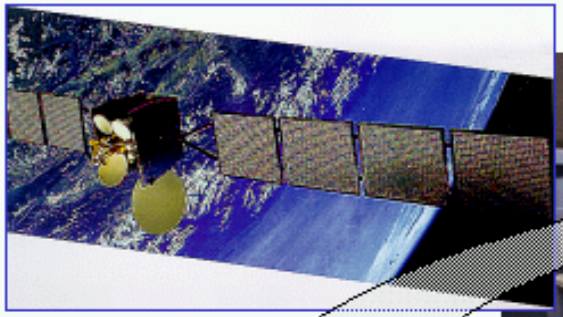
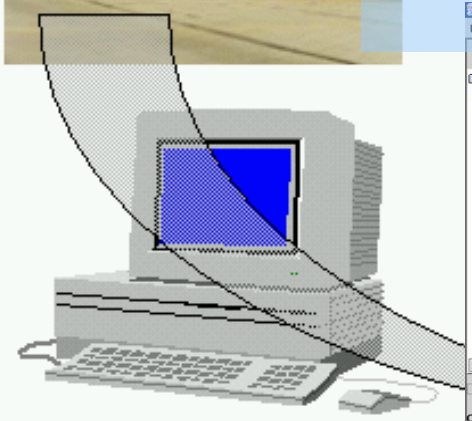
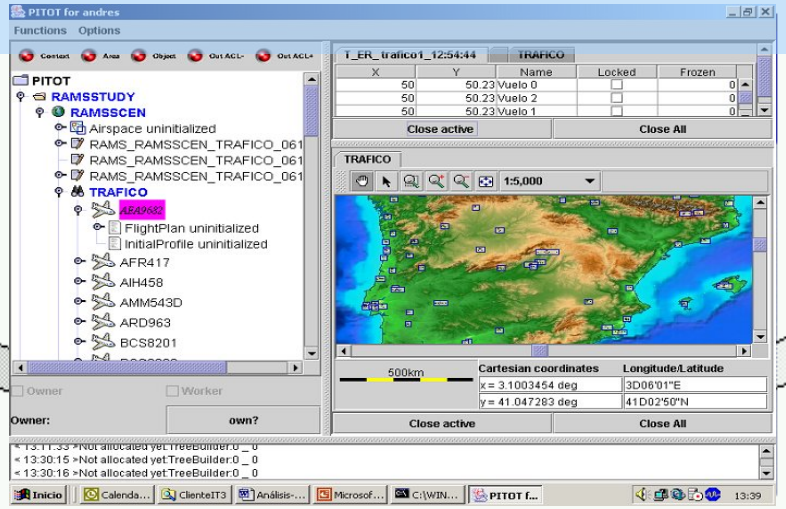
AP9 TIM

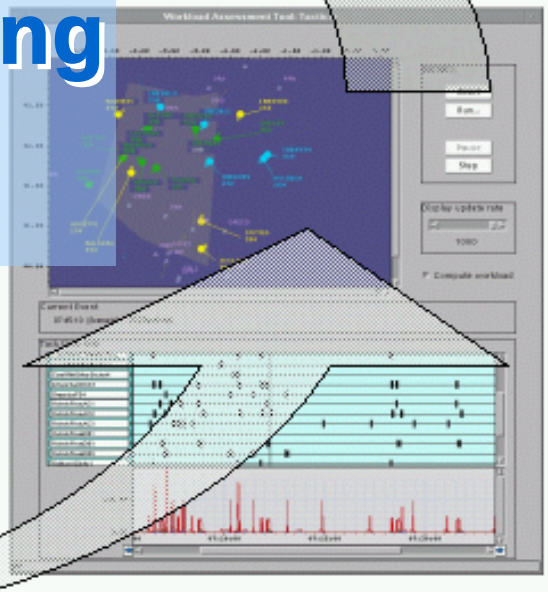
Madrid, 16th - 17th November 2006



System Wide Modelling in Europe





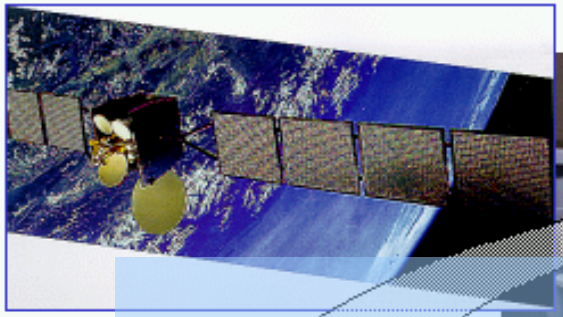


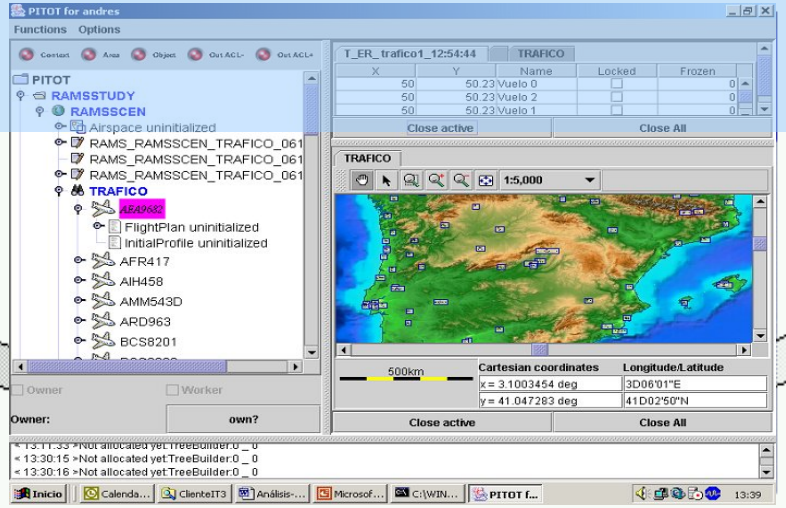
Manuel M. Dorado
Air Nav. Sys. Development Division
AENA, Spain

