



FROM INNOVATION TO SOLUTION

Flying SESAR from the RPAS Perspective

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founding members



Contents

- Setting the scene
- Selected operational issues
- SESAR can help!
- Research Roadmap
- Conclusions



RPAS Integration in ATM

RPAS is not the future – It is here – Activities are on-going in many countries.

RPAS need to adapt to ATM to avoid segregation -
Not the other way around – Just another airspace user

Integrate operational improvements addressing RPAS operations into the ATM Master Plan and its roadmaps



Main Objective

Safe integration of RPAS operations into the European aviation and ATM systems from 2016

Non-segregated ATM environments

SES/SESAR Compliant – Integrated into the European ATM Master Plan = ICAO Global Plan/ASBU alignment



First Thought

- What is an 'RPAS'?
 - A specific class of UAS ...
 - ... of which a UAV is part!
- Who are the users?
 - Military
 - Increasing civil
 - Increasing size - cargo?
- What does 'integration' mean to you?





Selected Operational issues

... or what's the problem, anyway?



ATC and communications

ATC:

- Compliance with IFR procedures
- Collision avoidance
- ACAS compatibility
- Climb/turn/speed performance
- Contingencies
- Navigation performance
- Transparency to controllers

Communications:

- Trajectory exchange
- Data link clearances
- Latency
- Party line
- Spectrum
- Relay



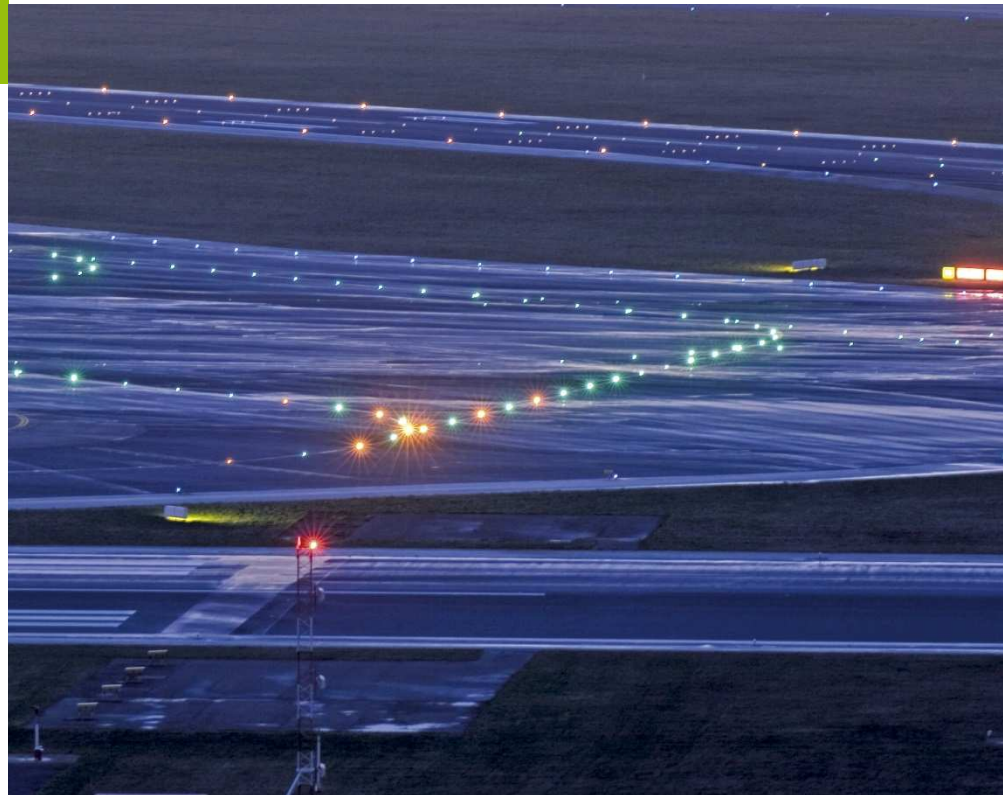
Airports

Ground:

- Entering runways – final checks
- 'Spotting' other mobiles
- Taxiway routes
- Signs/lights
- Signals from tower
- 'Follow me'
- Responsiveness to instructions
- Unexpected obstacles
- Closed surfaces
- Taxi/line-up/take-off expedition

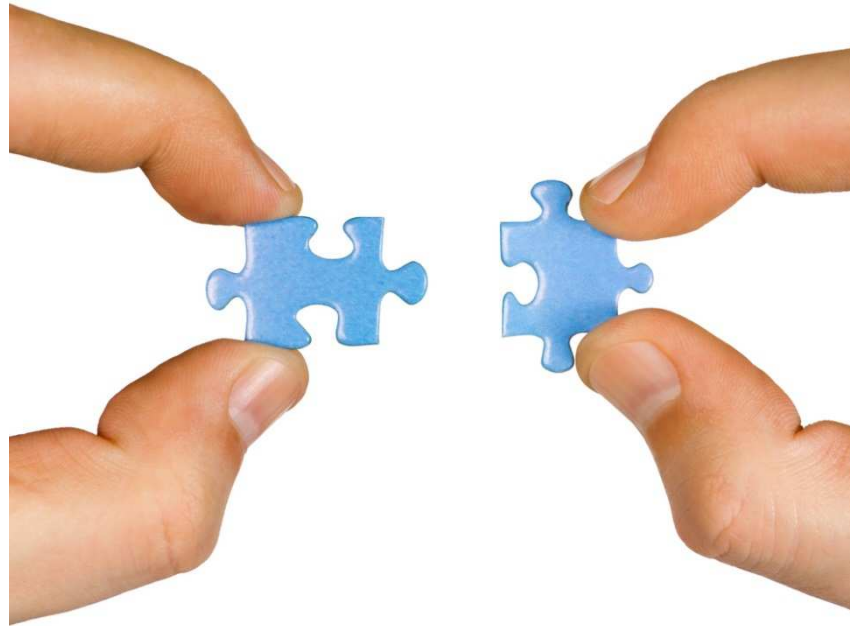
Air:

- VFR joining/spacing
- Common landing aids/procedures
- SID compliance
- Taxi speed/flexibility



Network

- Airspace requirements
- Operational idiosyncrasies
- Predictability
- Trajectory planning
- Impact of multiple RPAS
- Small operators' planning capability



CNS Equipage???

Communications:

- VHF radio
- VDL-2
- CPDLC
- LDACS

Navigation:

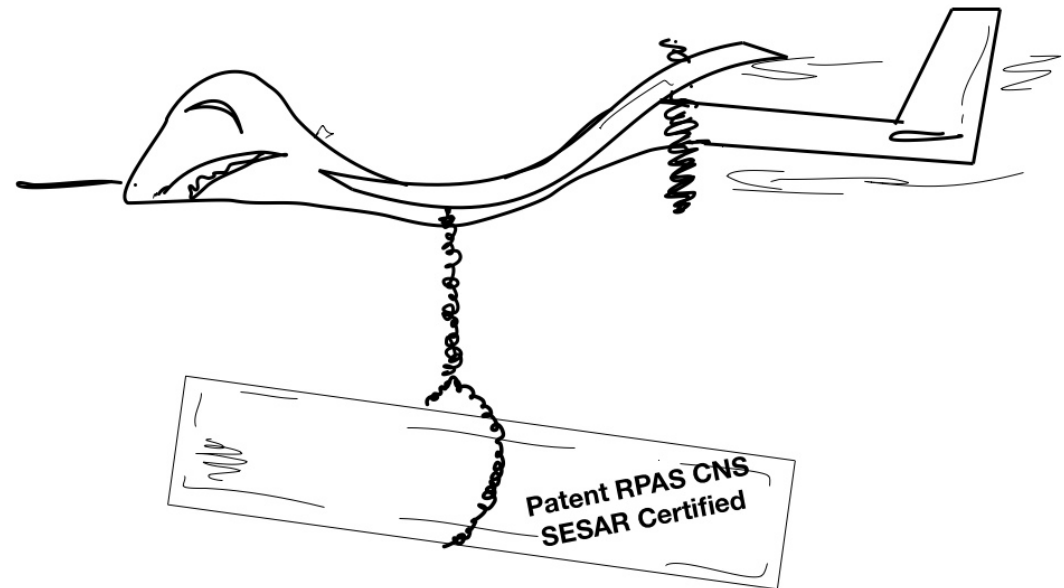
- GPS
- Galileo
- PBN computer

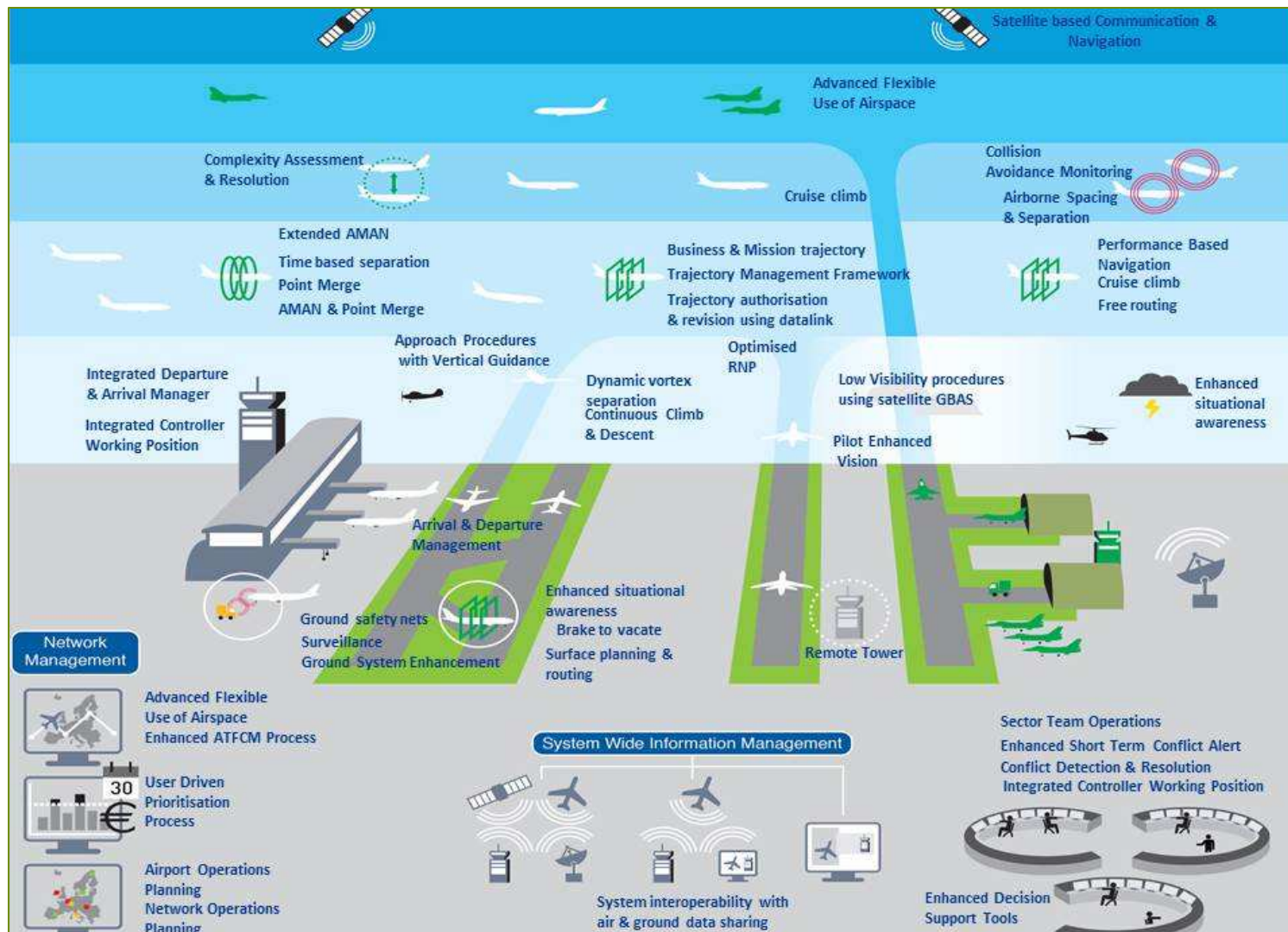
Surveillance:

- TCAS
- Sense and avoid
- Mode-S SSR
- ADS-B
- ADS-C

Ground:

- Obstacle avoidance
- DTAXI
- Sign/lights compliance etc, etc





SESAR can help!!!

... or we don't have to re-invent the wheel



ATC and communications

ATC:

- ACAS Xu is on its way
- Navigation performance requirements will be standardised

Communications:

- Trajectory exchange will be common
- Data link clearances will be common
- SWIM will support all users



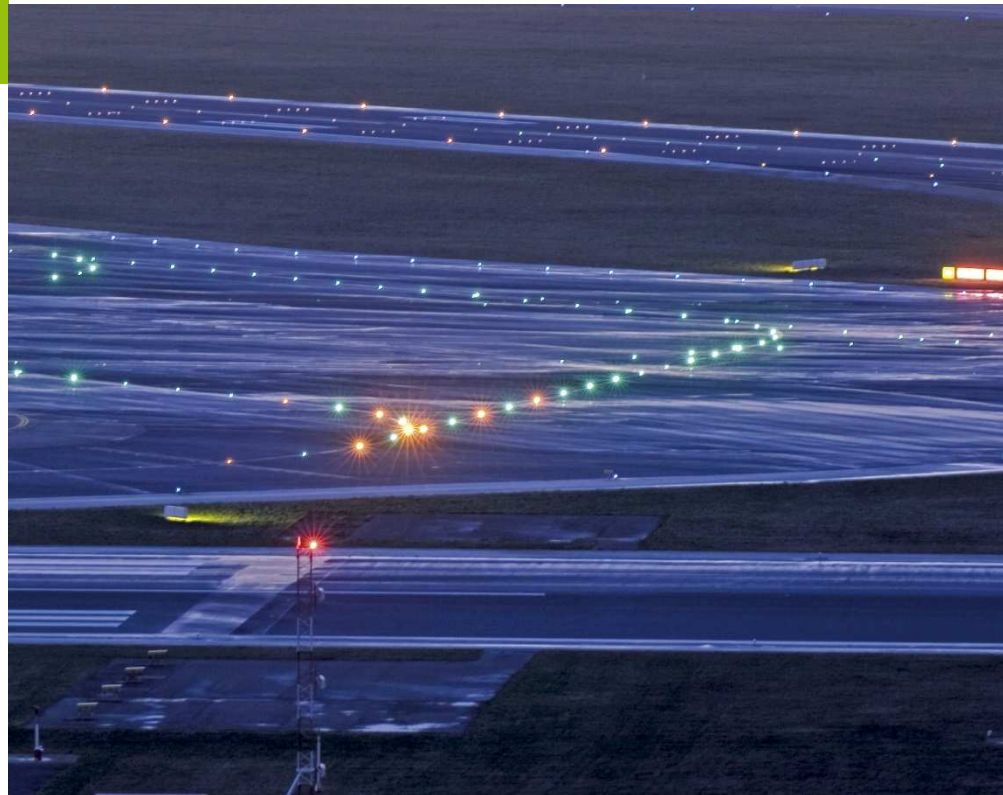
Airports

Ground:

- Uplink of taxi routes via data link helps unmanned operations
- A-SMGCS provides additional guidance and control
- Greater airport predictability helps unmanned operations
- New safety nets

