ICARUS Workshop
Second Advisory Board Meeting

Consortium Welcome

ICARUS Team

ICARUS Second Advisory Board Meeting – June 22, 2021

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Workshop Agenda

Chairman Peter Hullah

ICARUS Agenda	Speaker	Time	Schedule
❑ Welcome and Project Introduction	*Cristina Terpessi - e-GEOS*	10'	10:00 - 10:10
❑ ICARUS Problems & Concept Definition	*Alberto Mennella – Topview* *Pawel Korzec - Droneradar*	30’	10:10 - 10:40
❑ Q & A Session	*All*	10'	10:40 - 10:50
❑ ICARUS Design & Architecture ❑ GNSS ❑ Conversion Algorithm ❑ Alerting System ❑ GI Data	*Corrado Orsini – Telespazio* *Lorenzo Rossi -PoLIMI* *Pawel Korzec - Droneradar* *Gabriele Murchio – e-GEOS*	30’	10:50 - 11:20
❑ POLL	*All*	10'	11:20 - 11:30
❑ Coffee Break		15’	11:30 - 11:45
❑ ICARUS Preliminary Prototype	*Pawel Korzec - Droneradar*	10’	11:45 – 11:55
❑ ICARUS Services in ISO Standards	*Filippo Tomasello - EuroUSC*	10’	11:55 – 12:05
❑ Results of Poll	*Manuel Onate- EuroUSC*	10’	12:05 – 12:15
❑ Validation Activities	*Alberto Mennella – Topview*	5’	12:15 – 12:20
❑ Open Discussion	*All*	20’	12:20 – 12:40
❑ ICARUS Roadmap & Closing Meeting	*Cristina Terpessi - e-GEOS*	5’	12:40 – 12:45

We want your feedback

- If you have a question, please use the chat box at any time during the presentation. There will be a Q&A section and a Final Open Discussion to manage your requests.
- During the Q&A and the Open Discussion sections, the chairman will unmute your microphones, so that you can formulate your question to the speakers, please click on the hand icon to raise your hand.
- Also, remember that **the workshop will be recorded** and will be available at the private section of our website
- Please remember to send us your **Informed Consent form**, if you have not yet sent it

ICARUS Project Introduction

Cristina Terpessi **e-Geos S.p.A.**

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ICARUS Key Information

INTEGRATED COMMON ALTITUDE REFERENCE SYSTEM FOR U-SPACE

SESAR 2020 “Exploratory Research” Call H2020-SESAR-2019-2 (ER4)

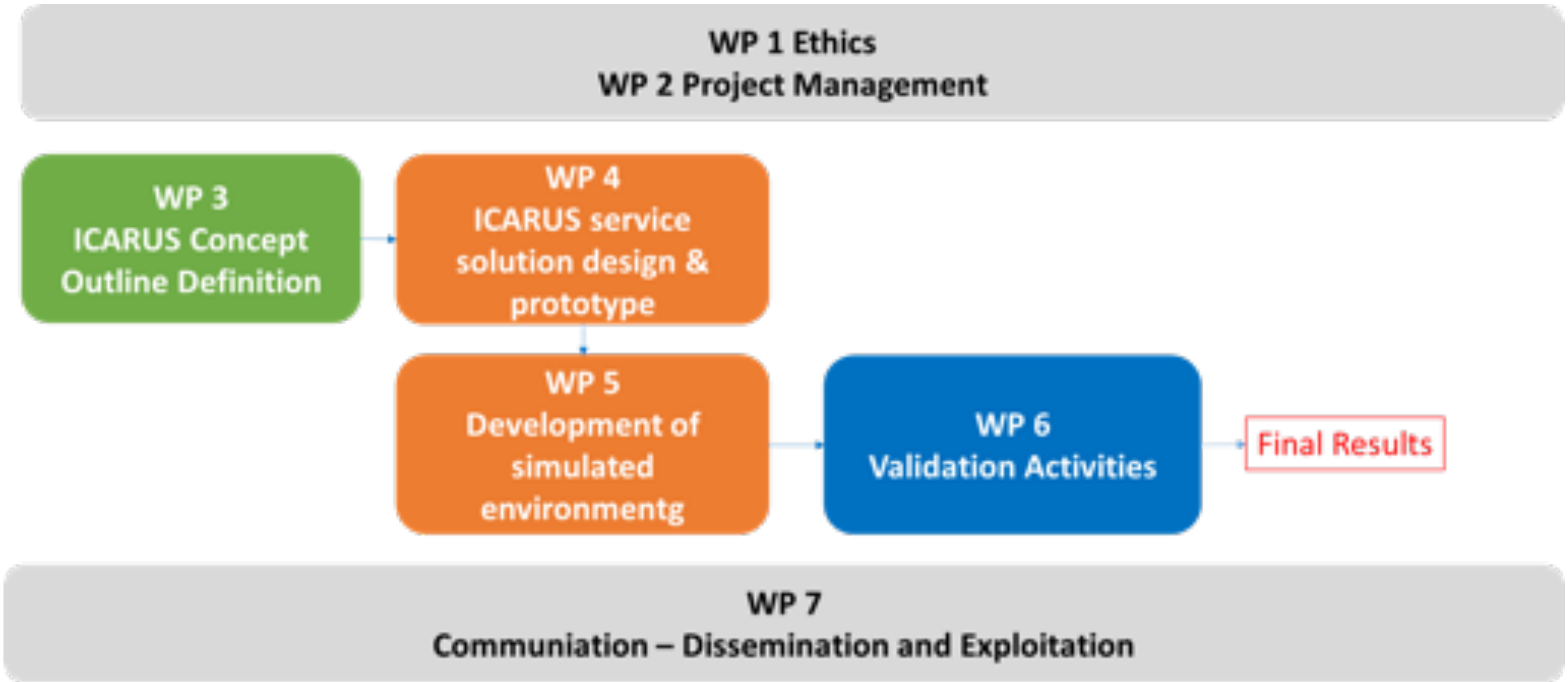
ICARUS project proposes an **innovative** and feasible **solution** to address the novel challenge of the **Common Altitude Reference** inside **VLL airspaces** with the definition of a **new U-space** prototype **service** and its validation in a real operational environment.

- Project Start Date: May 1, 2020
- Project End Date: July 31, 2022

ICARUS Consortium and Expertise

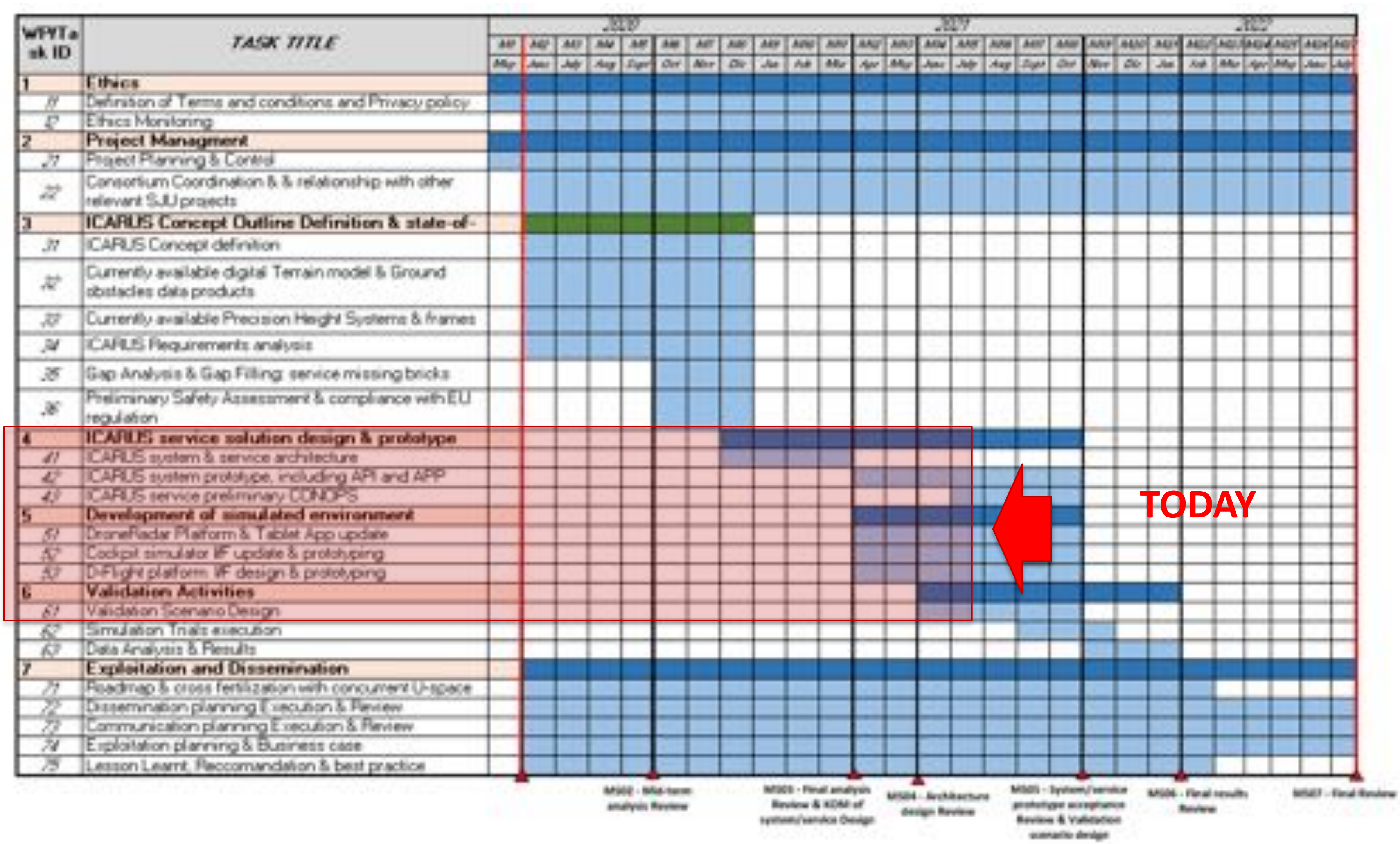
Expertise	EGEOS	TPZ	TOPV	DRAD	ECTL	EUSC	POLIMI	DICEA
Project management	✓	✓	✓					
Aeronautical info management				✓	✓			
Geomatics & DTMs	✓						✓	
Ground Obstacle data base	✓							✓
GNSS Navigation and pos. sys.		✓					✓	
UTM Service provisioning		✓		✓				
Drone operations			✓	✓				
Safety and regulatory assessment					✓	✓		
Requirement analysis and management		✓	✓		✓			
Service design and development	✓	✓		✓				
Aeronautical concept validation			✓	✓	✓	✓		
Communication dissemination	✓				✓	✓		✓

ICARUS Methodological Approach

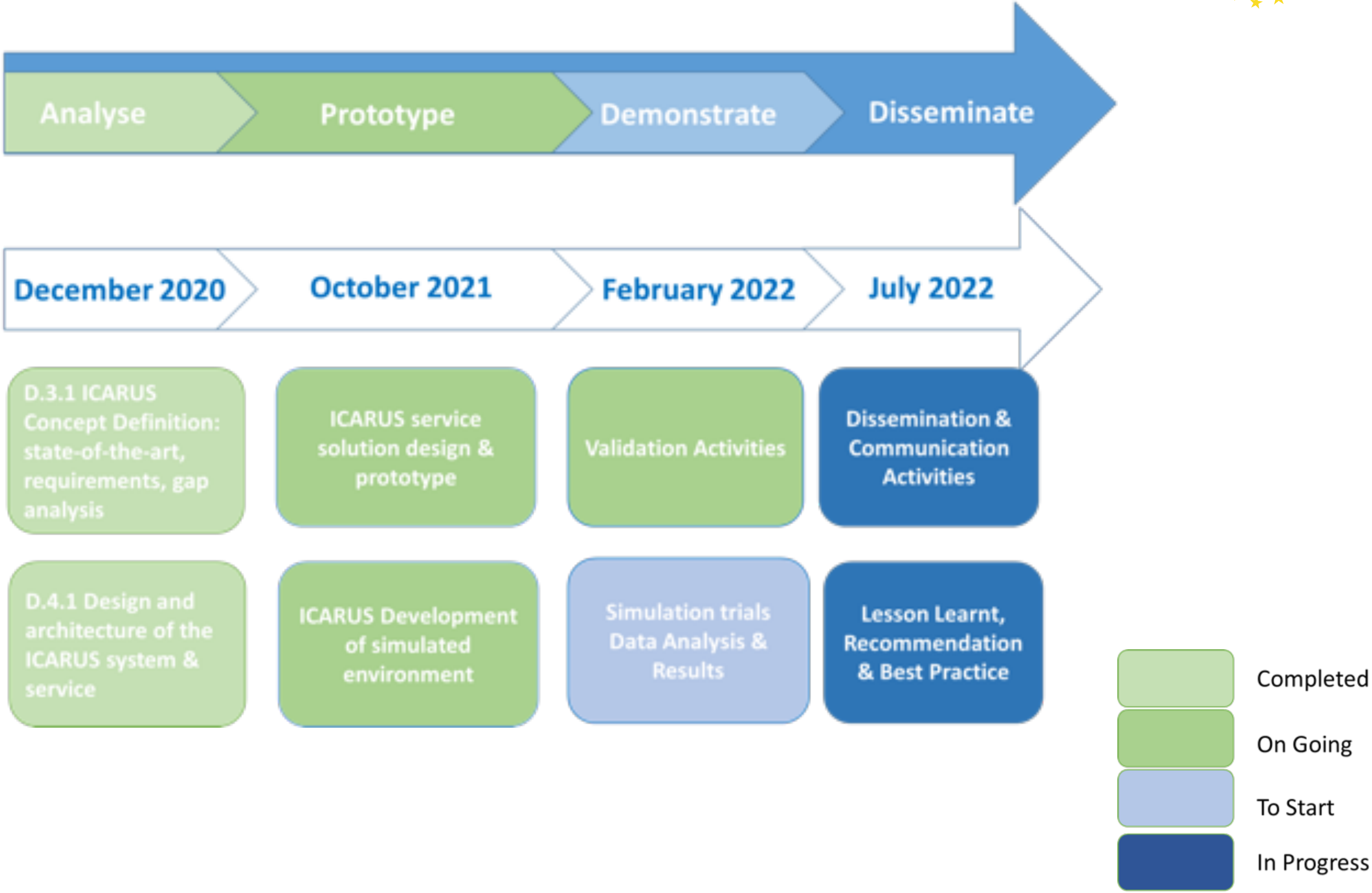


Logical sequence for methodology implementation carried on through the WP phasing

ICARUS Gantt



ICARUS Planning



ICARUS Problem & Concept Definition

Alberto Mennella TopView s.r.l.
Pawel Korzec Droneradar

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Why ICARUS ?

“If something works, why break it?”

Barometric altimetry has been the preferred way to ensure vertical separation for almost 100 years in manned aviation, and it works!

Why ICARUS ?

The short answer is:

If something has been working for almost 100 years, maybe it is time to revisit it!

Why ICARUS ?

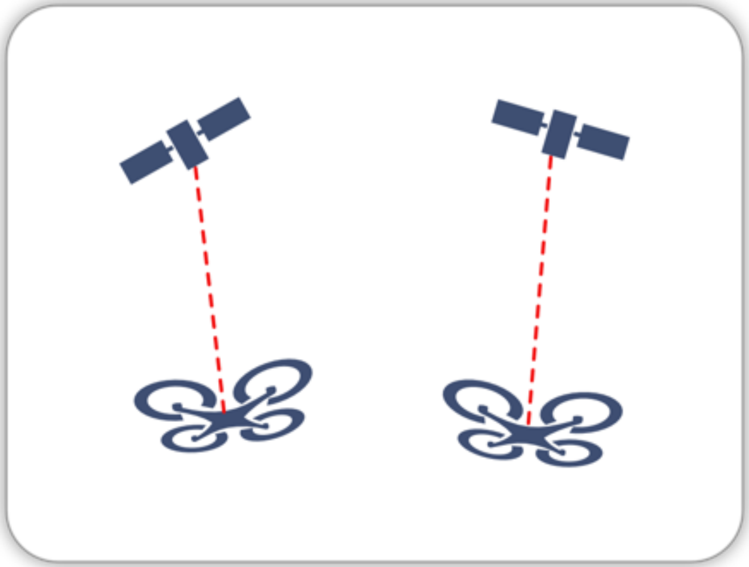
- Drone traffic vertical separation requires **more precise** height measurements
- Barometric measurements are **not reliable** at VLL, especially over cities
- ICARUS work will **enhance vertical separation** and enable **high density operations**

What is ICARUS ?