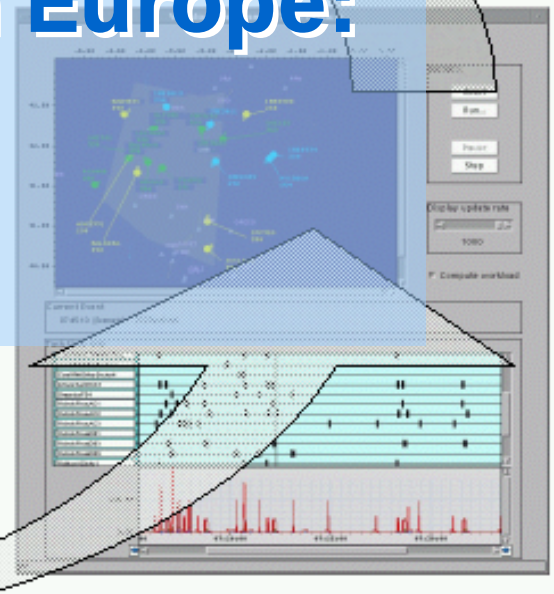
SUMARY

- System Wide Modelling in Europe: key ideas
- SESAR: “The future European ATM Concept”
  - SESAR Programme
  - Example of related project: VALIDATION
    Episode III Project: “Validation of the concept”
- System Wide Models in Europe
  - Macromodel examples
  - Gaming Exercises vs. Process Simulator
- Identified Gaps in System Wide Modeling
- Conclussion