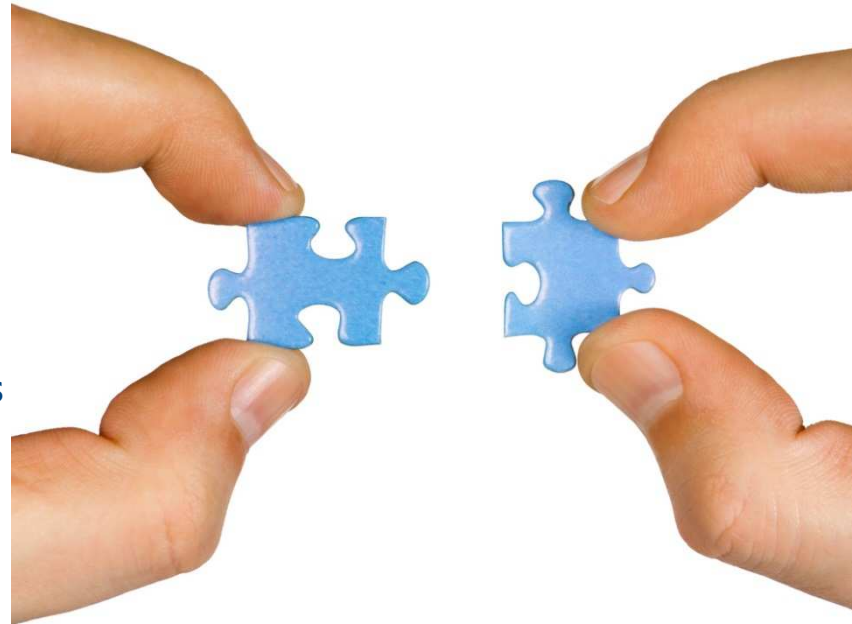
Air:

- GNSS approaches help RPAS



Network

- Airspace requirements can be flexibly managed
- Trajectory and flight planning is common
- Free-Route airspace supports unusual activities
- Sharing of trajectories with other users is common
- Advanced complexity management and dDCB supports unusual activities





The Roadmap

... or how do we get there?



UAS R&D Integration Perspective

OPERATIONS BASED APPROACH



VLOS

Small R&D effort

E-VLOS

Small R&D effort

B-VLOS

Large R&D effort

IFR/VFR

Large R&D effort



R&D Gap Analysis

Identification of gaps in procedures or technology led to the following topics:

- Types of Operations – what's new?
- Detect & Avoid
- Human factors
- C2 (Command & Control)
- SESAR compliance (ability to fly in a SESAR Step 1 ATM environment)
- Contingency – e.g. loss of link...
- Security



Below 500ft - VLOS & E-VLOS operations

-

Timeframe 2013- 2018

Small R&D effort identified:

- Security – e.g. flight planning operations
- Human factors – e.g. pilot & observer team work
- Contingency



Below 500ft - B-VLOS operations

Timeframe 2013-2020

Large R&D effort identified:

- Detect & avoid (replicate the human ability to see & avoid)
 - C2 communications
 - Human factors including mixed fleet compatibility
 - Contingency
 - Security
 - SESAR compliance (step 1)
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- B-VLOS below 500ft is completely new to aviation



