



Pilot Perspective of ASAS Self-Separation in Challenging Environments

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→ Introduction

→ **MFF is a TEN-T European Project, co-funded by the European Commission**

→ **Partners in the MFF project:**

→ ENAV (Italy, Coordinator),
AENA (Spain), DNA (France),
Eurocontrol, HCAA (Greece),
MATS (Malta),
NATS (United Kingdom),
NLR (Netherlands) and
SCAA-LFV (Sweden)



→ **MFF is a pre-operational programme aimed at defining, testing and validating ASAS applications and procedures in selected Mediterranean scenarios.**

→ Principles of ASAS

→ **ASAS Awareness (Package I)**

- Improved traffic awareness on flight deck
- Controller responsible for separation

→ **ASAS Spacing (Package I)**

- Sequencing & Merging, Crossing & Passing
- Controller responsible for separation

→ **ASAS Separation (Package II)**

- Sequencing & Merging, Crossing & Passing
- Flight crew responsible for separation

→ **ASAS Self-Separation (Package II+III)**

- Conflict Detection, Resolution & Prevention
- Flight crew responsible for separation

→ Principles of ASAS

→ ASAS Awareness (Package I)

- Improved traffic awareness on flight deck
- Controller responsible for separation

→ ASAS Spacing (Package I)

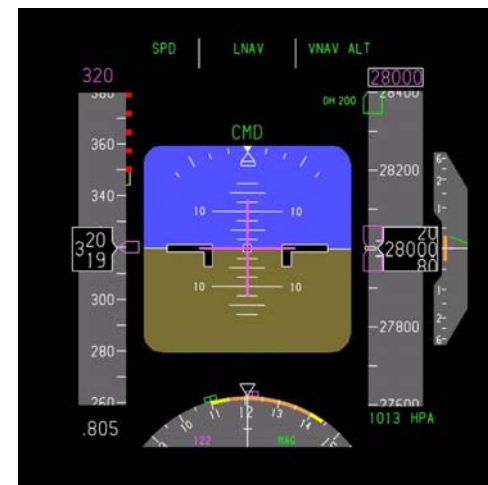
- Sequencing & Merging, Crossing & Passing
- Controller responsible for separation

→ ASAS Separation (Package II)

- Sequencing & Merging, Crossing & Passing
- Flight crew responsible for separation

→ ASAS Self-Separation (Package II+III)

- Conflict Detection, Resolution & Prevention
- Flight crew responsible for separation



→ Airborne Separation Assistance System

→ ASAS consists of:

- Cockpit Display of Traffic Information (CDTI), on Navigation Display (ND)
- Predictive ASAS (PASAS)
- Conflict Detection and Resolution (CD&R) algorithms, symbology and alerting logic
- Automatic Dependent Surveillance - Broadcast (ADS-B) system

→ The ASAS system can operate in several modes, among which:

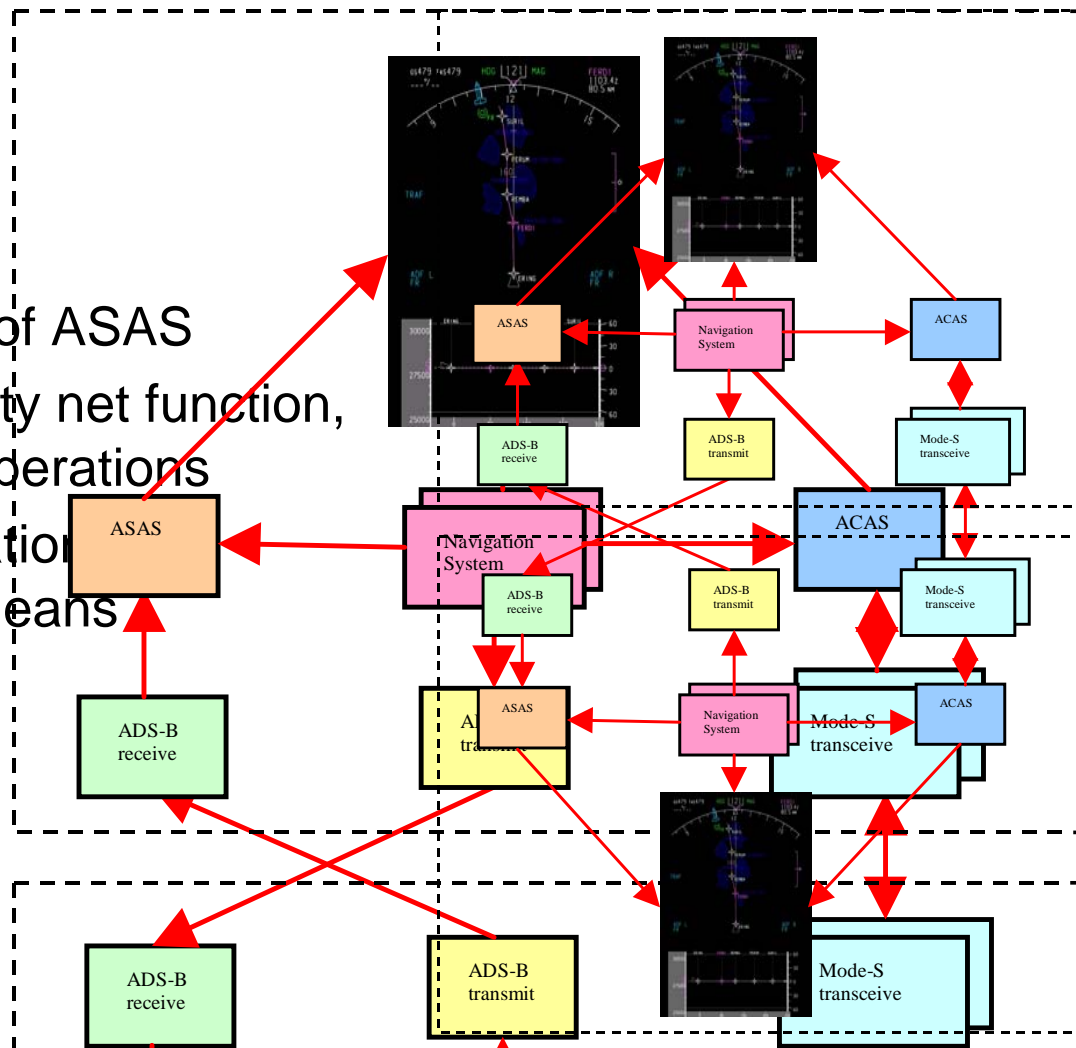
- Self-Separation mode (in FFAS)
- Awareness mode (in MAS)



→ Airborne Separation Assistance System

→ ASAS architecture:

- ACAS independent of ASAS
- ACAS provides safety net function, also in Free Flight operations
- ACAS/ASAS integration level of display by means of prioritisation



→ Airborne Separation Assistance System

→ Conflict Detection & Resolution, state-based, modified voltage potential, two phases:

→ priority rule based (6 - 3 minutes from intrusion)

→ *Aircraft not receiving priority shall manoeuvre.*

→ *Aircraft receiving priority is allowed to manoeuvre.*

→ co-operative (3 - 0 minutes from intrusion)

→ *Both aircraft shall manoeuvre when conflict is within 3 minutes.*

→ Four alert levels:

→ 6 - 3 minutes, with priority: green



→ 6 - 3 minutes, without priority: yellow



→ 3 - 0 minutes: amber



→ < 0 minutes: red



→ MFF experiments

→ Real Time Simulation 1 (RTS1):

- Free Routing
- ASAS Spacing

→ Real Time Simulation 2 (RTS2):

- ASAS Spacing
- Intent simulation
- ASAS Self-Separation

→ Real Time Simulation 3 (RTS3):

- Free Routing
- ASAS Spacing
- ASAS Separation
- ASAS Self-Separation



→ MFF experiments

→ Real Time Simulation 1 (RTS1):

