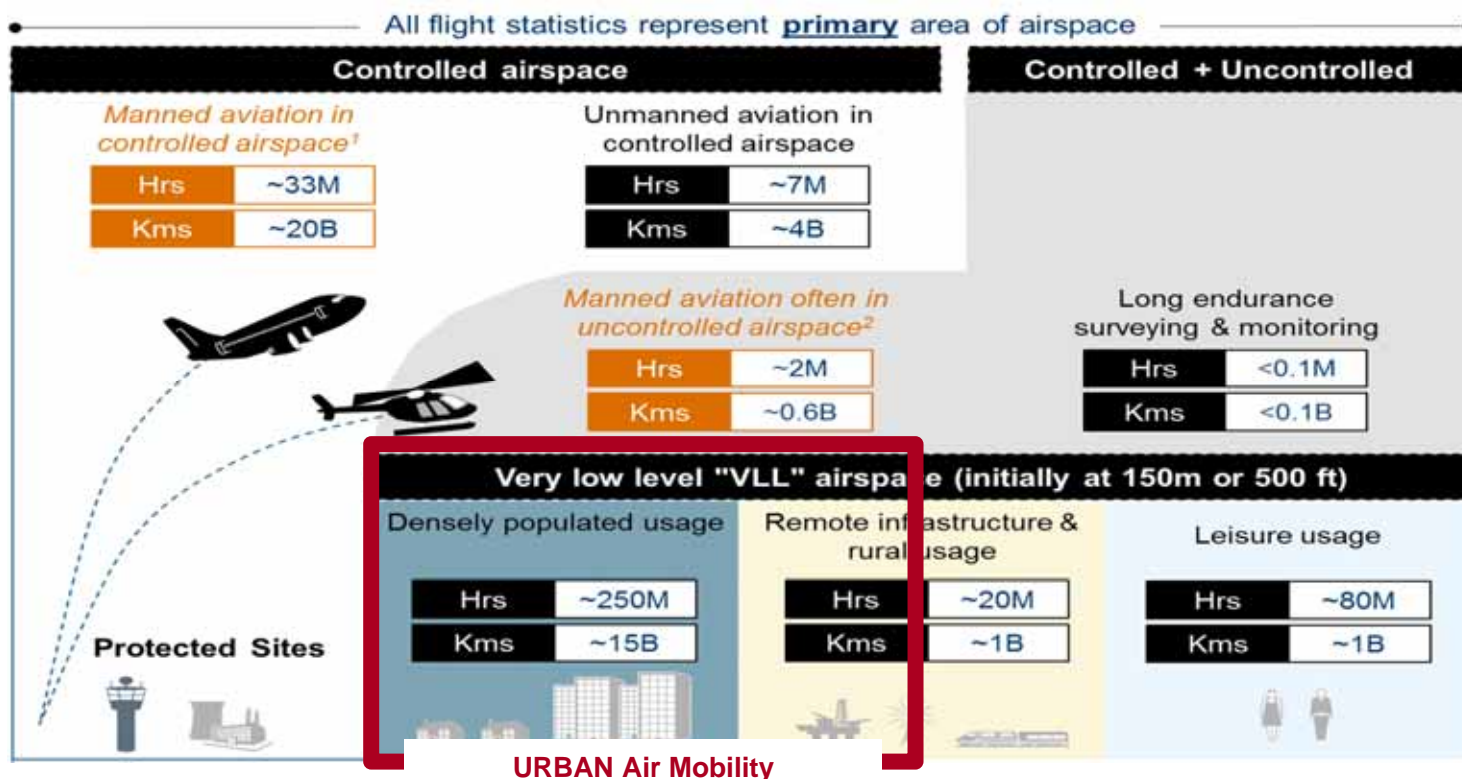
AIRBUS's Experience in the Field of UAVs

DEFENSE & SPACE



SESAR View of RPAS use of AirSpace (in 2050)