System Wide Modelling in Europe: key ideas





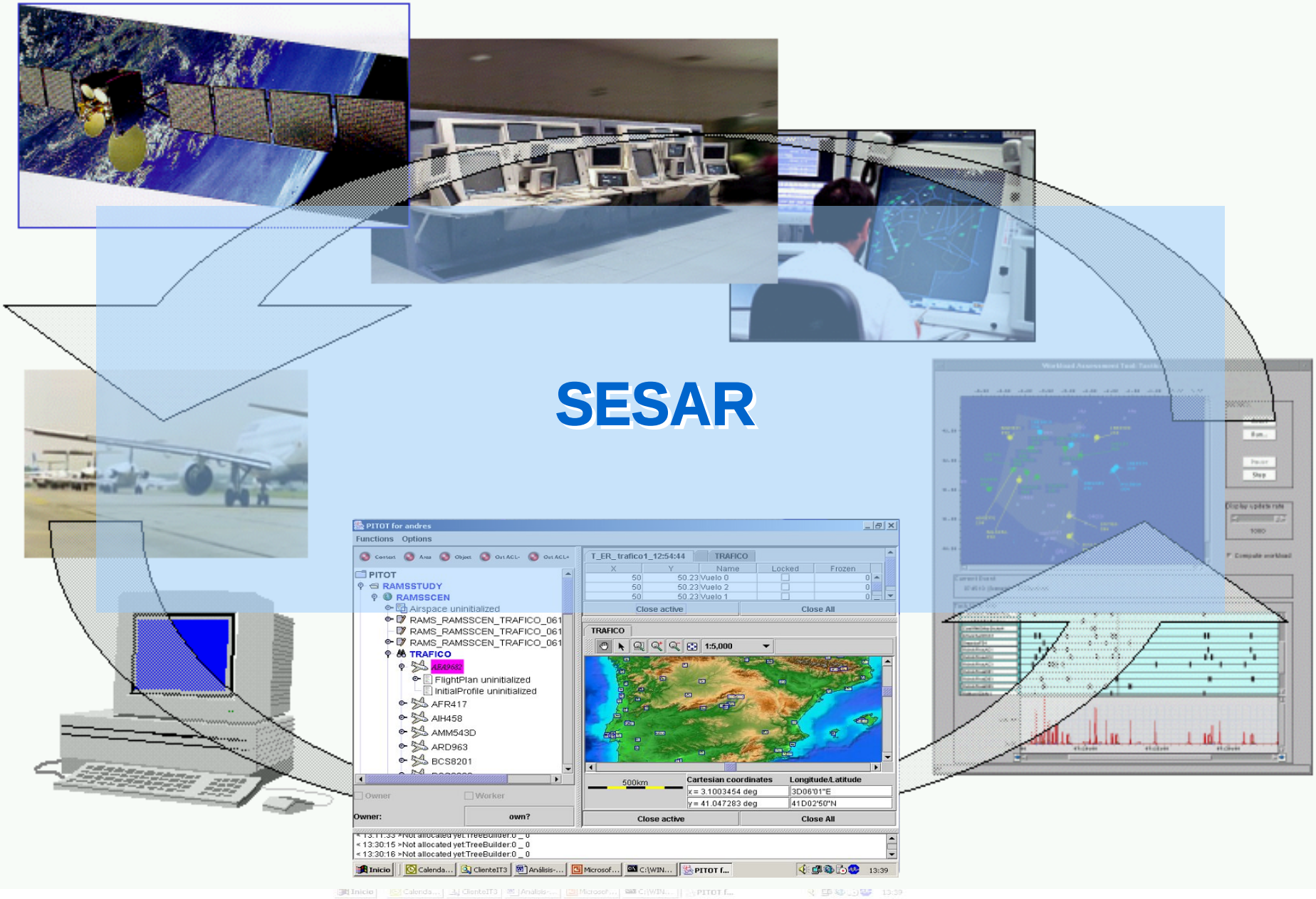


Focus

- System operations perspective
- Current and future needs of system wide models
- Future system wide concepts that might be considered for Simulation/Validation
- Models and methods for System wide modeling in the scope of Air Transportation
- Gaps and shortfalls in system wide modeling
- Economical, finantial, cost-effectiveness and technological issues are also taken into account (but they fall out of the scope of this presentation)

Key Ideas in Europe

- "System-wide": up to gate-to-gate operations
- Geographical scope in Europe: ECAC-Wide.
- Time period for model application: 1 day (e.g. NOP)
- Actors:
  - ✓ Several actors: ATM+TFM+AO+AL+MIL+Pilot+ATCo...
  - ✓ 1 actor is normally considered "classical FTS exercise"
- Time horizon
  - ✓ Present: just for baseline, reference or do-nothing assessments
  - ✓ Future: SESAR Concept
    - 2012
    - 2020


SESAR
PITOT for andres
Functions
Options
PITOT
RAMSSTUDY
RAMSSCEN
Airspace uninitialized
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TRAFICO
ABA9682
FlightPlan uninitialized
InitialProfile uninitialized
AFR417
AIH458
AMM543D
ARD963
BCS8201
T_ER_trafico1_12:54:44
TRAFICO
Close active
Close All
1:5,000
500km
Cartesian coordinates
Longitude/Latitude
x = 3.1003454 deg
y = 41.047283 deg
3D06'01"E
41D02'50"N
Owner:
own?
Owner
Worker
< 13:30:15 >Not allocated yet:TreeBuilder:0 _ 0
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What is SESAR?

The forecasted air transport growth is setting a complex challenge for the 2020 Air Traffic Management's infrastructure (need for airspace optimization, reduced operating costs, improved safety and security levels as well as minimized environmental impacts) cannot be reached within the current framework.

The Single European Sky legislation (SES) launched by the European Commission in March 2004 has set the political frame for actions in Europe to unlock viable growth in Air Transport.

SESAR is the "operational" part to the legislative packages of the SES and is proposing a new approach to reform the ATM structure in Europe. It includes two phases, starting with the establishment of a commonly agreed European ATM Master Plan, one of the key Deliverables of the SESAR Definition Phase Study. The SESAR Definition Phase is a feasibility study. It aims at proposing concrete actions and measures to plan, research, validate, develop and support the implementation of the SES.

Building on the results of the Definition Phase, the Implementation Phase will start covering development and deployment of the European ATM Master Plan.

More information at www.sesar-consortium.aero

SESAR Consortium

The Definition Phase Study is co-funded by the European Commision and EUROCONTROL

Airports Group

Airspace Users Group

ANSP Group

Military Organisations

Professional associations

Research Centres

Suply Industry

SESAR Definition Phase Outputs

- **Concept Elements Definition:** Future (2012-2020) ATM Concept
- **Performance Targets:** based upon ICAO standard KPA-KPI.
- **Preliminary Validation Exercises:** Exercises

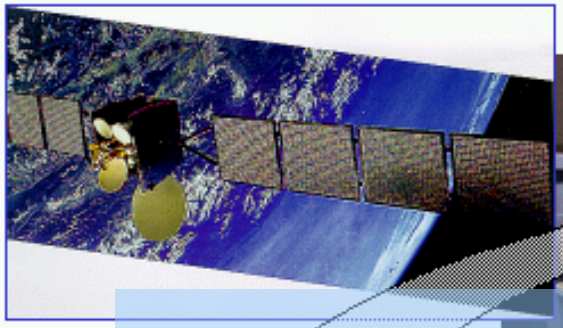
  (Gaps in validation infrastructure will be identified here).
- **Implementation Plan:**
  - ATM Master Plan
  - Work Programme 2007-2012:

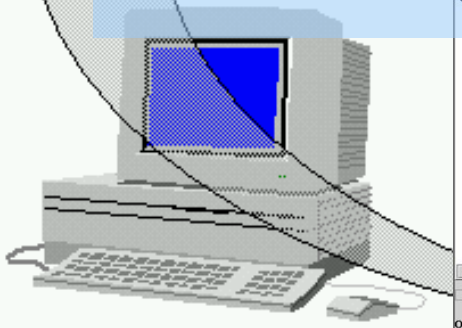
    (Development & Implementation)

