Distributed Interactive simulation and Advanced Distant learning

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Introduction.

- Motivation of using the GRID by TOS-EMM. COMS infrastructure to support different distributted tools as:
  - distributted simulations
  - Distributted learning
  - Collaborative visualization
  - Collaborative engineering

Distributted Interactive simulation

- Standard Technology (IEEE 1516).
- Tested in ESA projects since 1994:
  - **Simulation of chaser/target vehicles (95)**
  - **Focused on distributed interactive simulation (96)**
  - **First ever application of DIS Std. in space (97)**
  - **First ever application of HLA Std. in space (98)**
  - **Distributed Interactive Simulation for Rendezvous Mission (DIS-RVM, with EADS (former Aerospatiale) and D3)**
  - **Distributed User centres for Earth Observing Small Satellites (Headway)**
  - **Remote Operation of Rendezvous Sensor Test Facility (EPOS, DLR)**
  - **ESA – NASA demonstration in 2001**
  - **ESA – NASA – NASDA 2003.**

SAMPLE TESTING SCENARIOS

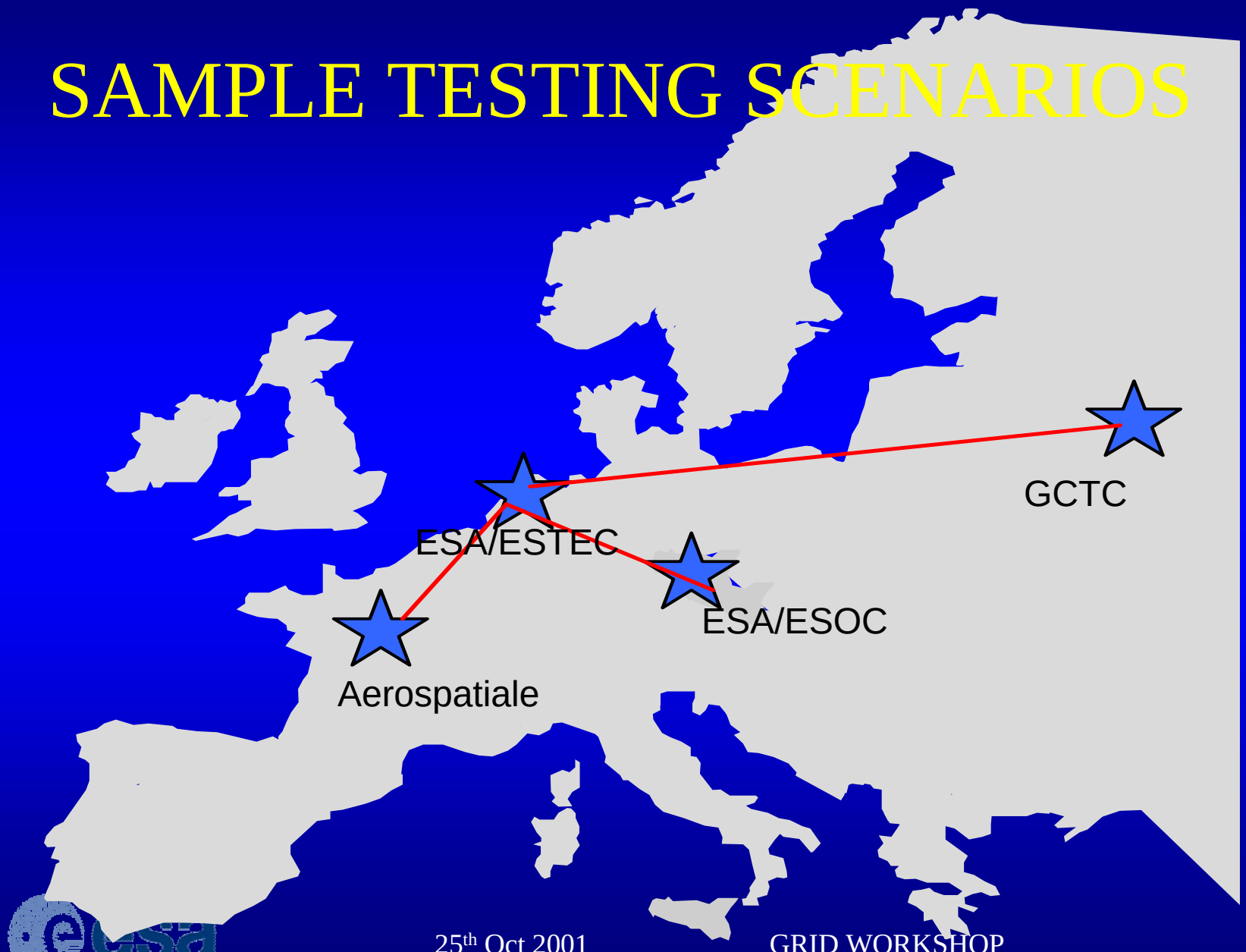
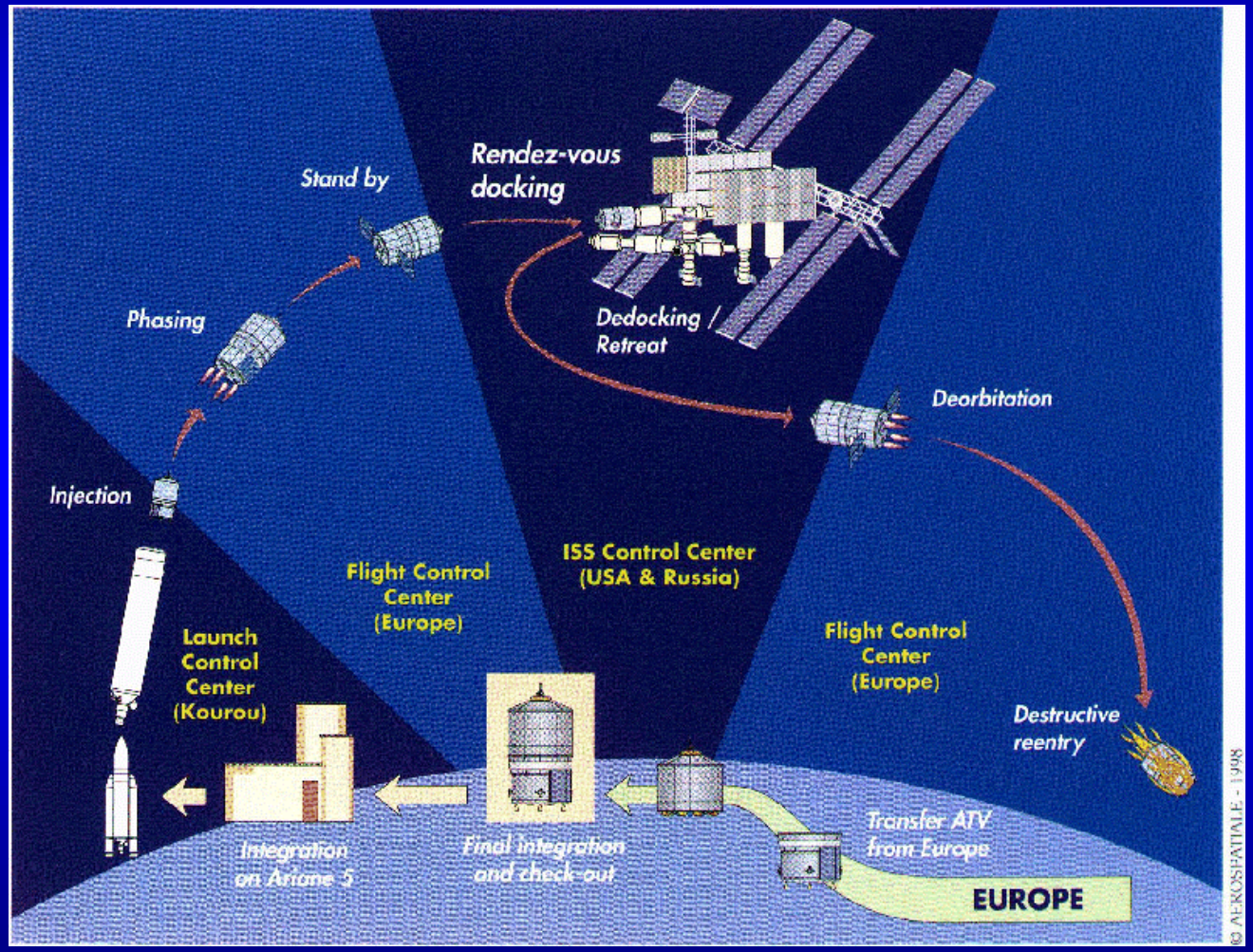


