

ECHO ConOps Vision

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European Concept for Higher Airspace Operations (ECHO)
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Higher Airspace Operation: Long term (Vision 2050+)

Technology

- HA Platforms, Suborbital spaceplanes and reusable space transportation
- Subsonic, supersonic and hypersonic transport

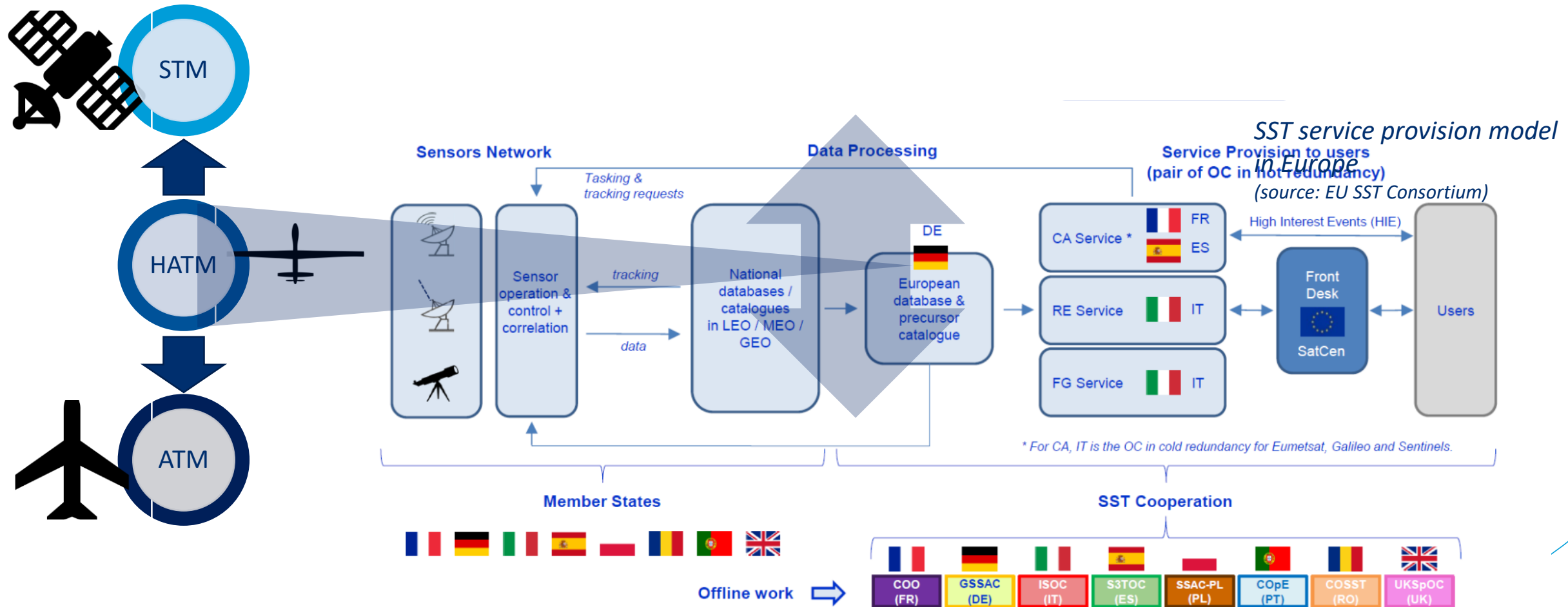
Demand

- HA extensively used
- Transcontinental suborbital hypersonic A to B introduced
- Daily access to space from several locations

Operation

- **Seamless integration** (network and space)
- Operators **plan, modify and execute in real-time**
- Desired airspace negotiated /ensured by **full automation**





Seamless integration

→ Managing airspace transition

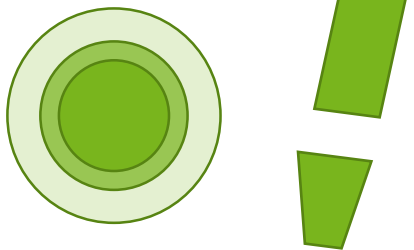
Planning and Execution Phase – managing airspace transition

- Transit through lower- and upper airspace to and from HA region
- Dependencies on controllability, navigational performance, tracking and certification status

When segregated airspace is required

•State-of-the art

- Pre-defined and agreed TRA/TSA and Danger Areas



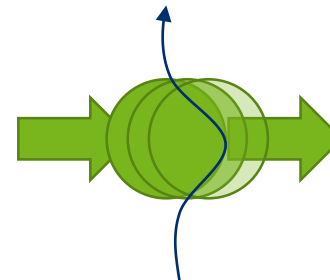
Advanced Near/Mid-Term

Advanced Flexible Use of Airspace (AFUA)



Advanced Mid/Long-Term

Dynamic Mobile Areas, type3



Seamless integration

→ Managing airspace transition

Planning and Execution Phase – managing airspace transition

- Transit through lower- and upper airspace to and from HA region
- Dependencies on controllability, navigational performance, tracking and certification status

When vehicle can operate as cooperative airspace user

• Target concept: based on CDM and TBO principles

- Applied TBO trajectory planning and monitoring process
- Collaborative decision making including, cooperative air situation awareness and strategic cooperative deconflicting
- Specific separation requirements might be necessary based on vehicle (category) specific performance requirements (buffer zones provision)
- Certain prioritisation requirements might arise

Seamless integration

→ Integrated Airspace / HA / Space Operation

Space Vehicle related management services,
real time monitoring and use of (dynamic) Hazard Areas

•State-of-the-Art:

- Segregation of airspace regions
 - above accept. level of risk
- Static airspace closure CBA/TSA/TRA, TFR, SUA or Restricted, Prohibited, Dangerous areas,
- Information via Aeronautical Information (AIM) or cooperative information management process

Short-term/medium term:

- Advanced planning of risk areas,
 - dynamic airspace closures;
 - Real-time monitoring
 - Real-time hazard area provision
- opening up airspace segments sufficient to react;
- Further improvement: real-time Hazard Areas for airborne vehicles

Medium term/long term:

- Dynamic safety zones (e.g. 4D compact envelops)
 - minimized segregation;
 - real-time data provision
 - dynamic adaptation to non-nominal events,
 - higher levels of automation.