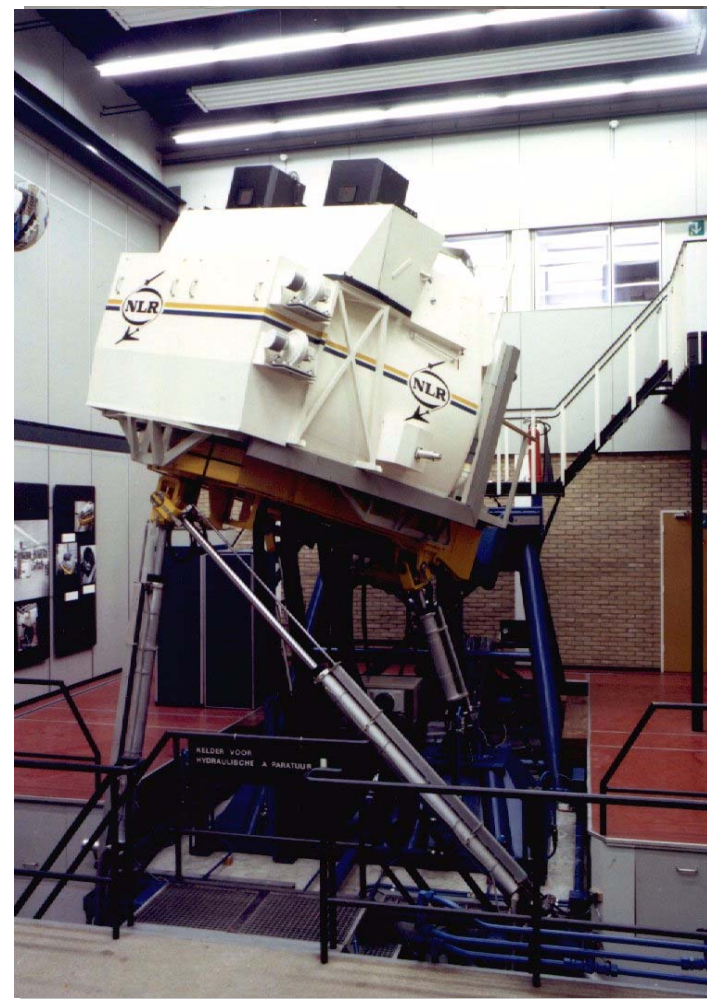
- Free Routing
- ASAS Spacing

→ Real Time Simulation 2 (RTS2):

- ASAS Spacing
- Intent simulation
- **ASAS Self-Separation**

→ Real Time Simulation 3 (RTS3):

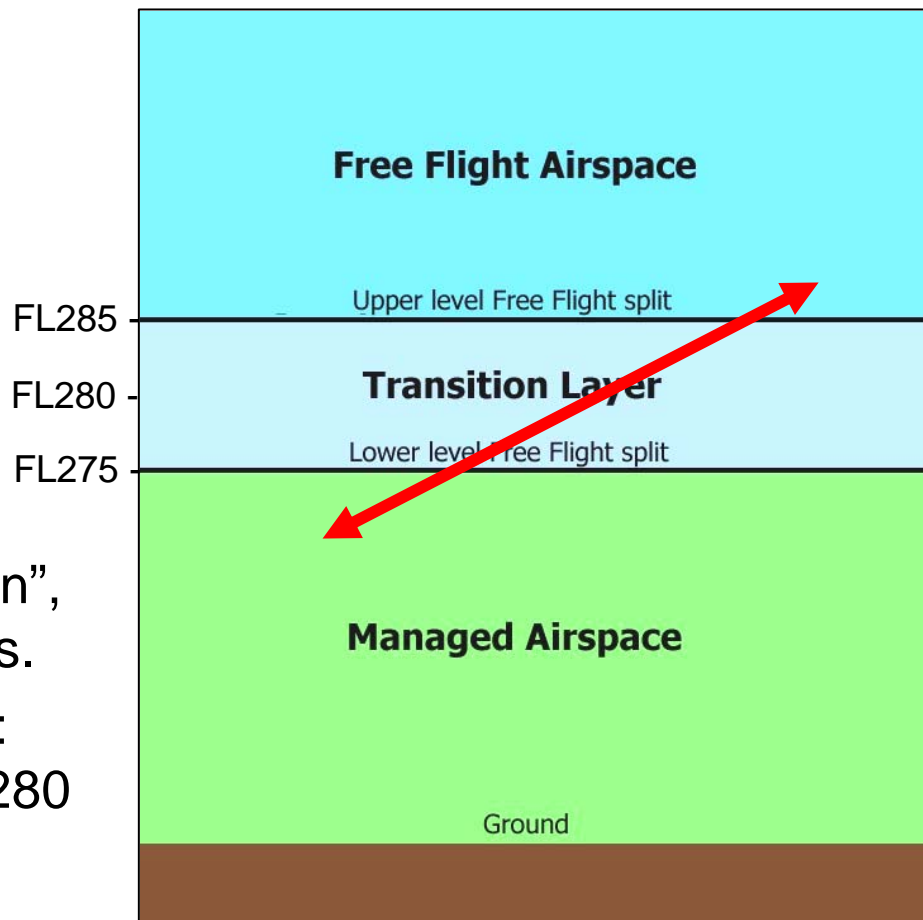
- Free Routing
- ASAS Spacing
- ASAS Separation
- **ASAS Self-Separation**

