



ERASMUS



ERASMUS *Transition Issues*

Roger Guerreau, EUROCONTROL

Plan

- ERASMUS in SESAR IP2
- Lines Of Changes
- Changes needed

ERASMUS in IP2

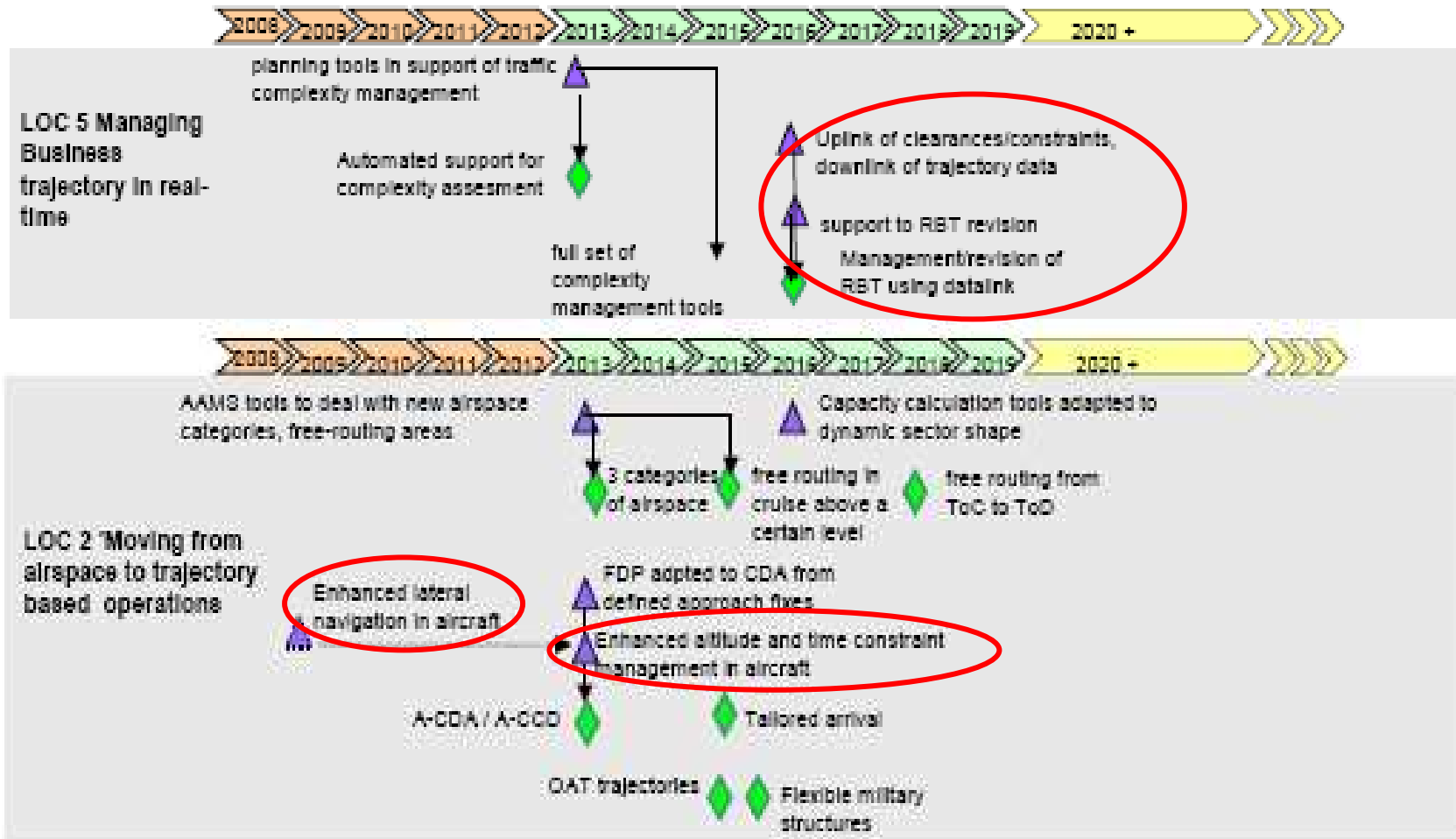
- The TC-SA new separation mode defined in the SESAR D2 & D3 corresponds to the IP2 deployment sequence described in the SESAR D4
- SESAR has identified IP2 Lines of Changes to implement and deploy TC-SA (Trajectory Control by minor **Speed Adjustment**)
 - It is envisaged to consolidate or to propose updating of the D4 IP2 **Lines of Change (LoC)** in comparison with the issues identified during the ERASMUS investigation



