



# European Medium-Term Conflict Detection Field Trials

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# Presentation

- ASA; Medium-Term Conflict Detection
- Field Trials
- Results from Rome
- Conclusions





# MTCD is a planning tool

# WHY MTCD ?



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Provide better service to users  
- direct routes .....free routes  
optimum profiles even when busy

Safety - at a planning level  
finds the conflict  
that might be missed

Early conflict detection with less uncertainty  
leading to optimum resolution

Re-balance sector team  
workload - improve efficiency  
in sector team

Improves traffic awareness

Provides future workload indication

# WHY MTCD ?



CONTROL  
for Europe'





# Acronyms

## Programmes/sub-programmes:

- EATMP = European Air Traffic Management Programme
- ASA = Automated Support to Air Traffic Services (Programme)

## Functions/tools:

- AMAN = Arrival Management
- APW = Area Proximity Warning
- CORA = Conflict Resolution Assistant
- DMAN = Departure Management
- EMAN = Enroute Management
- MSAW = Minimum Safe Altitude Warning
- MTCDD = Medium-Term Conflict Detection
- STCA = Short-Term Conflict Alert

## ATS Units:

- ACC = Area Control Centre
- UAC = Upper Area Control Centre

## EUROCONTROL validation platforms:

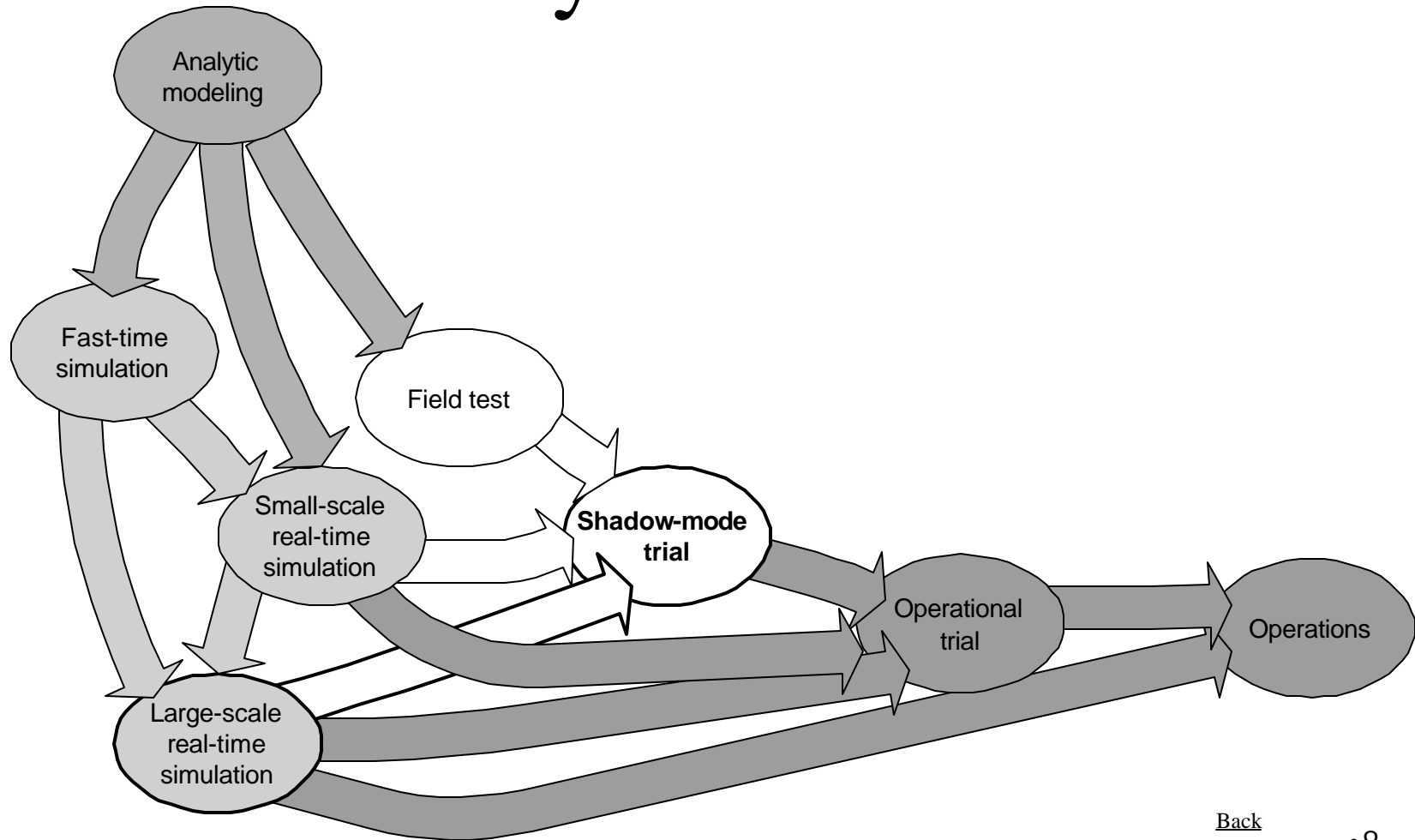
- ESCAPE = Eurocontrol Simulation Capability & Platform Experimentation
- PROVE = Pre-Operational Validation & Experimental Trials Platform