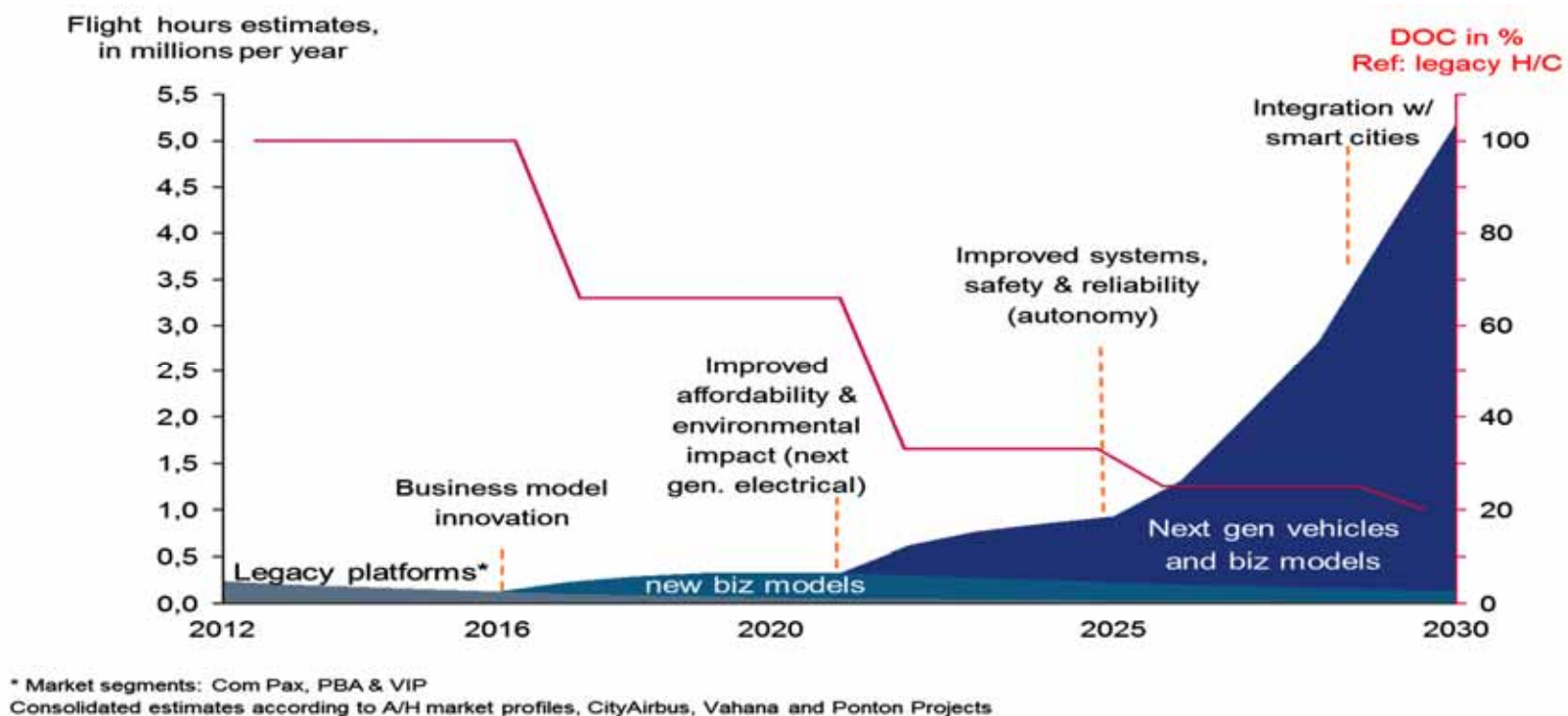
DEFENSE & SPACE



Urban Air Mobility will become a Premium Offering to a Mass Market Solution

DEFENSE & SPACE

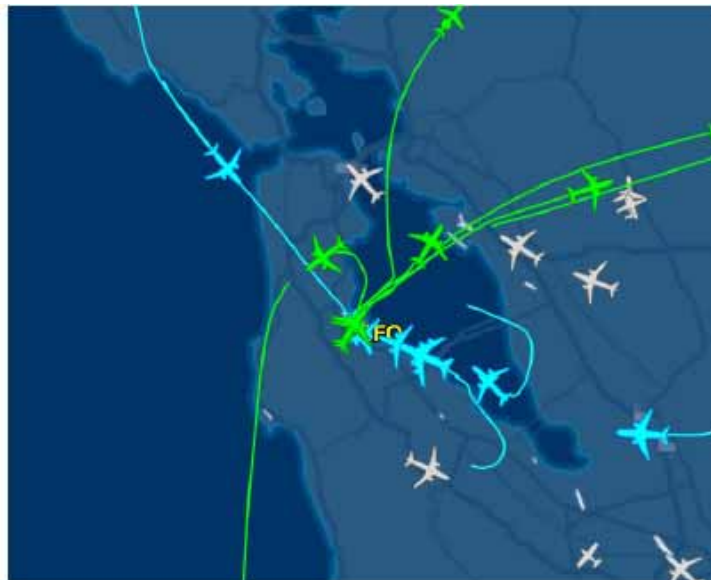
Airbus Confidential



Exponential market growth is predicted beyond 2030

Example of Traffic Density in 2035: Urban Air Mobility

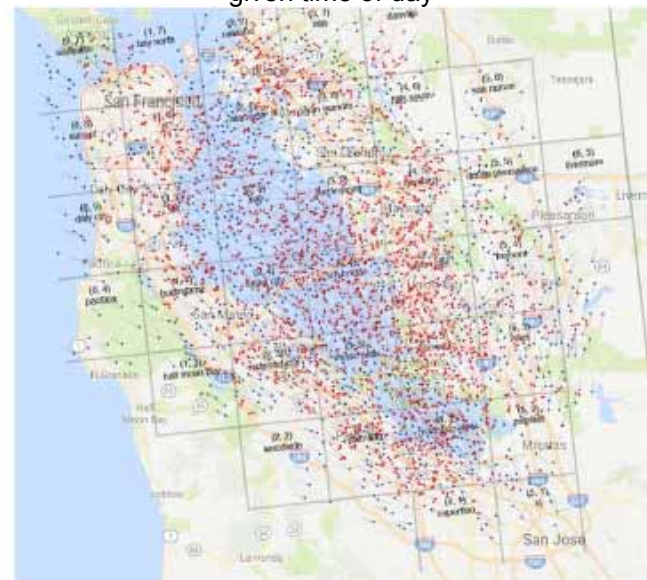
DEFENSE & SPACE



Traffic over the SF Bay Area
(11 am Pacific, 23Feb2017)



~5000 vehicles flying over SF Bay Area at any
