



# ICARUS: INTEGRATED COMMON ALTITUDE REFERENCE SYSTEM FOR U-SPACE



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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 ?

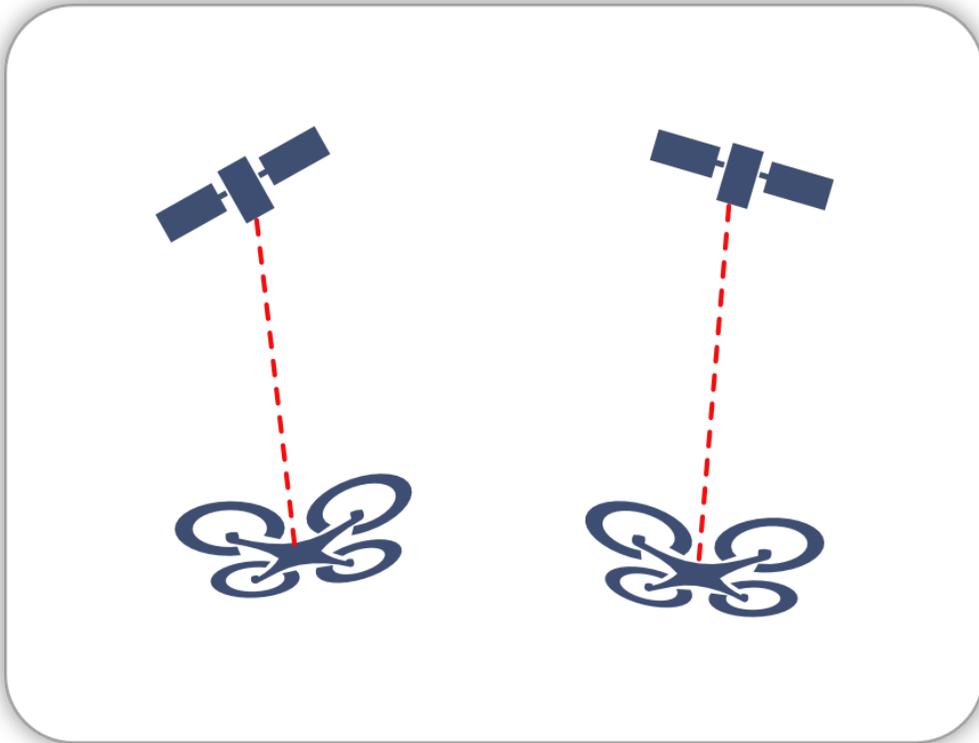
- Drone traffic vertical separation requires **more precise** height measurements
- Barometric measurements are **not reliable** at VLL, especially over cities
- ICARUS work will **enhance vertical separation** and enable **high density operations**

