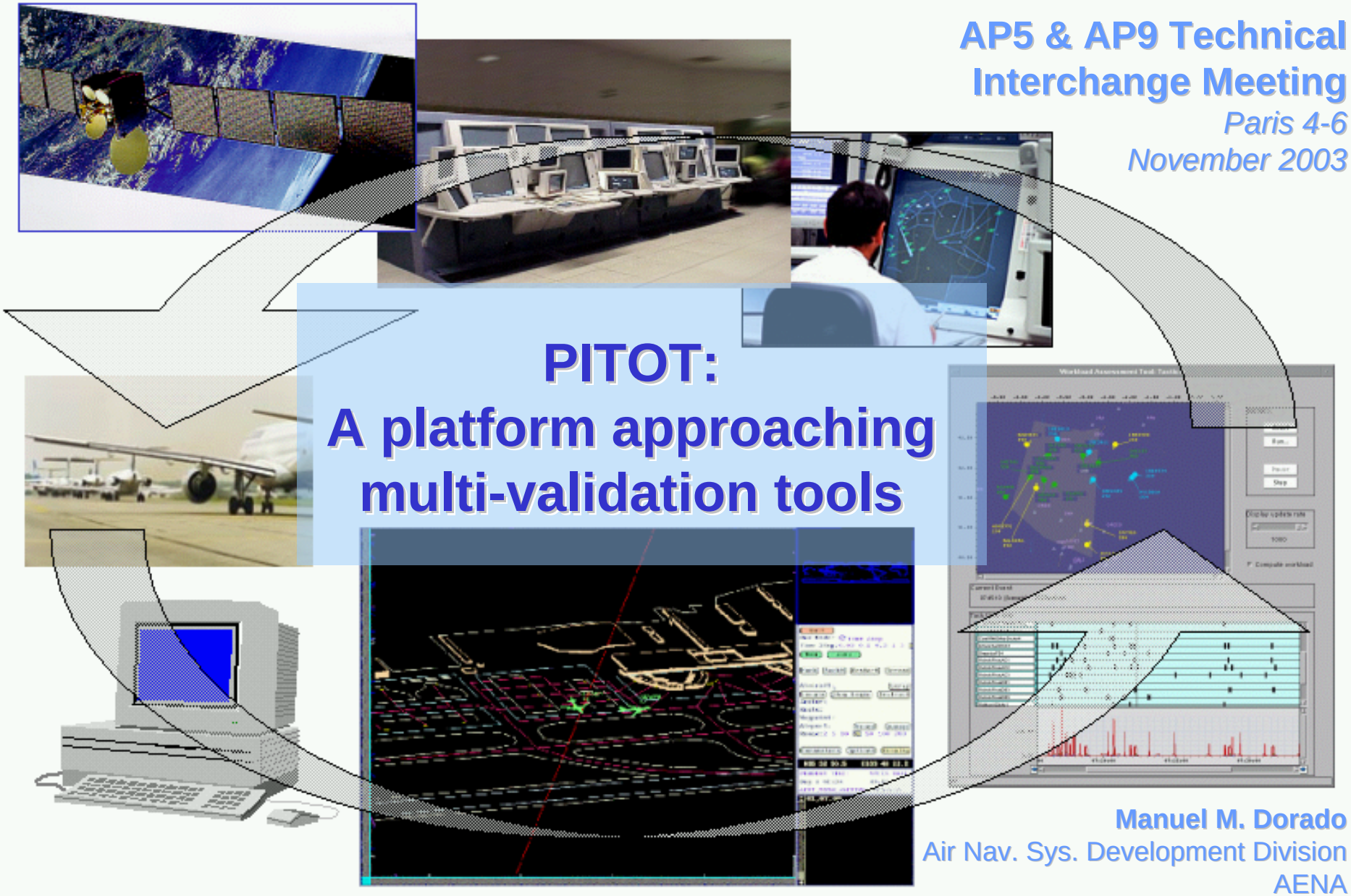


AP5 & AP9 Technical Interchange Meeting

Paris 4-6 November 2003

PITOT: A platform approaching multi-validation tools

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

WHY THIS PRESENTATION?

- To present our…
  - Day to day work?
  - Interesting project?
  - Exchange FTS experiences?
- Why attending Technical Interchange Meeting?
  - Do we have any need?
  - Do we have any problem?
  - Can we find any likely solution?

SUMARY

- DDSNA: Air Navigation System Development Division
  - Fast time simulation at DDSNA
- The need: Using several FTS tools together
- The problem: Using several FTS tools together
- The solution – side effect problems
- The other solutions
  - PITOT
- PITOT project
- Conclusion

Air Navigation System Development Division

SIMULATION UNIT

SIMULATION TOOLS

RAMS
SIMMOD
WITNESS
CAMACA
PUMA
TAAM
INM
COSAAC

Methodology development and implementation

GLOBAL SIMULATION SYSTEM

SIMULATION NETWORK
OWN DEVELOPMENT SW
UNIX
PC's
...
HARDWARE

SUPPORT TOOLS

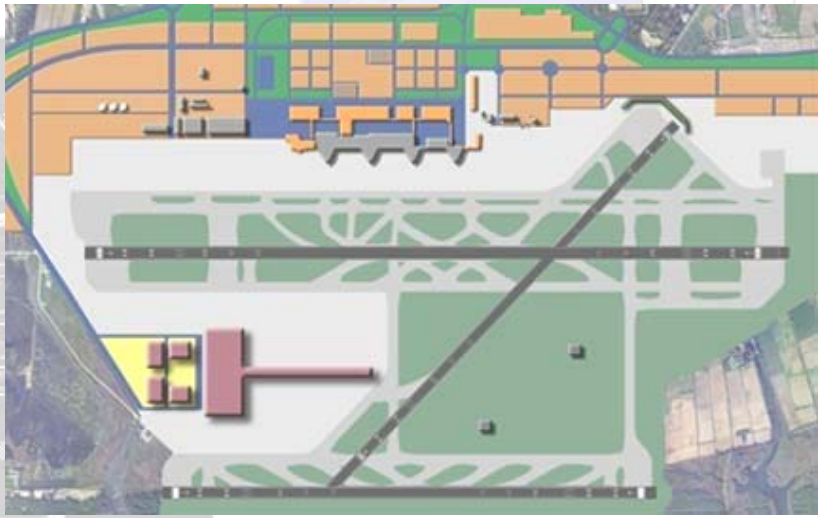
MATHEMATICAL TOOLS
GRAPHICAL TOOLS
TRAINING SUPPORT CBT
MADESA

The need

i.e.: BARCELONA project

BARCELONA project

- New parallel runway in 2004:
  - ⇨ New taxiway system
  - ⇨ New aprons
  - ⇨ New terminal buildings
  - ⇨ New procedures (P-RNAV)
  - ⇨ New terminal Airspace
    - ⇨ Approaches (segregated)
    - ⇨ Departures
    - ⇨ Final sectors
    - ⇨ Feeder sectors
    - ⇨ Covering 2 more airports
  - ⇨ Changes on en-route sectors
  - ⇨ Capacity estimation
  - ⇨ Real Time Simulation