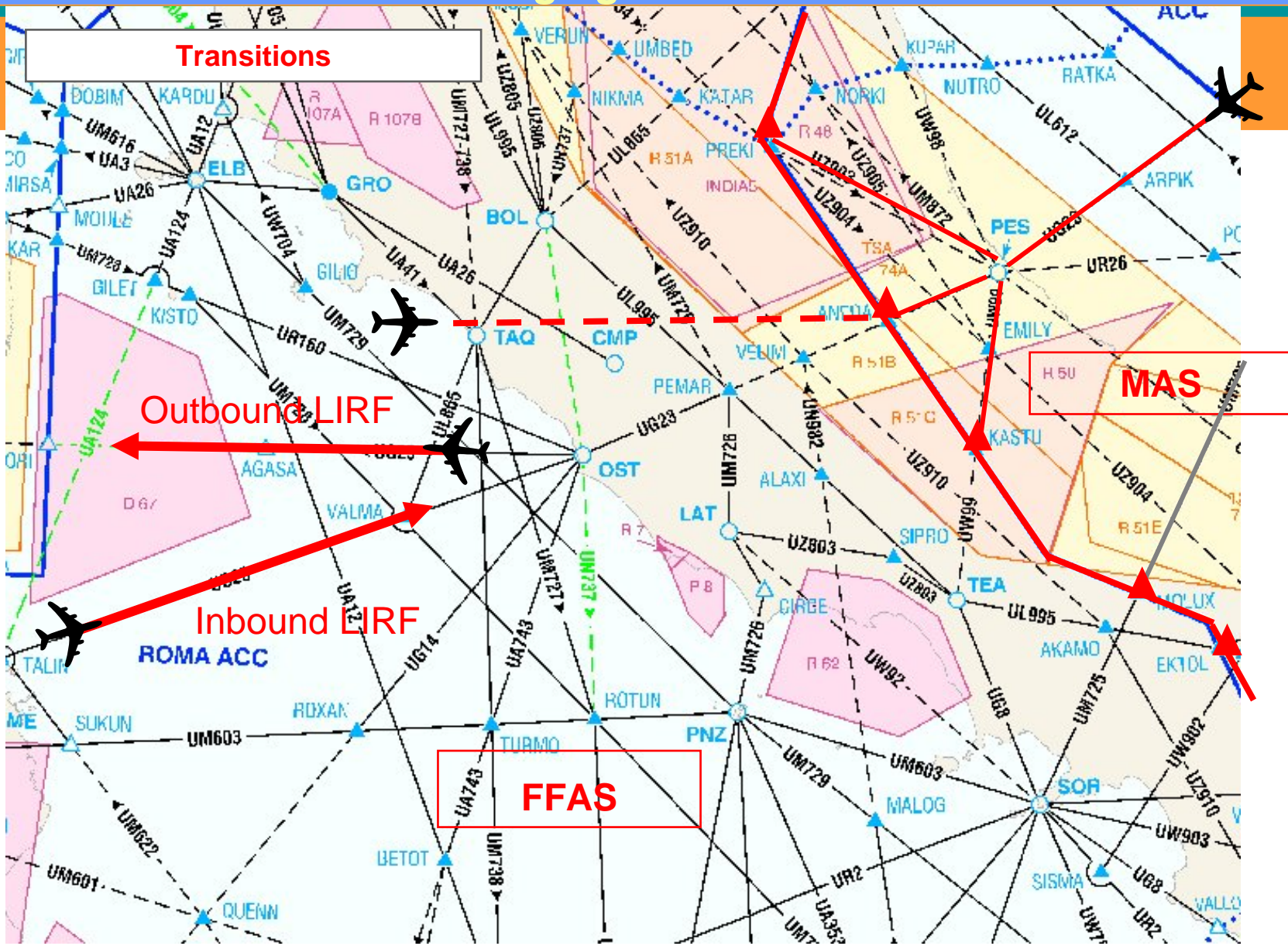


→ MFF experiments & results – RTS2

→ RTS2:

- Investigate horizontal and vertical transitions between Free Flight Airspace and Managed Airspace.
- A single alternate Flight Level Orientation Scheme (FLOS) was applicable: westbound “even”, eastbound “odd” flight levels.
- FL280 is a “transition” level: traffic is only allowed at FL280 after ATC clearance.