## FAA:

- URET = User Request Evaluation Tool



# Field Trials in EATMP Lifecycle



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# Human-in-the Loop

## Planning Controller

**Monitor** Operational Data  
**Issue** Clearances  
**Adapt** Flight Plans

## MTCD

**Inspect** predicted trajectories for conflict situations

**Observe**  
conflict display

**Inform**  
controller  
about conflict

**Estimate**  
gravity  
of conflict

**Store**  
necessary  
conflict data

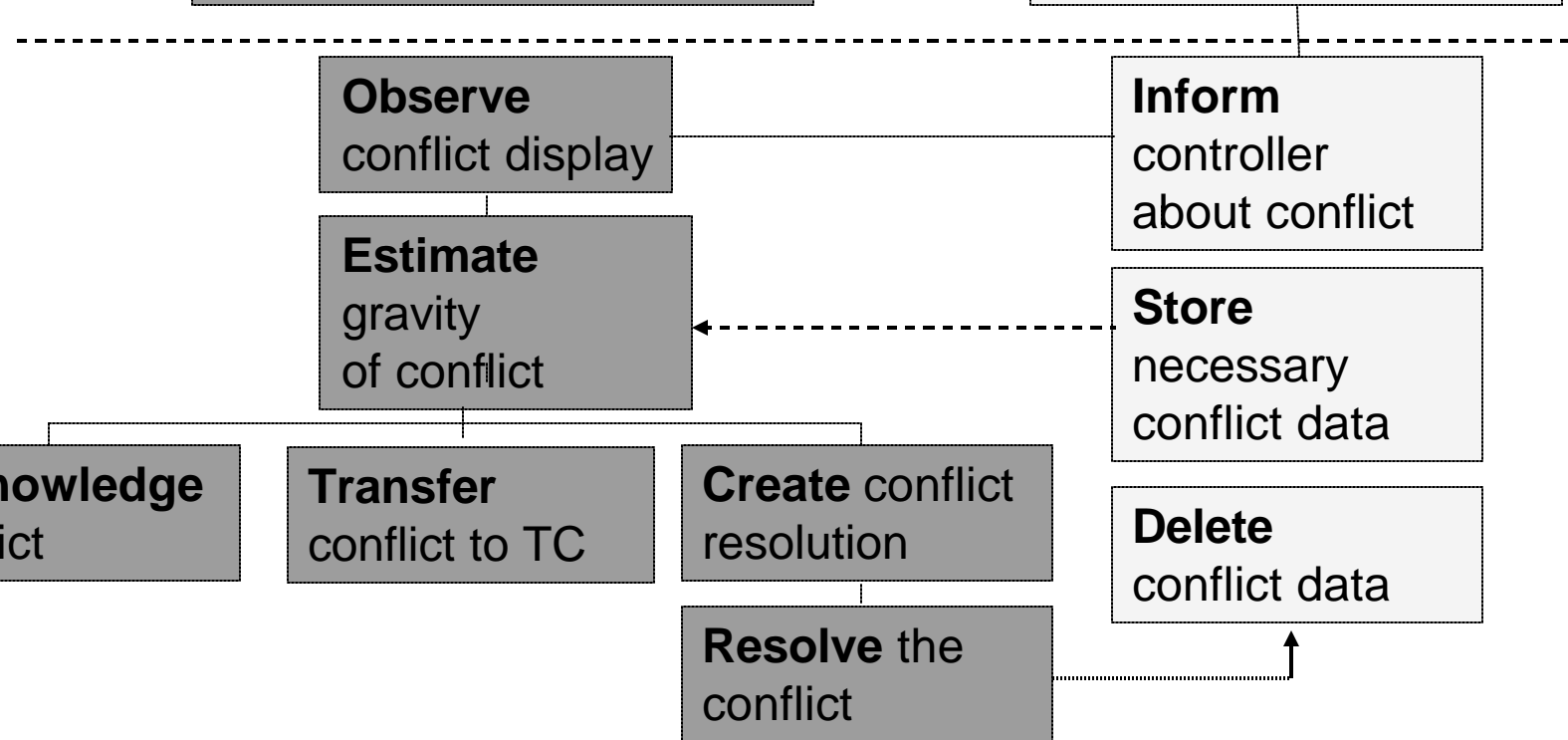
**Acknowledge**  
conflict

**Transfer**  
conflict to TC

**Create** conflict  
resolution

**Delete**  
conflict data

**Resolve** the  
conflict





# MTCD Architecture

- Platform uses a client/server architecture with a CORBA-based middleware.
- MTCD is a server with HMI as a client
- MTCD uses information provided by Trajectory Prediction service
- Stimulated by a “tick” service (every 5-sec).
- MTCD provides conflict to HMI (create-update-delete)

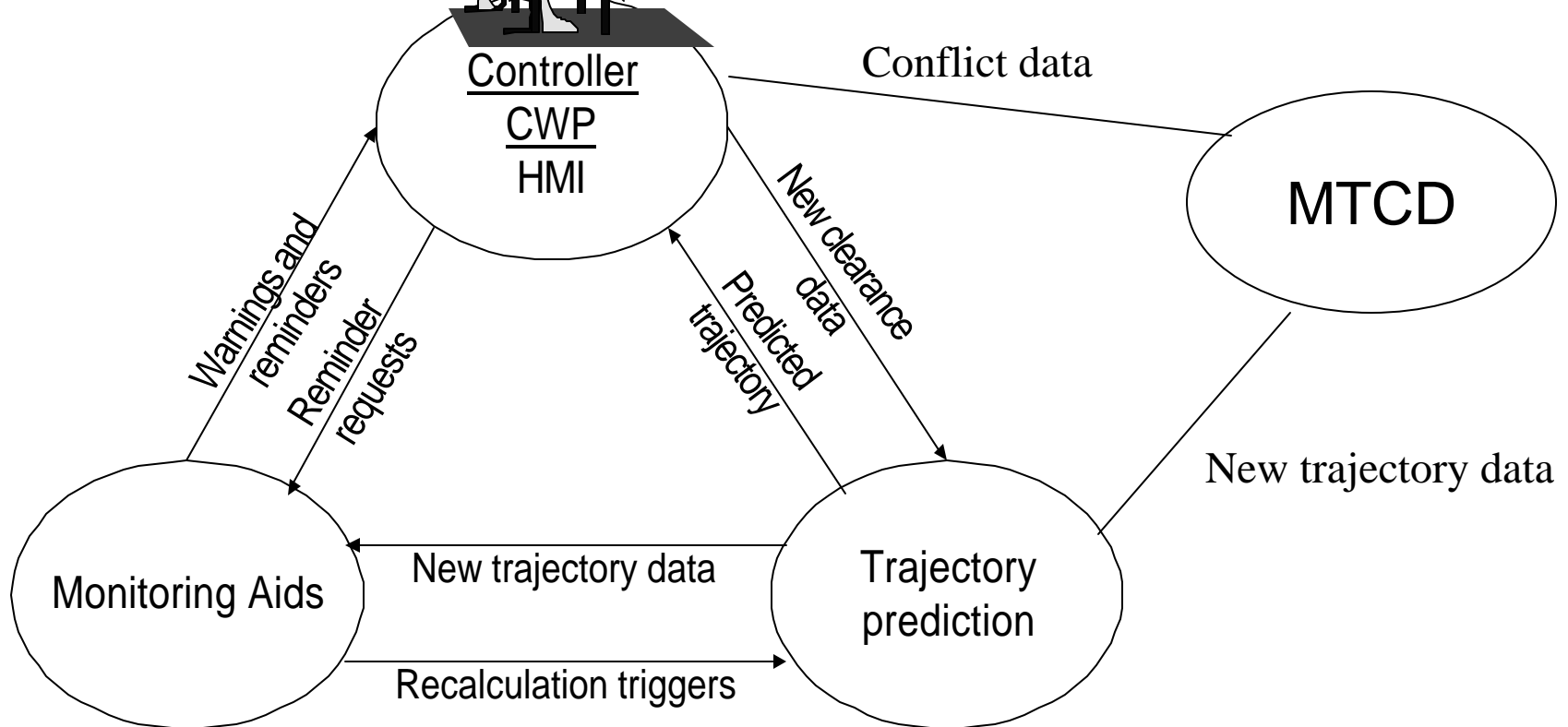
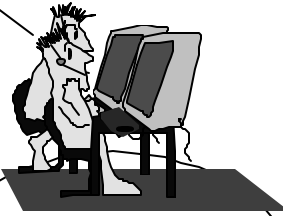
## Conflict Detection

(Diagram of components and their relationships)