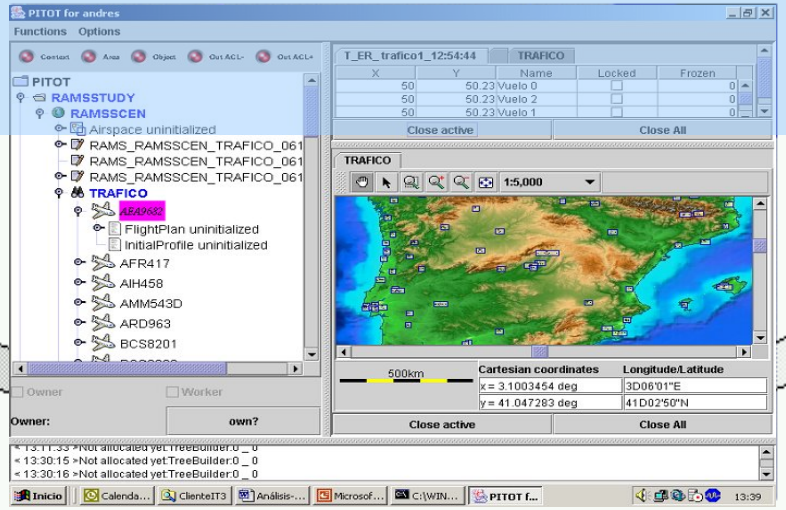
Episode III Project

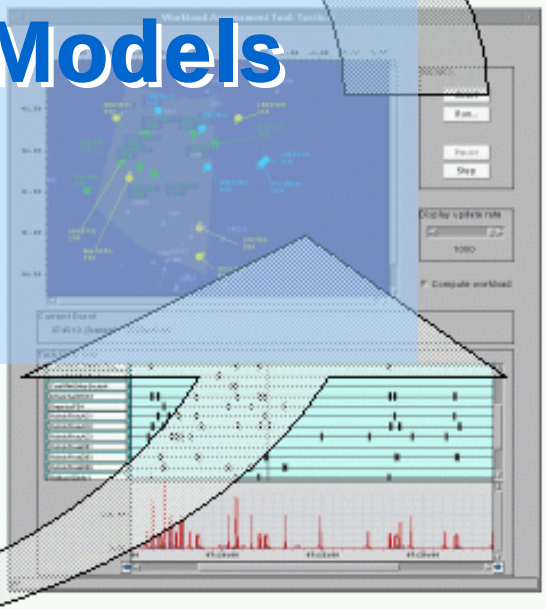
- Proposal to EU VI th Framework Programme
- Objective: Validation of the SESAR Future ATM Concept
  - Includes RTS, FTS, System Wide Modeling…
  - Includes development of validation means.
- Validation:
  - Local
  - ECAC-Wide
- Different perspectives:
  - Performance:
    - EG, RTS, FTS, Macromodels (System Wide Models)…
  - Processes/procedures:
    - EG, GE, Process Simulators
  - Technological assessment