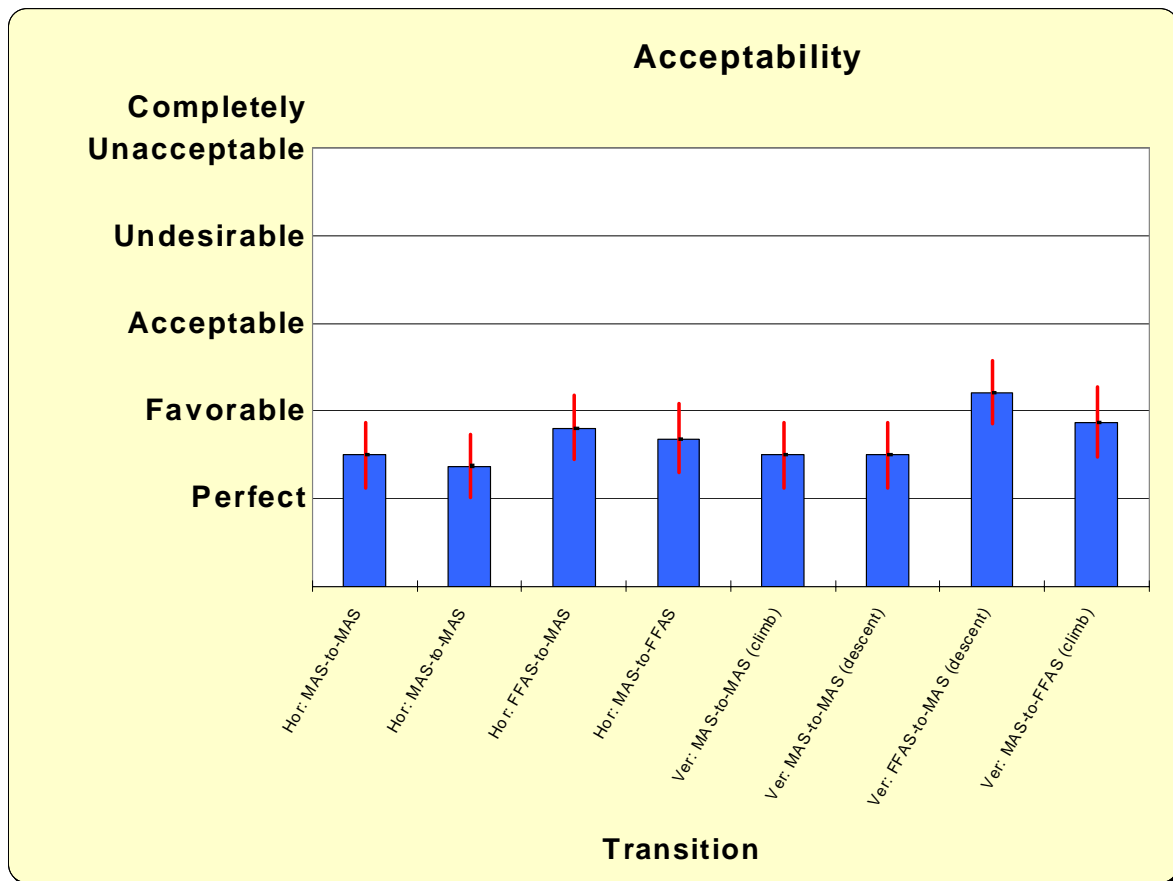
→ MFF experiments & results – RTS2