IFR/VFR operations

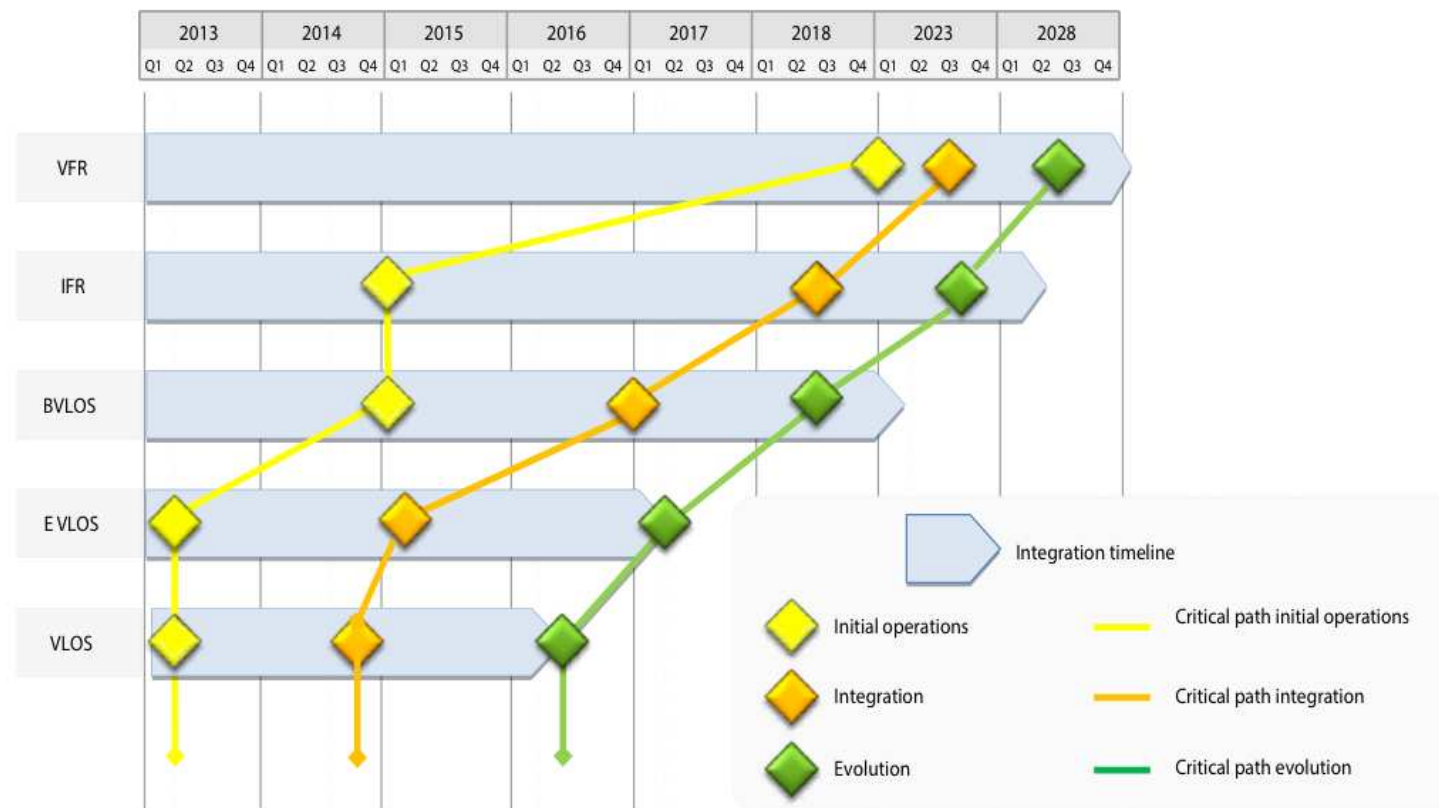
Timeframe 2013-2028

Large R&D effort identified

- Detect & Avoid
- Airspace and Airports access
- C2 communications
- Human factors
- Contingency
- Security
- SESAR compliance