Esamples of System Wide Models in Europe







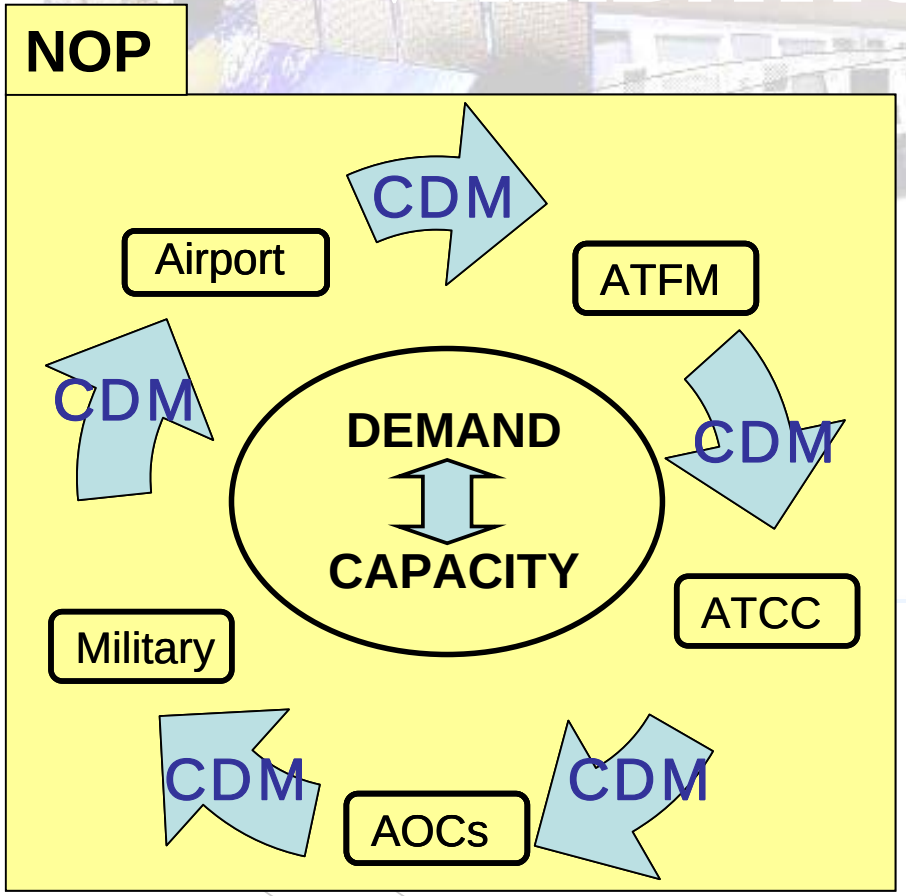


System Wide Models in Europe

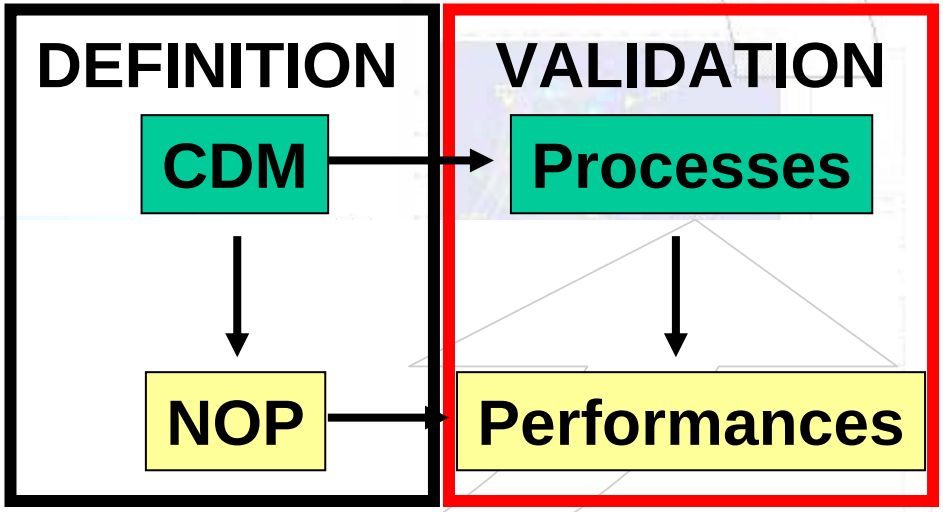
- ATC FTS: RAMS, TAAM, EAM, OPAS... ✓
  - Capacity gain.
  - Efficiency: delays, distance flown, fuel burn, times, regulations...
  - Safety: conflicts, trajectory dispersion...
- TFM Simulators: COSAAC, others ✓
  - Efficiency: delays, distance flown, fuel burn, times, regulations...
- EUROCONTROL System Wide Models: FAP, SAAM ✓
- Macromodels
- Process Simulators ✓
- Gaming Exercises Infrastructure
- Future System-Wide Modeling Architecture ✓

Macromodel example: Episode III proposal

VALIDATION OBJECTIVE



NOP provides an up to date overview by integrating all stakeholders.
CDM provides the way stakeholders cooperate through enhanced data sharing that is supported by the NOP.



Two VALIDATION STREAMS:
PROCESSES (CDM) AND PERFORMANCES

Macromodel example: Episode III proposal

PERFORMANCES VALIDATION

Expert Group

Contingency Assessment (unexpected events)