ICARUS is a U3 U-space service, providing:

- **UAS-UAS: Common altitude reference at VLL**
  - Performance based navigation approach
  - Sources: DFMC GNSS receivers and UAS barometers
  - Technical requirements and error budgets
- **UAS-Ground: Obstacle awareness at VLL**
  - Sources: DTM/DSM/DEM models
  - Error budget for terrain models and WGS-84 datum
- **UAS-Manned: Common altitude flight reference**
  - WGS-84 vs QNH dynamic offset calculation (translation service)
  - Communication mechanisms and avionics integration
  - Altitude translation service

UAS-UAS: Common reference at VLL



Objective #1

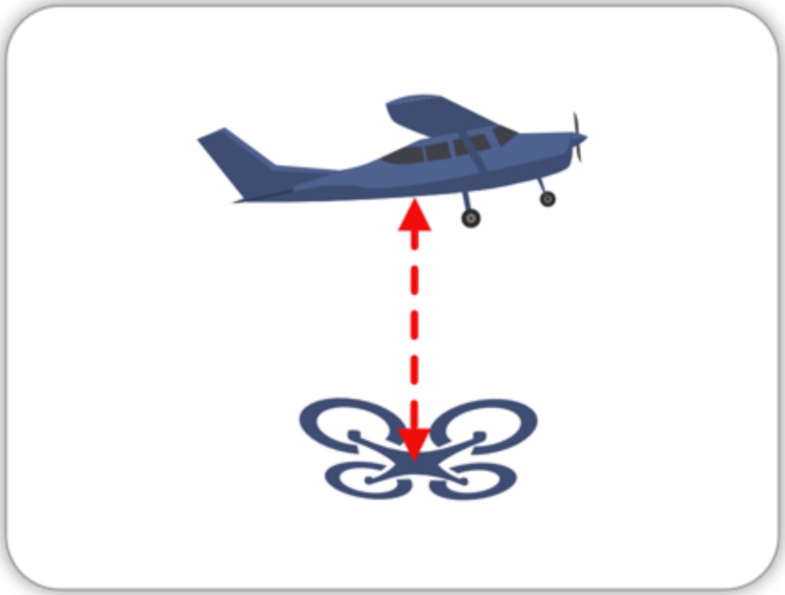
Define the technical requirements for high accuracy GNSS-based altitude measurement for drones, allowing a reliable and accurate common vertical reference (UAS-UAS)

UAS-Ground: Obstacle awareness

Objective #2

Investigate the vertical accuracy and resolutions achievable by the actual DTM/DSM services for ground obstacle and terrain profile, with respect to the geodetic WGS-84 datum

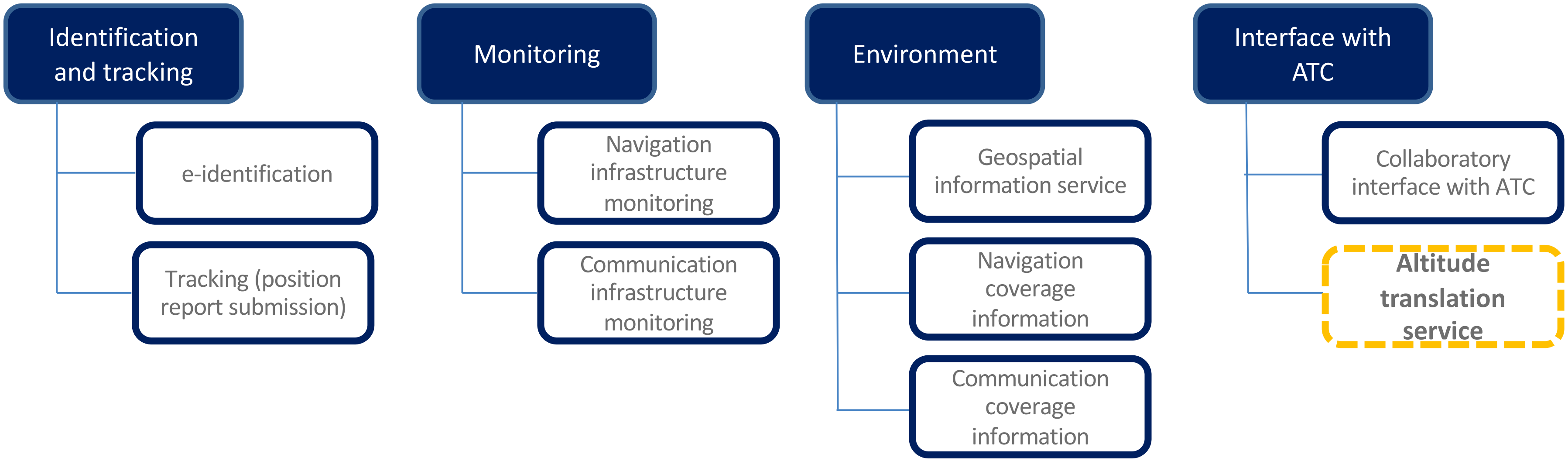
UAS-Manned: Common reference



Objective #3

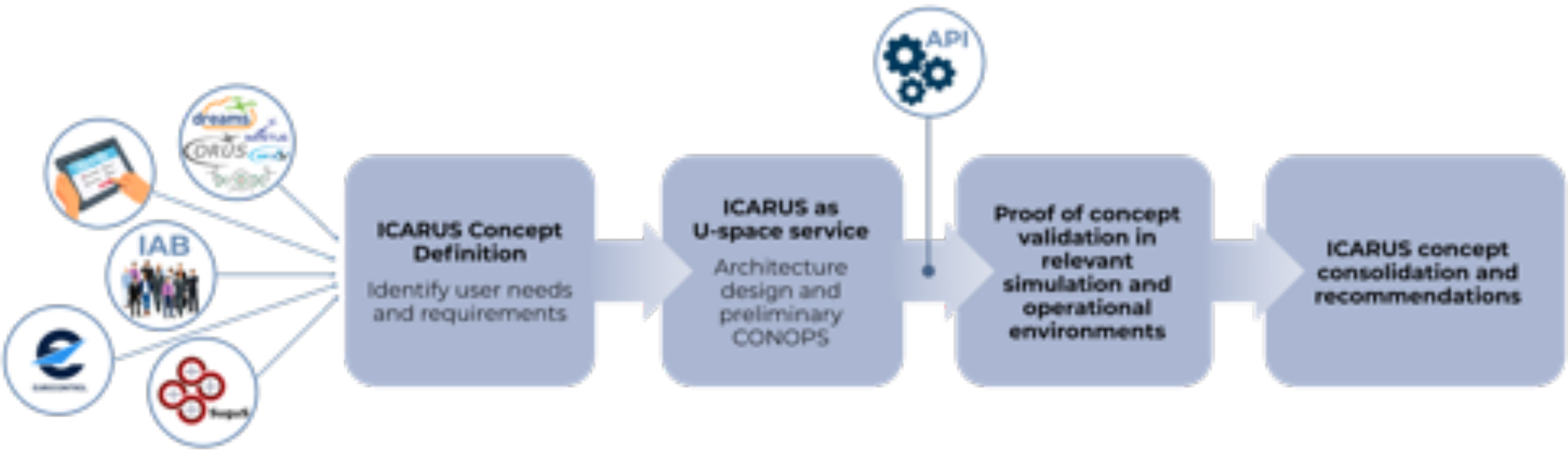
Design a tailored U-space service for altitude translation between geometric to barometric altitude for UAS and manned aircrafts

ICARUS as a U3 service



ICARUS will interact with different existing and planned U-space services and introduces a new U3 service

Methodology



Five relevant use cases

	Industrial ski-lift inspection	Spare parts delivery to offshore platform	Industrial power line inspection	Bio sample delivery	Airport-vertiport passenger transport
Scenario	Mountains / Rural	Above the sea	Rural / Suburban	Urban / Suburban	Airport /Rural / Suburban / Urban
Population density	None to low	None to low	Low	Medium to high	Medium to high
Conflicting traffic	None	Ultralight and GA in neigh. airspace	UAS / Helicopter / Other leisure GA	Other UAS / HEMS	Commercial flights / Other UAS
Airspace	X only Adjacent: G	Y only Adjacent: G	Y only Adjacent: G	Zu only (CTR) Adjacent: G	ATZ (Za), CTR, Zu Adjacent: G
Altitude data	WGS-84 Home points	UAS : WGS-84 Ultralight: WGS-84 GA: QNH	UAS: WGS-84 Ultralight: WGS-84 GA: QNH	UAS: WGS-84 HEMS: QNH / ADS-B	Taxi UAS: QFE (or QNH) in ATZ, WGS-84 inside GAMZ

https://youtu.be/i5nj4XtZXGU

Q&A

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ICARUS Design and Architecture

Corrado Orsini **Telespazio S.p.A.**

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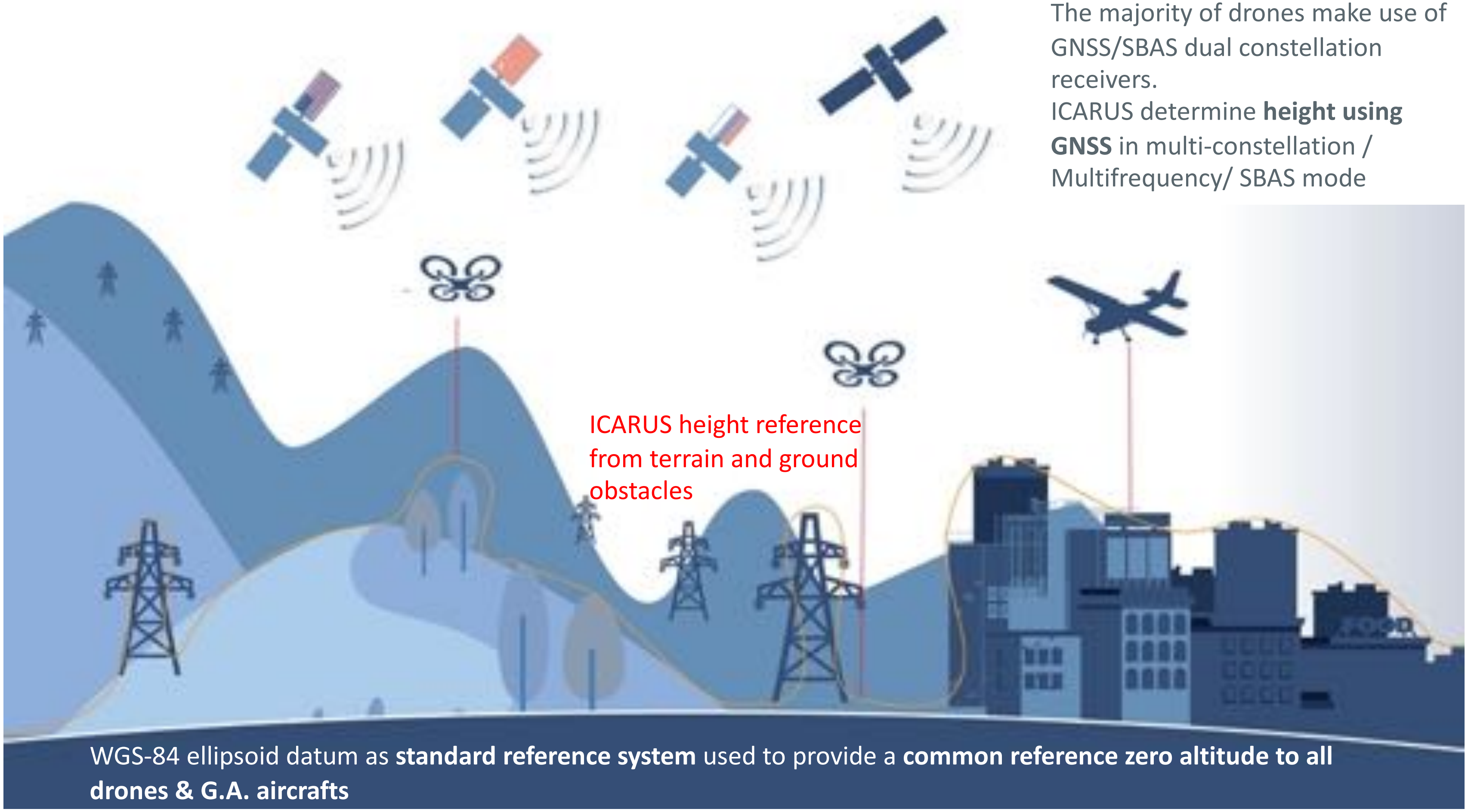
ICARUS System

The majority of drones make use of GNSS/SBAS dual constellation receivers.
ICARUS determine **height using GNSS** in multi-constellation / Multifrequency/ SBAS mode



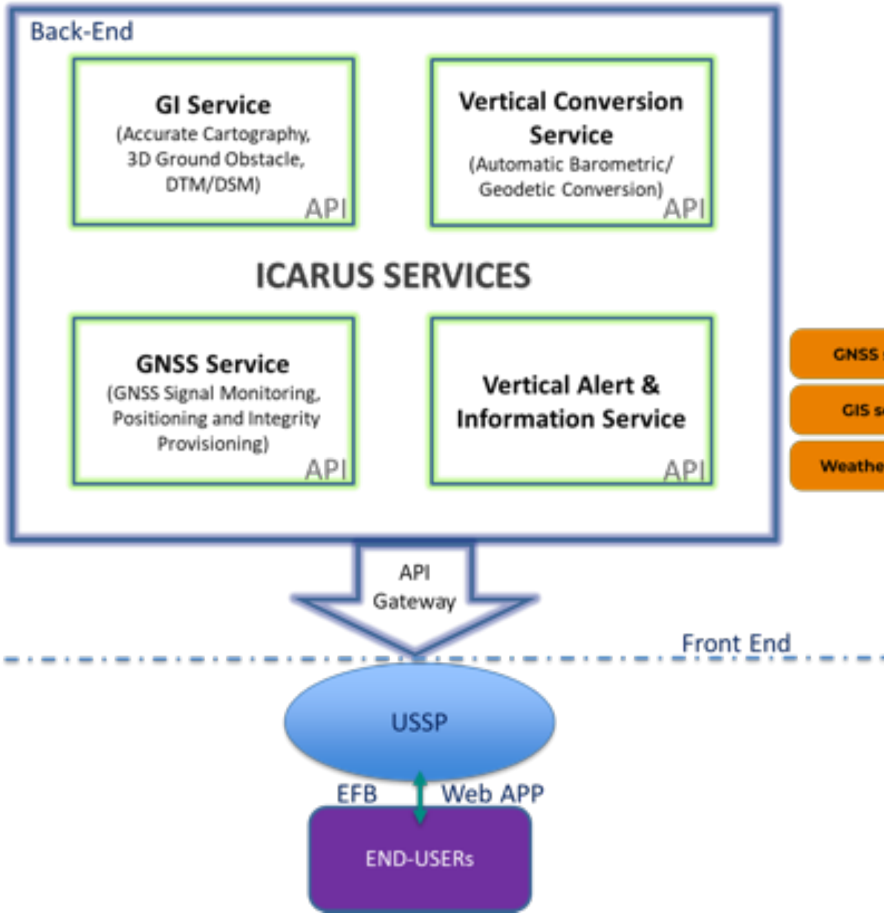
ICARUS Provide:

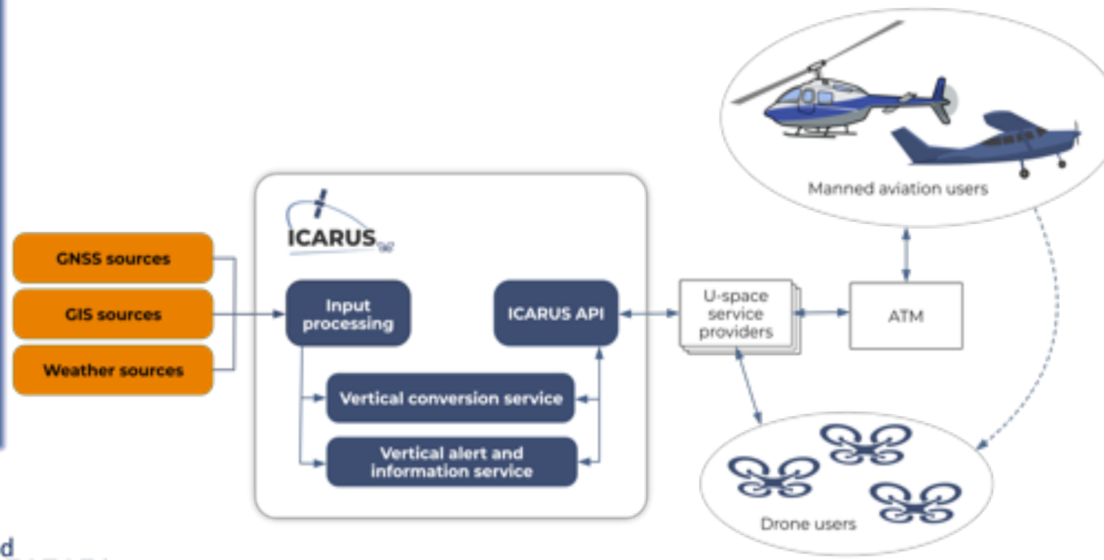
- Sub metric accuracy
- Vertical distance from terrain & ground obstacles
- Strategic and tactical deconfliction from ground obstacle
- Conversion from barometric to geometric altitude and viceversa for G.A. pilots