→ Pilot responses.

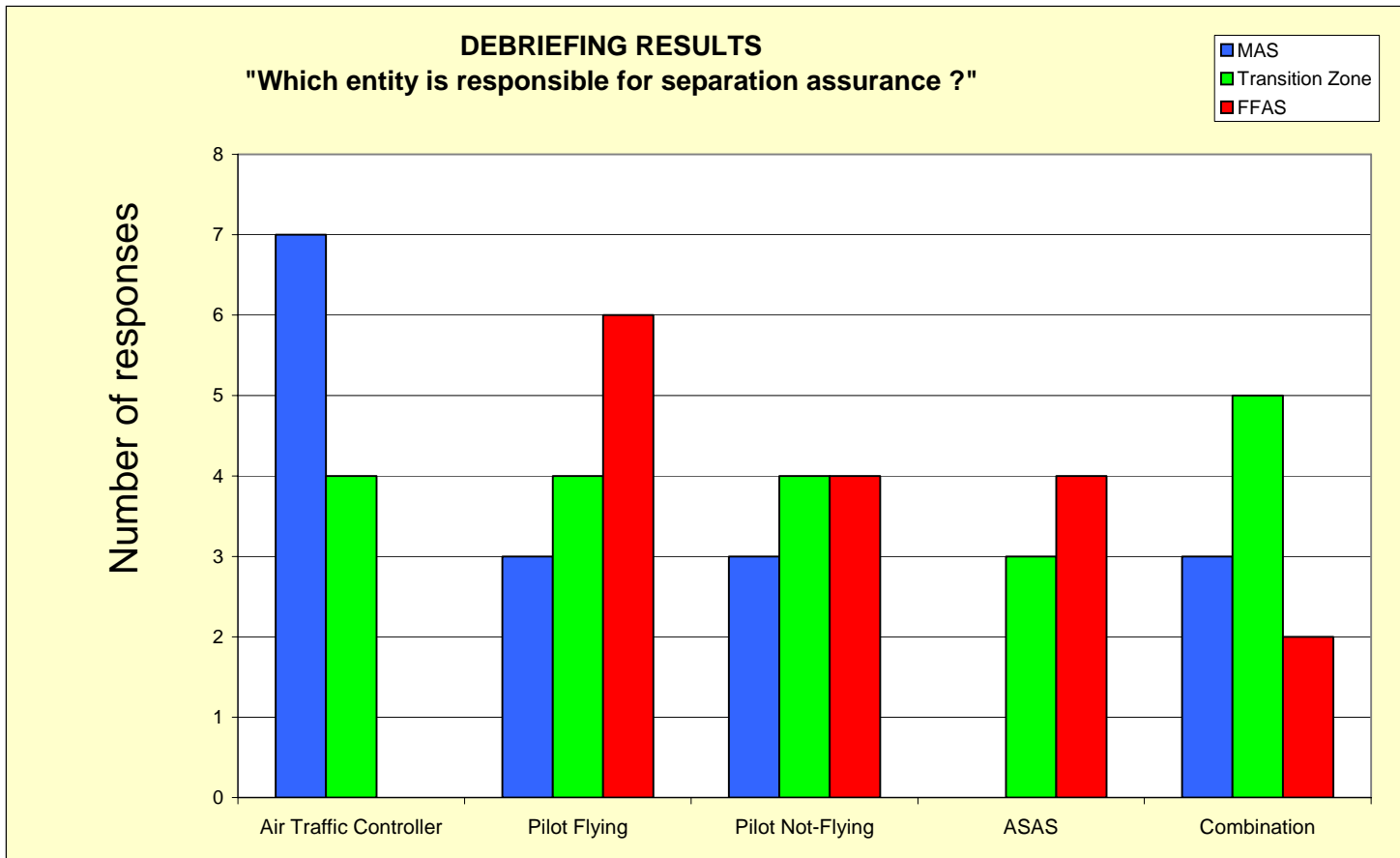
→ Generally well accepted.