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Concept of Use





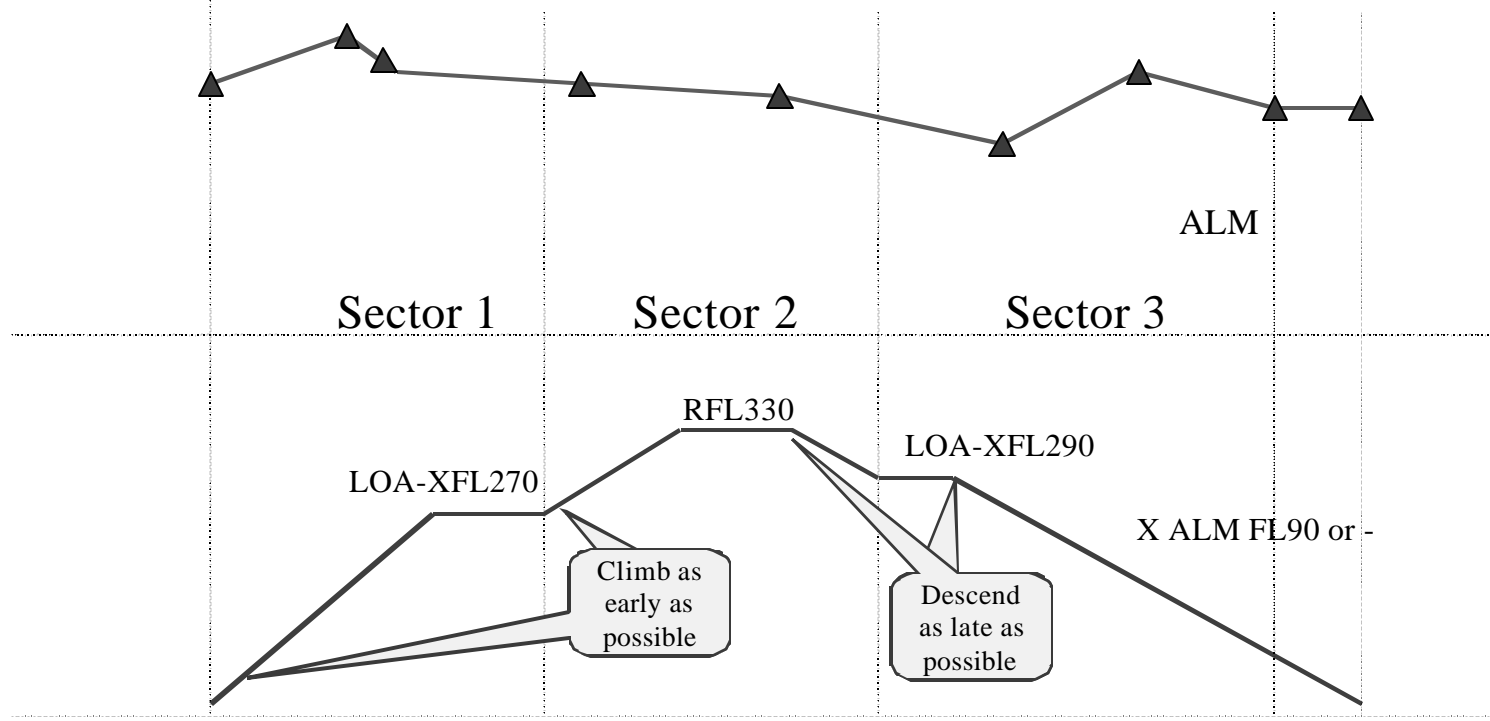
# MTCD Overview

- Traffic evolution is specified by a set of trajectories.
- Trajectories examined in pairs and reported, if trajectories come too close



# Trajectory Prediction; Initial

Planned Trajectory calculated initially according to flight plan, aircraft performance (BADA) and ATC constraints



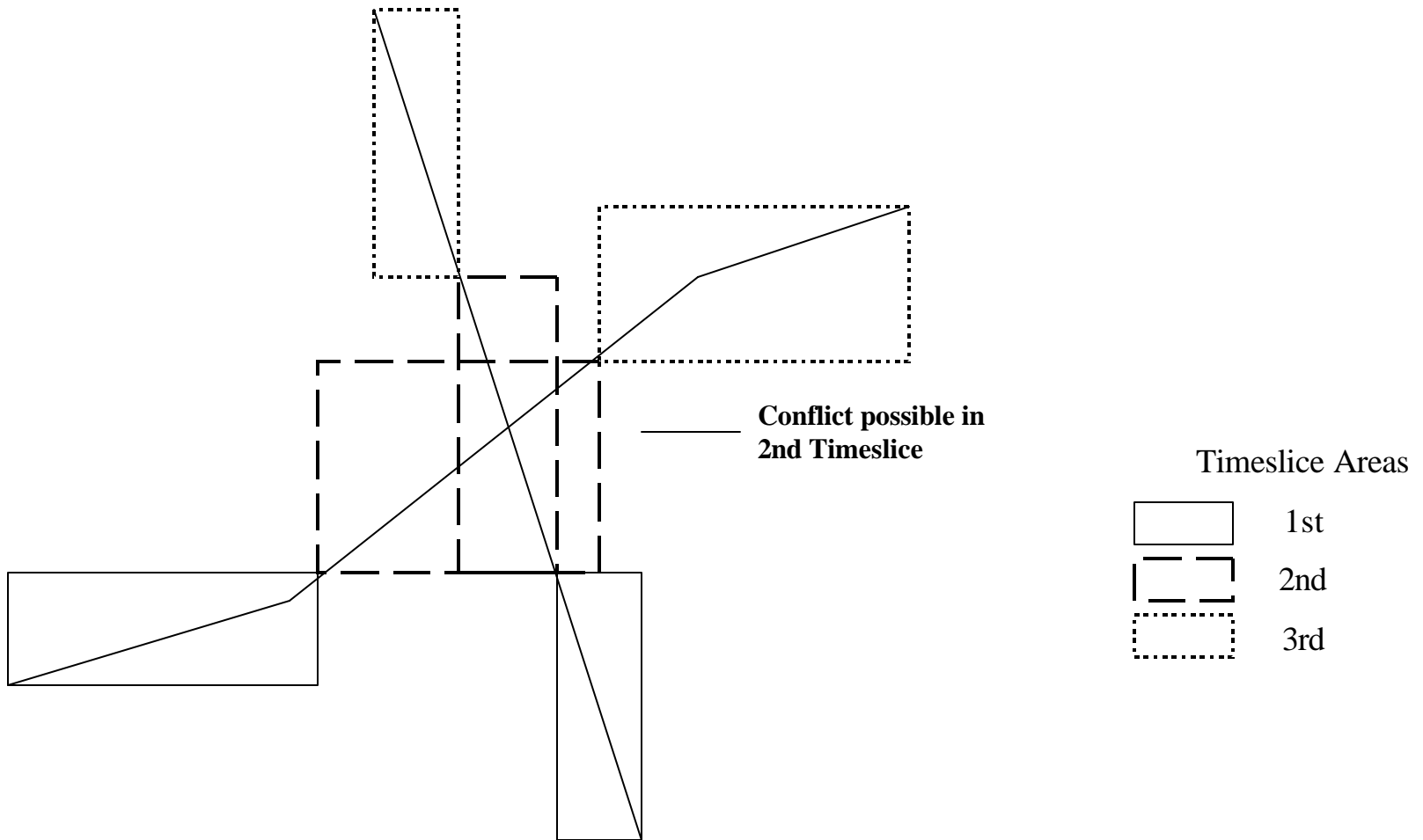


# MTCD Calculations

- Projection system used, WGS-84
- MTCD transfers lat/long to projection plane
- We calculate in flat projection having ensured that errors were insignificant
  - worst case for relative distance of 5NM is 0.05NM with maximum segments of 50NM
- Aircraft are assumed to fly along a straight line, in reality along a great circle