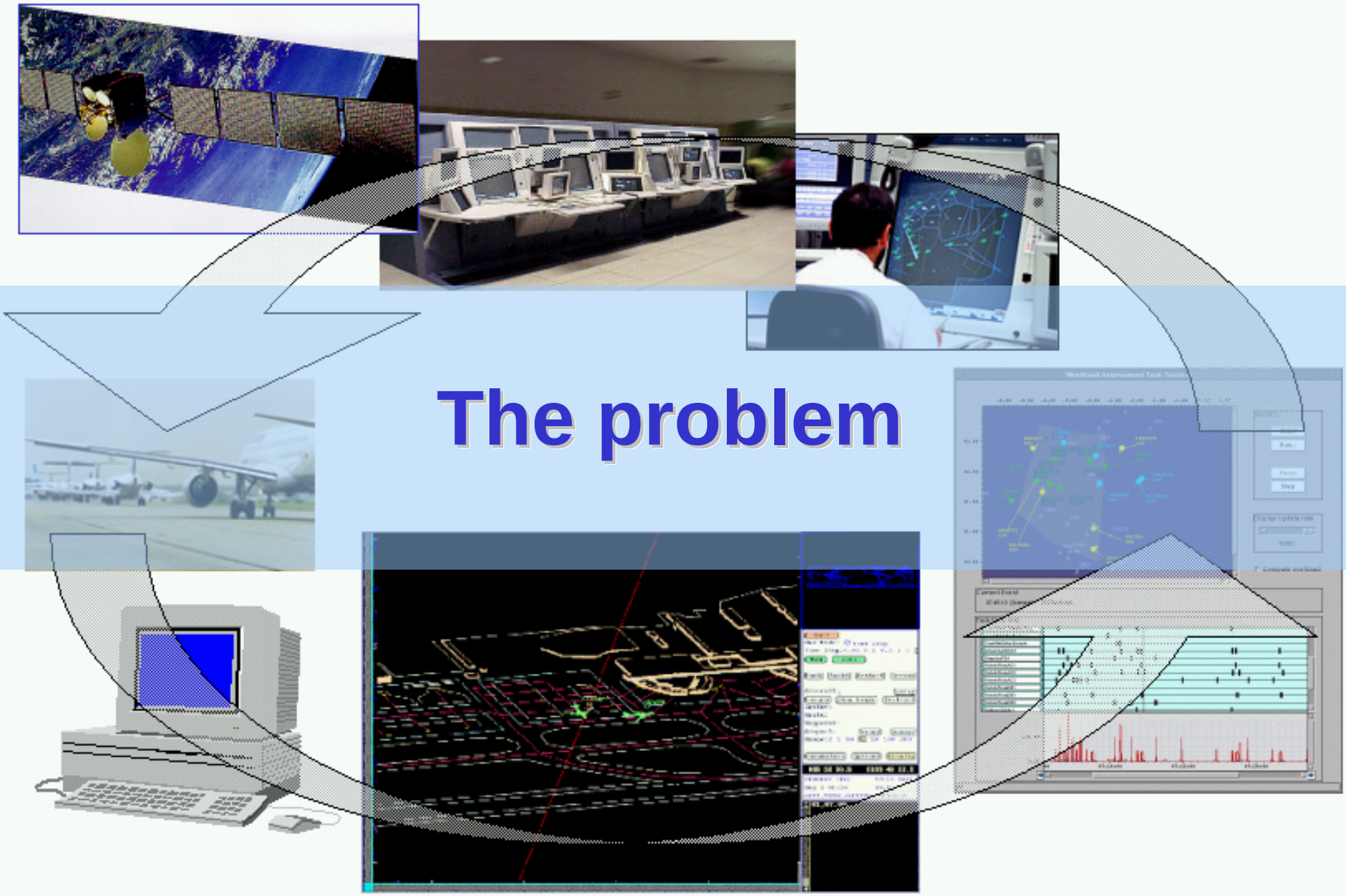


Barcelona scenarios

- Analysis of taxiway, apron and runway system:
  - ⇨ More than 20 scenarios (already done using SIMMOD)
- Analysis of terminal area:
  - ⇨ 6 scenarios
- Analysis of en-route sectors:
  - ⇨ 4 scenarios
- Analysis of terminal area sectors combination:
  - ⇨ 7 scenarios
- Analysis of en-route sectors combination:
  - ⇨ 6 scenarios
- Analysis of departure sequencing:
  - ⇨ 2 scenarios
- Analysis of sectors saturation:
  - ⇨ 5 scenarios
- Analysis of P-RNAV certified AC (30%, 70%, 100%):
  - ⇨ 3 scenarios
- Analysis of approach separation (3 Vs. 2,5 NM)
  - ⇨ 2 scenarios

10 months!

Real need for:
- RTS
- Airspace Design
- Airport working in 2004!


The problem

How to conduct such a project

- Assign as much human resources as suitable
- No single model meets all the needs
- Taxiway, apron and runway: keep it in SIMMOD
  - ⇨ Simple but it works.
- Terminal area: TAAM
  - ⇨ Quite complete terminal area simulation for complex terminal areas.
- Capacity
  - ⇨ PUMA workload (TAAM-PUMA): AENA's validated model
- En route sectors: RAMS
  - ⇨ Complete and easy to use en-route model
  - ⇨ Even if data are already in TAAM
  - ⇨ Hopefully we have a TAAM-RAMS-TAAM converter
  - ⇨ PUMA workload (RAMS-PUMA)
- RTS: TAAM&RAMS – RTS converter

BARCELONA project

- New parallel runway in 2004:
  - ⇨ New taxiway system — SIMMOD
  - ⇨ New aprons
  - ⇨ New terminal buildings — WITNESS
  - ⇨ New procedures (P-RNAV) — TAAM
  - ⇨ New terminal area
    - ⇨ Approaches (segregated)
    - ⇨ Departures
    - ⇨ Final sectors
    - ⇨ Feeder sectors
    - ⇨ Covering 2 more airports
  - ⇨ Changes on en-route sectors — RAMS
  - ⇨ Capacity estimation: — PUMA
  - ⇨ Real Time simulation — SACTA Simulator

PROBLEMS

- Lack of Automation
  - ✓ Hand process = errors
- Repeating modelling: SIMMOD, TAAM, RAMS deviate the final user from ATM issues and worries him/her with SW issues
- Repeating software: TAAM-PUMA, RAMS-PUMA, TAAM-RTS, RAMS-RTS

Is there any solution?