+

Statistical Analysis

Constraining Airports Identification

→

FTS

Picture of flows

Restrictions Identification

→

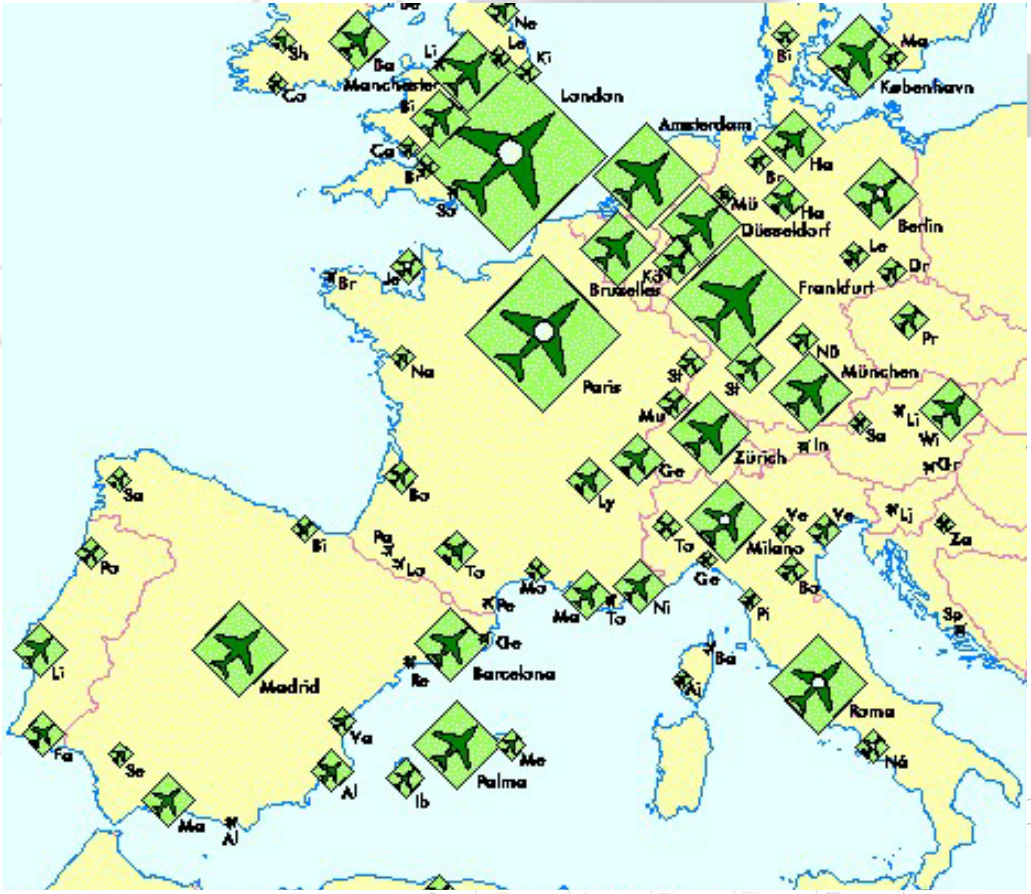
MACROMODEL

Links: Flows

Nodes: Restrictions&SUAs& Constrained Airports

FTS example: Episode III proposal

ECAC wide fast time micro , meso and macro-modelling environment, to macro evaluate system performance, identifying bottlenecks and sustainable processes.



AIRPORTS

- **3000 AIRPORTS BETWEEN WHICH THE TRAFFIC FLOWS TAKE PLACE:**
  - **2000 AIRPORTS WITHIN THE ECAC AREA**
  - **1000 NON-ECAC AIRPORTS (connect the ECAC area to the rest of the world)**

TOP 133 AIRPORTS carry 90 % of the ECAC IFR TRAFFIC

FTS example: Episode III proposal

LEVEL 1: SOURCE/DRAIN OF FLIGHTS

No Runways, No procedures

LEVEL 2: RUNWAY SYSTEM

Runways and procedures

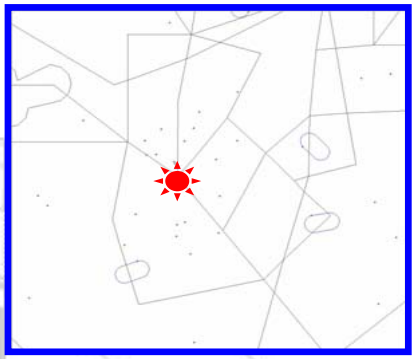
LEVEL 3: COMPLETE LAYOUT

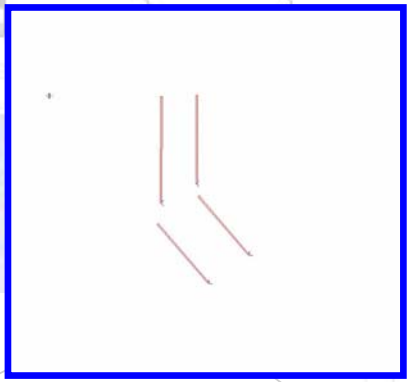
Runways, Taxiways, Apron, Gates, Procedures, Surface management