given time of day



Projected UAS traffic over the SF Bay
Area In 2035

DEFENSE & SPACE

Ongoing demonstration in Urban Last mile delivery

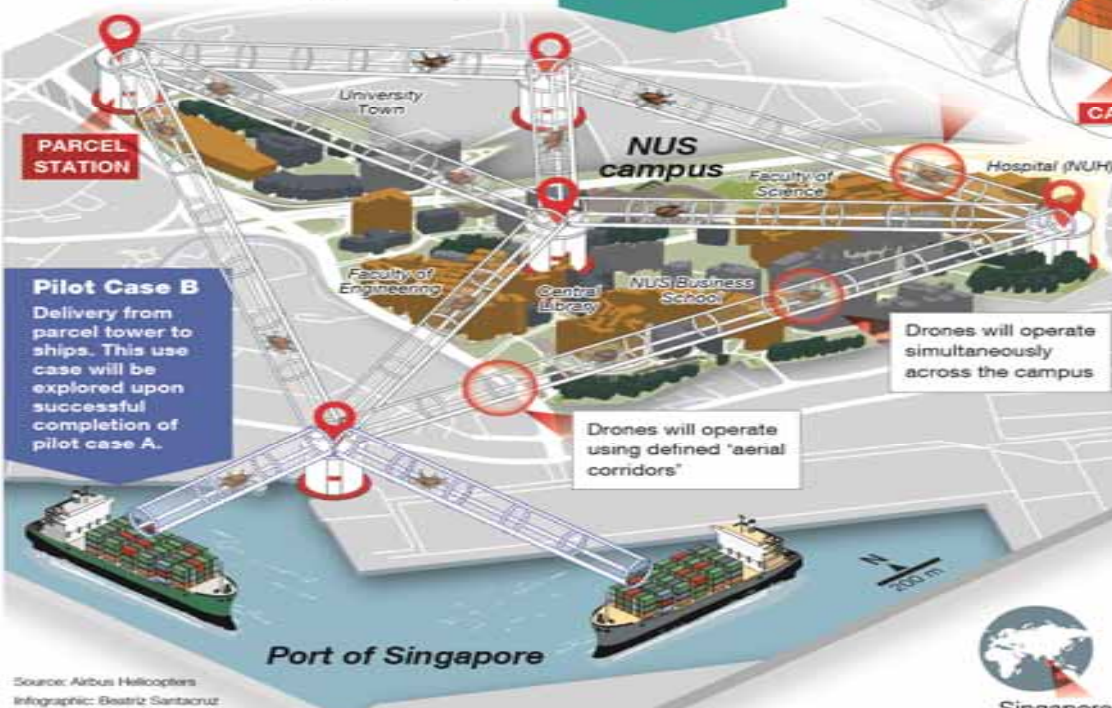
SKYWAYS

Urban last-mile delivery solution

Airbus' Skyways project aims to provide efficient, seamless delivery of small parcels to students and facilities via drones across the National University of Singapore's campus.

Pilot Case A

Delivery of parcels on the NUS campus through Skyways network.