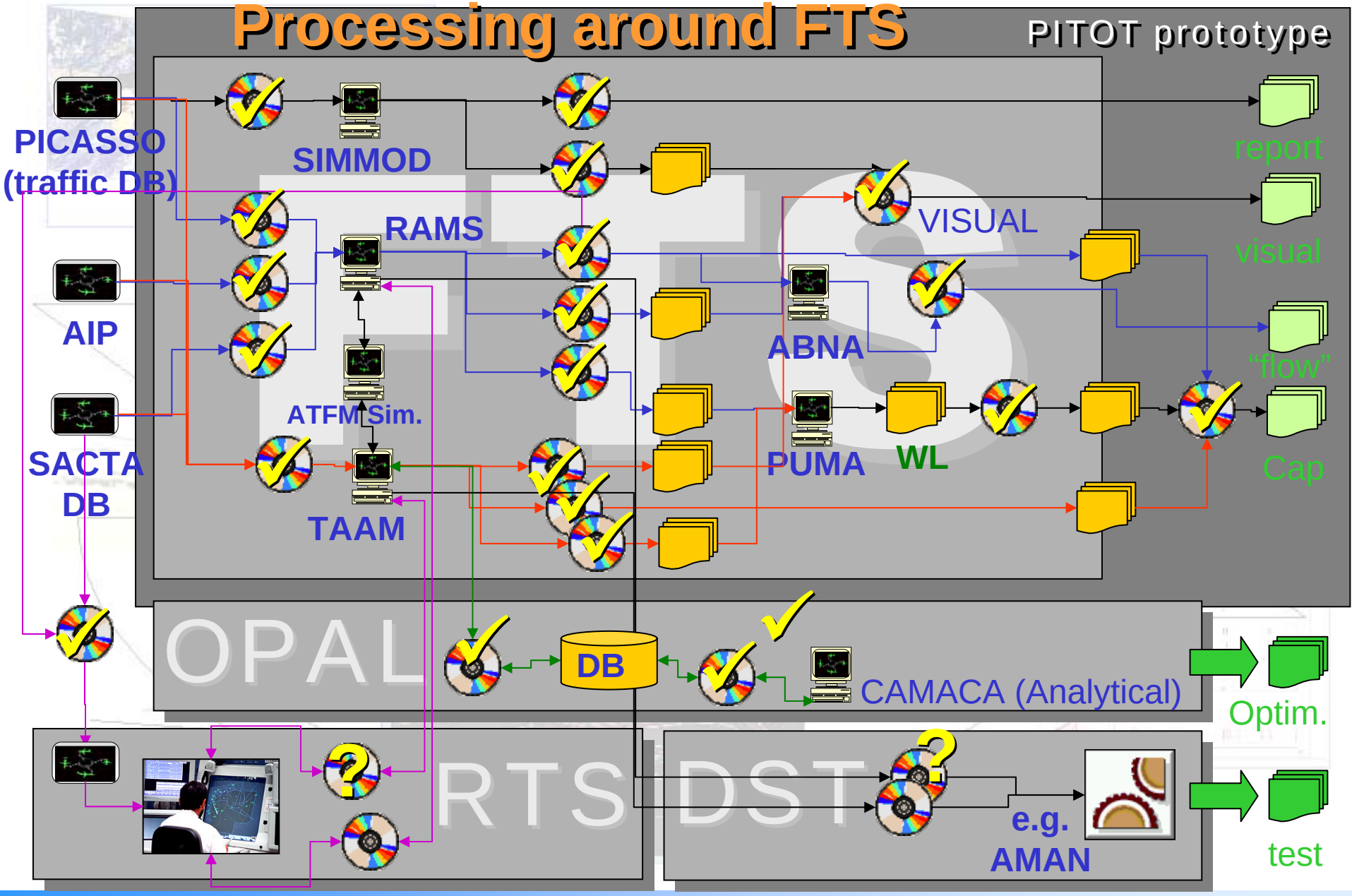
PROBLEMS

- Lack of Automation
  - ✓ Hand process = errors
- Repeating modelling: SIMMOD, TAAM, RAMS deviate the final user from ATM issues and worries him/her with SW issues
- Repeating software: TAAM-PUMA, RAMS-PUMA, TAAM-RTS, RAMS-RTS