# 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

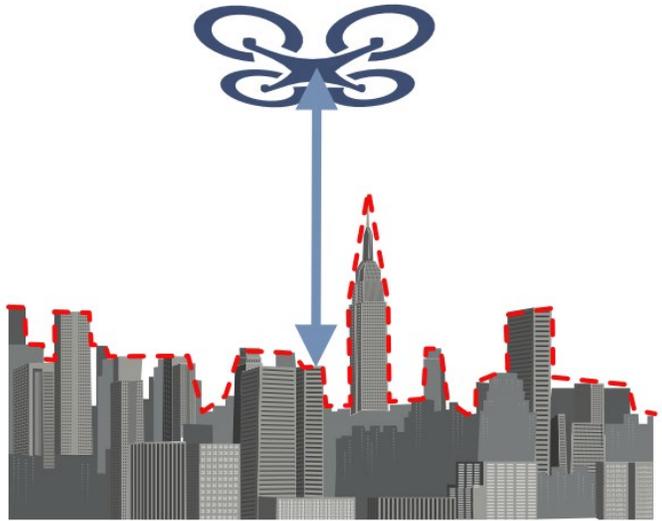
# UAS-UAS: Common reference at VLL



## 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)

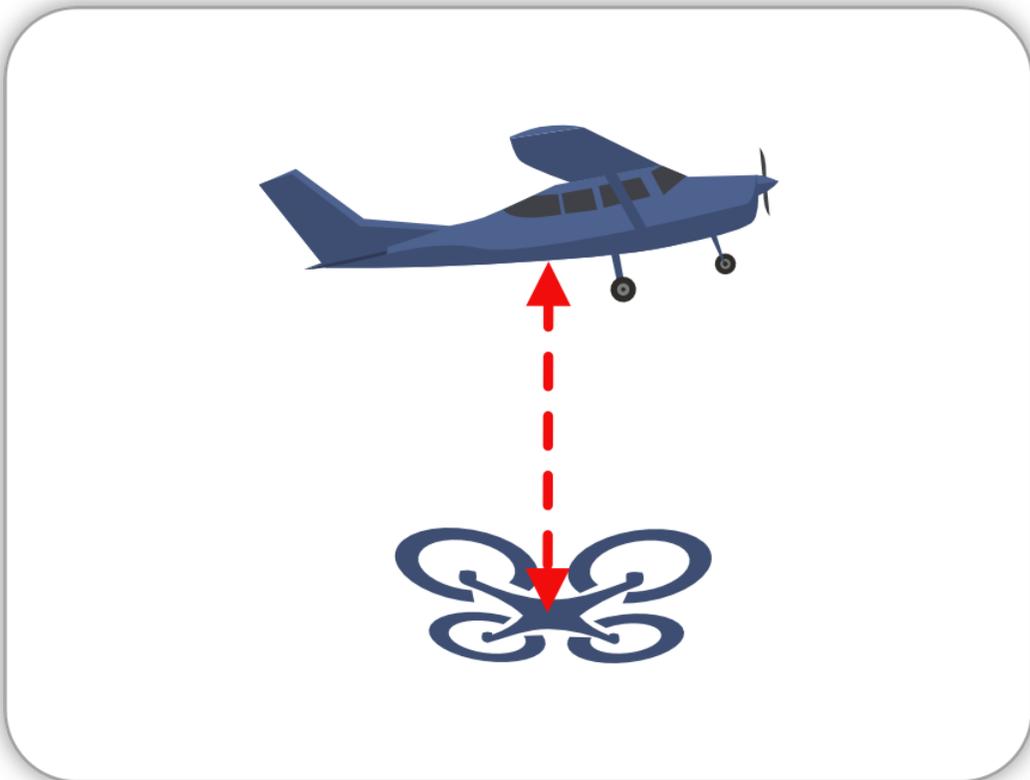
# UAS-Ground: Obstacle awareness



## 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

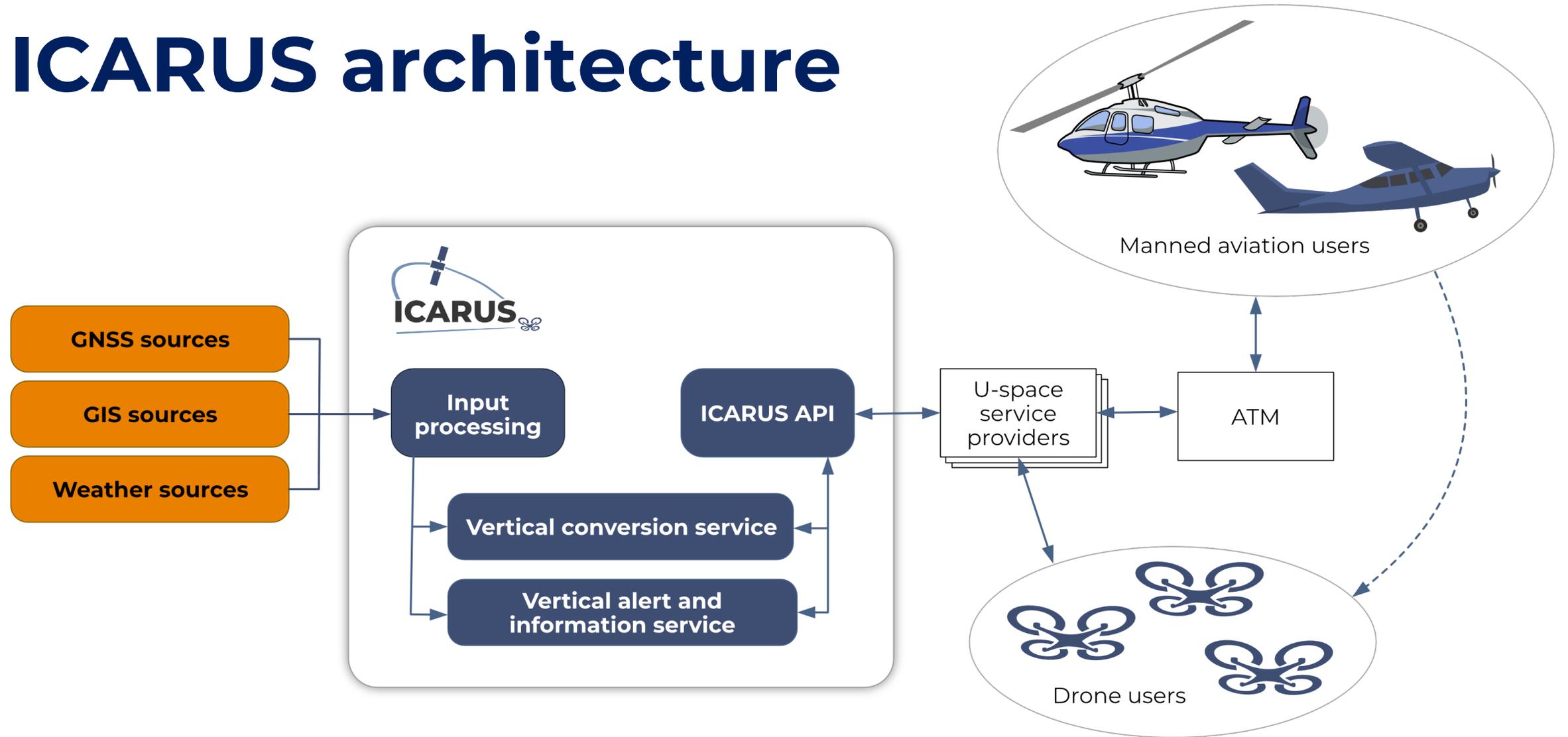
# UAS-Manned: Common reference



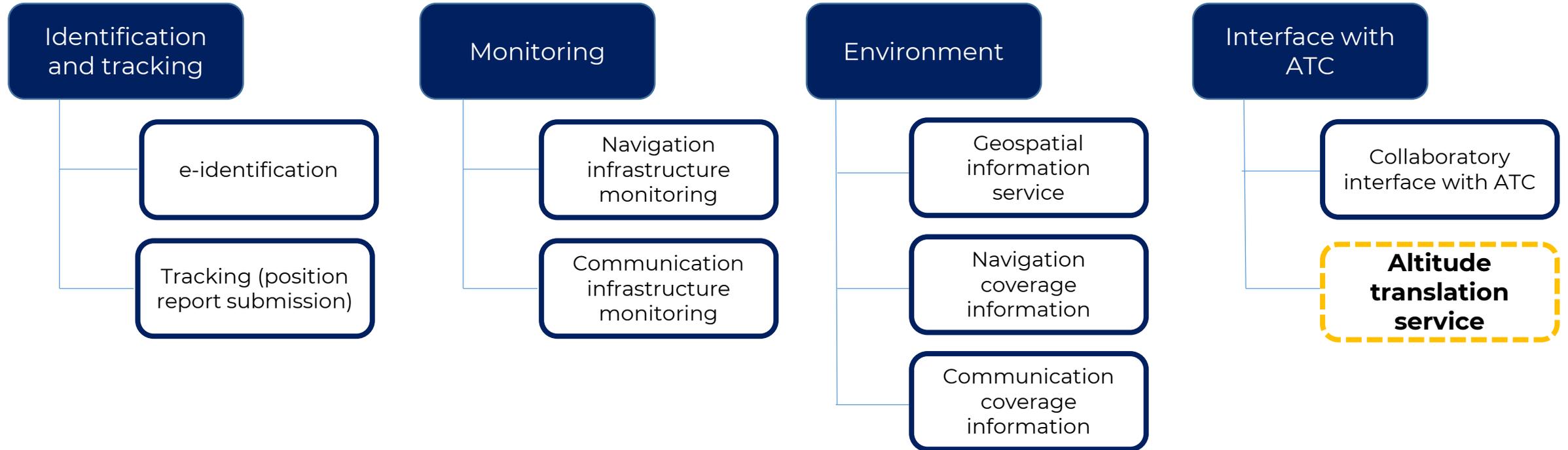