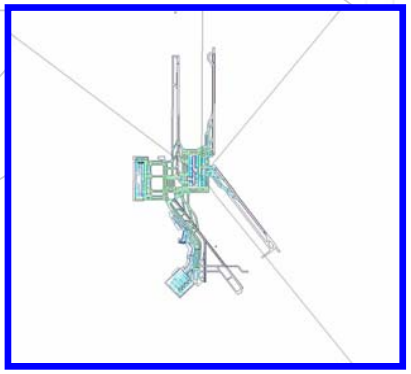
Macro

Mesos

Micro







Example: Episode III proposal

PROCESESS (CDM) VALIDATION

Expert Group
Global CDM Definition
Global CDM Rules
Contingency Assessment

→

Gaming Exercise
Showstoppers detection
Solutions

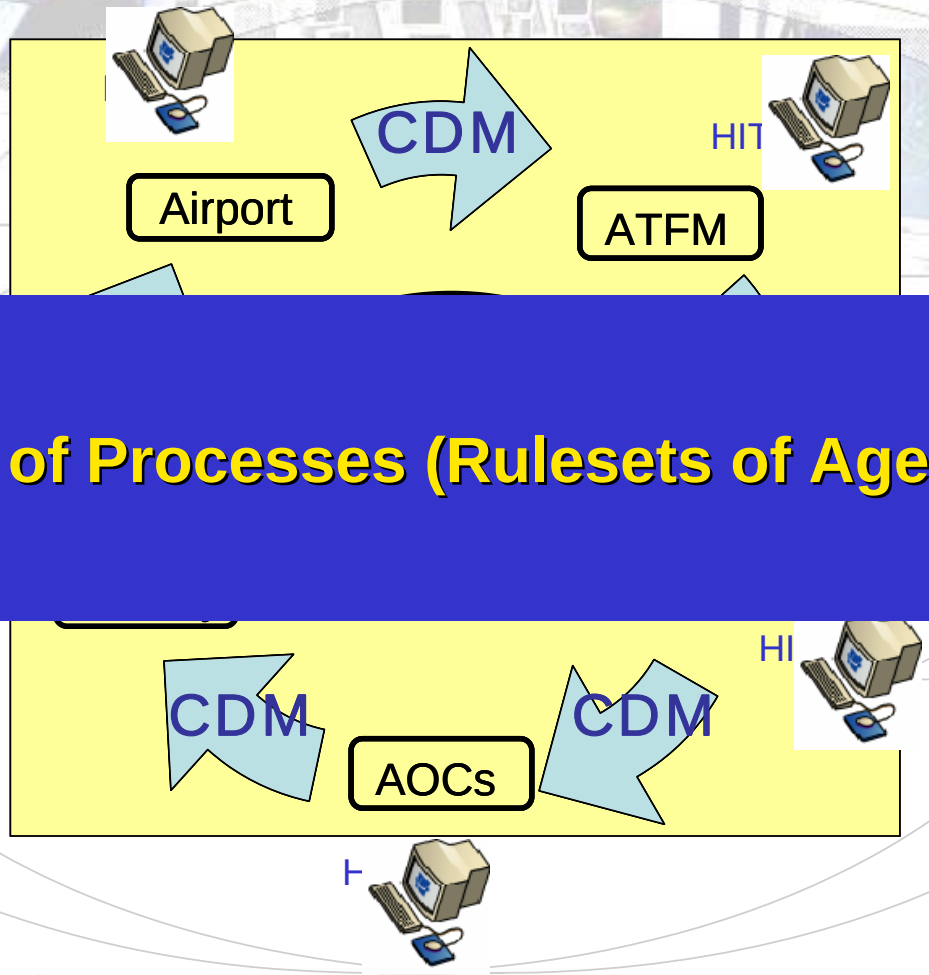
→

Gaming Exercise + **MACRO MODEL**

↓

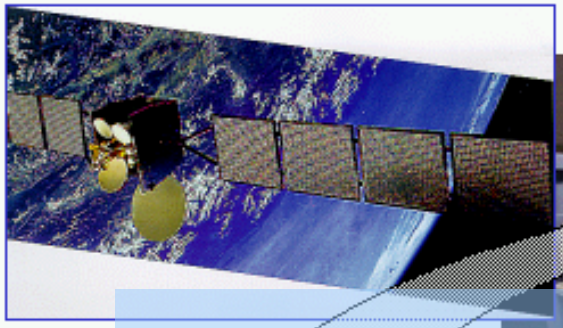
Processes Simulations

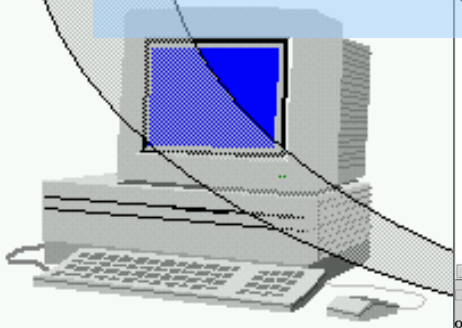
Gaming exercise Vs. Process Simulator

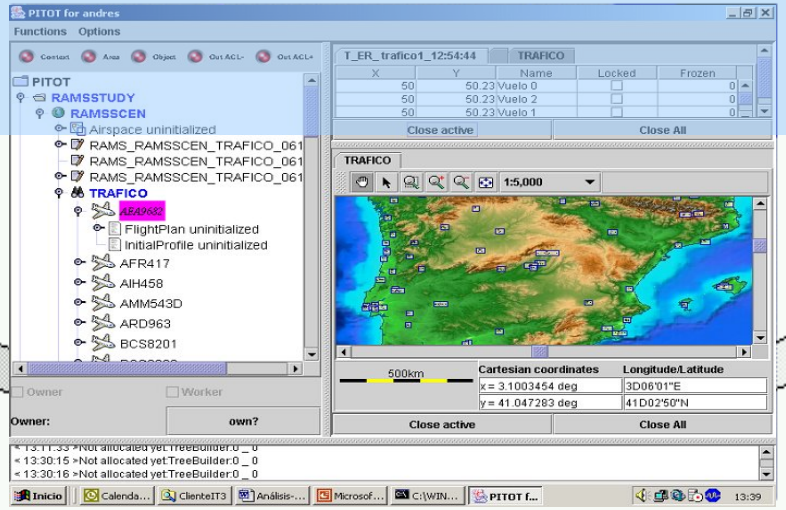


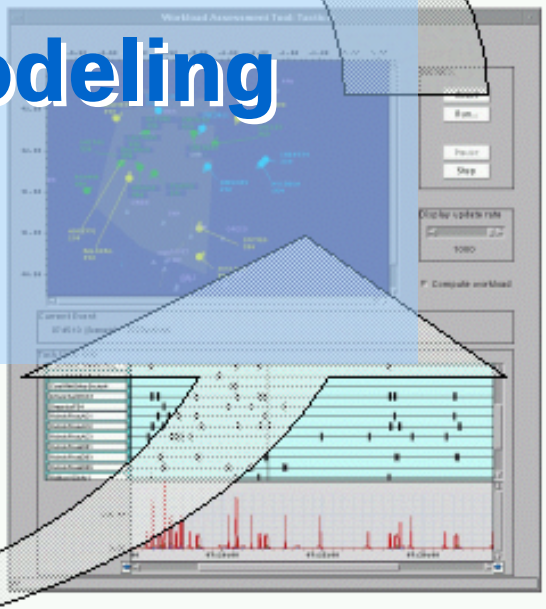
RTS to FTS of Processes (Rulesets of Agents at CDM)