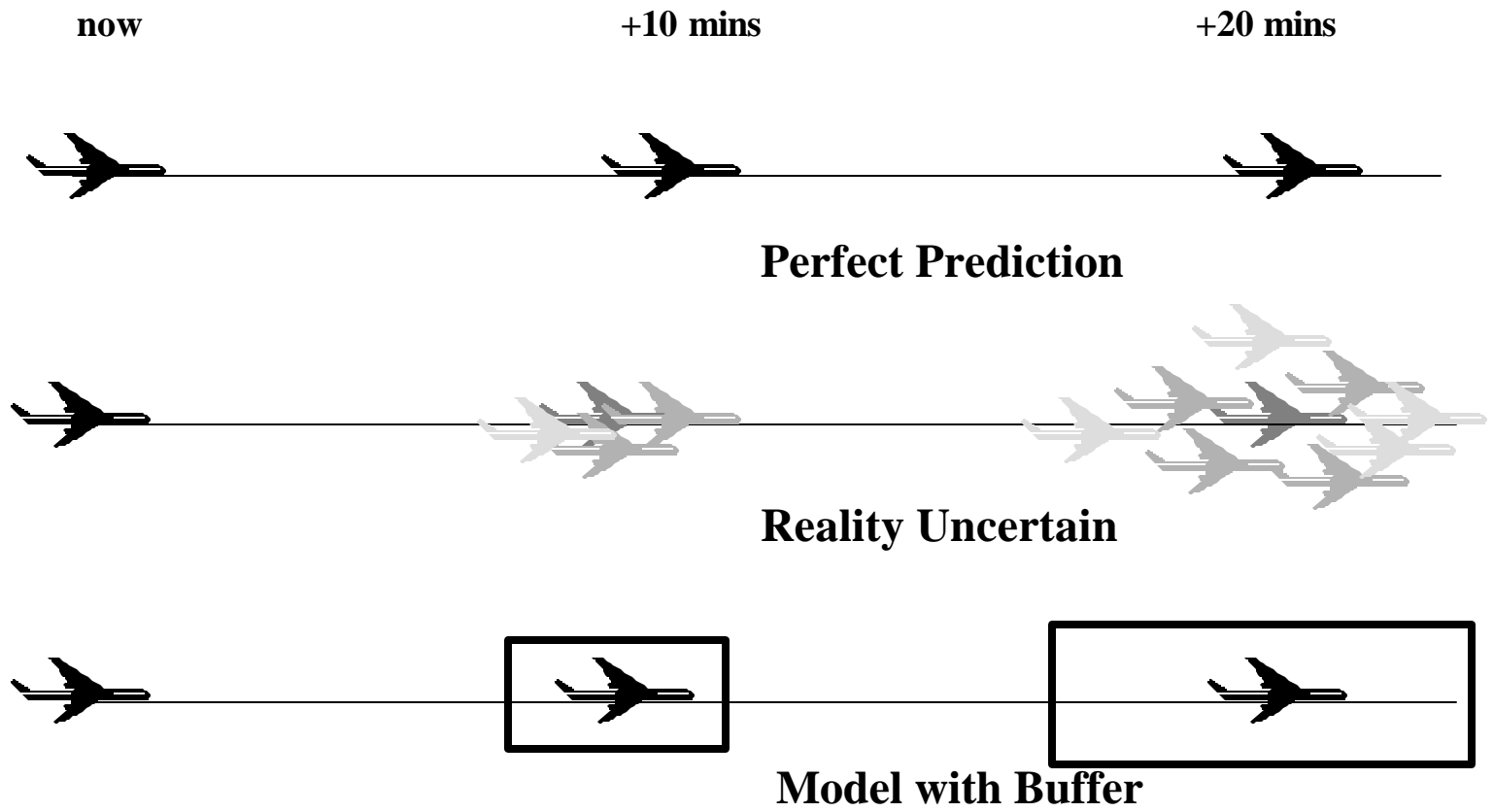


# Timeslice Filtering





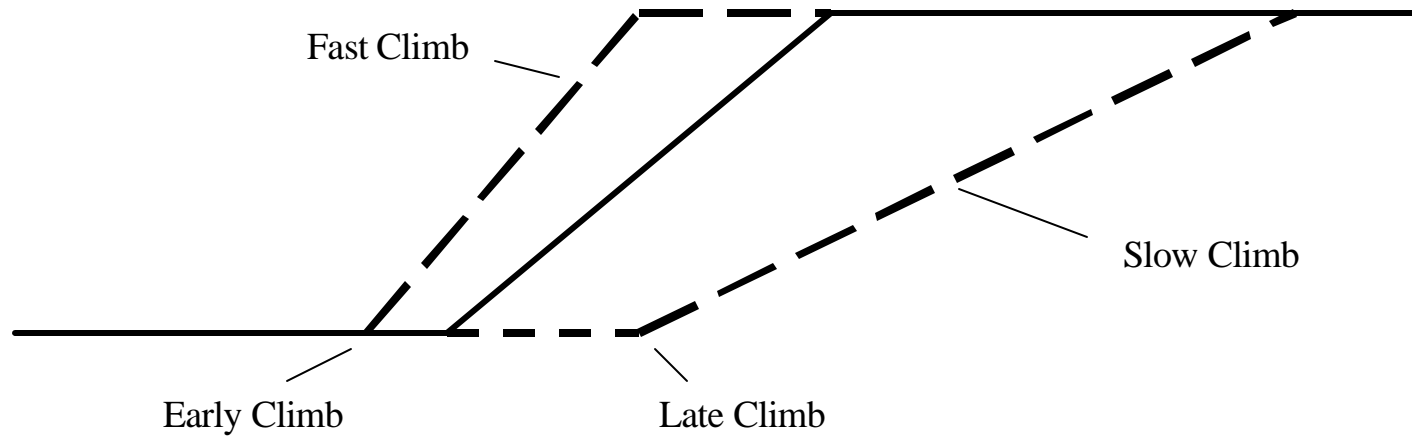
# Uncertainty Modelling with buffer zone