ICARUS Design and Architecture

High level ICARUS System Architecture

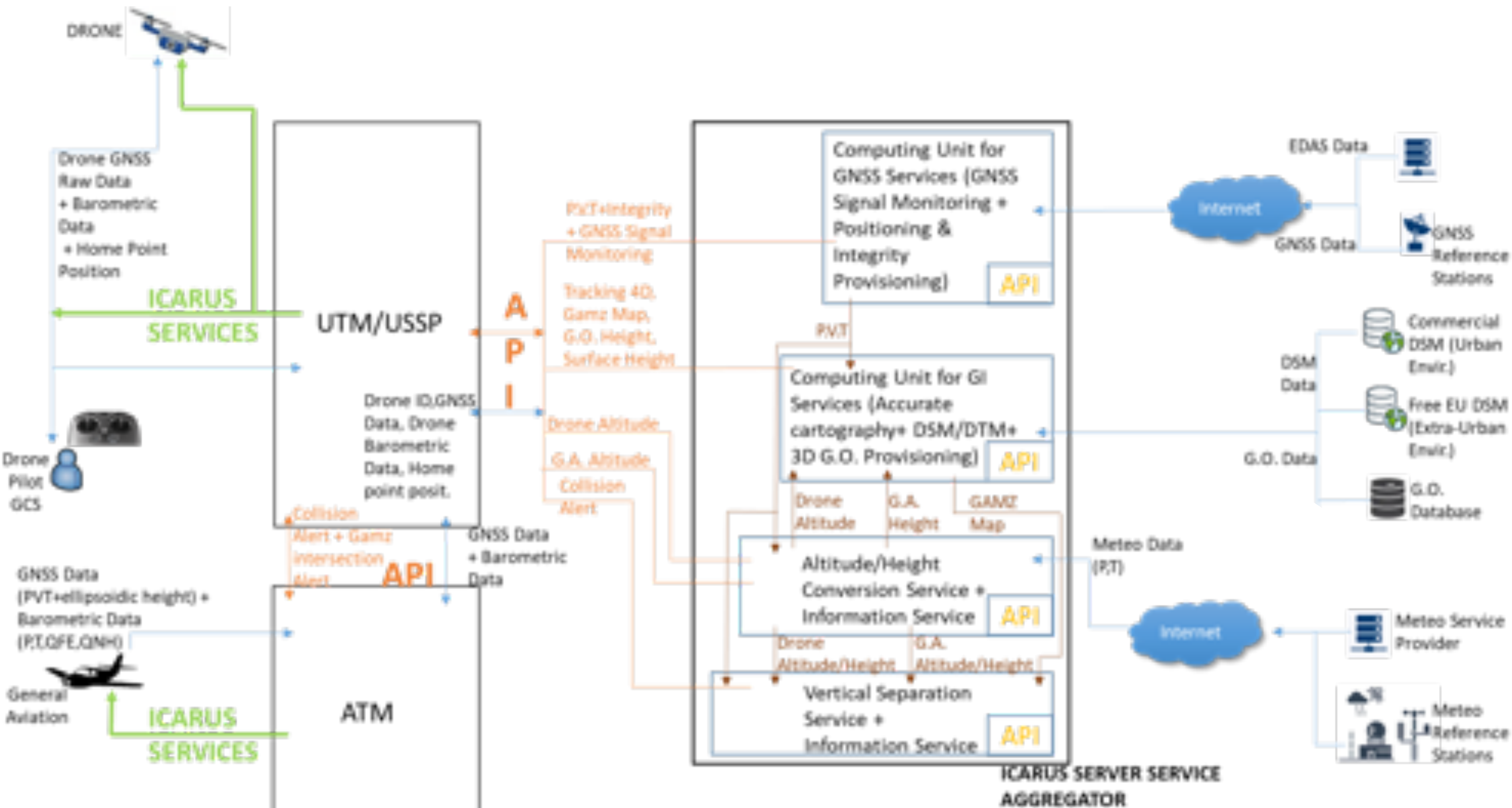
Service distributed to the end-users (manned and unmanned pilots) as **an add-on** to the pre-existing **U-Space platforms** (web application - EFB for manned)





ICARUS Design and Architecture

Detailed ICARUS System Architecture



ICARUS Design and Architecture: GNSS

Corrado Orsini **Telespazio S.p.A.**

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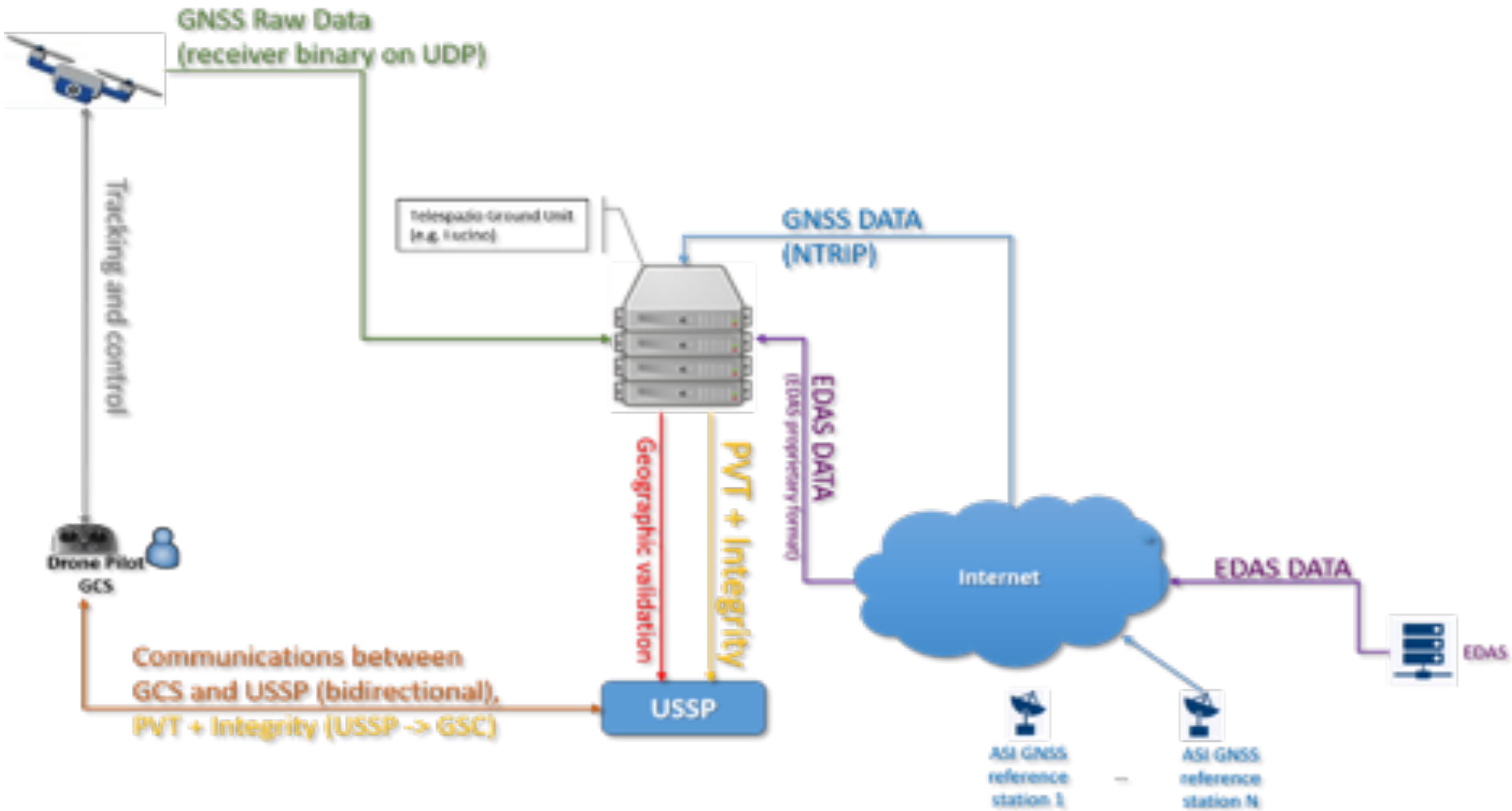
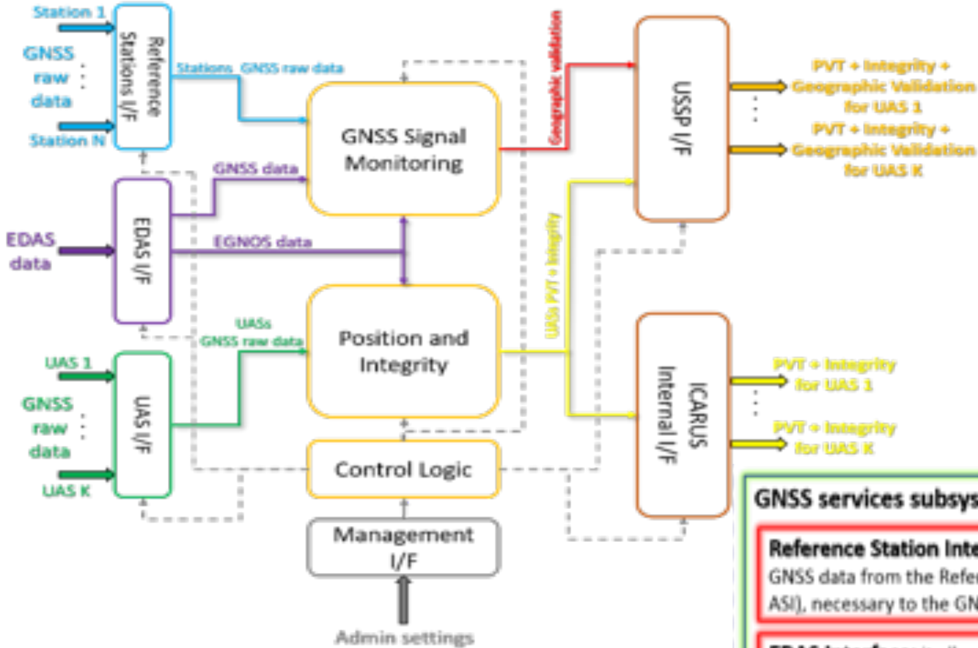
ICARUS Design and Architecture: GNSS

The GNSS subsystem provides a reliable and certified means to compute the **position** of registered UASs in **real-time**: it is a **key enabler for all the ICARUS services**.



Through the processing of **raw GNSS observables** from drones, and **support messages** and **data from external entities**, it **provides** the **PVT solution** for each monitored UAS, together with its **integrity parameters** and a **validation mechanism** based on the use of data coming from a network of **trusted reference stations**.

GNSS Services



Computing algorithms

1) GPS + EGNOS

- EGNOS-based accuracy enhancement through external augmentation
- Integrity provisioning
- External computation: applicable also to low cost receiver
- No Galileo Constellation: limited availability

GNSS services subsystem functionalities

Reference Station Interface: it allows the reception of raw GNSS data from the Reference Station Network (IGS, EUREF, ASI), necessary to the GNSS Signal Monitoring

EDAS Interface: it allows the reception of EGNOS messages and raw GNSS data of RIMS stations from the EDAS server, necessary to the integrity parameters computation and the GNSS Signal Monitoring

UAS Interface: it allows the reception of raw GNSS data from the tracked UAS, necessary to compute its position and to calculate the integrity of the position solution

USSP Interface: it allows the communication between the TCU (Telespazio Computing Unit) and the USSP, necessary to share the UAS computed position, the integrity parameters and GNSS monitoring status

Telespazio Computing Unit: it performs the calculus of the desired parameters

- **GNSS Signal Monitoring:** computation of GNSS parameters in a set of reference station(s) in the nearby of the UAS to evaluate the SIS performances
- **Position and integrity:** computation of the UAS position and integrity parameters according to the selected algorithm and options
- **Control Logic:** selection of the reference stations, raising of alerts, etc.

Management: it allows access to the subsystem and its configuration and maintenance

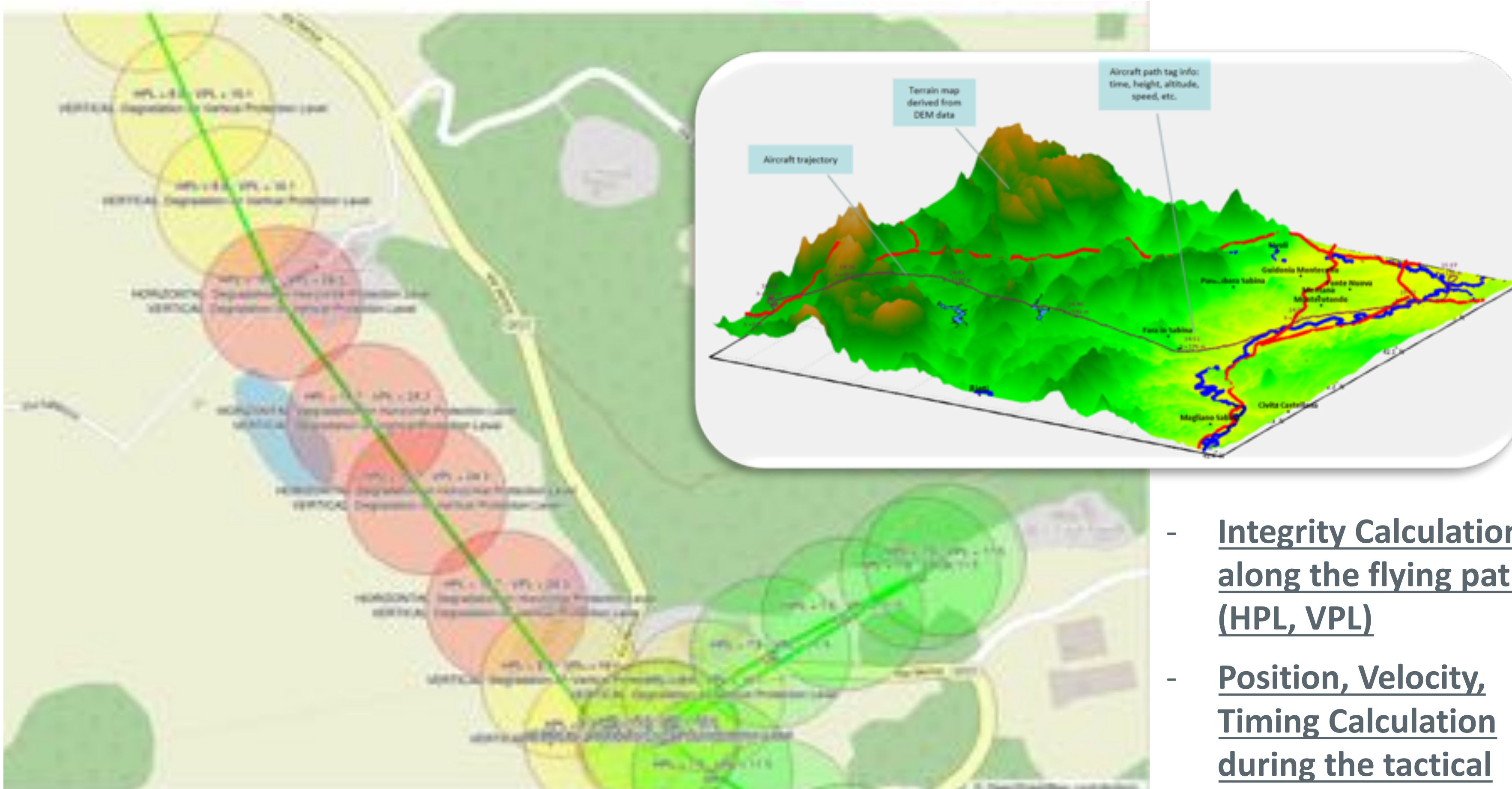
ICARUS Internal Interface: it allows the communication between the GNSS service subsystem and the other ICARUS services, necessary to share the UAS computed solution and its integrity parameters with the GI subsystem, the Conversion Service subsystem, and the Vertical Separation Service subsystem

2) GPS + Galileo + ARAIM

- dual-frequency, dual-constellation computation
- Galileo satellites: improve availability
- Integrity provisioning
- External computation: applicable also to low cost receiver

- No external augmentation systems
- need to assess performance in an urban environment

GNSS Services Functionalities



- <u>**Integrity Calculation along the flying path (HPL, VPL)**</u>
- <u>**Position, Velocity, Timing Calculation during the tactical phase**</u>
- <u>**Pretactical and tactical analysis of GNSS Signal Degradation**</u>

ICARUS Design and Architecture: Conversion Algorithm

Lorenzo Rossi **PoliMi**

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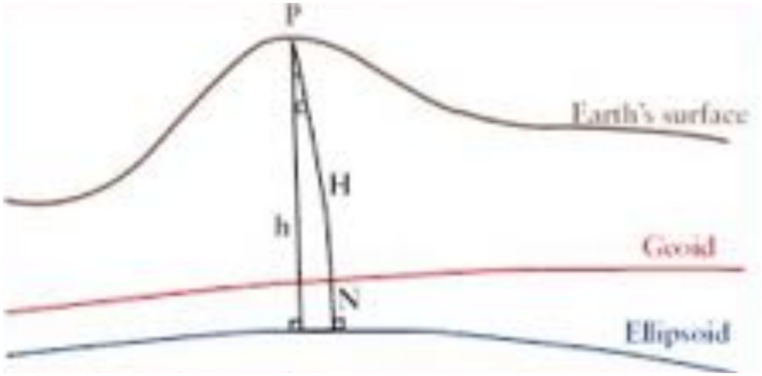
ICARUS Design and Architecture: Conversion Algorithm



- **Ellipsoidal height**

  Purely geometric quantity

  Directly observed by GNSS

- **Orthometric/Normal height**

  Physical quantity related to the gravity field

  It can be related to the ellipsoidal height through a geoid model

  It represents the so-called height above the mean sea level (AMSL)

- **Barometric height**

  Physical quantity related to the atmospheric pressure field

  Subjected to local and temporal variation of the atmospheric pressure

- **Height above the terrain / surface**

  It can be easily related to ellipsoidal or orthometric height through a DTM or DSM model

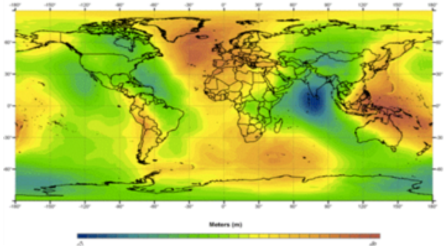
ICARUS Design and Architecture: Conversion Algorithm

Geoid models

Global gravity models

Accuracy better than **0.3 m**

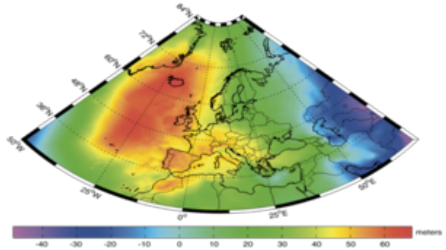
Given in terms of spherical harmonic coefficients



Continental models

Accuracy better than **0.1 m**

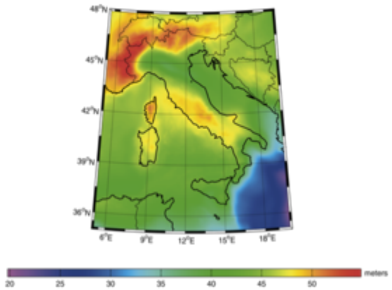
Given on a regular grids (interpolation is required)



National / local models

Accuracy better than **0.05 m**

Given on a regular grids (interpolation is required)



When using a geoid model, consistency has to be maintained in all the steps of the conversion process (e.g. when converting the DTM or determining the “0 level” of barometric height).