→ Vertical transition (descent) most

challenging (converging, passing favorite busy flight levels)



→ MFF experiments & results – RTS2



→ **Responsibility in transition layer unclear.**

→ MFF experiments & results – RTS3

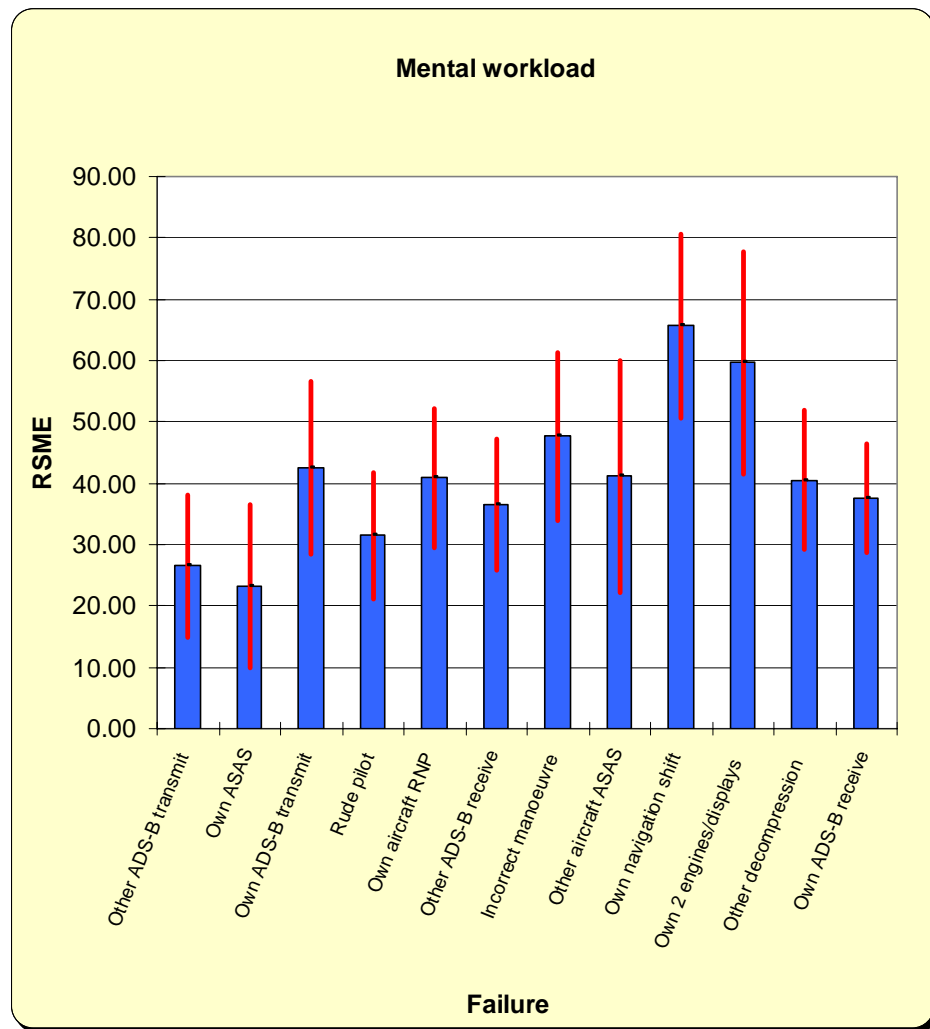
→ RTS3:

- Investigate failures, the training needs and the necessity of a Vertical Navigation Display in challenging, realistic environments, including significant weather and military activities.
- Between subjects design:
 - *one group trained on the full flight simulator*
 - *one group trained mainly on a Computer Based Training (CBT) tool*
- Transition layer removed