D4 LoC

Lines Of Changes

Managing Business Trajectory in Real-Time



Taken from SESAR D4 document

Lines Of Changes

Managing Business Trajectory in Real-Time

D4:

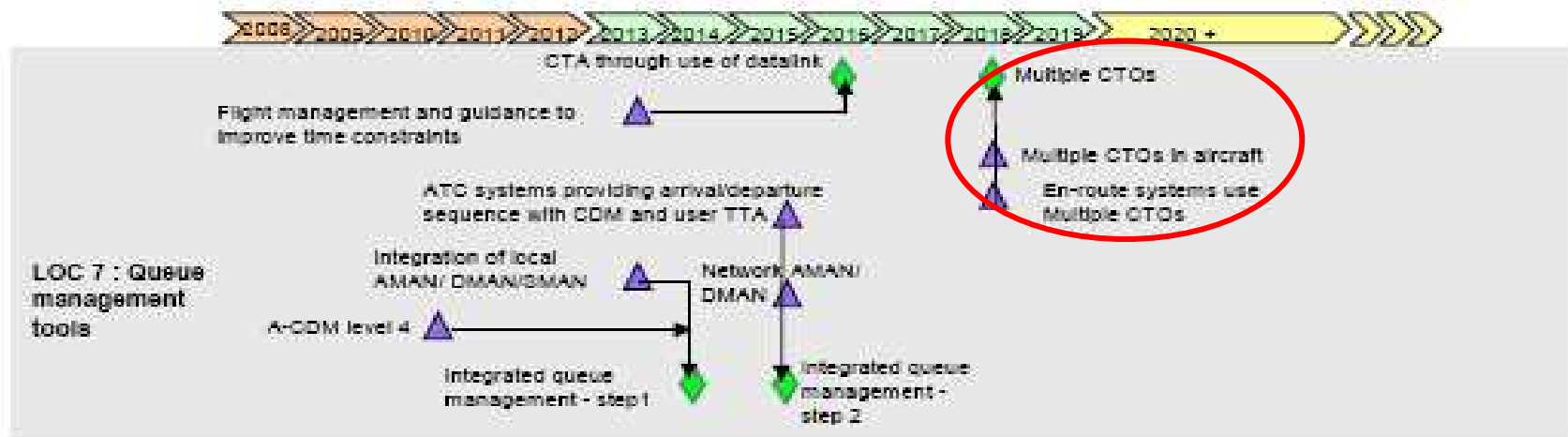
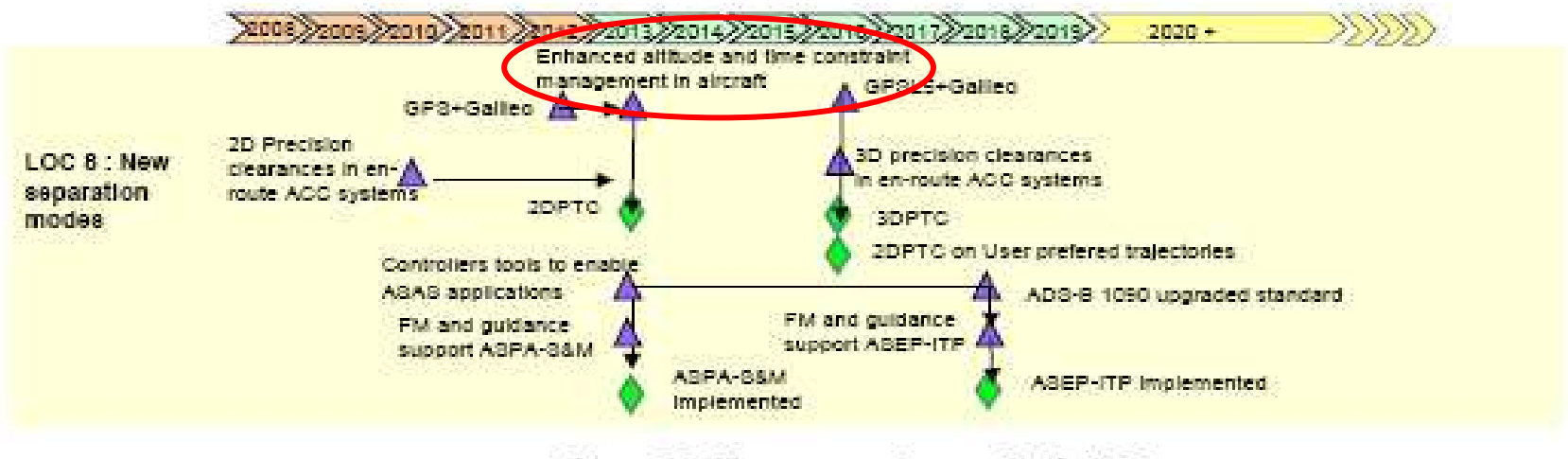
- *Downlink of trajectory data/Uplink of constraint clearance*
- *Greater accuracy informing controller about forthcoming complex situation*
- *Automated support for complexity assessment : density & conflict*