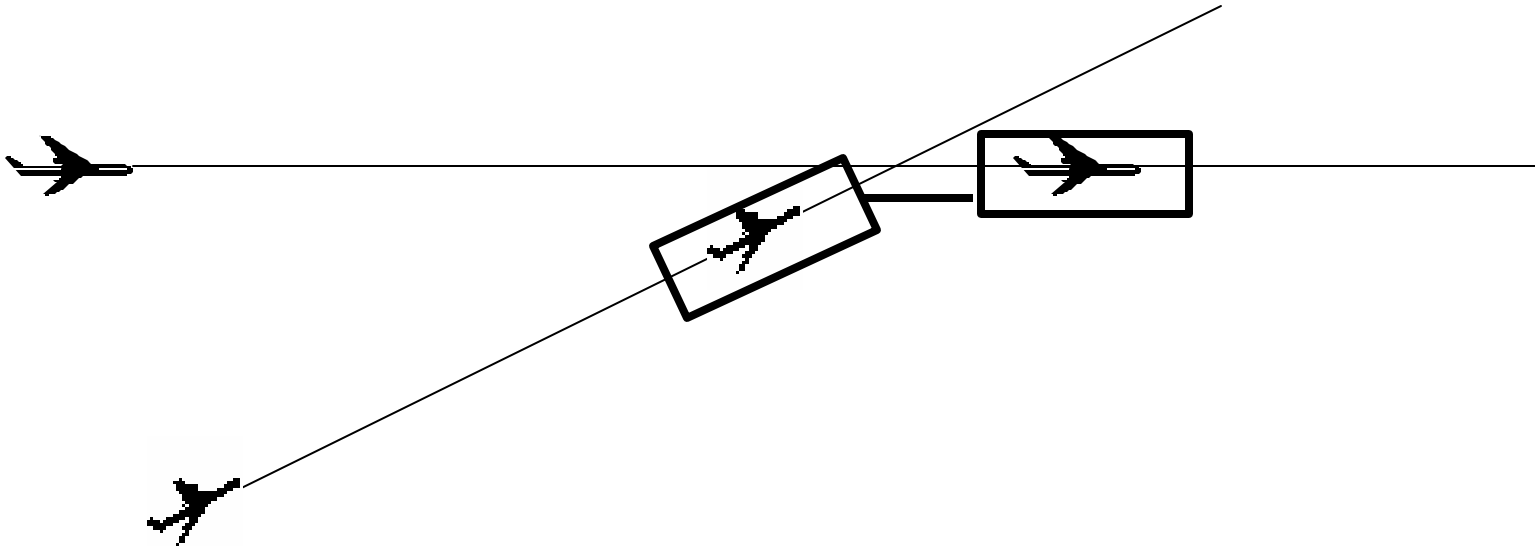




# Vertical Uncertainties



# MTCD Checks for horizontal separation loss between buffers



*FAA/NEXTOR*

# Field Trials



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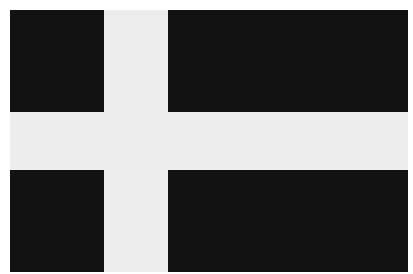
## Trials Objectives (2)

- Evaluate Controller roles, tasks and working methods when using MTCD tools
  - to identify, analyse, monitor and resolve problems in a stripless environment
- Identify tasks where use of MTCD leads to time saving for the Controller in order to estimate the potential impact on controller workload
- Permit ATS providers to conduct an analysis of MTCD in their own system to identify and quantify future implementation risks, constraints and challenges



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# Trials Partners



**Malmö ACC**



**Rome ACC**

- Generic validation plan produced by UK NATS
- Analysis done by Dutch National Airspace Laboratory
- Safety analysis by SOFREA VIA