If coherency is lost systematic errors up to 2 m could be introduced.

ICARUS Design and Architecture: Conversion Algorithm

Barometric height

Knowing the pressure P_0 at a reference altitude H_0, the height H_P of a point A can be estimated by observing its pressure P_A

$$H_\mathrm{A} = \frac{T_0}{L}\left[\left(\frac{P_\mathrm{A}}{P_0}\right)^{-\frac{LR}{\bar{g}}} - 1\right] + H_0 = f(P_\mathrm{A}, P_0)$$

where

T_0 is the temperature at the reference height (usually approximated by a standard model)

L is the vertical temperature gradient (-6.5 K / km)

R is the specific gas constant (287.05287 J / Kg K)

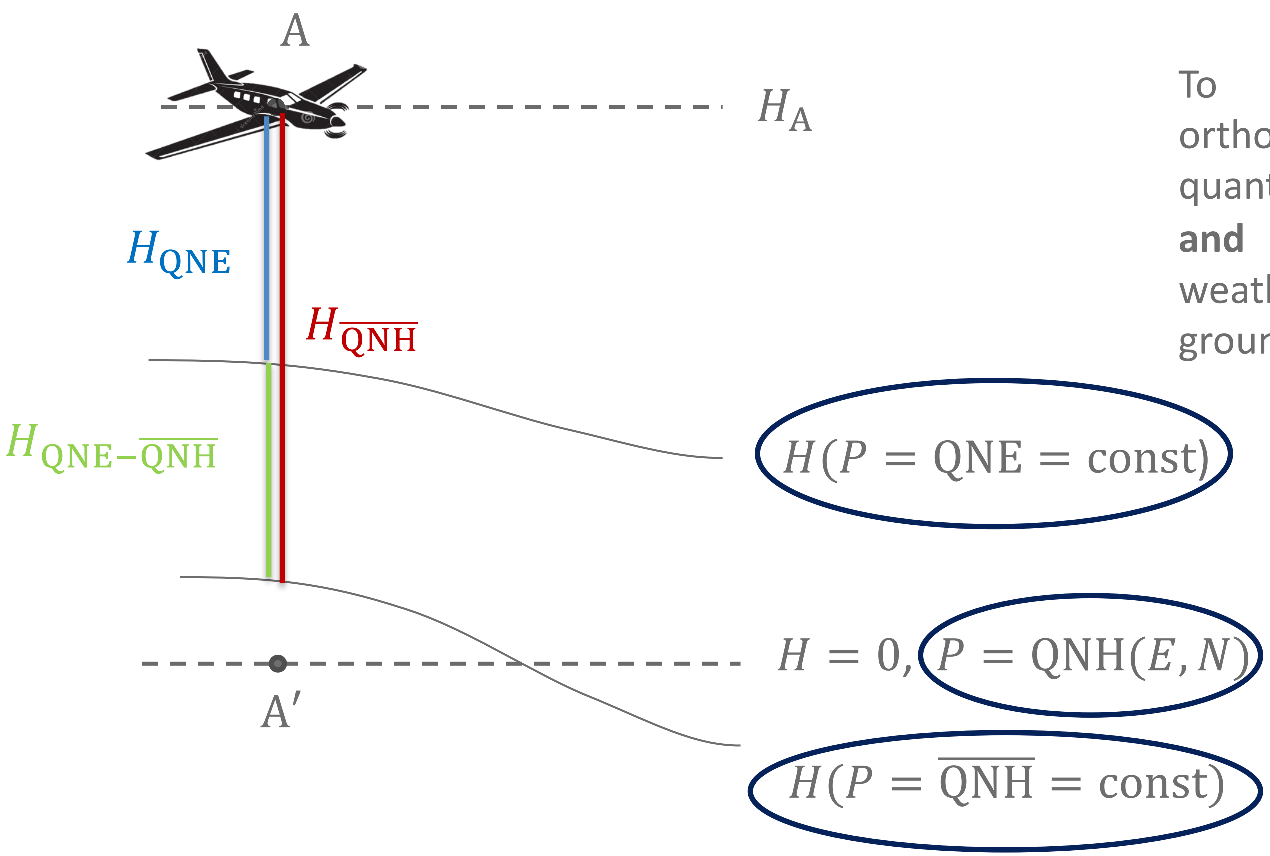
$\bar{g}$ is the mean gravity acceleration between the reference (0) and the observation (A) points

Common reference pressures P_0 in manned aviation

QNE	constant pressure set to 1013.25 hPa (with unknown reference height H_0)
QNH	average pressure at the mean sea level over the considered region

ICARUS Design and Architecture: Conversion Algorithm

Barometric height conversion



To correctly determine the orthometric height, one of the circled quantity **should be known in space and time**, e.g. from an external weather service or from a set of ground weather stations.

Alternatively, they can be inferred from vehicles equipped with both a GNSS and a barometric sensor (but the quality of those sensors has to be checked and validated)

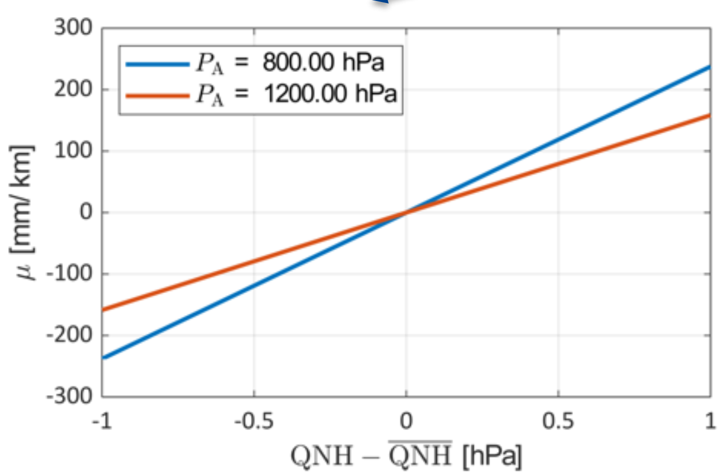
ICARUS Design and Architecture: Conversion Algorithm

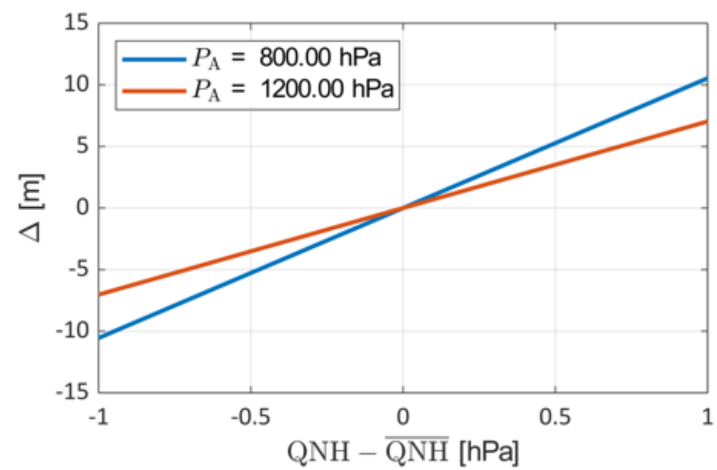
Barometric height conversion: Example for altitude over the average $\overline{\mathrm{QNH}}$

Orthometric height

Observed by the vehicle

$$H_{\mathrm{A}} - H_{\overline{\mathrm{QNH}}} = \mu\, H_{\overline{\mathrm{QNH}}} + \Delta$$





If no external information is available, the quality of the conversion will be affected by a systematic error of the order of **10 m for 1 hPa difference** between the **average and the actual QNH**.

An analogous conversion can be implemented for the altitude over QNE.

ICARUS Design and Architecture: Alerting

Pawel Korzec **Droneradar**

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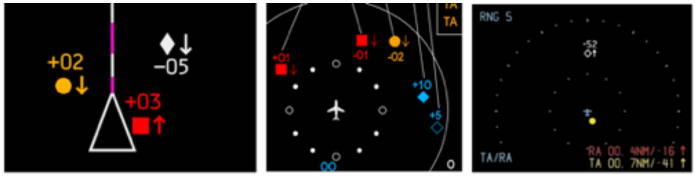
Alerting



- **Manned vs UAS** (selected justifications)
  - As it is obvious at present stage of technology the best way of avoiding possible collision with commercial traffic is segregation.
  - This analysis shows that there is no need to introduce new TCAS/ ACAS II symbol – since there is no benefit out of such action.
  - The only valid and operationally proven airborne collision avoidance system at present stage is TCAS 7.2 but it designed operation limitation at low altitudes where statistically there is the most dense UAS activity. In order to use the benefit of ACAS UAS traffic shall be segregated at these altitudes in vicinity of known trajectories of manned aviation (STAR, SID, APP PROC, VFR ARR/DEP RTEs, ATZ, CTR etc.) to avoid nuisance messages.
- **UAS vs UAS**
  - Require Detect and Avoid algorithms which are not available
  - ICARUS may in future provide support for vertical deconfliction
- **UAS vs Terrain, Surface and or Obstacle**
  - Ground Proximity alerts scenario will be tested
    - VAL (Vertical Alert Limit) – the alarm will be triggered when the volume of the virtual VAL Cylinder reach the surface or obstacle

ICARUS Design and Architecture: GI Data

Gabriele Murchio **e-GEOS S.p.A.**

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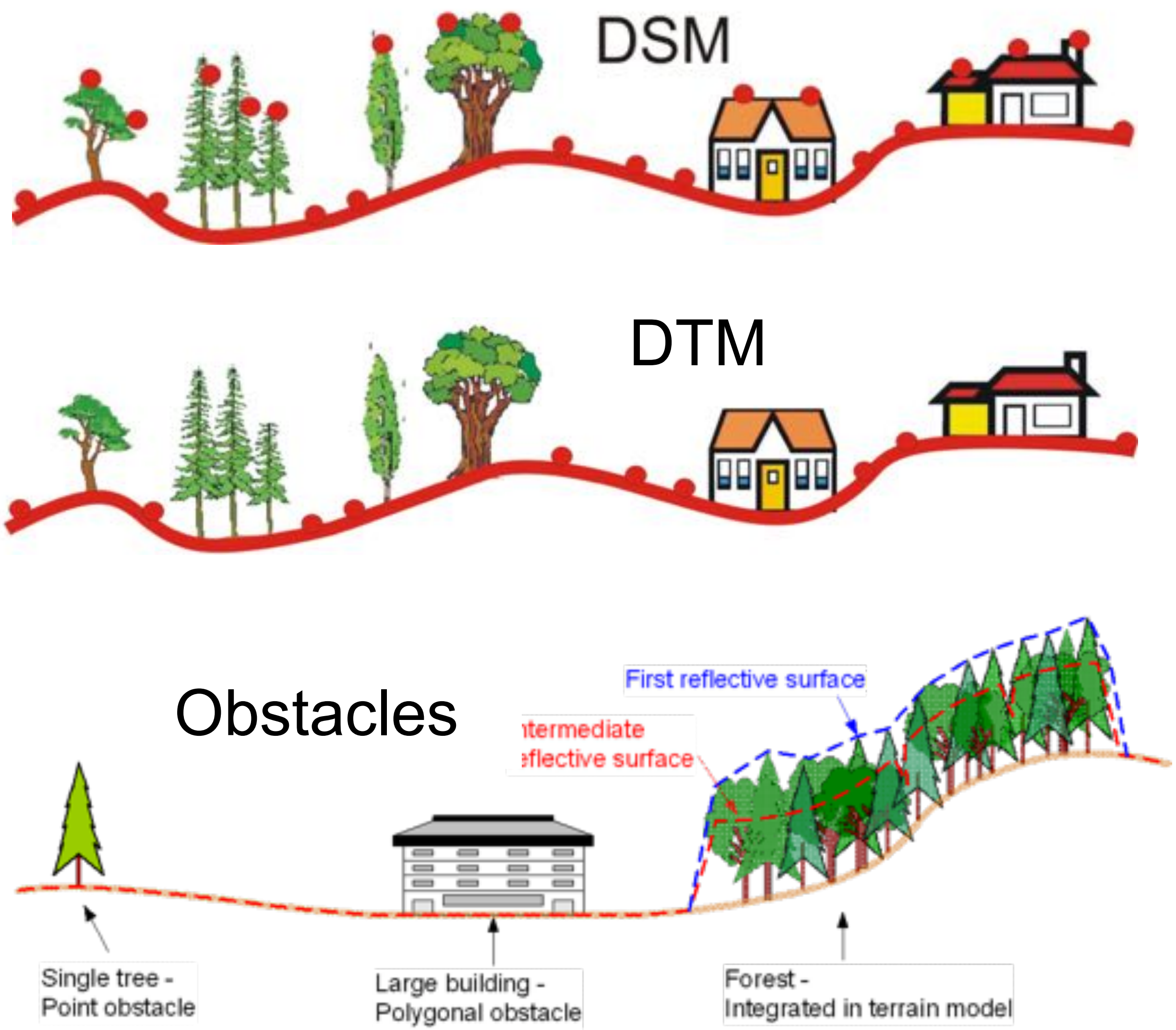
ICARUS Design and Architecture: GI Data



1. Urban areas

An Urban model is needed, including all obstacle data that describes all buildings, infrastructure, objects and vegetation constituting the urban environment (enhanced eTOD)

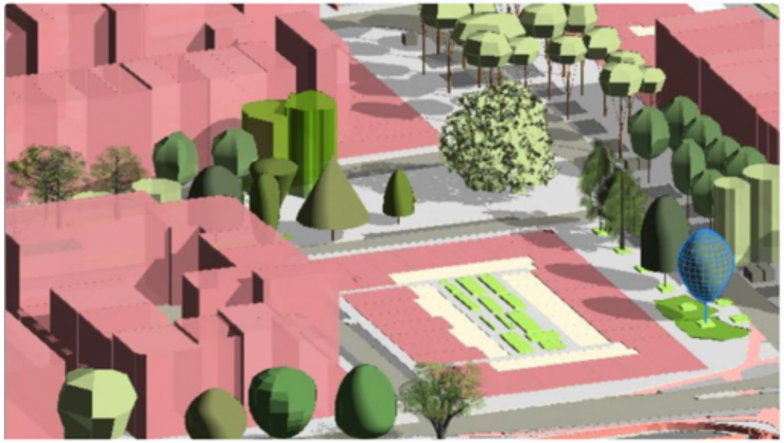
2. Extra-urban areas

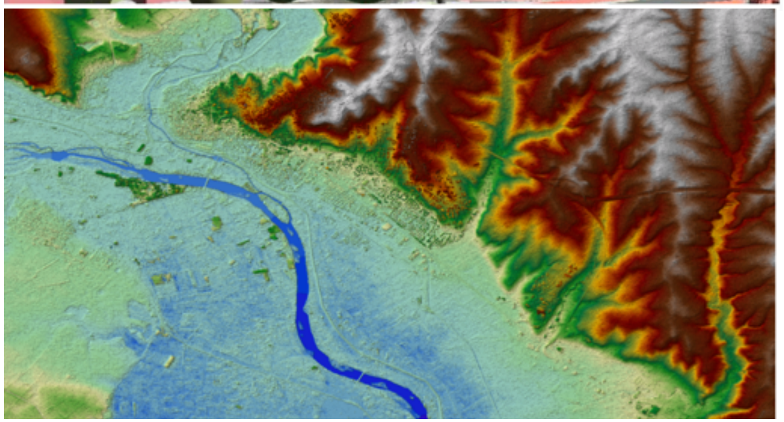
morphology of the 3D terrain, vegetation and possible man-made objects

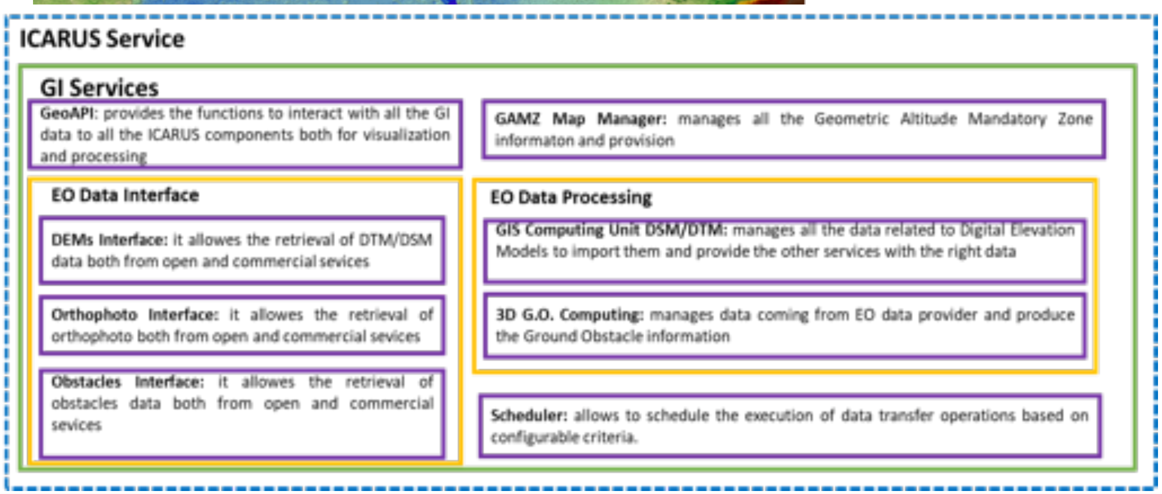
UAS.OPEN.010 General provisions

When flying an unmanned aircraft within a horizontal distance of 50 metres from an artificial obstacle taller than 105 metres, the maximum height of the UAS operation may be increased up to 15 metres above the height of the obstacle at the request of the entity responsible for the obstacle.