ERASMUS:

- Robust Information (Accuracy + reliability) : Guaranteed ?
- Conflict management
 - Conflict detection
 - Conflict resolution : highly complex
- Complex situation information : MTCD HMI, MONA,...

Lines Of Changes

New Separation Mode



Taken from SESAR D4 document

Lines Of Changes

Queue Management & New Separation Mode

D4:

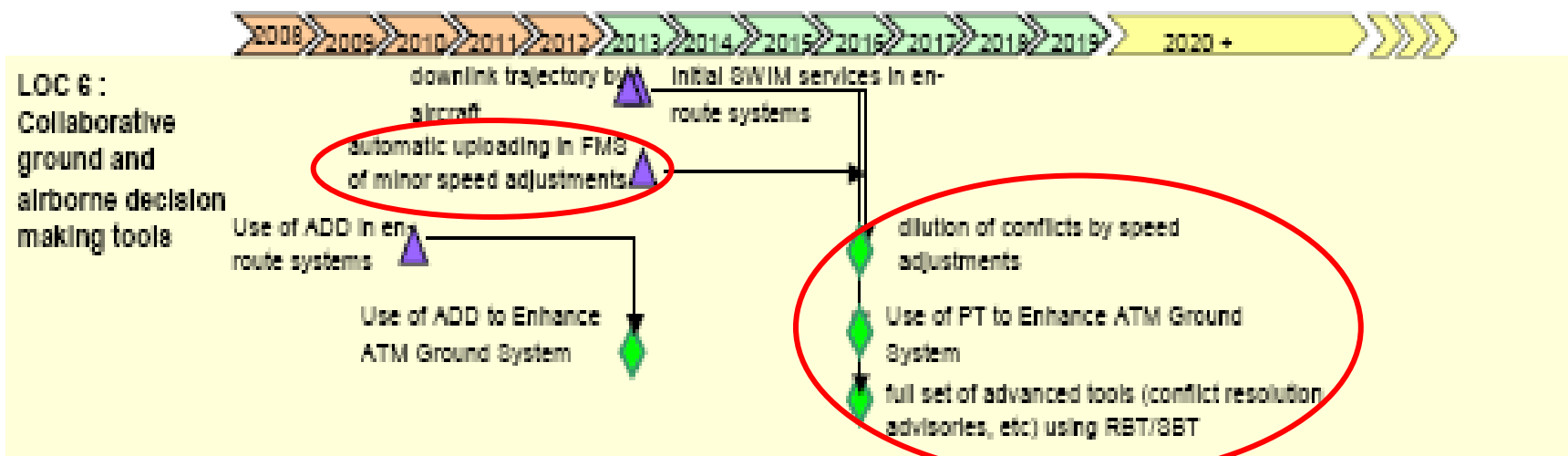
- *Systems are gradually implemented to provide constraints and clearances to aircraft, in order to handle ground computed time constraints on specific points (en-route – CTOs...) on the basis of the estimated times provided by the airspace users and handled onboard the aircraft*
- *The navigation aircraft architecture will support new positioning, flight management and guidance system evolutions for enhanced altitude and time constraint management (2013) and multiple time constraints (2018)*
- *Airspace users will be required to evolve their fleet in accordance with the appropriate ATM capability level of each evolution period*