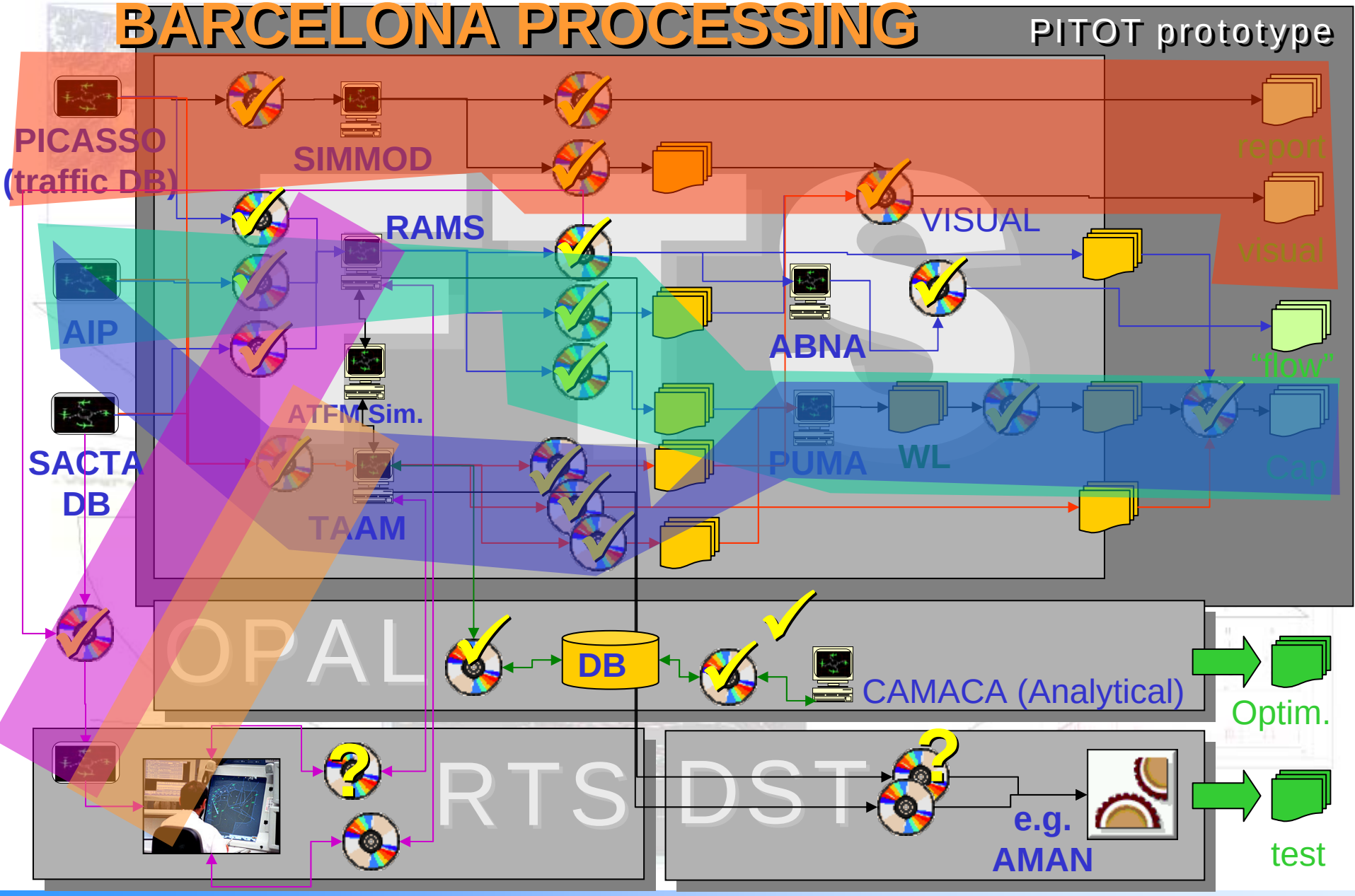
SOLUTIONS

- Pre & Post PROCESSING

Processing around FTS



BARCELONA PROCESSING

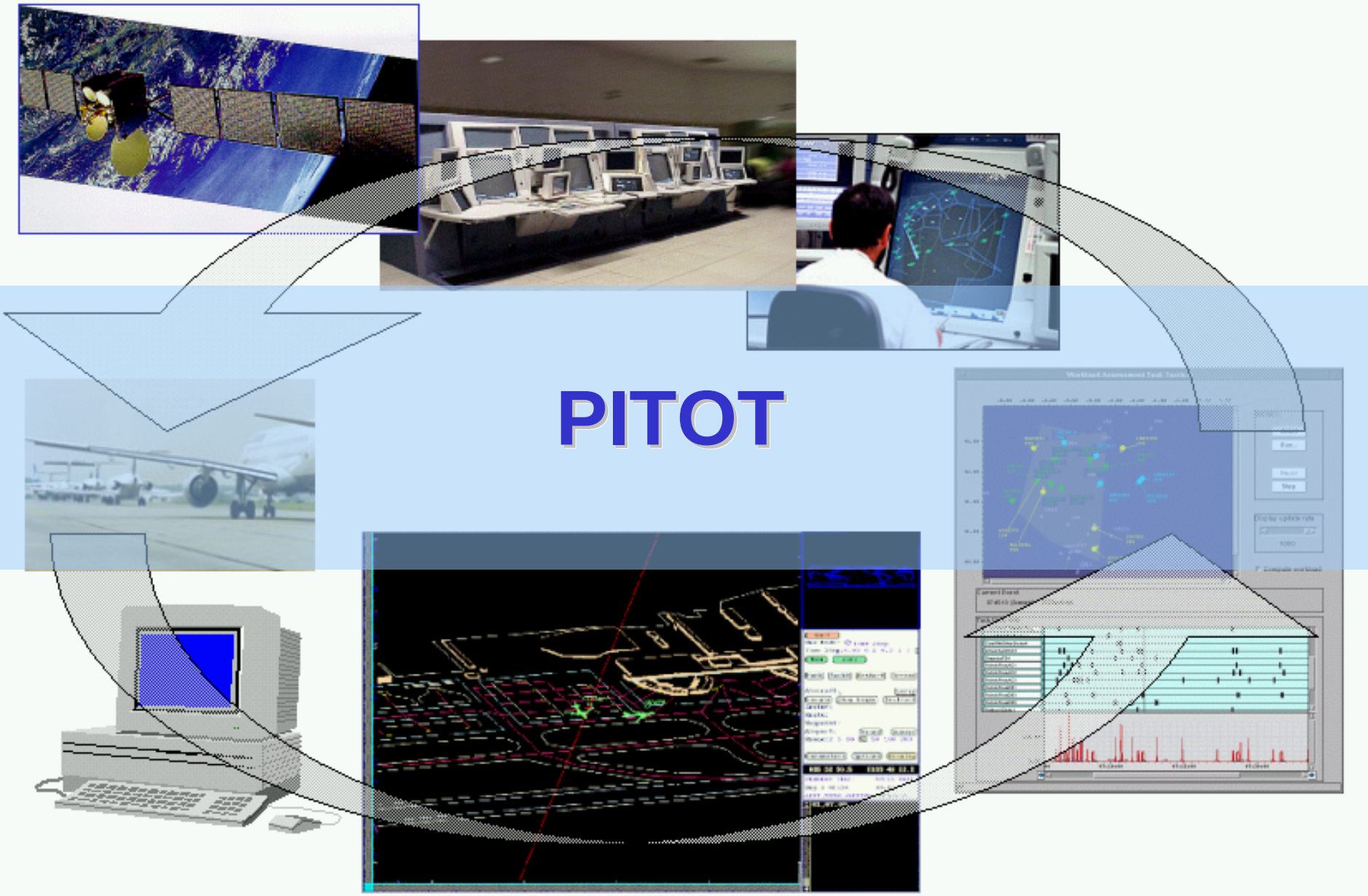


PROBLEMS

- Lack of Automation
  - ✓ Hand process = errors
- Repeating modelling: SIMMOD, TAAM, RAMS deviate the final user from ATM issues and worries him/her with SW issues
- Repeating software: TAAM-PUMA, RAMS-PUMA, TAAM-RTS, RAMS-RTS
- Massive Pre & Post processing

SOLUTIONS

- ONE SINGLE simulator working fully properly
- Evolve towards fully modular simulation
- PITOT?


PITOT

PITOT Why?

Some clear and basic objectives:

- Automate simulation – analysis processes, enabling
  - ✓ linking tools
  - ✓ Optimisation loops
- Provide One Unique data model
- Isolate the final user from SW issues
- Enable easy evolution: metamodel
- Test real system: Decision Support Tools
- Integrate FTS and RTS

- Efficient simulation
- Powerful simulation
- ATM model
- ATM specialist
- Thinking for tomorrow
- Long term
- Long term

ON-LINE (integrated) PITOT Components, processors, FTS or RTS **modules** or future simulators:
i.e. Testing real system decission support tools or RTS-FTS integration

PITOT

Present & **Future**

PITOT meta-model

Java API
Java API
Java API
Java API

Views server

PITOT HMI (Clients)

J2EE Application Server

JAVA OODB

Stores OO PITOT CNS/ATM Model

ADAPTER

XML integration bus

Workflow Engine

ADAPTER
ADAPTER
ADAPTER
ADAPTER

RAMS
TAAM
PUMA
Other
...