(ANNEX TO IMPLEMENTING REGULATION (EU) 2019/947 — UAS OPERATIONS IN THE 'OPEN' AND 'SPECIFIC' CATEGORIES)







1. Urban areas

Enhanced
eTOD:eTOD+DVOF+NOTAM
(V)Accuracy: 1-2 metres (Obstacle)
(V)Accuracy : <3m (Terrain)

2. Extra-urban areas

DSM 5m post spacing
(LE90= 3m)

ICARUS USE CASE:
GAF EuroMaps available trough DAP Copernicus or TPM ESA programme

Advanced 3D GI services :
future prospect and UTM functionality enabled

- New concept of eTOD database for UAS
- Enached eTOD update (define AIRAC cycle for mobile and fixed obstacle)
- Applied 3D geocontent services :
    - Mission management in impervious area and for specialized drone operator services (Corridor, power lines, bridge inspection)
    - Close range sensing survey coverage
    - Augmented reality in FPV BVLOS mission
    - Georeferenced Hot spot capture in AR environment

ICARUS Real Time Survey

Francesco Russo **TopView s.r.l.**

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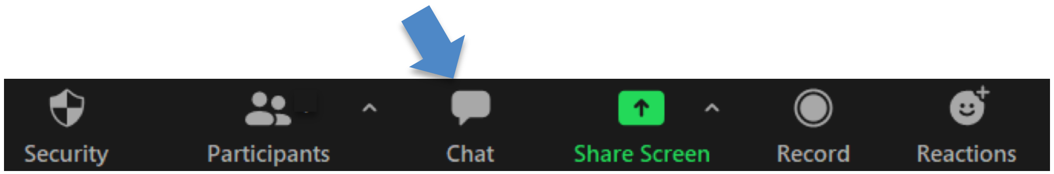
Real time survey

We are going to start a real time survey with all the participants in this Advisory Board.

1. Take part in the survey using the link in ZOOM chat



2. 5 minutes to fill the form
3. Overview of the results after the “ICARUS Services in ISO Standards” section

Q&A

Please note: for all topics not covered in this questionnaire you can ask in the open discussion in the end.

Real time survey

You have 5 minutes to fill in the form

Thank you!

Responses

0

COFFEE BREAK

11.30 – 11:45

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ICARUS Preliminary Prototype

Pawel Korzec **DroneRadar.**

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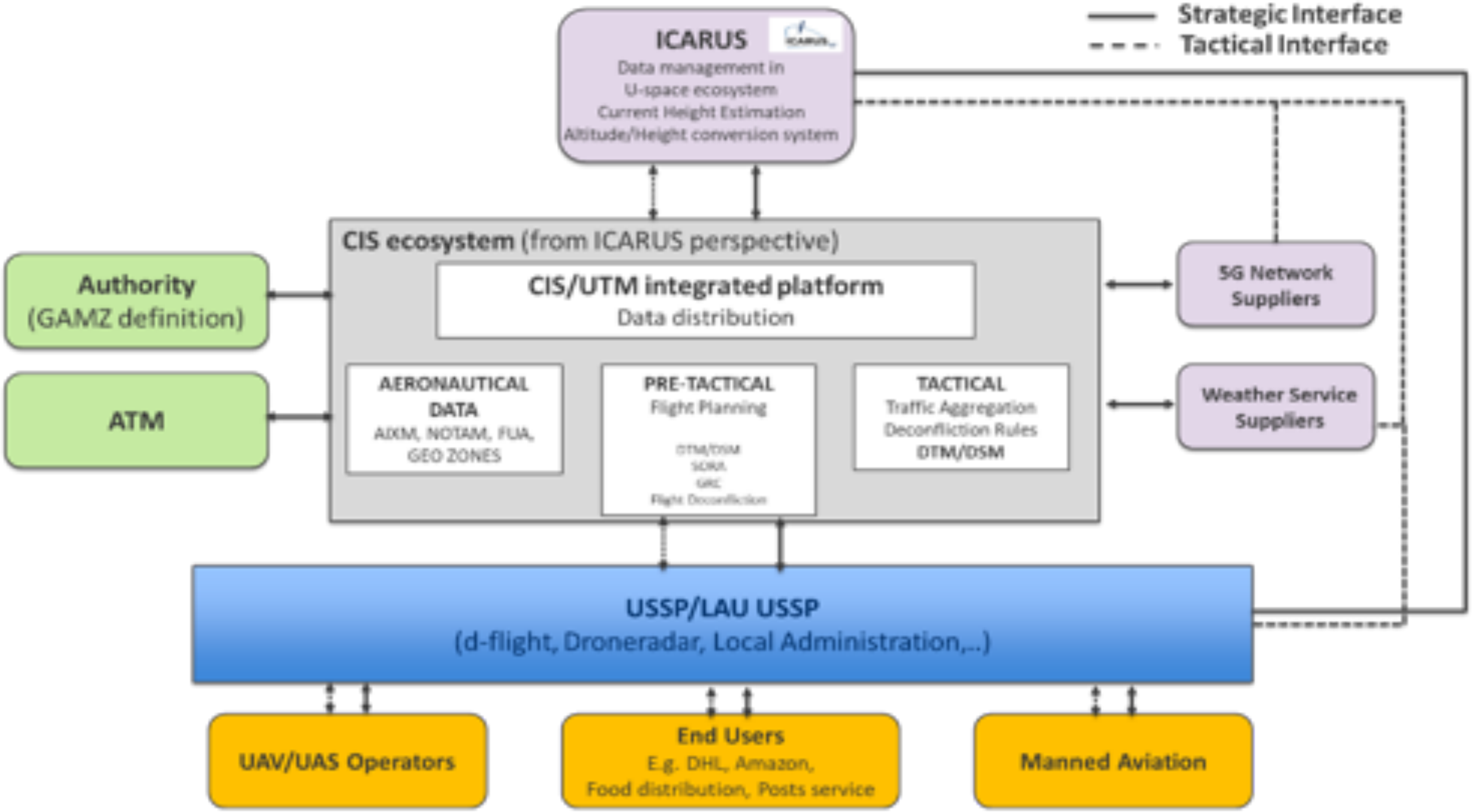
ICARUS Preliminary Prototype



USSP – U-Space Services provider* must provide 4 basic services:
NIC, Geo-awereness, Authorisation, TIS
ICARUS- allows USPPs to provide additional U-space services

WP4: Performed tasks and deliverables

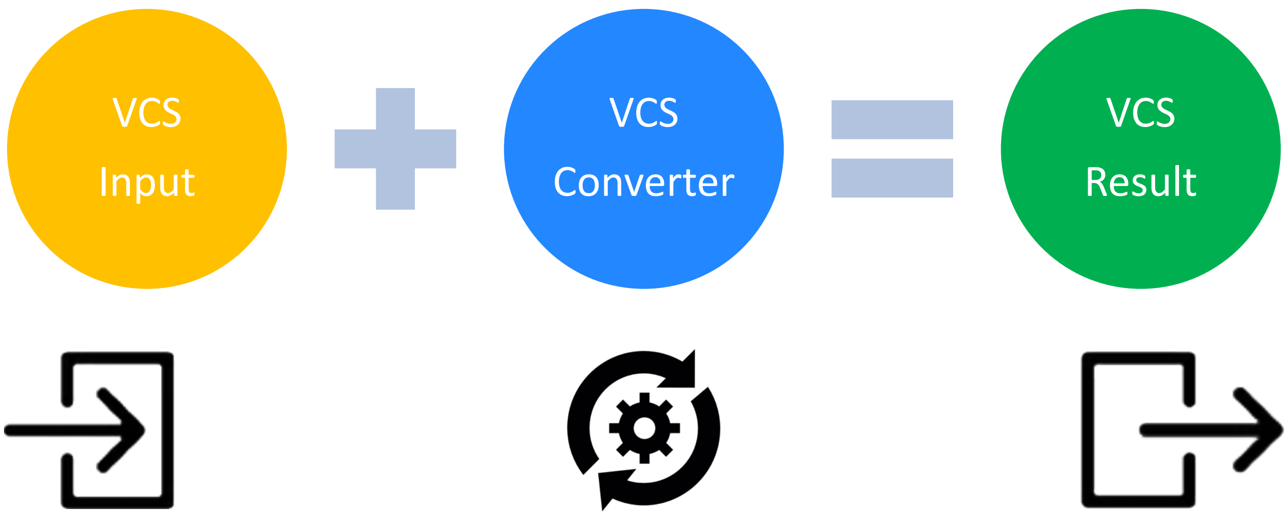
- Preparation and administration of the Software development environment and team collaboration tools
- Preparation, installation and configuration of the ICARUS service foundation
  - RabbitMQ, environment
  - Real time database
- Preparation and initial configuration of data sources for VCS* Converter Reference Systems (see table on next slide)

* VCS - Vertical Conversion System

Vertical Information DECORATION

One-to-many – one input generate all outputs

Telemetry	VCS.QNH.01	Telemetry
VCS.C.AGL	VCS.GNSSSLA.01	VCS.C.AGL
VCS.C.ASL	VCS.DTM.01	VCS.C.ASL
VCS.C.AMSL	VCS.DSM.01	VCS.C.AMSL
VCS.C.Elipsoid	VCS.OBST.01	VCS.C.Elipsoid
VCS.C.QNH	VCS.Geoid.01	VCS.C.QNH
VCS.C.QNE	VCS.Elipsoid.01	VCS.C.QNE



Data source – VCS Converter Reference Systems

Interface ID	Source	Specs
VCS.TELEMETRY.01	Multiple sources: 1. individual from each USS 2. aggregated from USSP, SUSSP	See GitLab
VCS.QNH.01	QNH (Mockup)	QNH basic regions Local QNH (CTR) Contingency QNH Regions QNH change notification QNH Contingency notification Local pressure stations timestamp
VCS.GNSSSLA.01	Multiple sources	Characteristics of the area where GNSS signal degradation may occur (size, time, horizontal and vertical value, how often?) Characteristics of degradation occurrence - time to predict, how often, repeatability The meaning of GNSS signal degradation and it’s impact on each type of aviation timestamp
VCS.DTM.01	GeoTIFF	RASTER – heightmap Accuracy H/V resolution timestamp
VCS.DSM.01	GeoTIFF	Raster - heightmap Accuracy H/V resolution timestamp
VCS.OBST.01	Polygon	Horizontal Vertical
VCS.Geoid.01	Math formula	including undulation
VCS.Elipsoid.01	Math formula	known

WP4.2: Future activities

- Implementation of the datum conversion microservices
  - GNSS based to barometric
  - Barometric to GNSS based
  - Standardisation of interfaces to query and distribution of DEM/DTM/DSM
- integration of all component elements
- Tests

ICARUS
Services in ISO Standards

Filippo Tomasello **EuroUSC**

ICARUS Second Advisory Board Meeting – June 22, 2021

Why ICARUS involved in ISO standards?

1. By definition, all Projects have a start and an end
2. Several EU funded Projects develop and test prototypes
3. Or produce reports …

… but … what remains few years after Project termination?

Nothing if standards are not produced

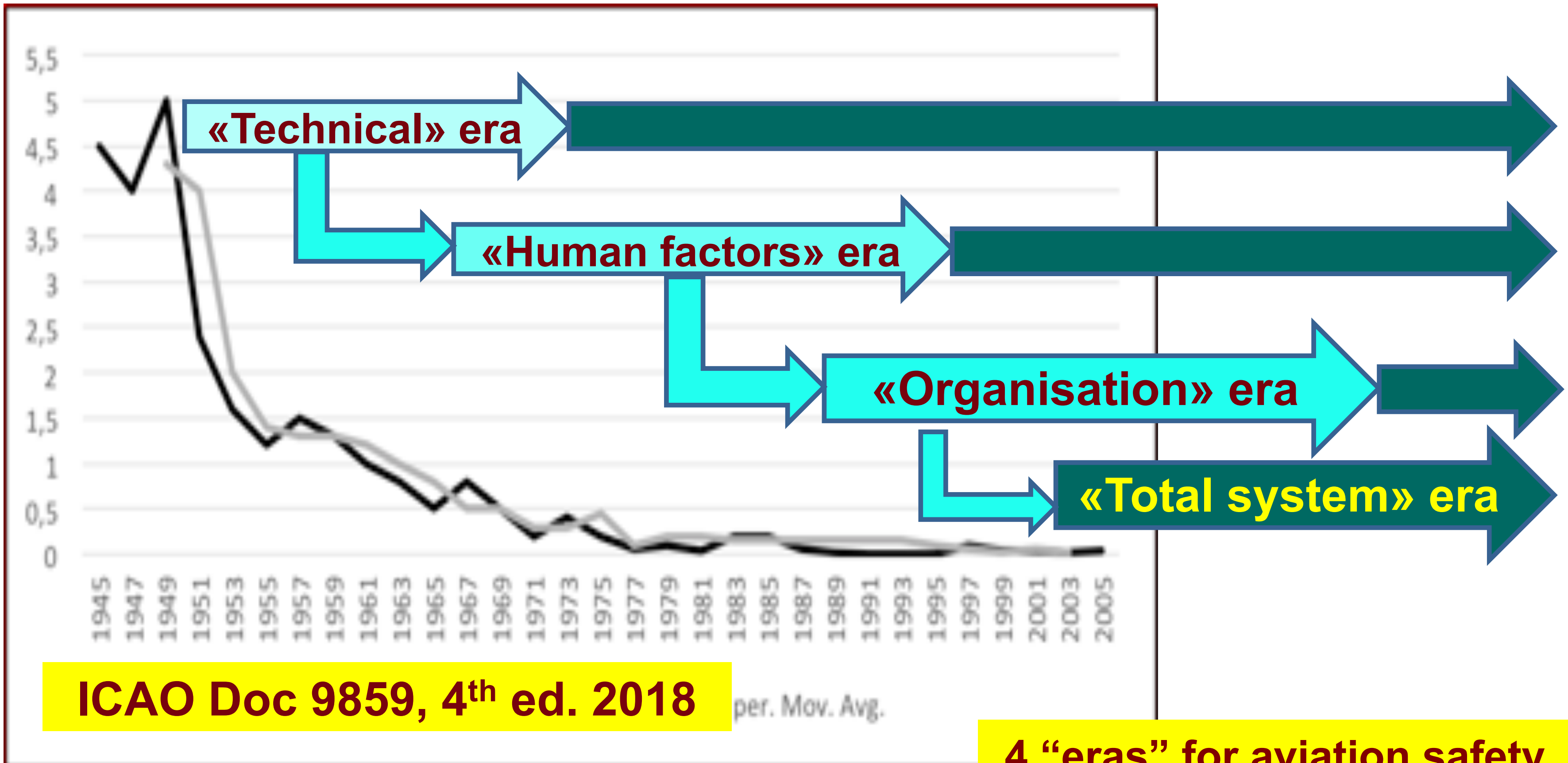
International standards last longer than Projects

3 steps to reduce workload on CAAs

3	Risk-based regulation	Delegation of some oversight tasks to Qualified Entities (QEs)
2	Pool resources at regional level	ICAO GASOS EASA
1	Performance-based regulation	Standards by industry

Without compromising safety

Evolution aviation safety



4 “eras” for aviation safety

ISO for safety of organisations

1. ISO has a reputation for standards on quality and safety of organisation
   a) ISO 9001:2015 Quality management systems
   b) EN 9100, based on ISO 9001
   c) ISO 45001:2018 Occupational health and safety management systems
   d) Etc.
2. ISO Sub-Committee SC 16 (UAS) of Technical Committee TC 20 (Aerospace) has:
   a) Produced 5 published ISO standards
   b) 25 more in progress
3. **Some cover ‘organisations’ and ‘services’**

Draft ISO Standards for UTM & services

CD	Subject	Stage
23629-9	UTM — Part 9: Interface with users	**10 (Proposal)**
23629-8	UTM — Part 8: Remote Identification	**20 (WD)**
23629-5	UTM — Part 5: UTM functional structure	**40 (DIS)**
5015-2	UAS — Part 2: Operation of vertiports for unmanned aircraft (UA)	**40 (DIS)**
23629-12	UTM — Part 12: Requirements for UTM service providers	**40 (DIS)**
23629-7	UTM — Part 7: Data model for spatial data	**50 (FDIS)**
21384-3 (2019)	UAS — Part 3: Operational procedures	**60 (IS) (Published)**
21384-3	UAS — Part 3: Operational procedures (2nd ed. includes Command & Control SP)	**90.92 (Revision)**

Maturity

ISO DIS 23629-12
UTM service providers

1. List of 30 UTM services
   - 11 safety-critical (potentially subject to certification by Authorities), **including two proposed by ICARUS:**
     a) **Real-time GIS**
     b) **Vertical Alert Service (VALS)**
2. 13 safety-related (ISO certification may suffice)
   - **Vertical Conversion Service (VCS)**
3. 6 Operation support services
   - E.g. RAA https://www.online-sora.com/

Main Topics in 23629-12

1. Scope & Normative references
2. Terms, definitions and abbreviations
3. Service Provision
4. **Safety & Security Management**
5. Software Safety Assurance
6. **Contingencies & Maintenance**
7. Privacy and Data Protection
8. **Personnel competency**
9. Manuals, procedures and records
10. Insurance