ERASMUS:

- Multiple time constraints (CTO)
- Fleet equipment

Lines Of Changes

Collaborative A/G Decision Making Tools



Taken from SESAR D4 document

Lines Of Changes

Collaborative A/G Decision Making Tools

D4:

- *The trajectory information accuracy is improved in 2 steps: initially by increased use of the Aircraft Derived Data (ADD) and then by direct use of the aircraft predicted trajectory (PT)*
- *Based on this improved predication and extensive use of the RBT, a full set of tools is deployed contributing to the task load reduction at sector level but still keeping the controller in the decision-making loop. The tools encompass conflict resolution providing resolution advisories, intent and improved conformance monitoring and support coordination free transfer of control*
- *In En-Route, Cooperative air/ground tools and enhanced data link facilities enable minor adjustments to be made to an aircraft's speed in order to "dissolve" potential conflicts. The pilot can validate the proposed speed adjustment*

ERASMUS:

- Controller User Interface : Guaranteed conflicting aircraft situation, conformance monitoring
- CPDLC format (time constraints : HH:MM:SS)
- Pilot User Interface : Time-based conflict resolution manoeuvres

Changes Needed Procedures

Mixed Separation modes

- Structured/non Structured route network
- Separation modes (TC-SA, ASAS,)

System designed to manage nominal traffic

- *Current ATC is designed to manage non-nominal situations and unexpected events*
 - *Mainly based on human activities*
- IP2 System is designed to manage nominal situations
 - Mainly based on technical capabilities
 - Executive controller will move from a high tactical content to a separator role (fewer potential conflict) (IP2), then delegation of spacing (IP3)
 - Planner controller will move from an organisational content to conformance monitoring

Changes Needed Human

An advanced level of automation will impact controller's roles and responsibilities

- Controller's situation awareness will change !
 - Human will not any longer be in a position to take over manually in case of automation degradation
 - Second automation will have to function as a fallback
 - Legal responsibility and liability will shift from the current front-line operators (controllers) to the systems designers/manufacturers

- Certification
 - In order to properly deal with the subsequent legal liability issues, the current certification process for airborne systems should be extended to include ground systems with a special emphasis on air/ground integration

Changes Needed System

High-precision 4D Trajectory Prediction

- TP information Guarantee
 - Accurate & Reliable
 - Certification

4D Trajectory Adjustment

- Multiple-CTO
 - Accurate & Reliable

Data-Link

- CPDLC format (time constraint)
- Bandwidth correlated with the needs

Automation failure monitoring and recovery strategy : second automation fallback

- Trajectory Conformance and Monitoring
- TCAS + STCA

Changes Needed Institutional

An advanced level of automation will impact controller's roles and responsibilities

➤ Liability

- Evolution of roles/responsibilities of individual/organisation might have legal implications
- Legal Framework clarification/extension for liability

Legal accountability and liability (for example in case of malfunctions, incidents and accidents) will in those cases shift from the current end users (typically pilots and air traffic controllers) to the system designers, manufacturers and maintenance engineers.

➤ Certification

In order to properly deal with the subsequent legal liability issues, the current certification process for airborne systems should be extended to include ground systems with a special emphasis on air/ground integration

Interoperability and standardisation

- Strategic de-conflicting as a plug-in to specific Controller Working Position Environment
- Strategic de-conflicting systems connected