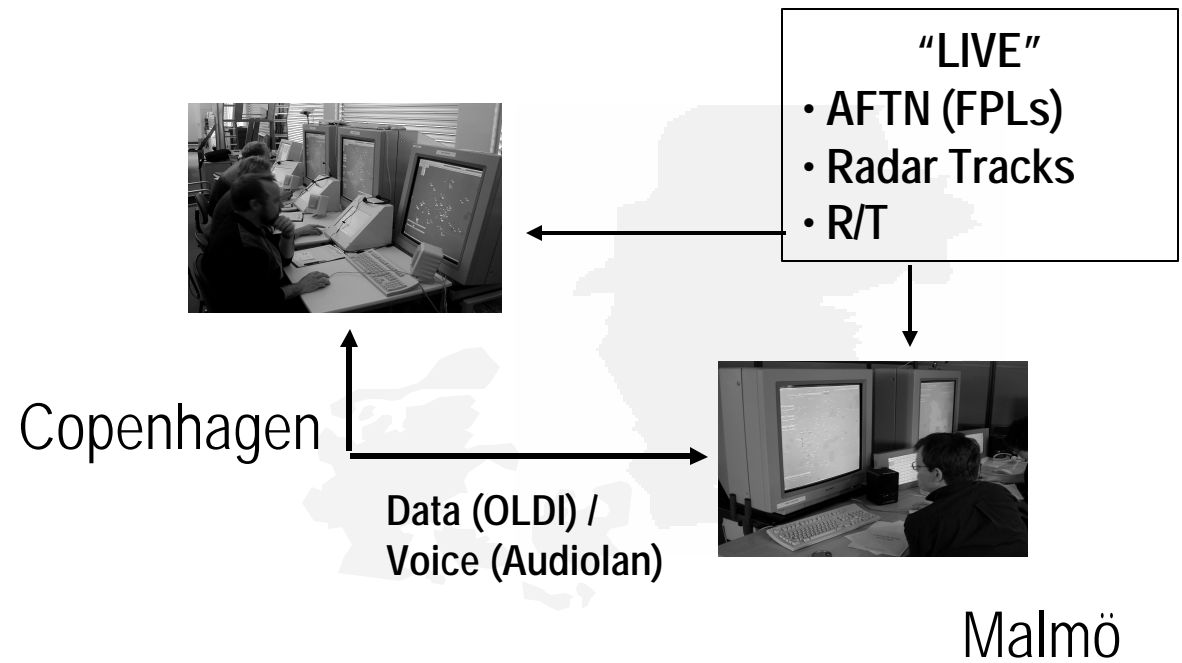
**EUROCONTROL**  
**Maastricht UAC**





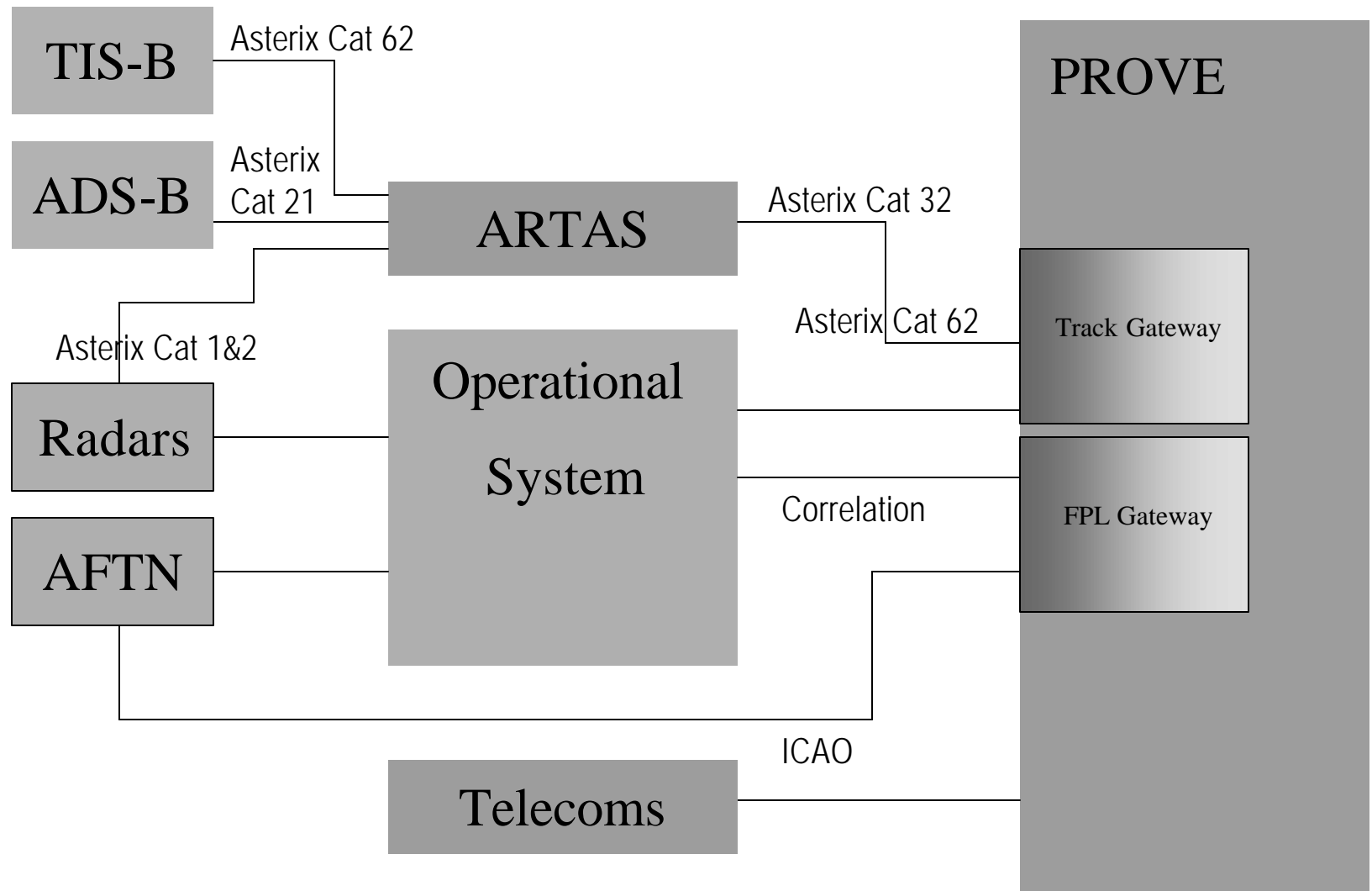
# We use PROVE?

- A live field trials infra-structure deployed in many ACCs around Europe





# PROVE Platform



# Technical System

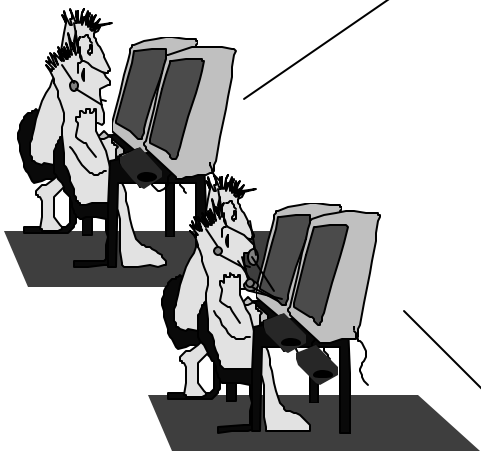


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Ente Nazionale di Assistenza al Volo  
**Host ACC System**