Based on Project development and input from Adv Board, more technical standards on RGIS, VALS & VCS might be proposed to ISO in the future

Results from Poll

Manuel Onate EuroUSC

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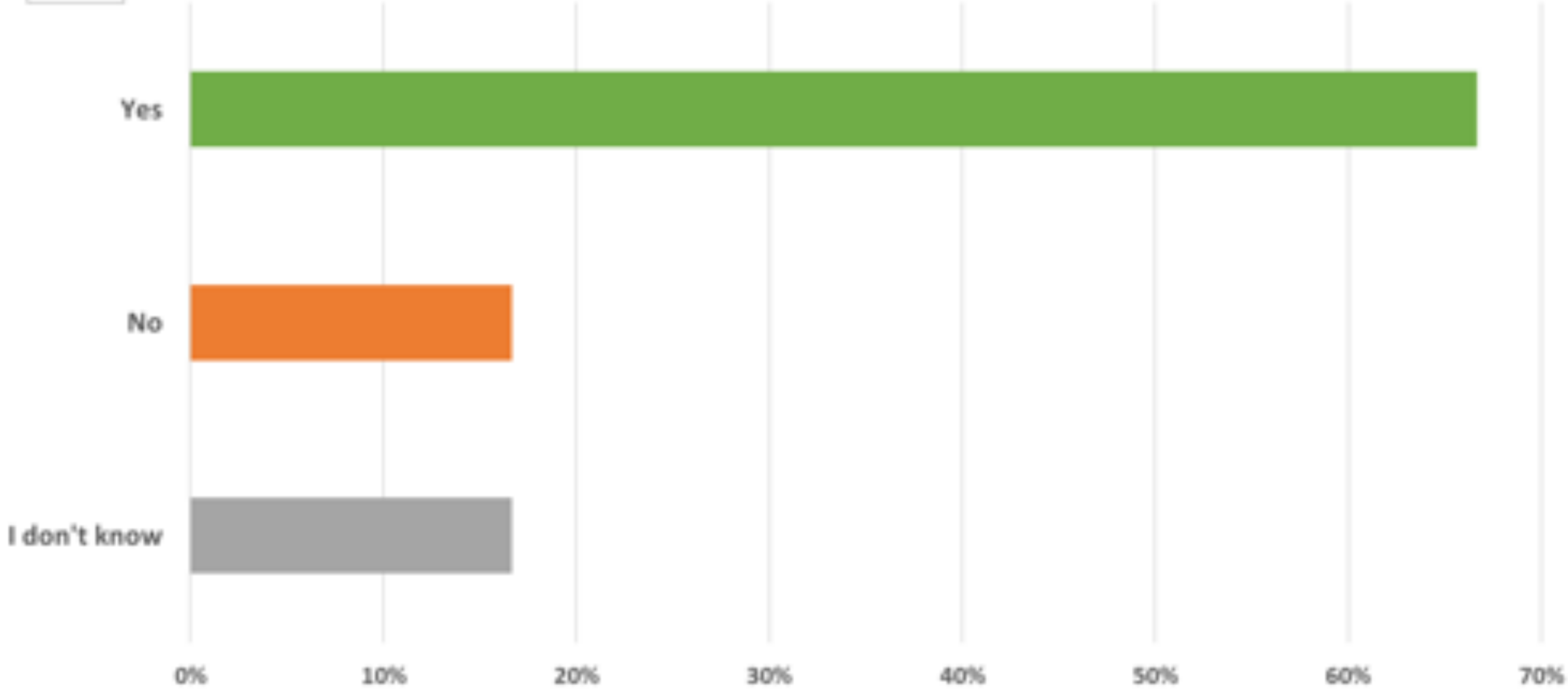
Founding Members

EUROPEAN UNION EUROCONTROL

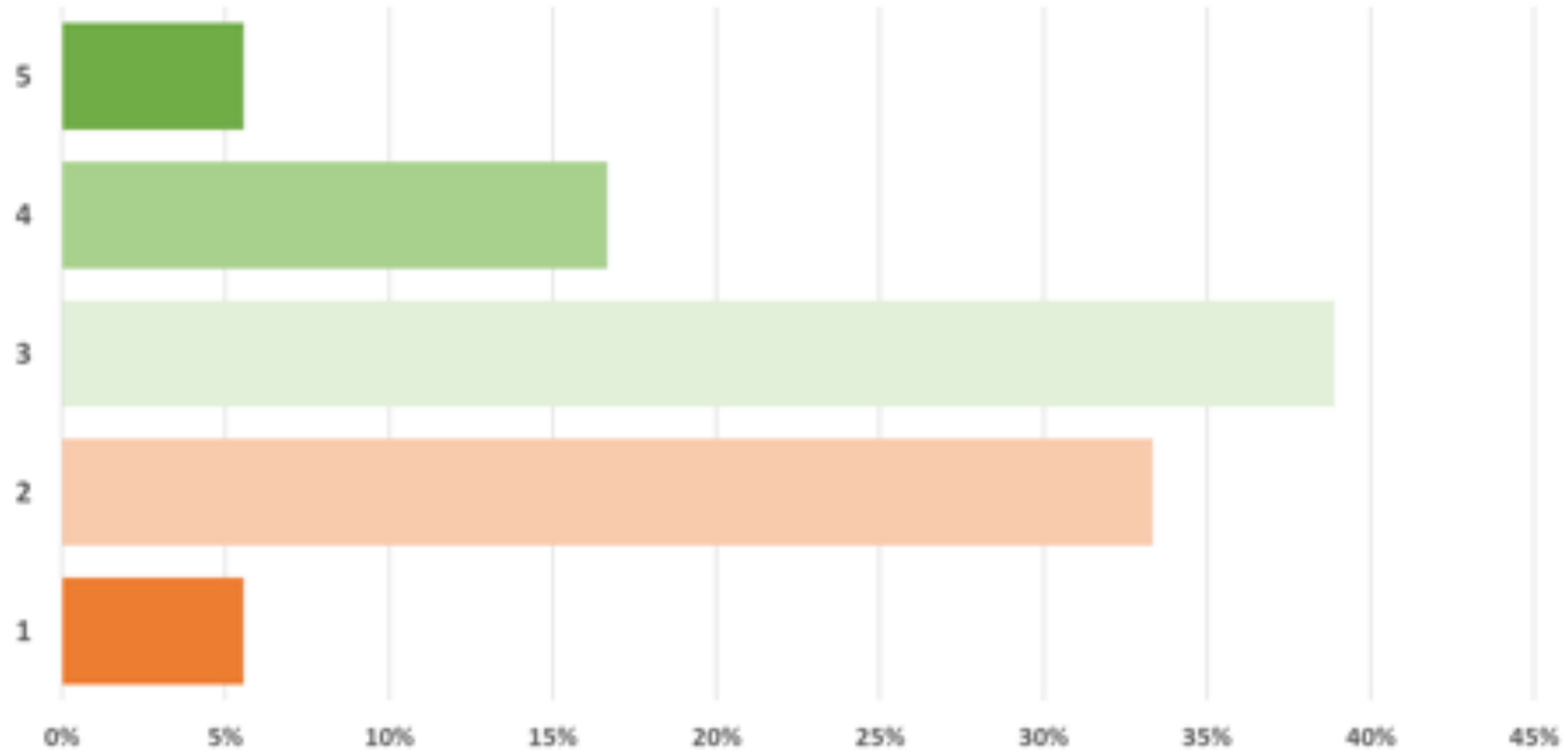
1

If necessary, would you favor reduced Flight Technical Error (FTE) and GNSS integrity over greater accuracy for positioning?



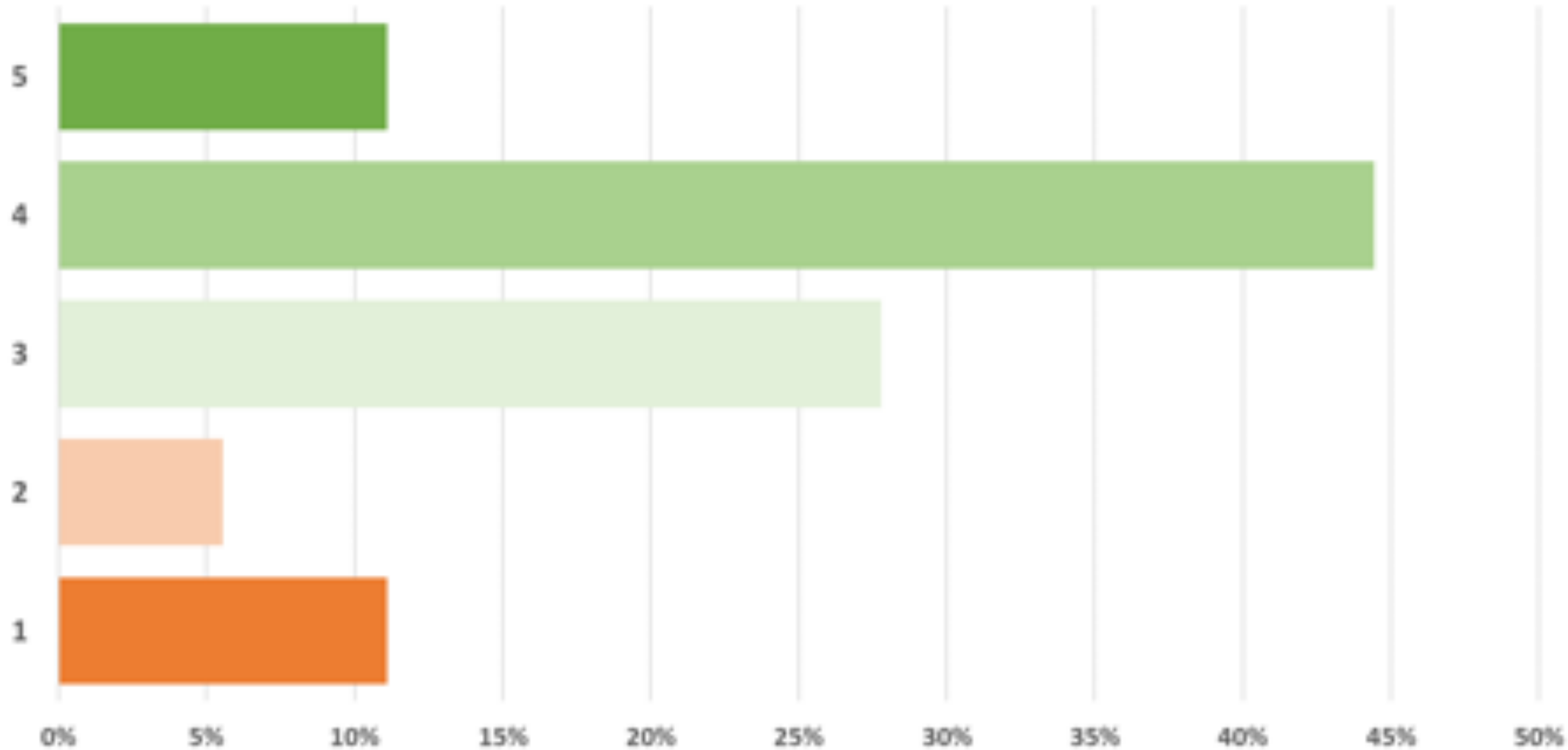
2

A service like ICARUS can be, compared with a GNSS chipset implementing on-board integrity calculation: Cheaper



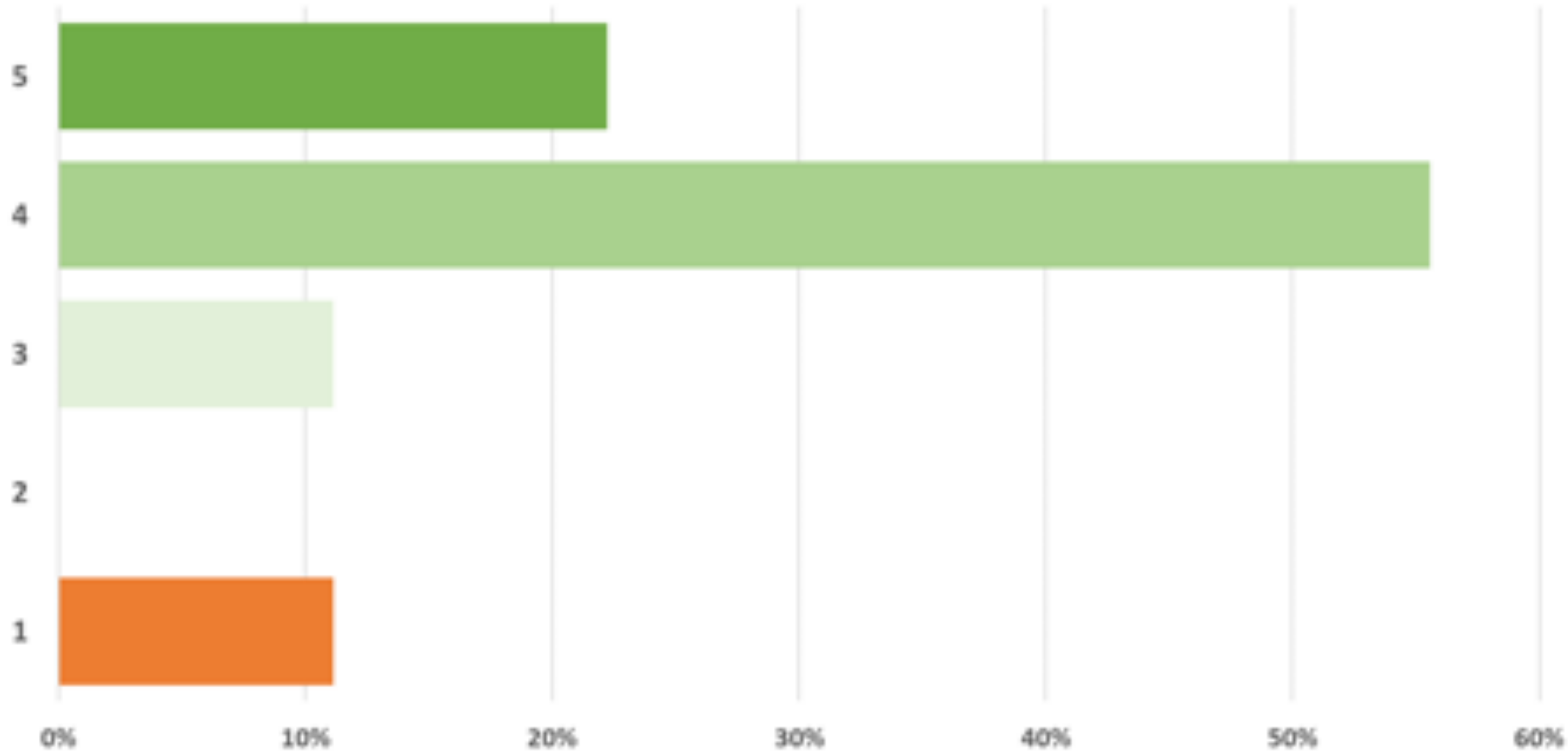
3

A service like ICARUS can be, compared with a GNSS chipset implementing on-board integrity calculation: Easier to customize



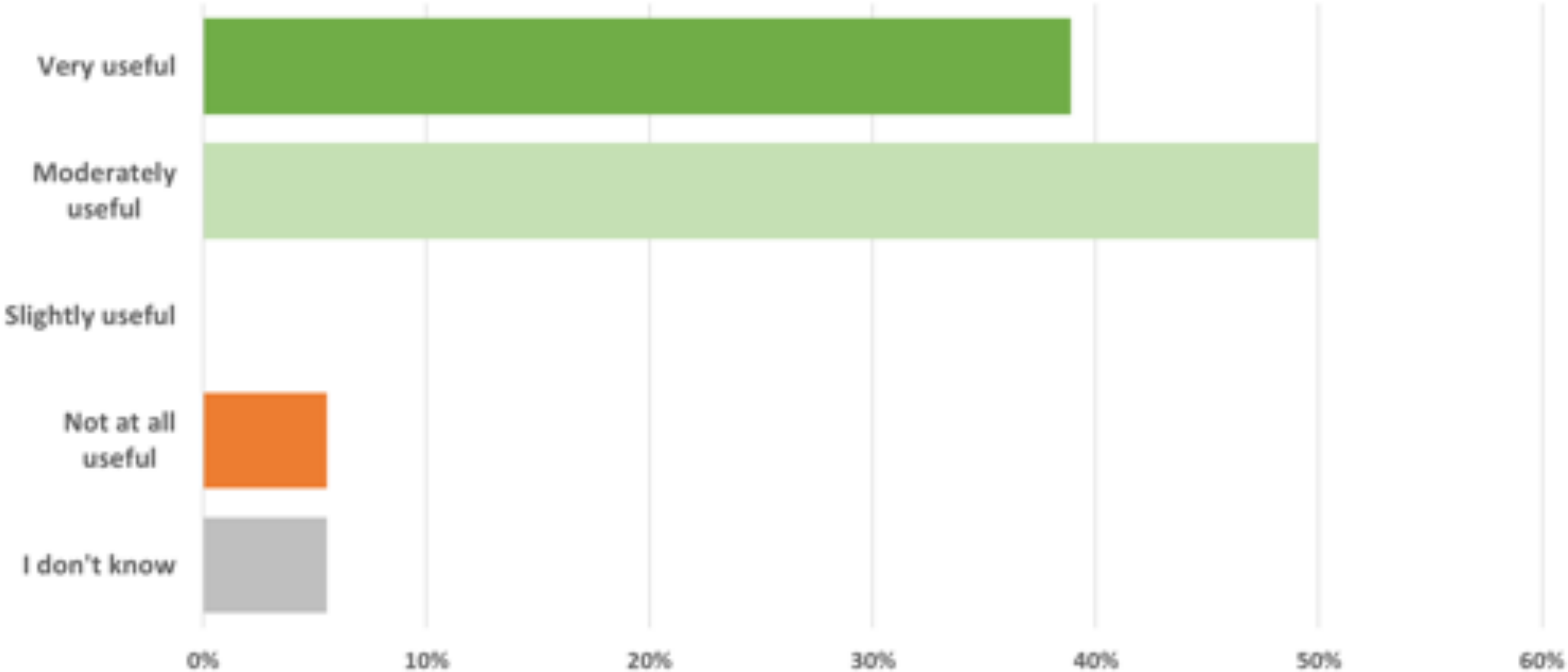
4

A service like ICARUS can be, compared with a GNSS chipset implementing on-board integrity calculation: Easier to upgrade