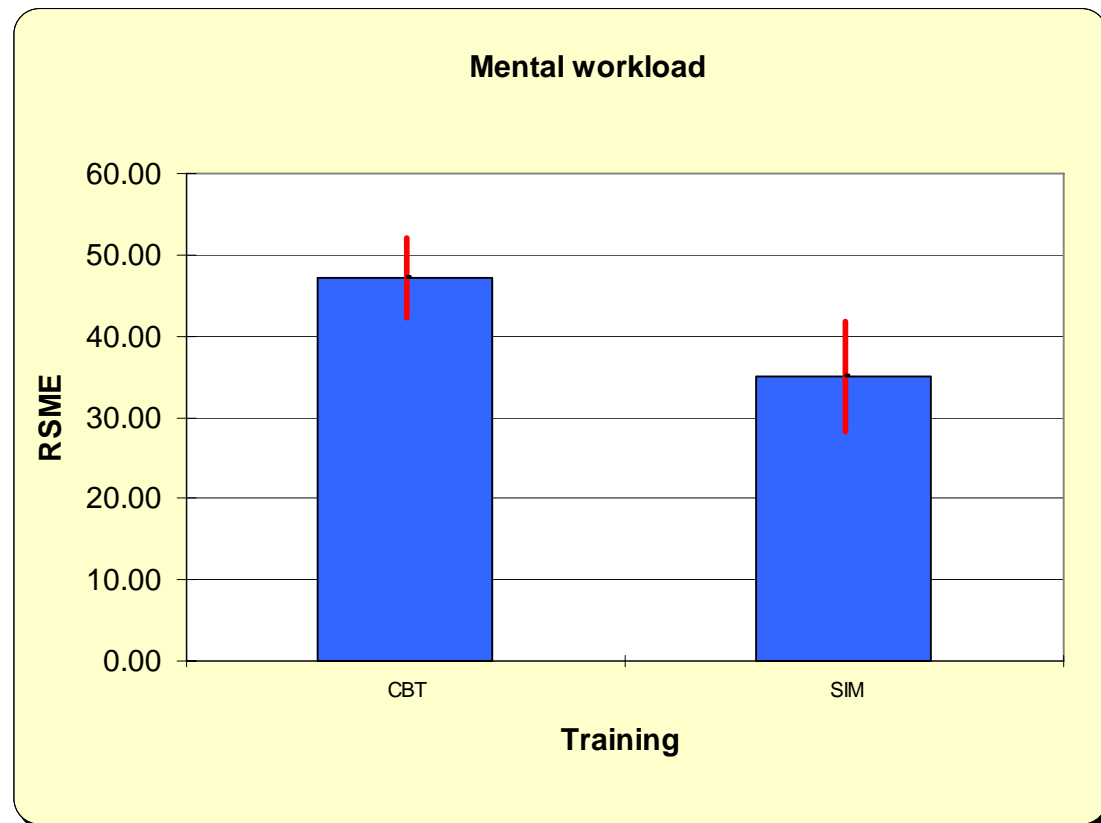
→ MFF experiments & results – RTS3

- Effect of failures significant
- Effect of weather and military areas is limited
- Vertical navigation display preferred, but not needed.



→ MFF experiments & results – RTS3

- **CBT not sufficient to train on Self-Separation**
- **Optimal training is combination of extensive briefing guide, a demonstration, the CBT and one full-flight simulator session.**



→ Conclusions

- **No showstoppers found for ASAS Self-Separation in challenging environments**
- **Human Machine Interface and Conflict Detection & Resolution algorithms well accepted.**
- **Transition layer in between MAS and FFAS not recommended.**
- **Issues identified:**
 - Recommended to study using selected altitude in state-based CD&R algorithms to reduce false alerts.
 - Use of priority rules for Conflict Detection & Resolution should be further assessed and evaluated.
 - ACAS / ASAS algorithms and prioritisation between ACAS and ASAS should be further investigated and tuned.



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→ Flight trials in progress ...





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