System flight plans  
radar data

**ALENIA Interface Component**



**PROVE**  
FDP TP  
MONA MTCD  
HMI



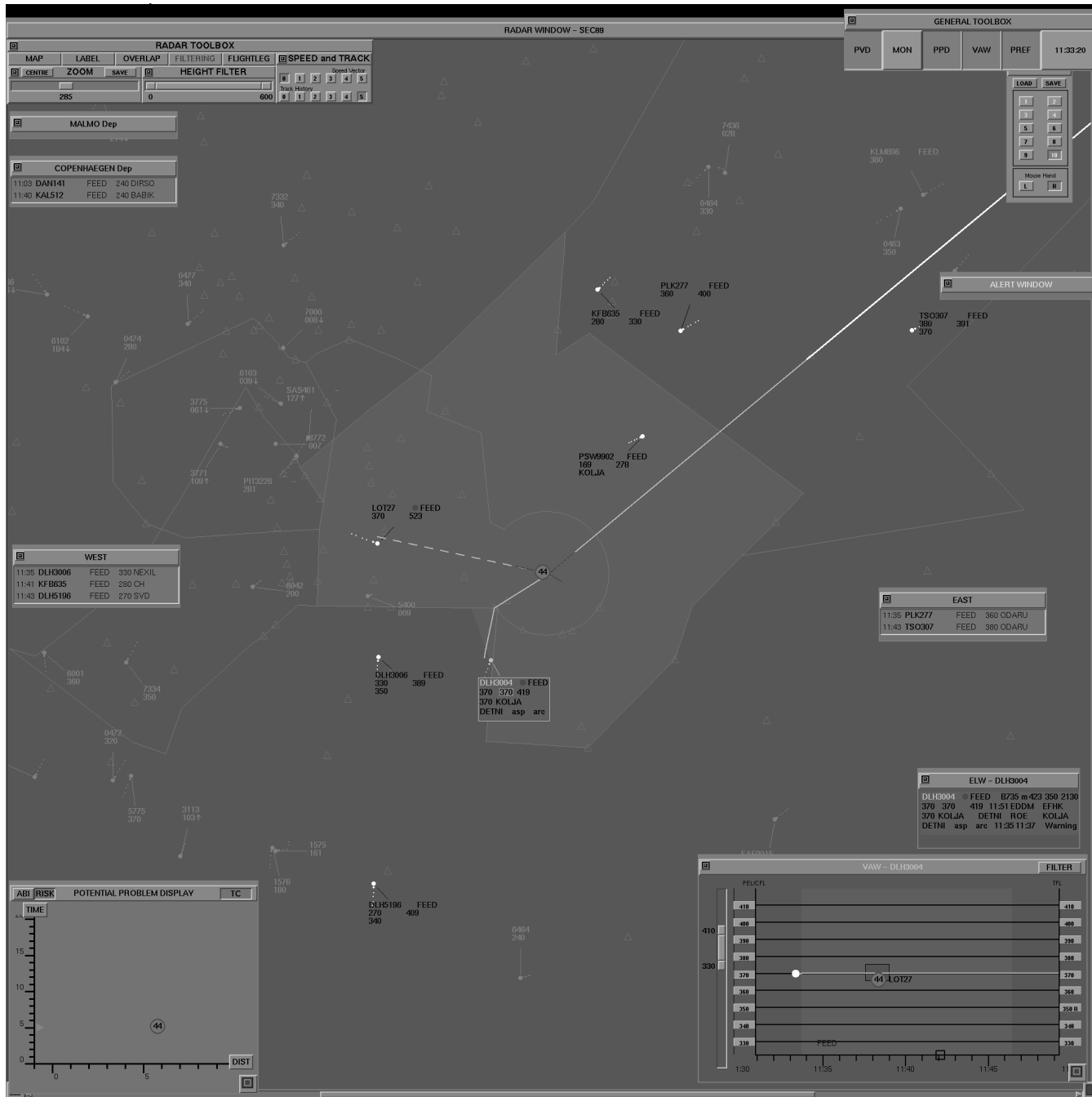


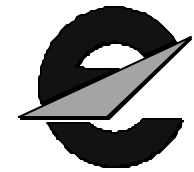
# MTCD CWP



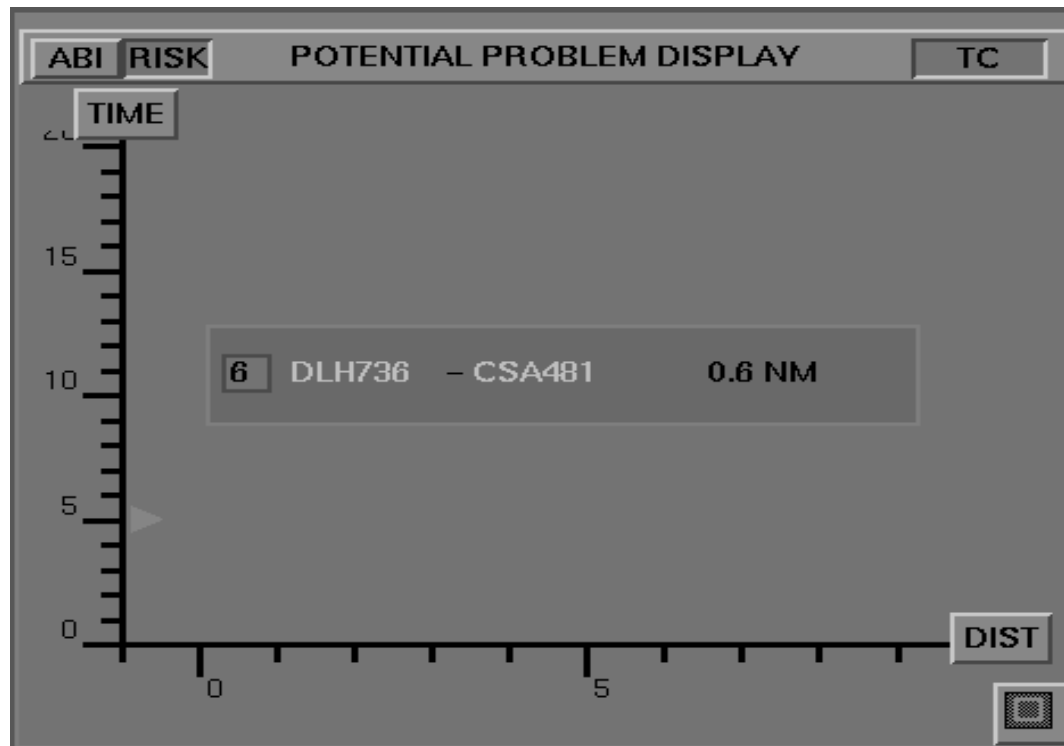


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# MTCD Problem Display





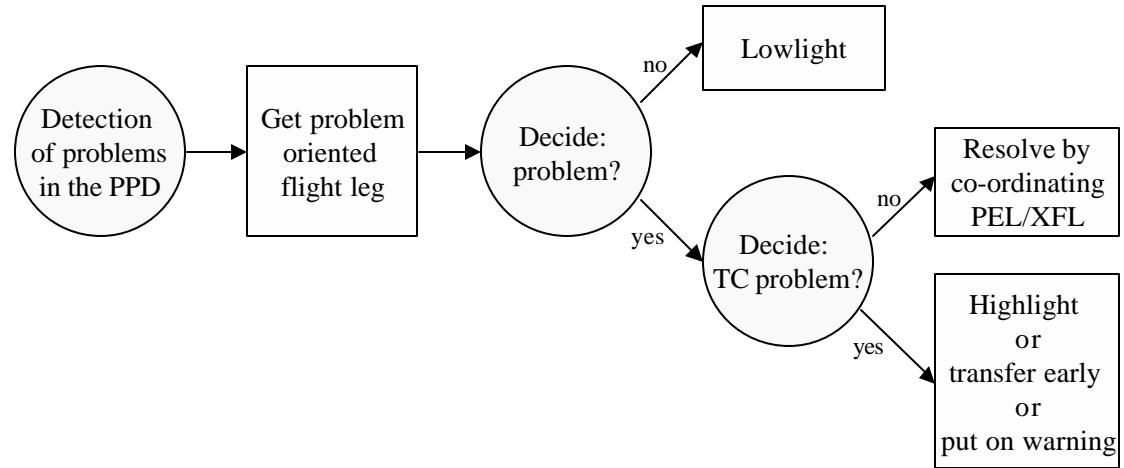
# Results

## Results

are available through  
the EUROCONTROL Experimental  
Centre WEB:  
[www.eurocontrol.fr](http://www.eurocontrol.fr)



# PC Decision Process



- Cognitive process/state
- Actions in the EATMP system



# Workload Assessment

- Main point of MTCD is a more equal distribution of workload within the sector.
  - PC to take over some of TC's workload
- Methods:
  - NASA Task Load Index (to assess the experienced level of workload), and
  - Interviews on the level of experienced workload as well as on anticipated workload changes.



# Usability Assessment

- Goals of use achieved (Effectiveness)
- Resources to achieve goals (Efficiency),
- Use is acceptable (Satisfaction).
- Methods:
  - System Usability Scale (Brooke, 1998),
  - Interviews on the usability of different system components, and
  - Observation of system interaction.



# Human Computer Trust Rating Scale

- Measures (scale 0-20)
  - Understandability, Technical Competence, Perceived Reliability, Faith, Personal Attachment
- Trust ratings were generally higher on Day 5 than on Day 1 of the validation
- Mean score (10) is middle of the scale
- Statistically significant increase was observed only for understandability





# Situation Awareness

- Built on aircraft-oriented flight leg and Extended Label Window
  - sort of an electronic strip presentation
- PPD used for conflicts and risks.
  - PPD was second step after an understanding of traffic situation built by radar.
- PPD data used with own understanding of traffic situation.