## Objective #3

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

# ICARUS architecture

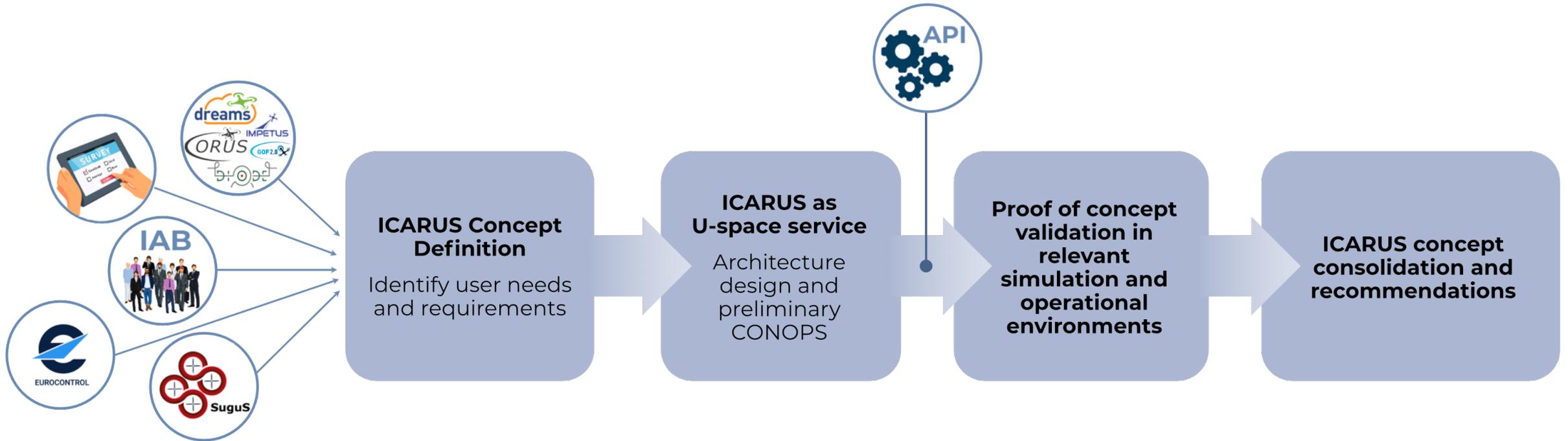


# ICARUS as a U3 service



ICARUS will interact with many **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

# Summary and ICARUS future

- ICARUS solves **new challenges** imposed by planned operations of UAS in VLL airspace using a completely **novel approach**
- While providing a safe **backwards compatible interface** with existing manned aviation procedures and systems
- It will be **tested initially by UAS traffic**, taking advantage of its enhanced functionality to support **high density operations**
- When proved successful, it might also be **used by manned aviation** (possibly extending its scope beyond VLL)
- ICARUS paves the way for **introducing new paradigms** into manned aviation, using drones as the experimental medium



**Thank you very much for your attention!**



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