1 The Skyways drone is an octocopter that carries air transport containers loaded on its underside.

2 The drone flies a fully automated route, landing on a designated landing pad.



3 Once landed, the drone is unloaded automatically.

4 End customers receive a delivery notification on their mobile phone to come pick up the parcel at the parcel station.



AIRBUS

E-VTOL Start-Ups are Developing UAM Prototypes

DEFENSE & SPACE



AIRBUS Demonstrators

DEFENSE & SPACE



VAHANA – Target Demo Flight in 2018



CityAirbus – Target Demo Flight in 2019

Pop.Up – A *Flying Car* Concept Study

DEFENSE & SPACE



Presented at the 87th Geneva International Motor Show 2017 with a strong interest by the car industry

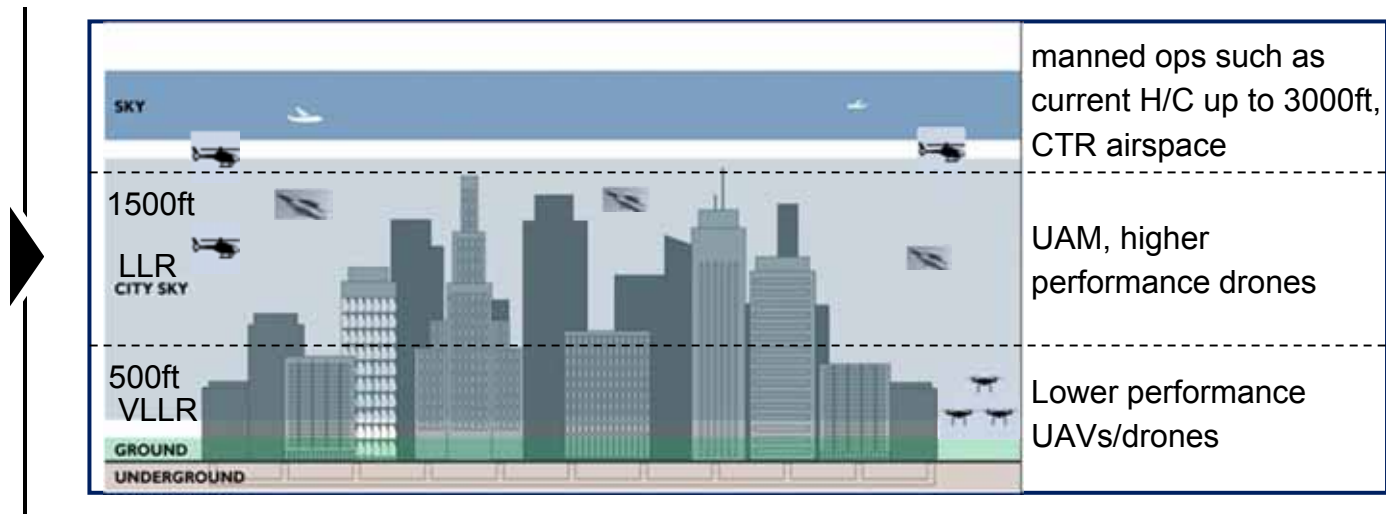


Altitude band for traffic segregation and to meet performance and safety needs

DEFENSE & SPACE

Selection of the altitude band according to:

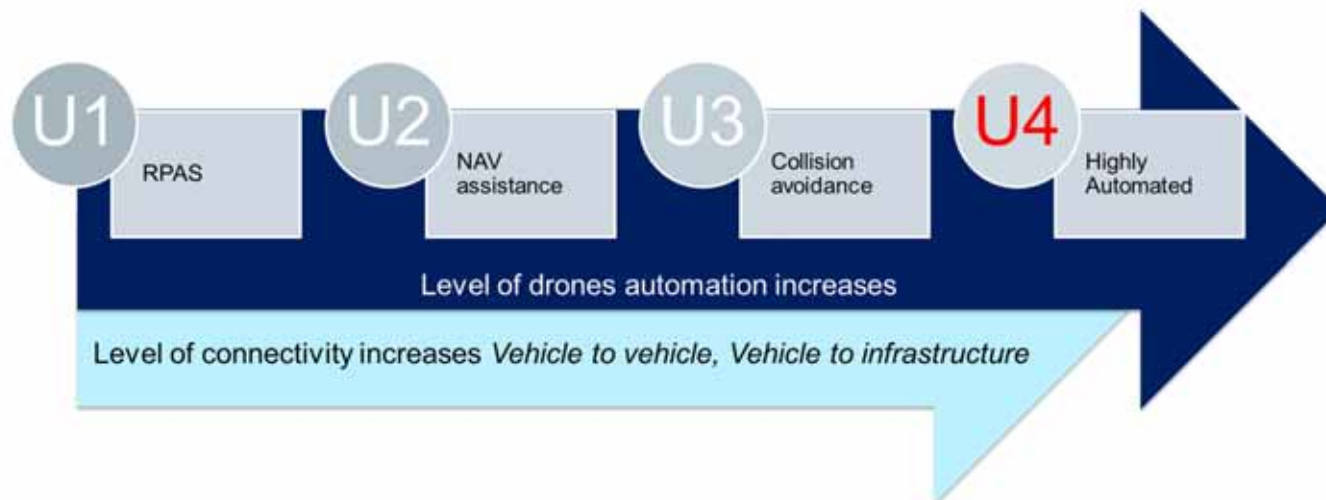
- vehicle performance
- safety reasons
- segregate from drones, helicopters and other manned traffic



Ensure specific drone VLL route network to de-conflict with UAM approach paths to helipads

Not a Dream – But We Need U4!