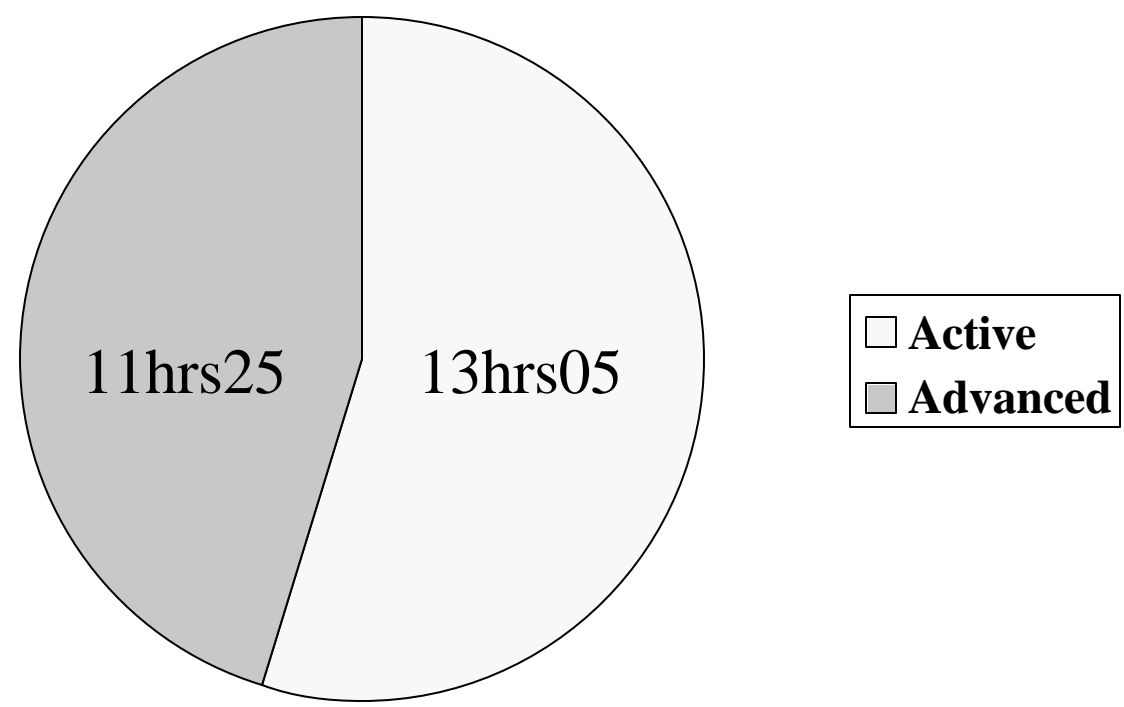
# Expected Changes In Controller Task

- PC/TC thought operational system like tried would considerably change their task.
- MTCO is expected to change when and by whom conflicts are solved:
  - conflicts solved earlier, and often by PC
- Controllers expect problems (e.g. de-skill, over-trust), if future controllers would stop monitoring the traffic situation



# Rome trial statistics

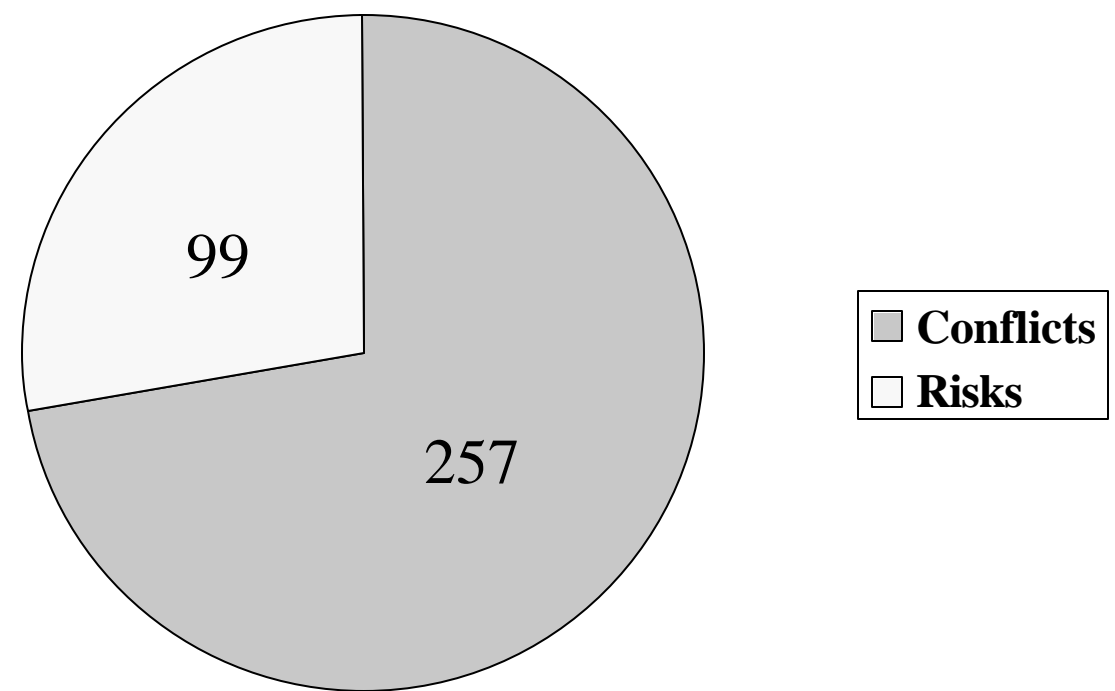
- 24:30 hours of shadow mode trials
  - 10 active sessions
  - 14 advanced sessions





# Rome trial statistics

- Conflicts and risks detected by MTC



- 54 conflicts disappeared within 10 seconds.
- 95 conflicts were lowlighted.



# Situation Awareness

- Earlier conflict identification due to:
  - MTCD information in PPD and flight leg,
  - early correlation of traffic at PROVE platform.
- Better insight into problem geometry due to:
  - display of minimum distance,
  - information on aircraft position.
- Benefits sometimes limited by:
  - nuisance alerts,
  - large changes in predicted minimum distance over time.



# Workload

- Experienced level of workload higher for Trial team than for OPS team (TLX), but
  - large training difference between current system and EATMP system,
  - EATMP system is an experimental system,
  - controllers combine conventional working methods with analysis of MTC D information.
- With more training and an approved operational system, decreases in workload are expected.



# Safety

- MTCD and MONA are expected to increase safety, because of:
  - Early conflict detection,
  - Monitoring of track deviations,
  - Transfer reminders.
- No new safety risks associated with MTCD were identified.



# Shadow mode trials

- (Advanced) shadow mode is a suitable way of testing a new system.
- Controllers are less tolerant towards system problems and restrictions in advanced shadow mode.
- System “limitations” mostly identified in advanced shadow mode
  - uncertainty in trajectory prediction,
  - trajectory re-calculation,
  - effect of wind.





# Conclusions

- Controllers felt confident to progress to advanced shadow mode in high traffic load.
- Concept of MTCD highly appreciated by controllers.
- Crucial aspects in the introduction of MTCD:
  - Controller working methods,
  - Knowledge of system potential and limitations.



# Workload

**Mean NASA TLX ratings  
as a function of team and controller role**