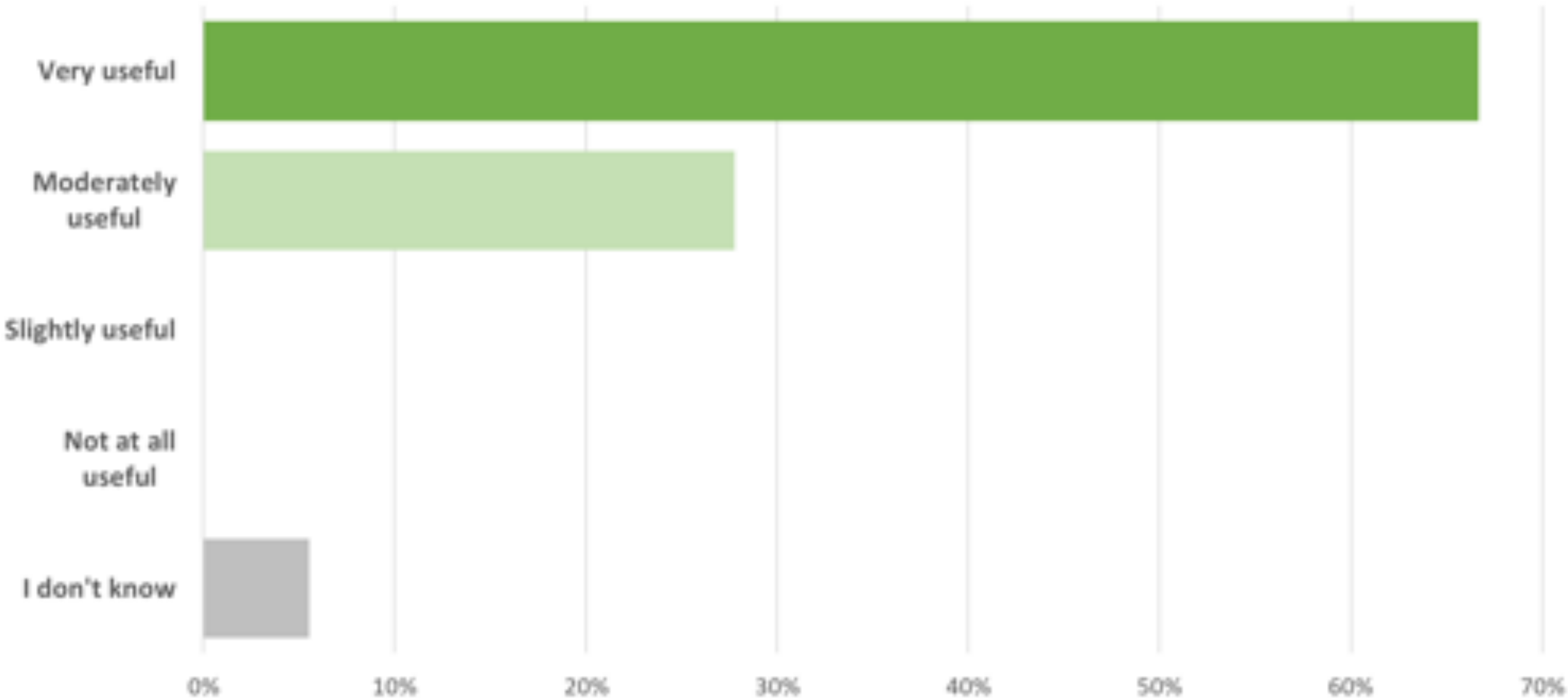
5

In the pre-flight phase a GNSS performance monitoring service can help in the selection of the best trajectory. How do you value this feature?



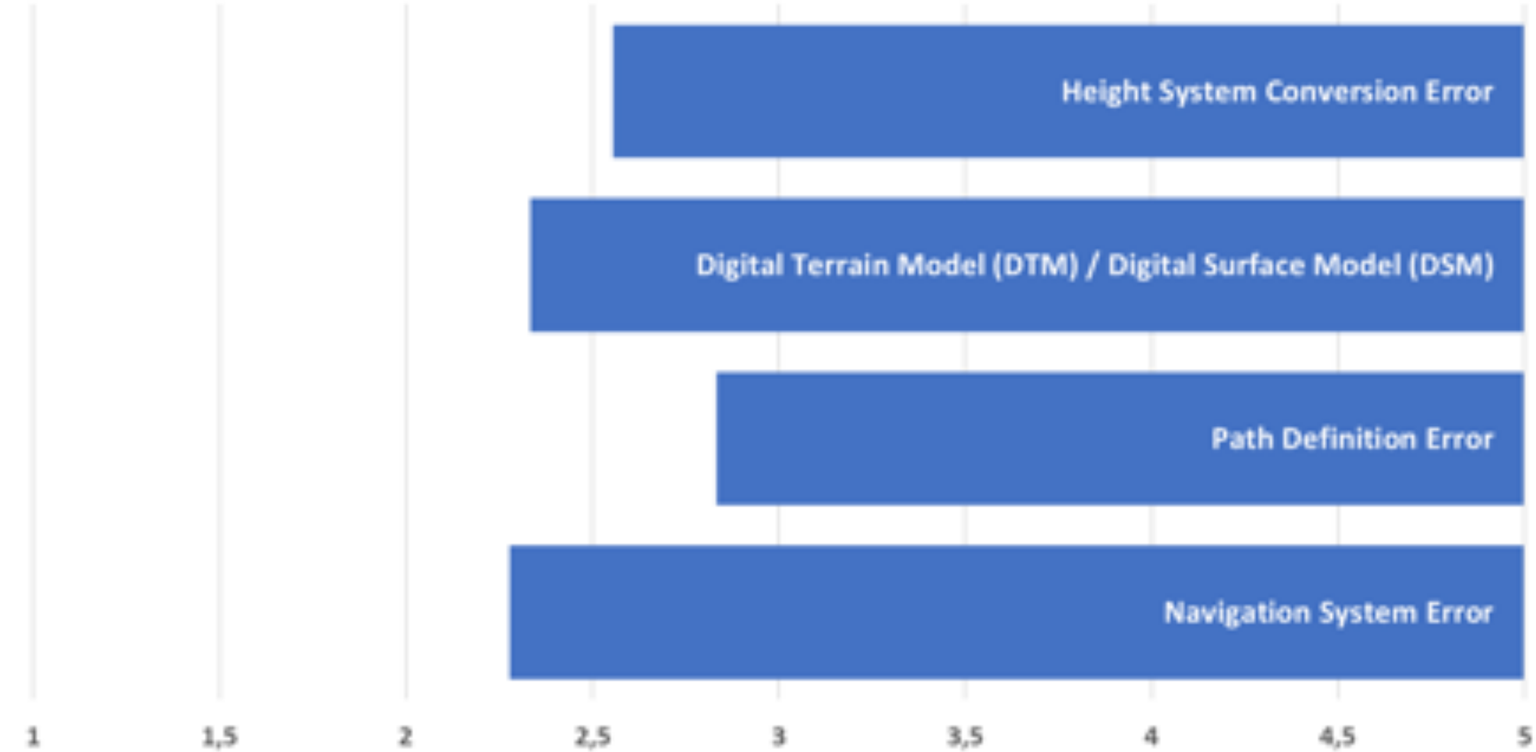
6

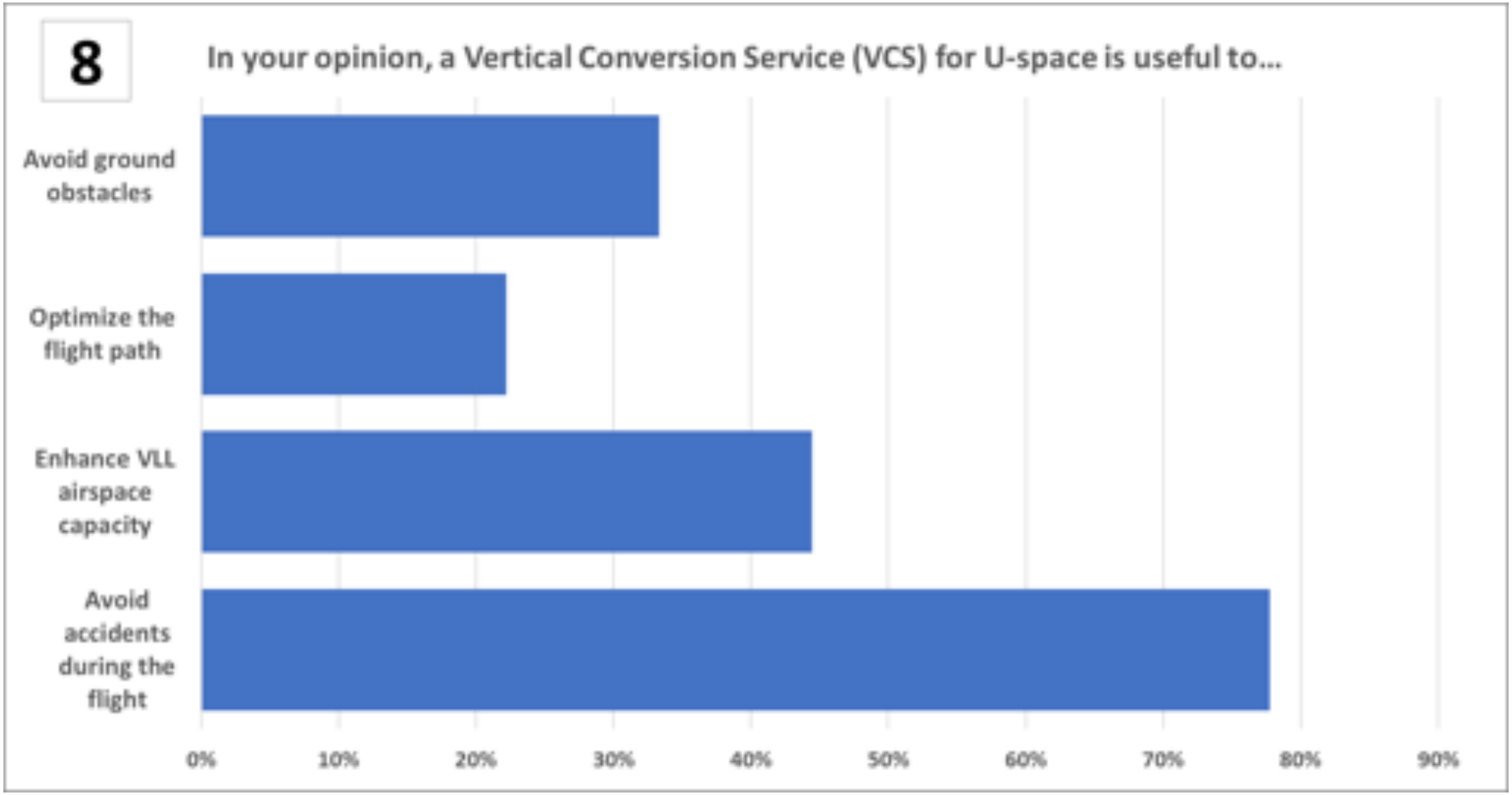
When is not possible to have the integrity information on the position of the drone during the flight, is it useful to have an information layer on a map that gives at least a rough indication of GNSS performance?

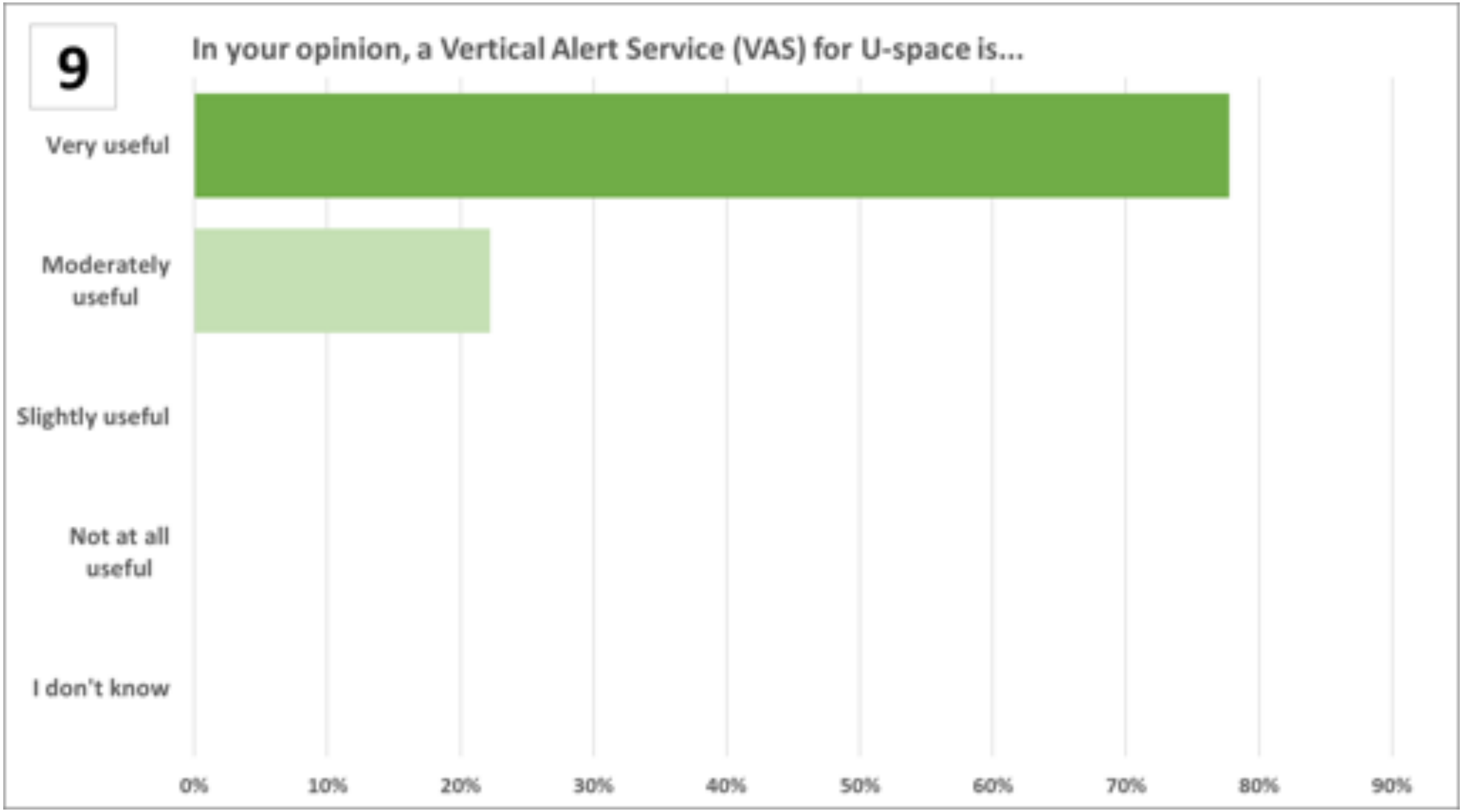


7

In your opinion, to fly in a urban environment, which of the following errors does impact on overall error budget the most?