DEFENSE & SPACE



**Airbus fully committed to fill the gap :
Providing technology / connectivity
From long term vision
...To short term actions**



DEFENSE & SPACE

Next Steps

REGULATION

STANDARDS

SAFETY

UTM DEFINITION

ENVIRONMENT

SOCIAL ACCEPTANCE

SAFE INTEGRATION

ETC.

AIRBUS

AIRBUS



Questions?

© 5th Element

AIRBUS

AUTONOMOUS DRONES

SESAR U-SPACE WORKSHOP / The Hague, NL – April
20th, 2017



Philippe Duvivier
Corporate Business Development
Parrot Drones

Autonomy

System Abilities

- Adaptability
- Cognitive Ability
- Configurability
- Decisional Autonomy
- Dependability
- Interaction Ability
- Manipulation Ability
- Motion Ability
- Perception Ability

Source : Robotics 2020, Multi-Annual Roadmap, For Robotics in Europe, Horizon 2020 Call ICT-2016 (ICT-25 & ICT-26), Release B 03/12/2015

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Decisional Autonomy

Description

- The ability of the robot to act autonomously
- Nearly all systems have a degree of autonomy
- It ranges from the simple motion of an assembly stopped by a sensor reading, to the ability to be self sufficient in a complex environment.

Source : Robotics 2020, Multi-Annual Roadmap, For Robotics in Europe, Horizon 2020 Call ICT-2016 (ICT-25 & ICT-26), Release B 03/12/2015

Decisional Autonomy Levels

- Level 0 - No autonomy
- Level 1 - Basic action
- Level 2 - Basic decisional autonomy
- Level 3 - Continuous basic decisional autonomy
- Level 4 - Simple autonomy without environment model
- Level 5 - Simple autonomy with environment model
- Level 6 - Task autonomy
- Level 7 - Constrained task autonomy
- Level 8 - Multiple task autonomy
- Level 9 - Dynamic autonomy
- Level 10 - Mission oriented autonomy
- Level 11 - Distributed autonomy

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Decisional Autonomy Level 4-5

Level 4 - Simple autonomy without environment model

The system uses perception to make moment to moment decisions about the environment, and so controls interaction with the environment in order to achieve a predefined task.

Level 5 - Simple autonomy with environment model

Source : Robotics 2020, Multi-Annual Roadmap, For Robotics in Europe, Horizon 2020 Call ICT-2016 (ICT-25 & ICT-26), Release B 03/12/2015

Decisional Autonomy Level 4-5

Level 4 - Simple autonomy without environment model

The system uses perception to make moment to moment decisions about the environment, and so controls interaction with the environment in order to achieve a predefined task.

Level 5 - Simple autonomy with environment model

Source : Robotics 2020, Multi-Annual Roadmap, For Robotics in Europe, Horizon 2020 Call ICT-2016 (ICT-25 & ICT-26), Release B 03/12/2015