Gaps in System Wide Modeling







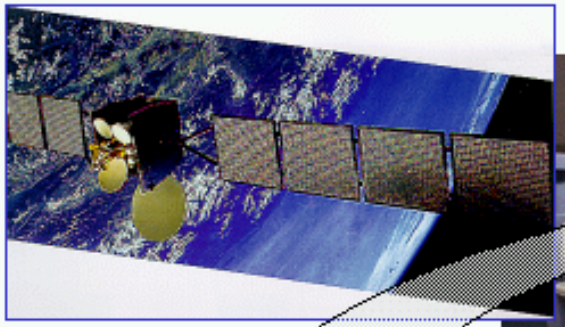


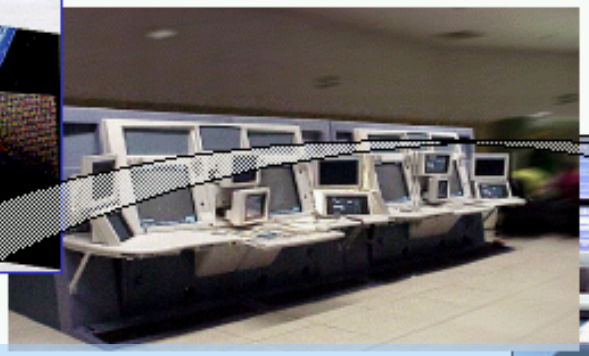
Gaps

- EVI (European Validation Infrastructure)
  - ✓This group* is gathering gaps (it uses AP9 reports among other sources of information)
  - ✓Produce high level recomentdations for new validation infrastructure needed
  - ✓KPA's analysis show some shortfalls: e.g. Security.
- SESAR will produce a high level gaps analysis

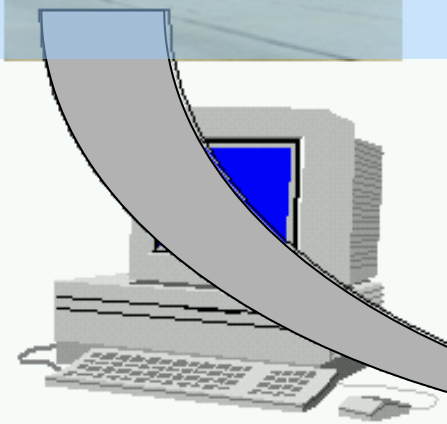
  (preliminary analysis show gaps in KPAs "participation" and "interoperability" for 4 main organisations working with FTS and limited processing of :Security, Flexibility, Access and equity, Cost effectiveness)
- Others: Episode III foresees Validation Infrastructure Development to cover gaps:
  - ✓Process Simulators
  - ✓Macromodels
  - ✓Architecture for System Wide Modeling
  - ✓Cross effects, complementary concept elements, domino effects.
  - ✓Others...

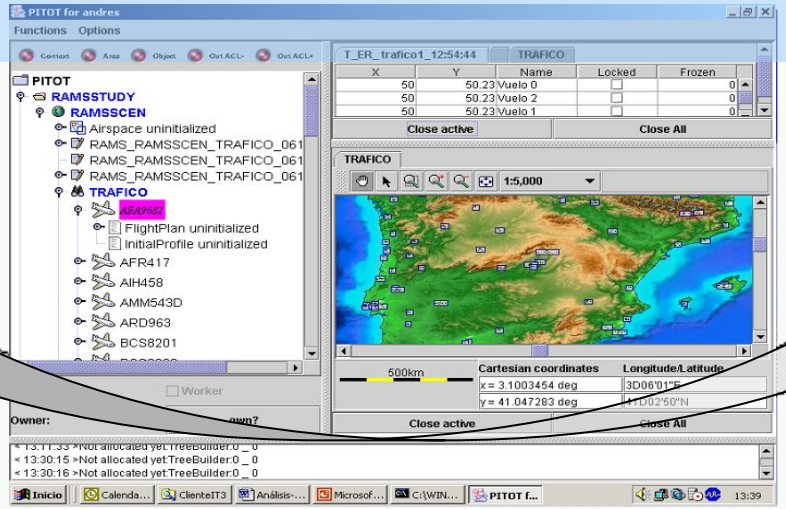
** Group belonging to EATRADA (R&D Organisations in Europe)*

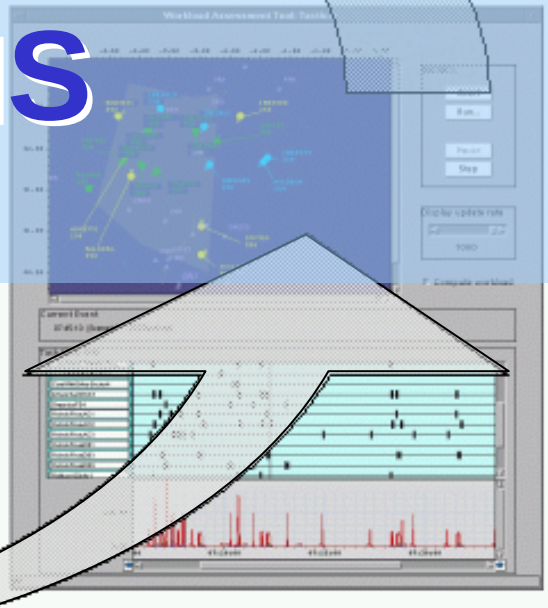




CONCLUSIONS







Conclusions

- There are some important innitiatives in Europe to validate System Wide concepts
- Validation projects are on-going
- There are some System Wide models available
- Future validation infrastructure has identified gaps/needs in System Wide Modeling