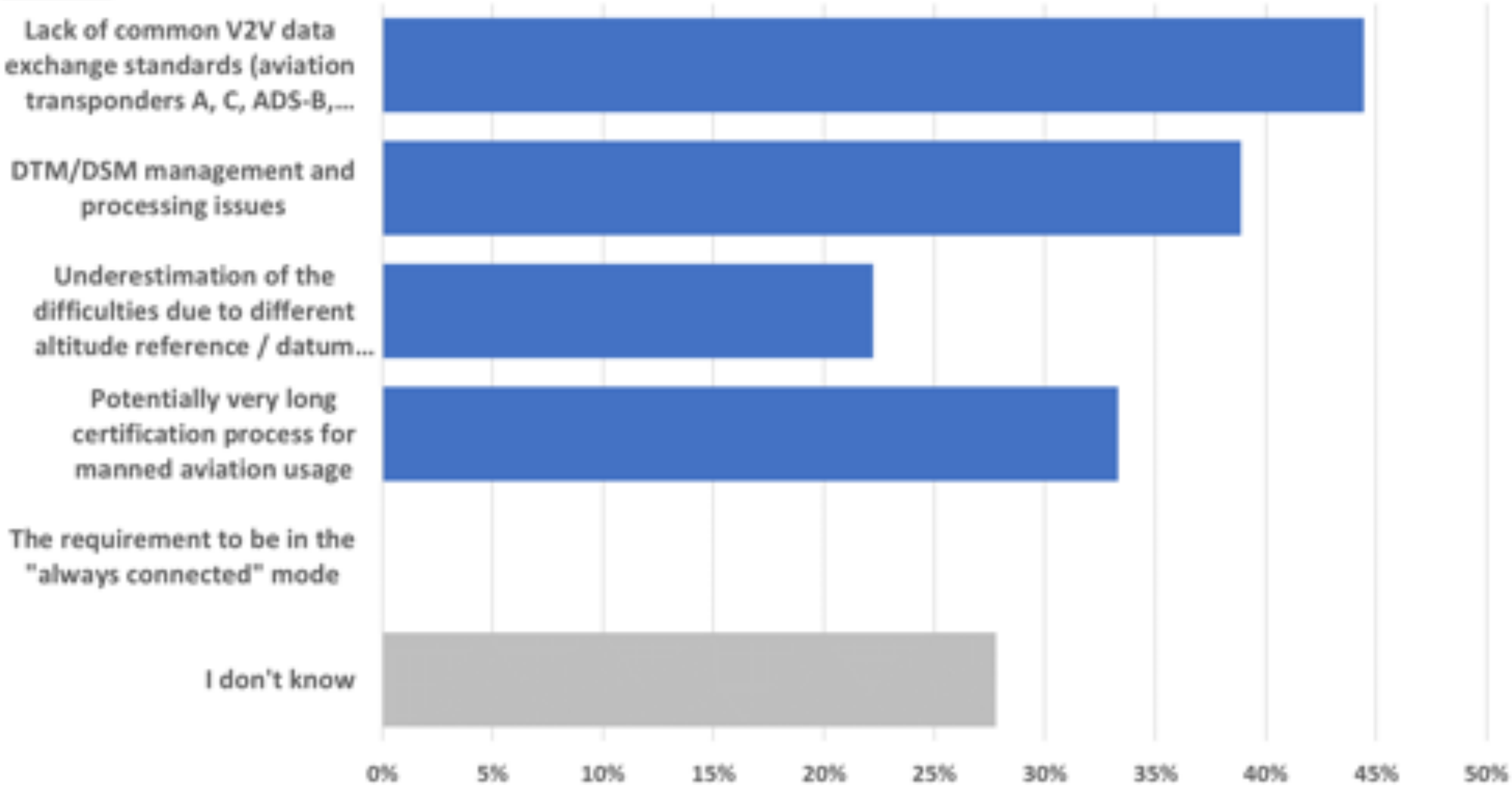



8
In your opinion, a Vertical Conversion Service (VCS) for U-space is useful to...
Avoid ground obstacles
Optimize the flight path
Enhance VLL airspace capacity
Avoid accidents during the flight
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%


9
In your opinion, a Vertical Alert Service (VAS) for U-space is...
Very useful
Moderately useful
Slightly useful
Not at all useful
I don't know
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%

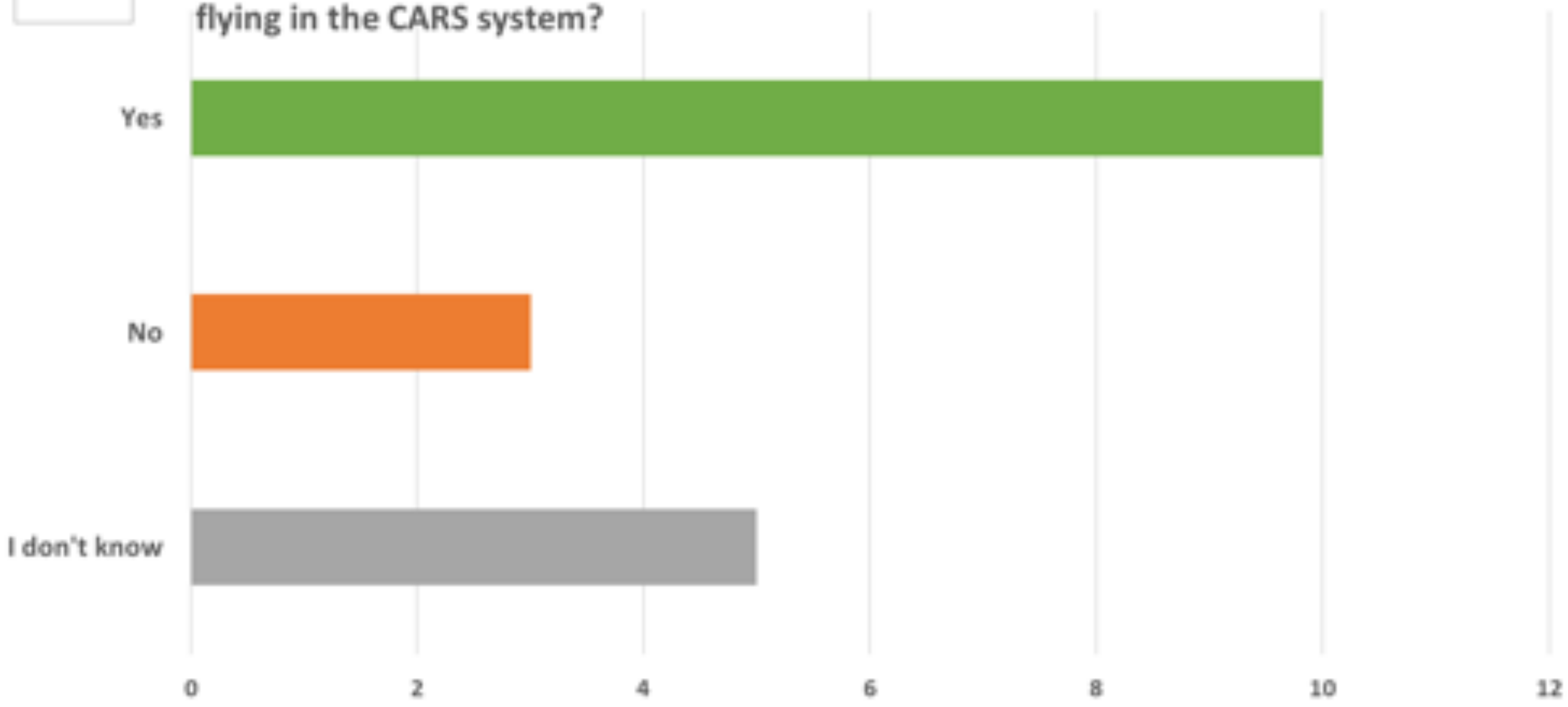
10

In your opinion, which of the following factors may be the most blocking for CARS deployment?



11

Do you think that it is appropriate to require all users of U-space, including manned aviation, to use additional equipment (SERA.6005) to implement the principles of flying in the CARS system?

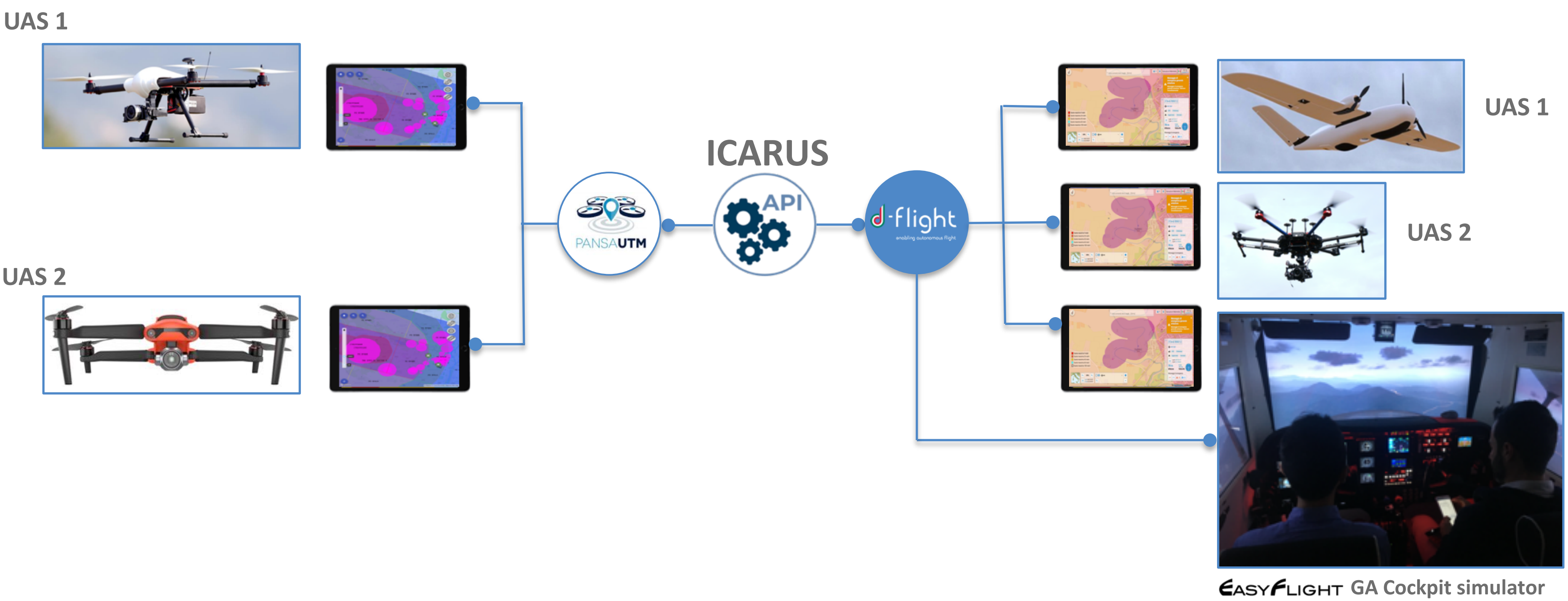


ICARUS Validation Activities

Alberto Mennella **Topview.**

ICARUS Second Advisory Board Meeting – June 22, 2021

Validation Activities



Mixed Real flights / simulated flights

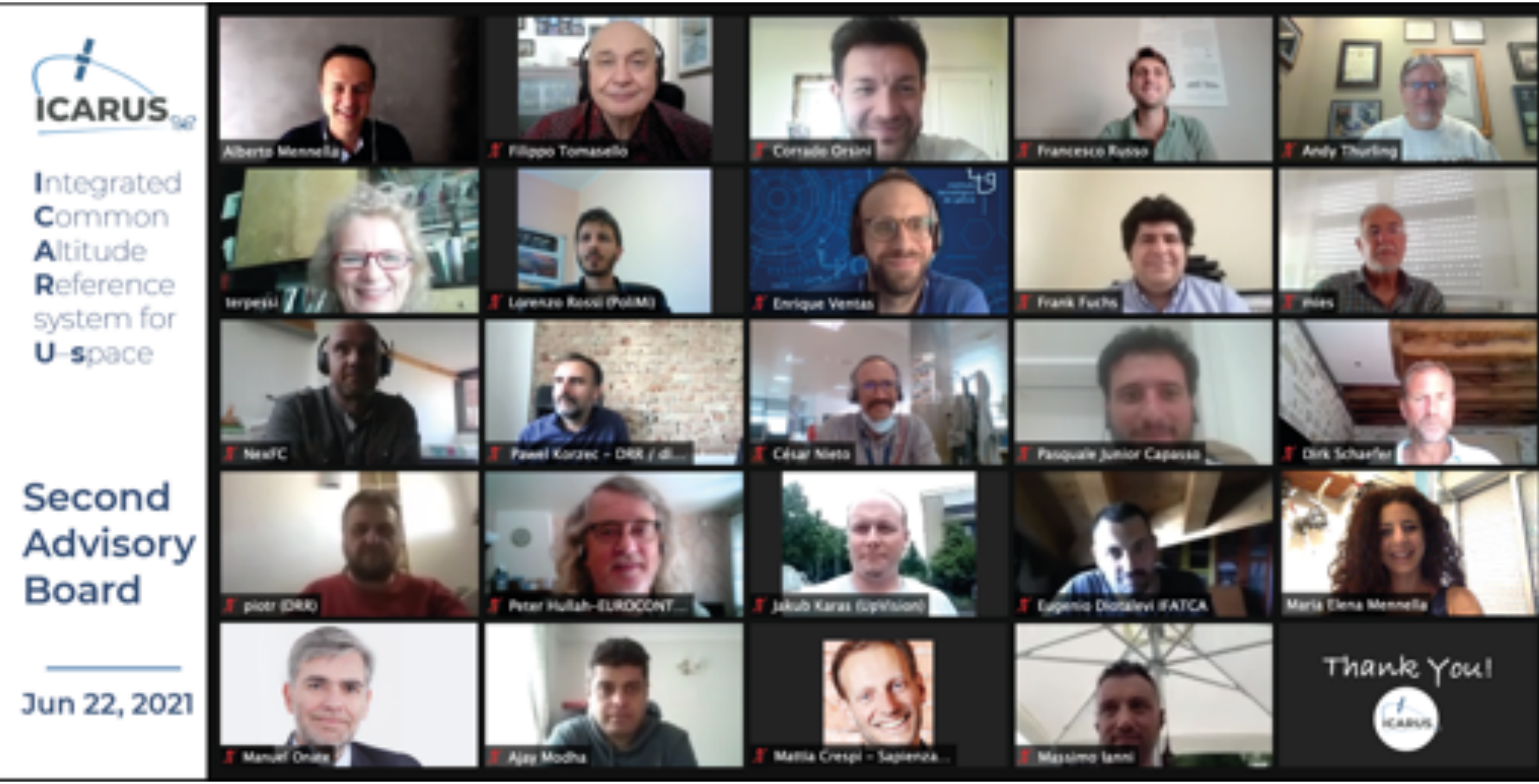
Validation scenario design

SCENARIO 1: UAS-GA CARS – SIMULATED / REAL OPERATIONS

SCENARIO 2: UAS-ULTRALIGHT– SIMULATED/REAL OPERATIONS

SCENARIO 3: UAM - DRONE TAXI UAM - SIMULATED

Family photo



ICARUS – Open Discussion

ICARUS Second Advisory Board Meeting – June 22, 2021

ICARUS – Roadmap & Closing Meeting

Cristina Terpessi **e-Geos**

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ICARUS Roadmap

- SESAR Intermediate Project Review Meeting June 24, 2021

- October, 2021   Finalisation of

  - WP4 ICARUS service solution design & prototype
  - WP5 Development of simulated environment

- From September to November 2021:

  - Demonstration Activities

Next Advisory Board   January 2022

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U-space ICARUS Project

Thank you very much for your attention!

This project has received funding from the SESAR Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No [number]

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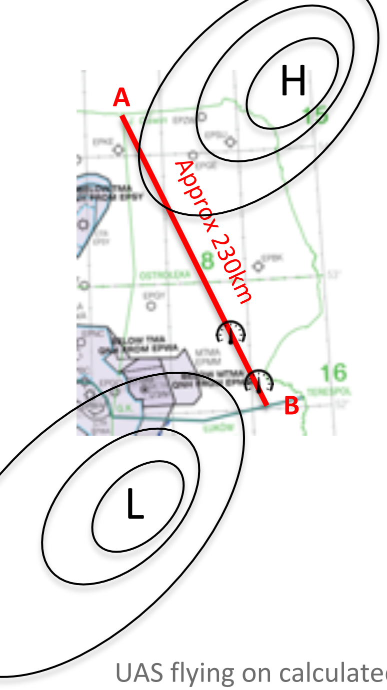
Backup slide

ICARUS – Milestones

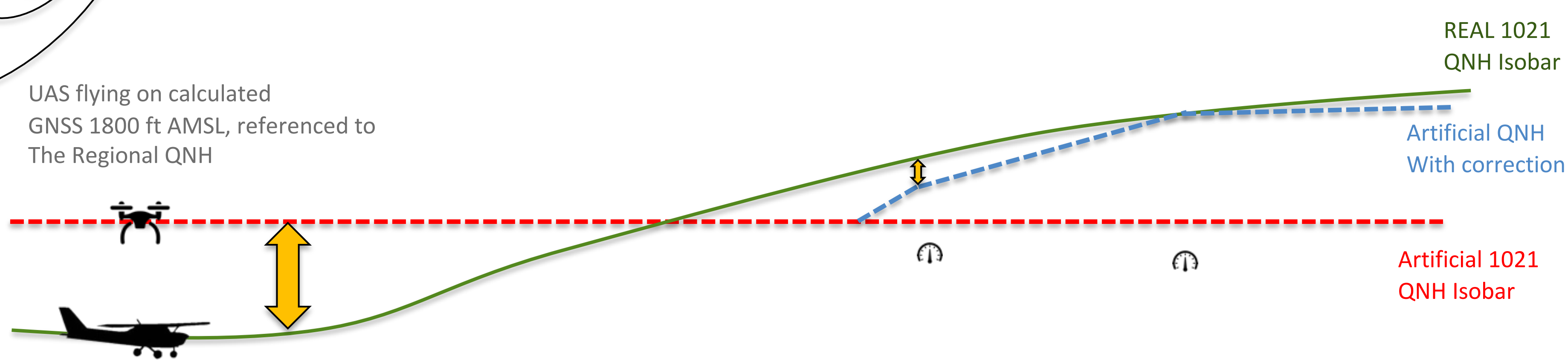
ID	Milestone	Date
M01	**Kick-Off Meeting**	May 27, 2020
M02	**Mid-term analysis Review:** • Project Management Plan – Issue 1 • D3.1 – ICARUS concept definition – Draft Version	October 1, 2020
M03	**Final analysis Review** • D3.1 – ICARUS concept definition – Issue 1 • KOM system/service Design	March, 2021
M04	**Architecture Design Review** • D4.1 Design and architecture of the ICARUS system & service	May, 2021
M05	**System/Service Prototype acceptance Review & Validation scenario design** • ICARUS Prototype- Preliminary CONOPS- Architecture- • Validation scenario and Simulation trials plan	October 2021
M06	**Final Results Review**	January 2022
M07	**Final Review (with dissemination results)**	July 2022



One QNH region, number 8

Flight A > B (approx 230km)

QNH: 1021 hPa



By adding more data from land pressure stations
We reduce the unknown error between **real** QNH
Reference and **calculated** QNH reference

QNH method calculation:
Regional
Lowest region pressure corrected every hour -3hPa

CTR and under **TMA** (continuously updated):
In reference to the Airport ARP