Present:
Off-line "conection" (data interchange) between simulators

Future:
On-line integration of simulation objects, modules and functionalities

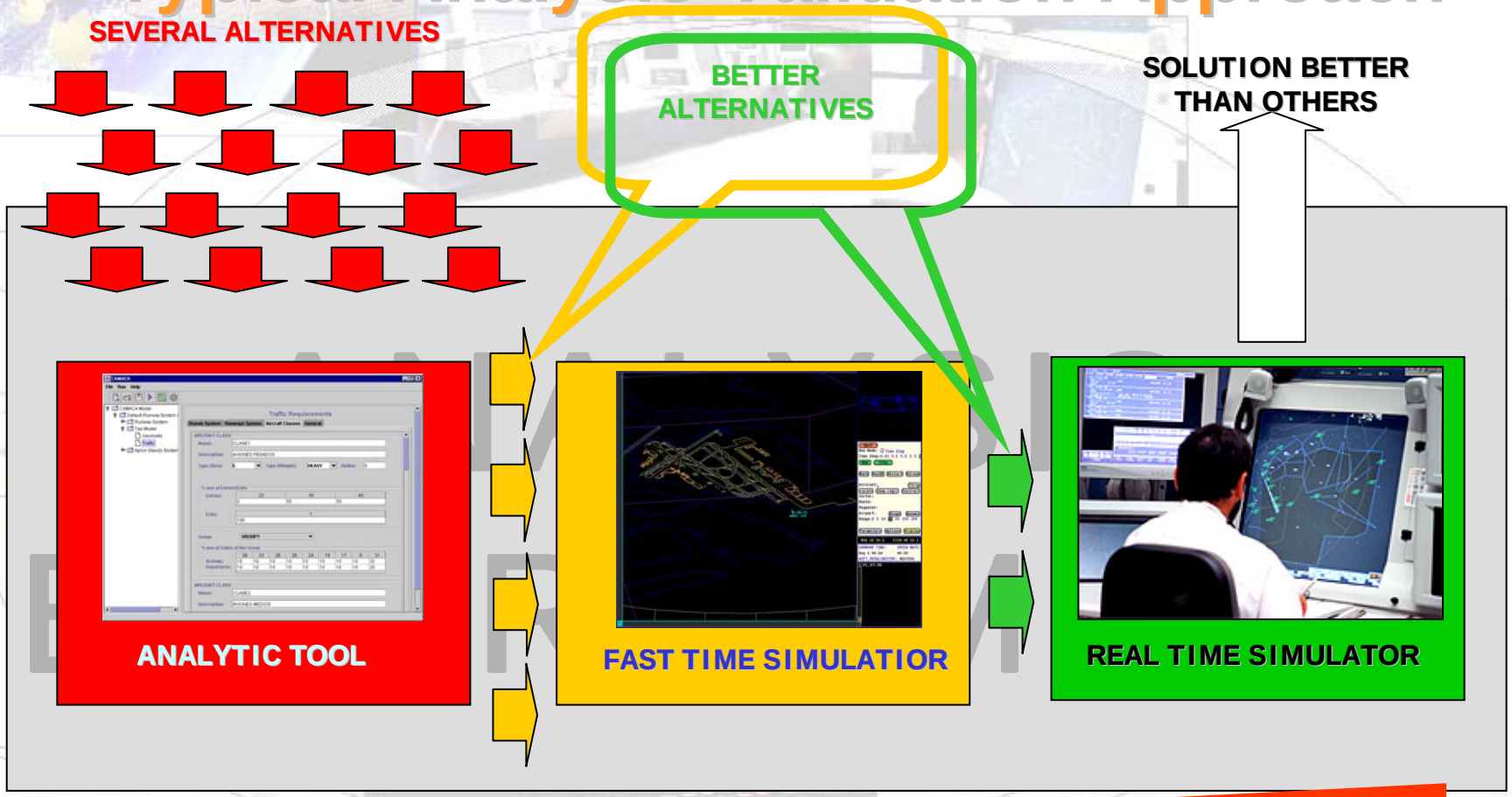
i.e. RAMS model

i.e. TAAM model

i.e. PUMA model

CURRENT SITUATION