European RPAS R&D Roadmap Timeline



Interdependence

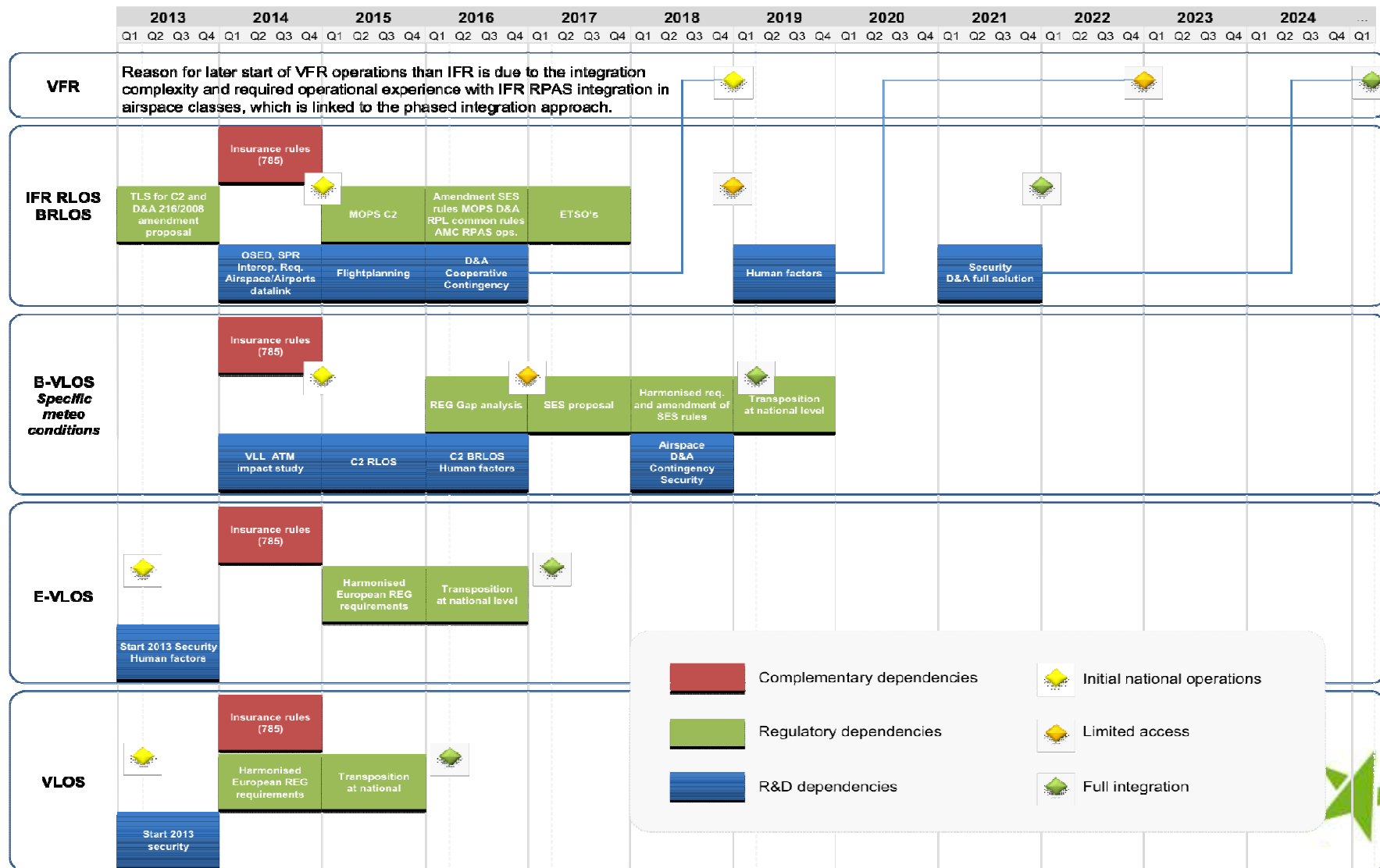
R&D and REG are interdependent:

- ✦ Whilst most of the requirements for RPAS integration are regulatory requirements there are also requirements and concerns around issues of liability and privacy

Ensure closed loop of activities to ensure consistency and feasibility



European RPAS Integration Roadmap



SESAR Plans

- WP'E' Projects
- 9 x RPAS Demonstration Projects – to learn from existing initiatives
- New RPAS Definition Phase to start in 2014
- Liaison with FAA and ICAO
- Integration of RPAS needs into the Master Plan



Link with EU ATM Master Plan

- RPAS are seen as another and to an extent new airspace users to ATM
- Integration principle is to fit into the ATM environment:
 - present
 - future
- Essential to incorporate RPAS Operations needs of technologies into the EU ATM Master plan



Conclusion

Thanks to the work performed through the RPAS roadmaps:

- ✦ RPAS is not the future – It is now and there is already a level of harmonisation
- ✦ We know what needs to be done
- ✦ We know how to do it
- ✦ R&D, Regulatory and liability/privacy issue dependencies identified as well as synergies with on-going SESAR activities for manned aviation.
- ✦ RPAS ATM integration coordination with the US/FAA just launched