Perception



Perception



Situational Awareness



Predefined Task



GRID MISSION

Best for 2D maps



DOUBLE GRID MISSION

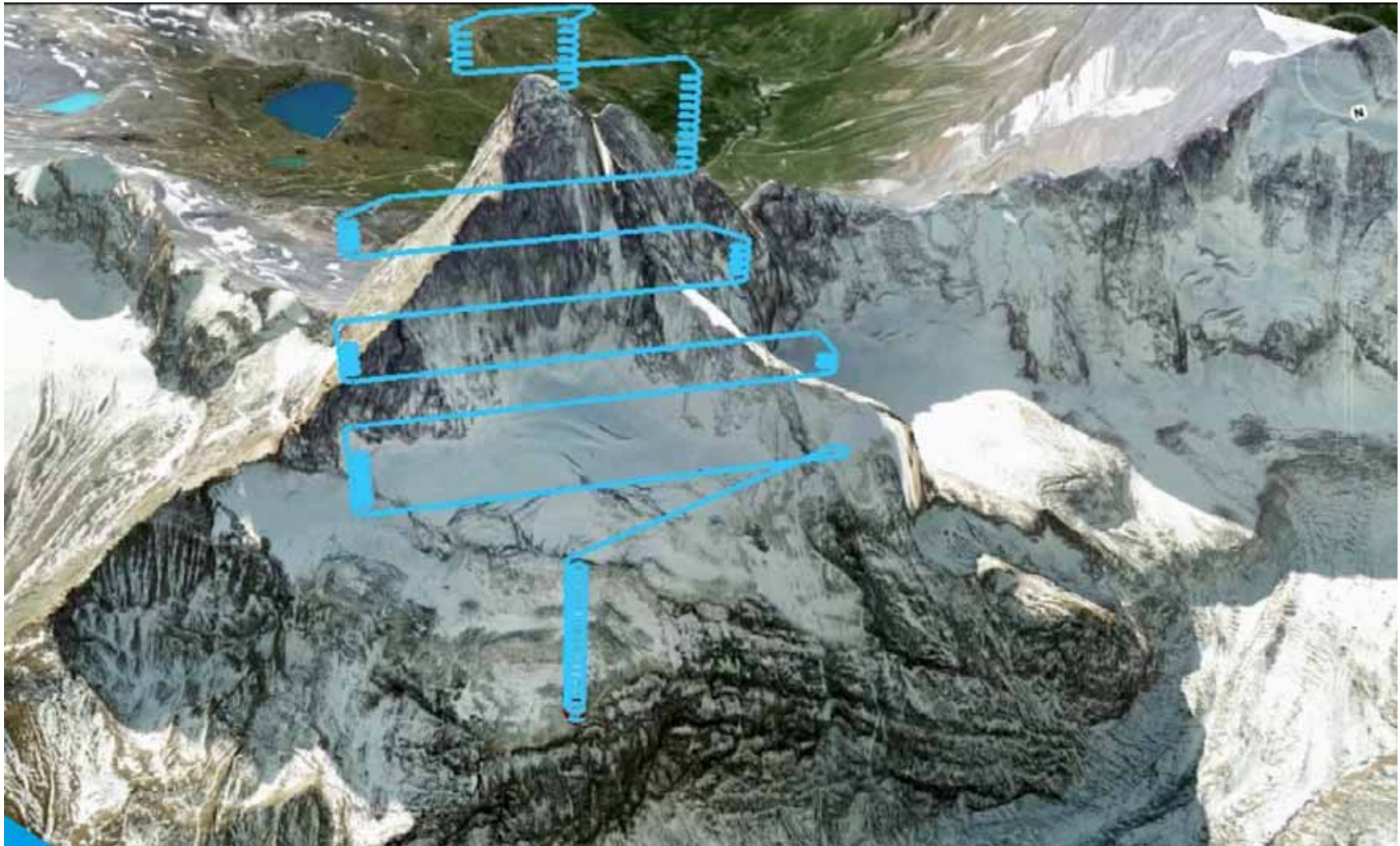
Best for 3D models



CIRCULAR MISSION

Best for single 3D models

Predefined Task



3D Modeling



3D Modeling

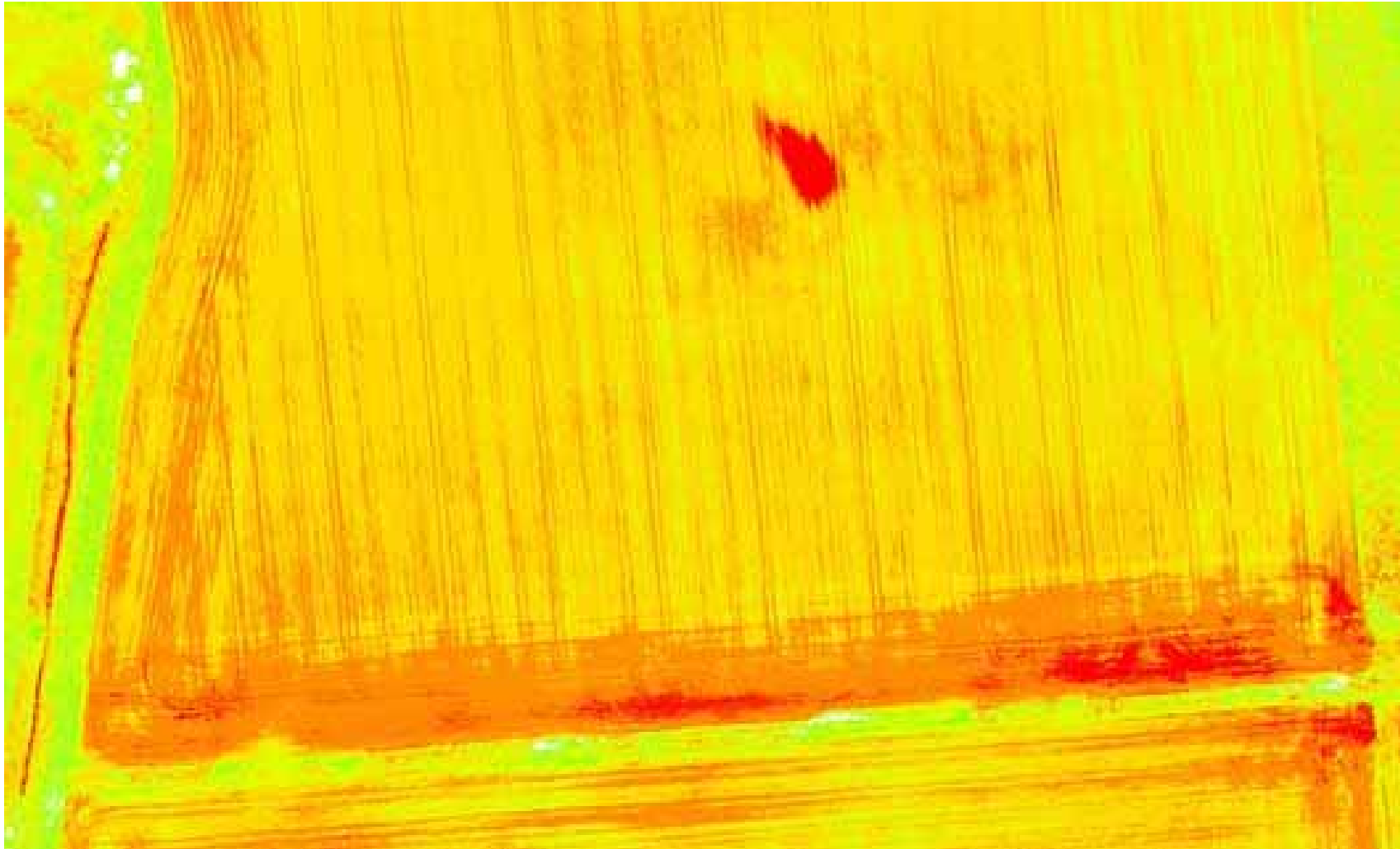


Vertical Mapping



NDVI Maps

AIRINOV



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SESAR
JOINT UNDERTAKING

U-Space Workshop

Michael Drobac

Small UAV Coalition
Drone Alliance Europe
Akin Gump Strauss Hauer & Feld LLP

akingump.com

Autonomous UAS Operations

Perspective from the U.S.

Small UAV Coalition

Verizon
Ventures



PRECISIONHAWK

kespry

AIRMAP

GoogleTM [x]

amazon
Prime Air



T-Mobile

Walmart

Flirtey
stuff by air anytime anywhere



PROVEN.cc



LINKING THE
WORLD

INTERNATIONAL HUMANITARIAN AID ORGANIZATION



Aerwaze

Small UAV Coalition Mission

- * **Commercial applications represent the long-tail of the UAS industry.**
 - * One report estimates the value of the global market for UAS solutions at more than \$127 billion.
- * **Support and advocate for law and policy changes that embrace and encourage industry growth, including:**
 - * Development and implementation of UTM framework.
 - * Routine operations BVLOS, over people, and at night – with varying degrees of autonomy – without waiver/approval process.
 - * Carriage and delivery operations.
 - * Flexible spectrum use policies to leverage commercial mobile networks, satellite and unlicensed.
 - * National standard for UAS regulations that promotes safety and enables innovation.

Current US Regulatory Framework

- * **Small commercial rule (Part 107) implemented August 2016 – just the first step:**
 - * Remote pilots must pass Aeronautical Knowledge Test.
 - * Maximum altitude of 400 ft AGL (except 400 feet above structures).
 - * 55 lb limit (not waivable).
 - * Waivers required for operations BVLOS, at night, over people, and to operate multiple UAS per pilot.



Looking Ahead

- * **Additional Rulemakings**

- * Draft rule for operations over people scheduled to be released by end of 2016 – stalled indefinitely due to “national security concerns.”
- * Piecemeal approach means next planned rulemaking (expanded operations, including BVLOS) stalled as well.

- * **Remote Identification Aviation Rulemaking Committee (ARC)**

- * Multistakeholder body tasked with developing standards for remotely identifying and tracking UAS within 3 months.
- * Safety and security key to integration, but remote identification only part of the puzzle.