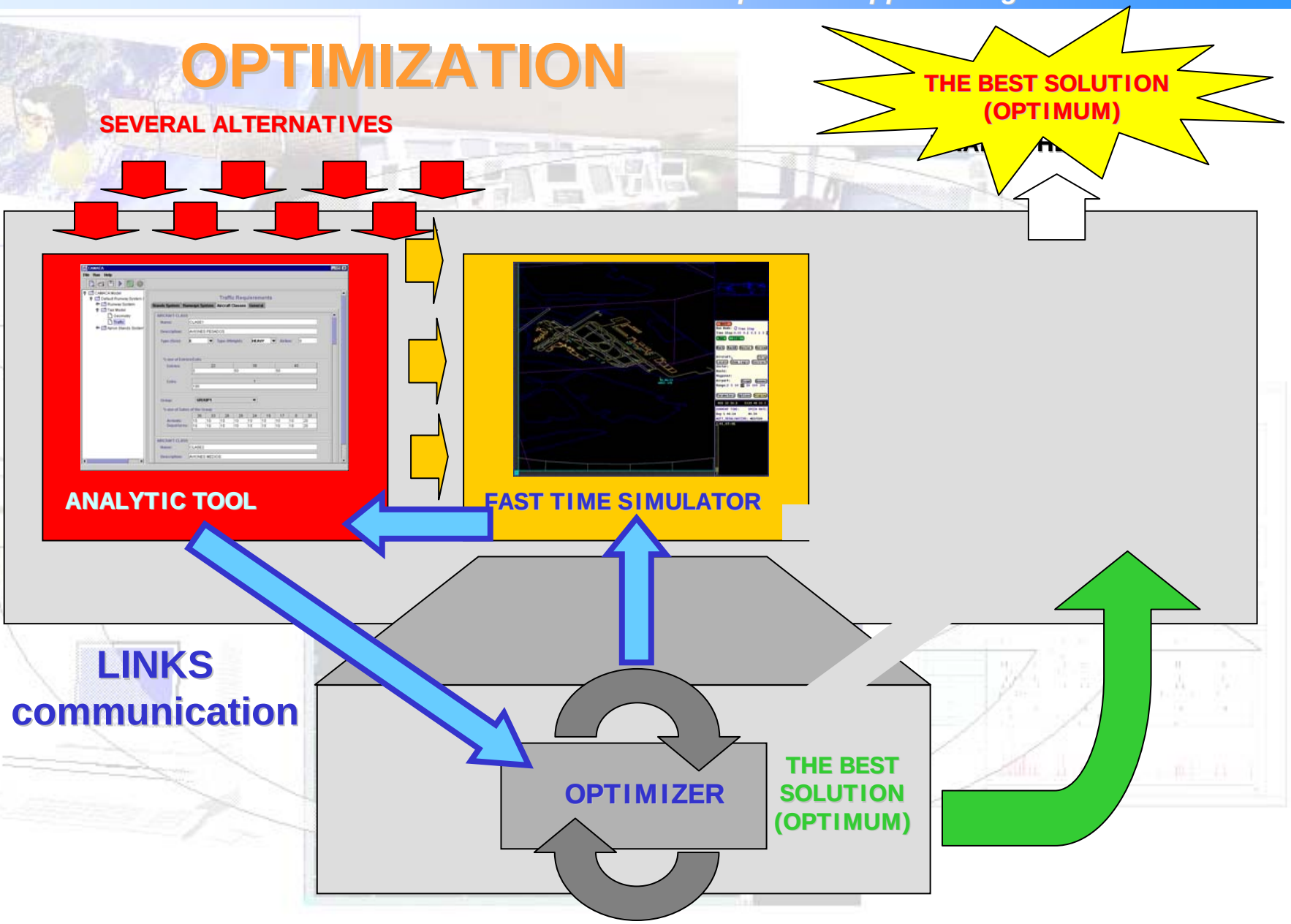
·Typical Analysis-Validation Approach·



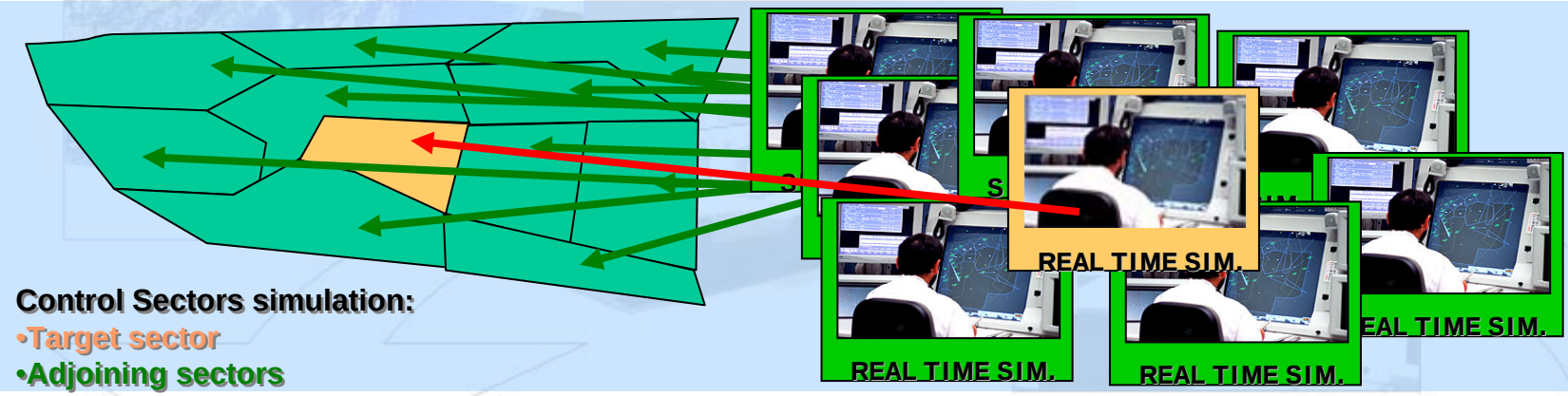
- Time & effort consuming +

+ Uncertainty -

OPTIMIZATION

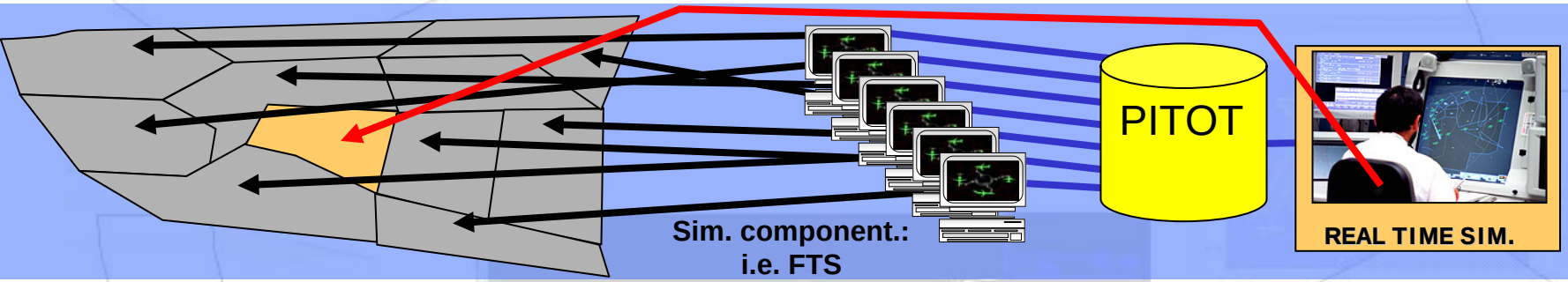


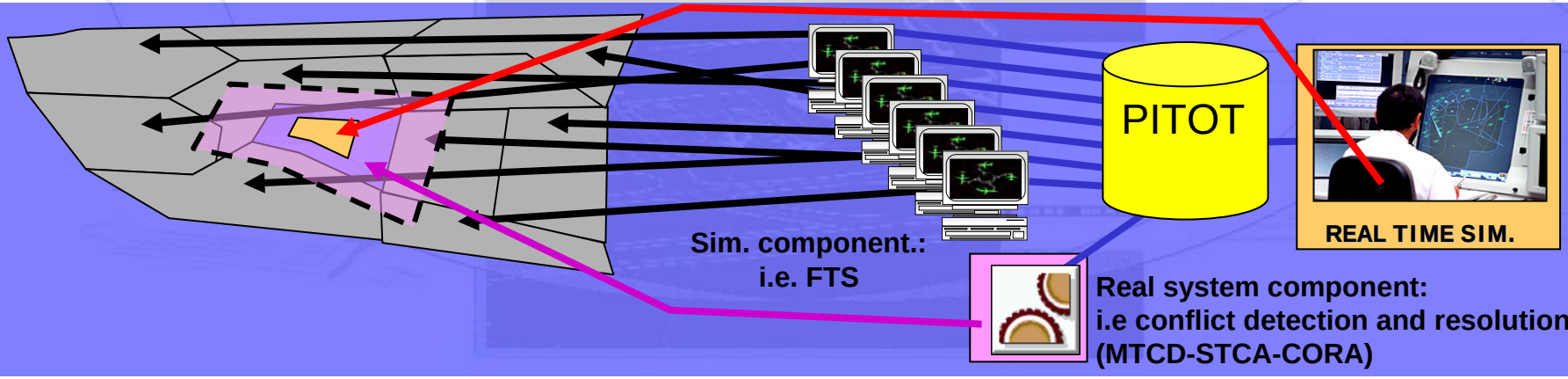
REAL TIME SIM. – FAST TIME SIM.