-Principles:

- Strategic cooperative deconfliction
 - 4D Trajectory Based Operation (trajectories, operational volumes)
 - Collaborative Decision Making
 - Tactical monitoring and fallback

-Planning process

- Strategic
- Pre-Tactical
- Tactical

-Phases of Flight

- Pre-Launch/Takeoff
- Launch/Takeoff and Ascent/Climb
- Cruise/Transfer/Mission
- Re-entry/Descent
- Landing
- Post-Flight

Operators plan, modify and execute in real-time → Airspace Management Services - Planning phase

Build on principals of Trajectory Based Operation (TBO)

-Strategic cooperative separation

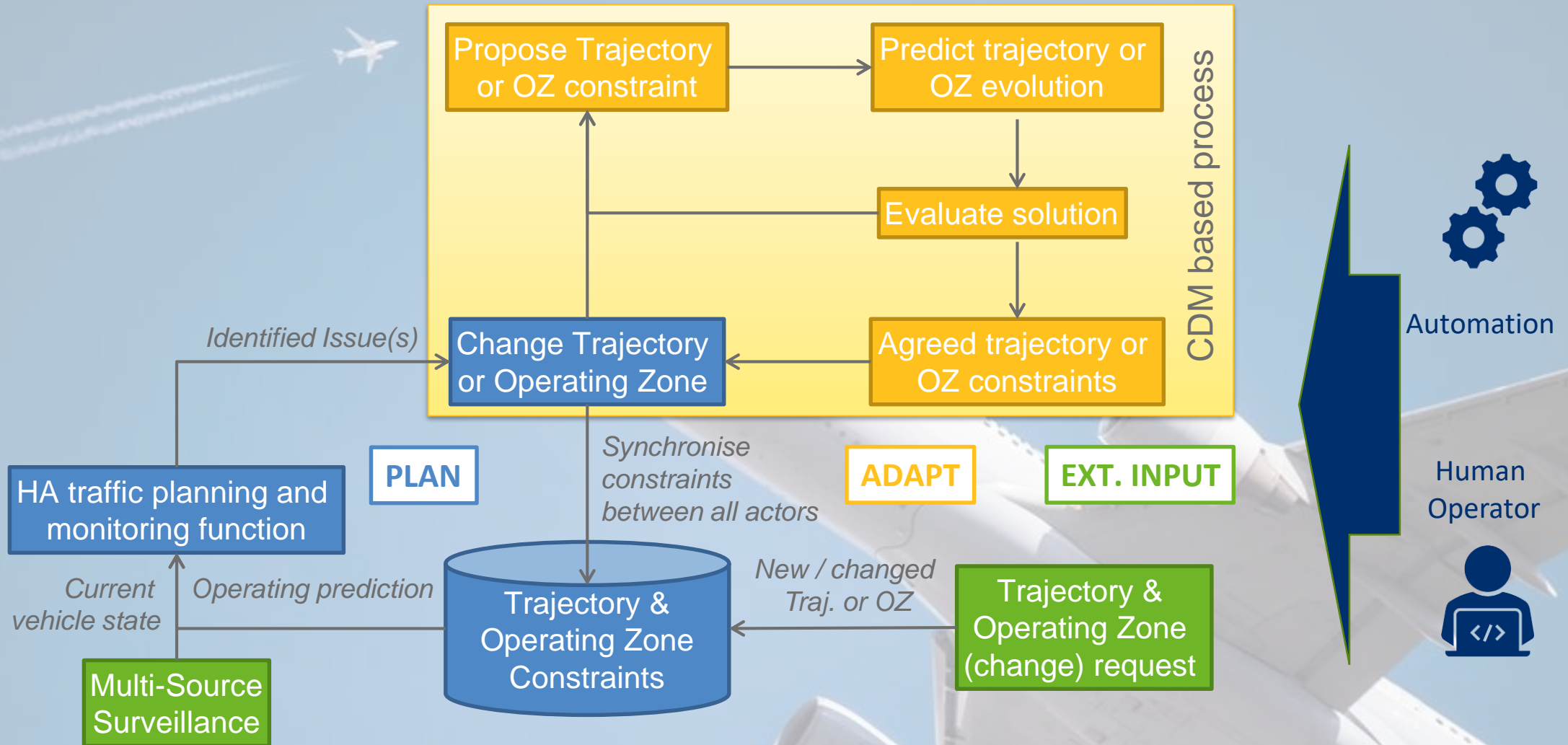
- Through all ATM planning phases: strategic, pre-tactical, tactical

-4D-trajectories and 4D Operating Zones

- Uncertainty of vehicle position over time → operating zone
- Performance- and mission-based four dimensional shape and volume
- Changes during operation covered by processes and services

-Higher Airspace Traffic Management (HATM)

- Augmented by tactical monitoring
- Mission assurance provided for long term planning
- Ensure space operations (HA transfer) free of conflicts
 - In legacy airspace, HA and in space → STM interface





THANK YOU FOR
YOUR ATTENTION

Q1:

- Are TBO based services appropriate to manage the expected vehicle landscape operating in Higher Airspace?

Q2:

- Are the suggested services suitable to allow a flexible and scalable implementation in short and medium term?