UTM: Unlocking Autonomy

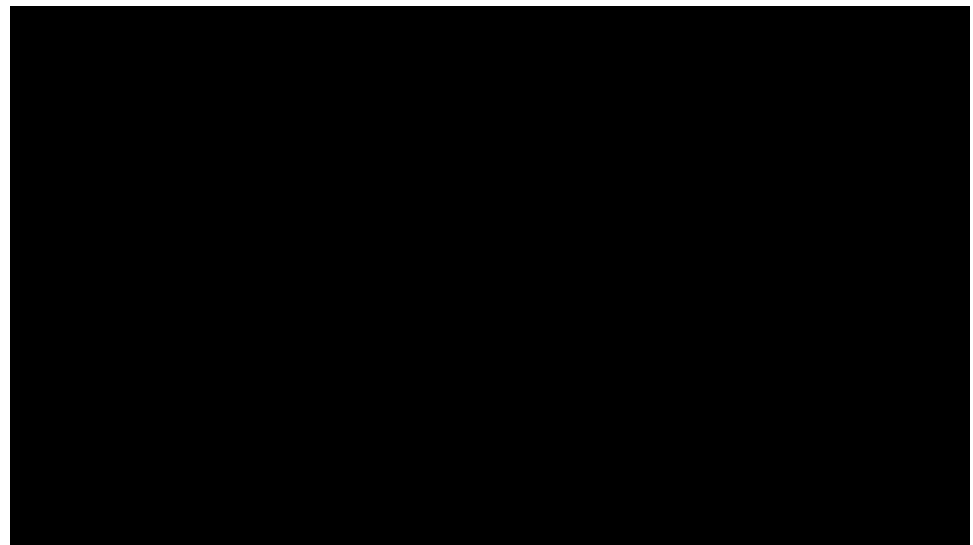
- * An unmanned traffic management system (UTM) will enable highly automated – even completely autonomous – operations BVLOS, over people, and at night.
- * Commercial-grade communications (cellular, satellite, etc.) ensure reliability and security; leverage existing, ubiquitous network architectures.
- * UTM will incorporate remote identification and tracking and “no fly zones” over sensitive fixed sites.
- * No anonymous flying – commercial and recreational operators must participate.

UTM: Where Are We?

- * NASA has been for years working with industry on UTM R&D.
- * FAA will have safety oversight, but private sector will build and manage system.
- * Congress directed FAA to establish two year UTM pilot program to begin by April – has it?
- * Phased implementation can and should begin before pilot program ends.
- * Remote identification ARC, other safety and security initiatives must move in parallel to development of new regulations to remove prohibitions and restrictions.
- * Technology continues to outpace regulation, inhibiting industry growth and innovation.

Autonomy In Action

- * Intel drone light shows around the US (and the world) about more than just entertainment – vanguard of autonomous operations.
- * First US Drone 100 show in Palm Springs, CA with FAA exemption.
- * Eight weeks of daily shows during the 2016 holiday season at Disney World – 300 drones choreographed for 12 minutes.
- * In October 2016, one remote pilot operated 500 Intel Shooting Star drones during a choreographed light show in Germany – using a single laptop.



Lady Gaga performed against a backdrop of 300 Intel Shooting Star drones during 2017 Super Bowl Halftime Show.

Next Steps and Opportunities

- * **FAA Reauthorization – Catalyst for Action**

- * Authorities expire September 30. Congress should:
 - * Direct FAA to implement a UTM system in a phased approach.
 - * Direct FAA to expedite development of more forward-leaning framework to expedite safe integration.
 - * Streamline waiver processes and authorization of expanded operations critical to integrating autonomous UAS.
 - * Establish a national standard for UAS regulations.

- * **Drone Advisory Committee (DAC)**

- * Tasked with identifying and proposing actions to the FAA to address issues affecting UAS integration into the NAS.
- * Three task groups under DAC Subcommittee: Airspace Access, Roles and Responsibilities, and Funding.
- * Airspace Access TG contemplating autonomous operations...*within “Beyond 24 months” Working Group.*

Drone Alliance Europe



DELFT AERIAL
ROBOTICS



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Autonomous drones: Q&A

20 April 2017, the Hague





Closing remarks

Florian Guillermet, Executive Director, SESAR JU

20 April 2017, the Hague



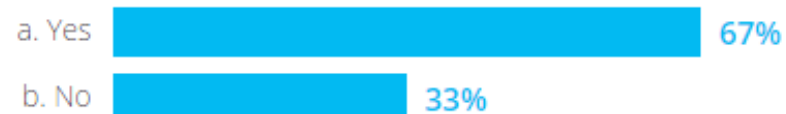
Survey results



Do you now better understand what U-Space is?



Have we been radical enough in our approach?





Thank you very much
for your attention!