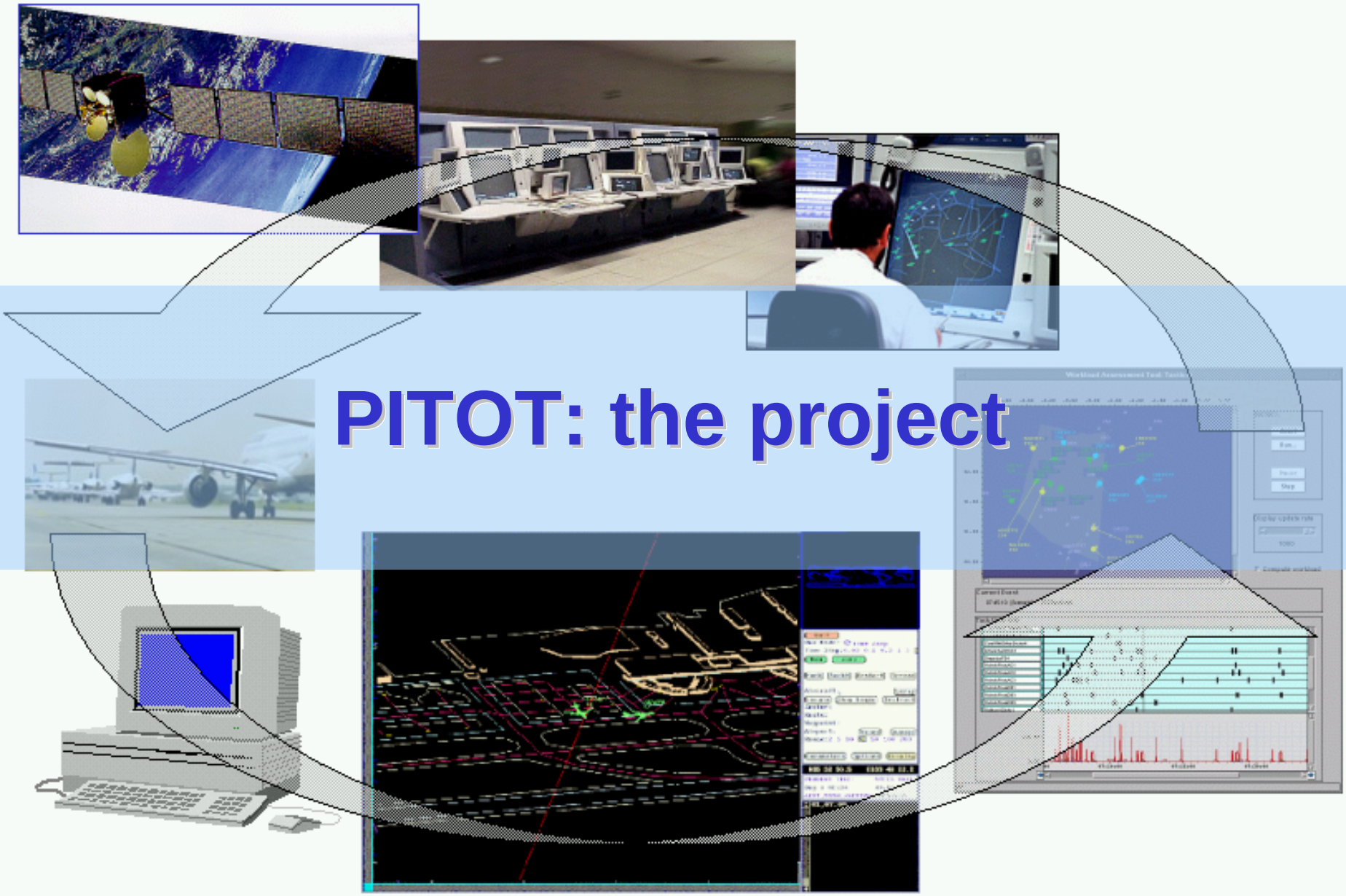


Control Sectors simulation:

- **Target sector**
- **Adjoining sectors**



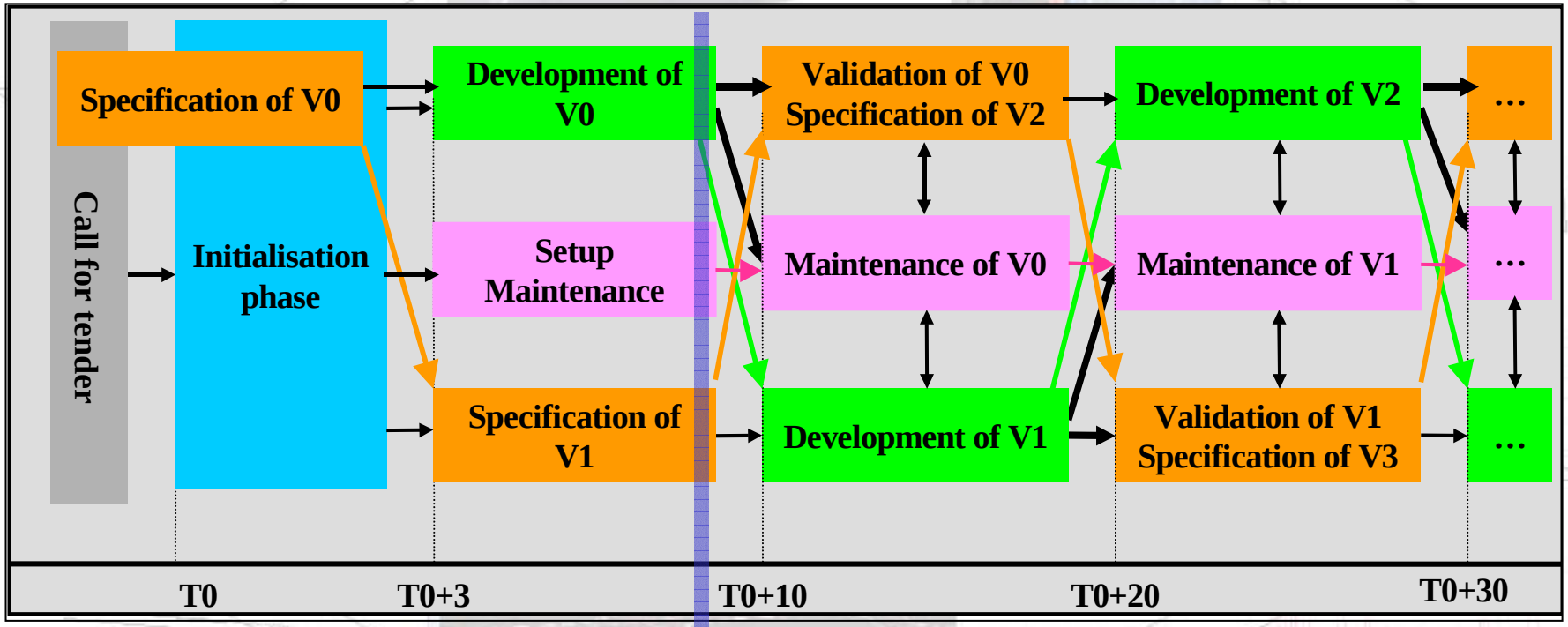



PITOT: the project

The PROJECT - Keep it small -

Effort and duration **Each version:**

- 5 man.years industry work + 2 man.years internal work
- lasts 10 - 12 months



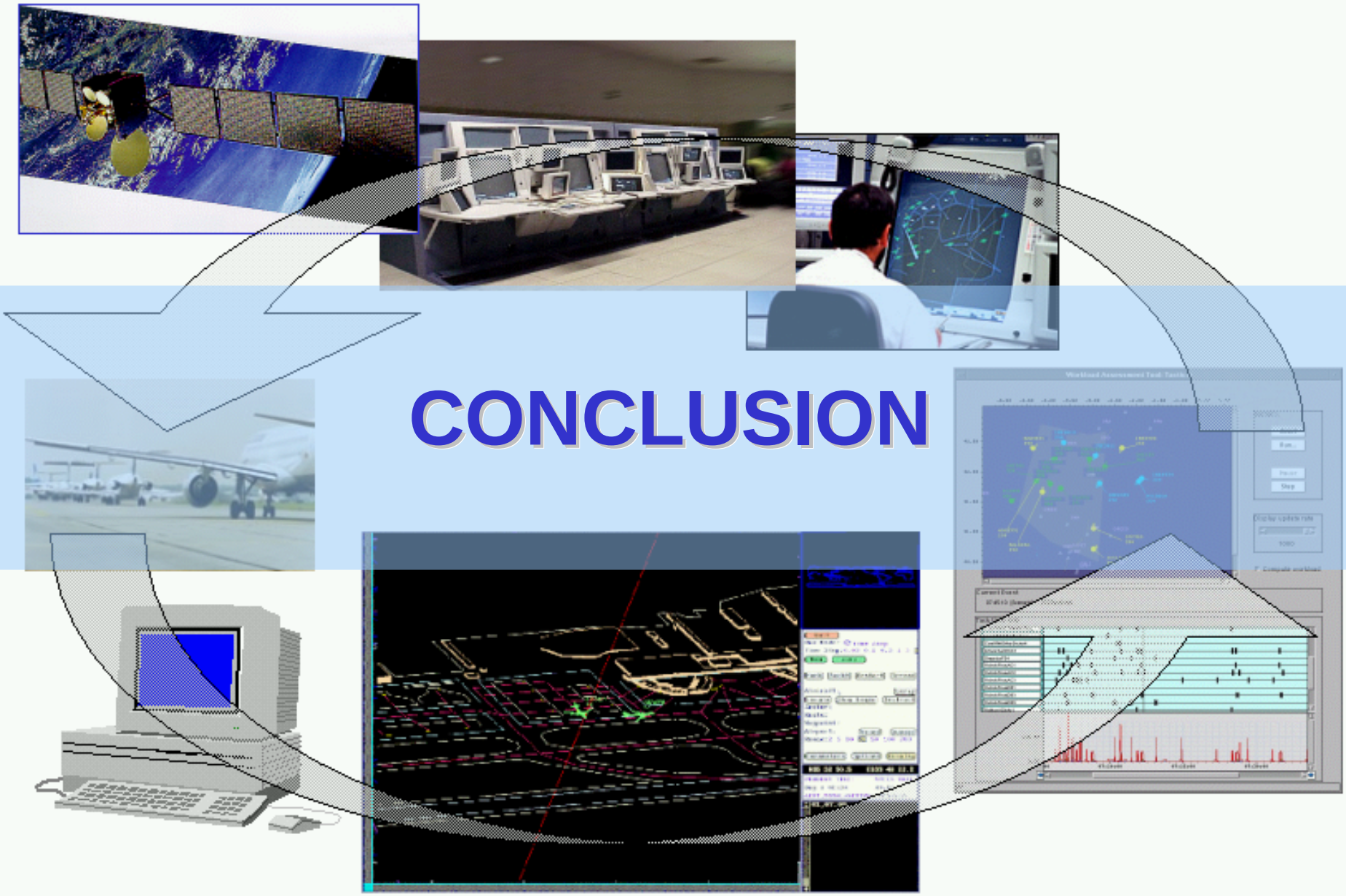
PITOT V0 is here:

- **Prototype delivered**
- **Testing prototype**
- **System architecture already designed**

Where are we now ?

***INDRA**: Developer of SACTA, the Spanish ATC Automated System*

- From February 2002
  - Selection of the successful consortium (INDRA)
- From Mid-July 2002: start of the project
  - Development of the test version (V0)
- April 2003
  - Iteration 1 and 2 of V0: HMI, Metamodel, OODB and Integration Bus
- Summer-Autumn 2003
  - Iterations 3 and 4 of V0: PICASSO-RAMS-PUMA-EXCEL integration and process, route processing and TAAM partial integration.
  - Additional components: MWM (Multi Workload Model), ABNA (Airspace BottleNeck Analyser) and TRAFGEN (Traffic Generator)
- September 2003:
  - PITOT V1 Call-for-tender published



CONCLUSION

CONCLUSION

PITOT supports the current business of model based simulation studies and provides means to make it evolve

AENA FTS Development Strategy:

- Will support development of new simulation modules
  - To be integrated in Open Simulation Platform
- Will support current FTS providers to evolve its products into Open Simulation modules
  - While keeping current simulators in production (as suitable).

Because we believe (in the past and now) in such an approach.