Illustration to reference scenario: mission of ISS supply vehicle



Simulation scenario: Final translation to docking

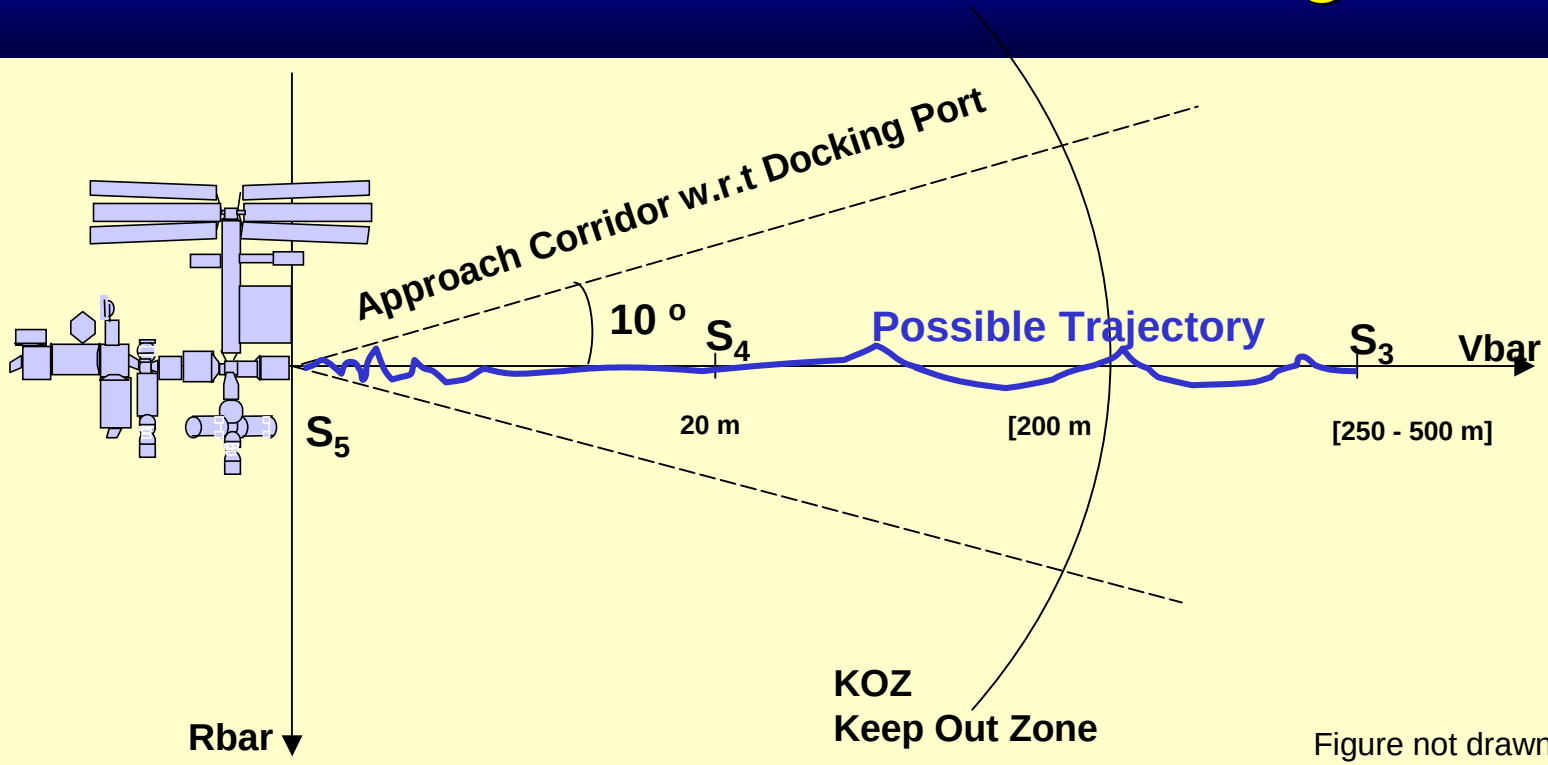


Figure not drawn to scale

Waiting Points

- S_3 : Waiting for authorization to enter KOZ
- S_4 : Acquisition of relative attitude wrt ISS docking coordinate system
- S_5 : Docking port

scenario de Houston, con la distribucion de los federates entre Houston y ESTEC.
Se probo un escenario real con operaciones / operadores (tu y el otro muchacho) realisticos.

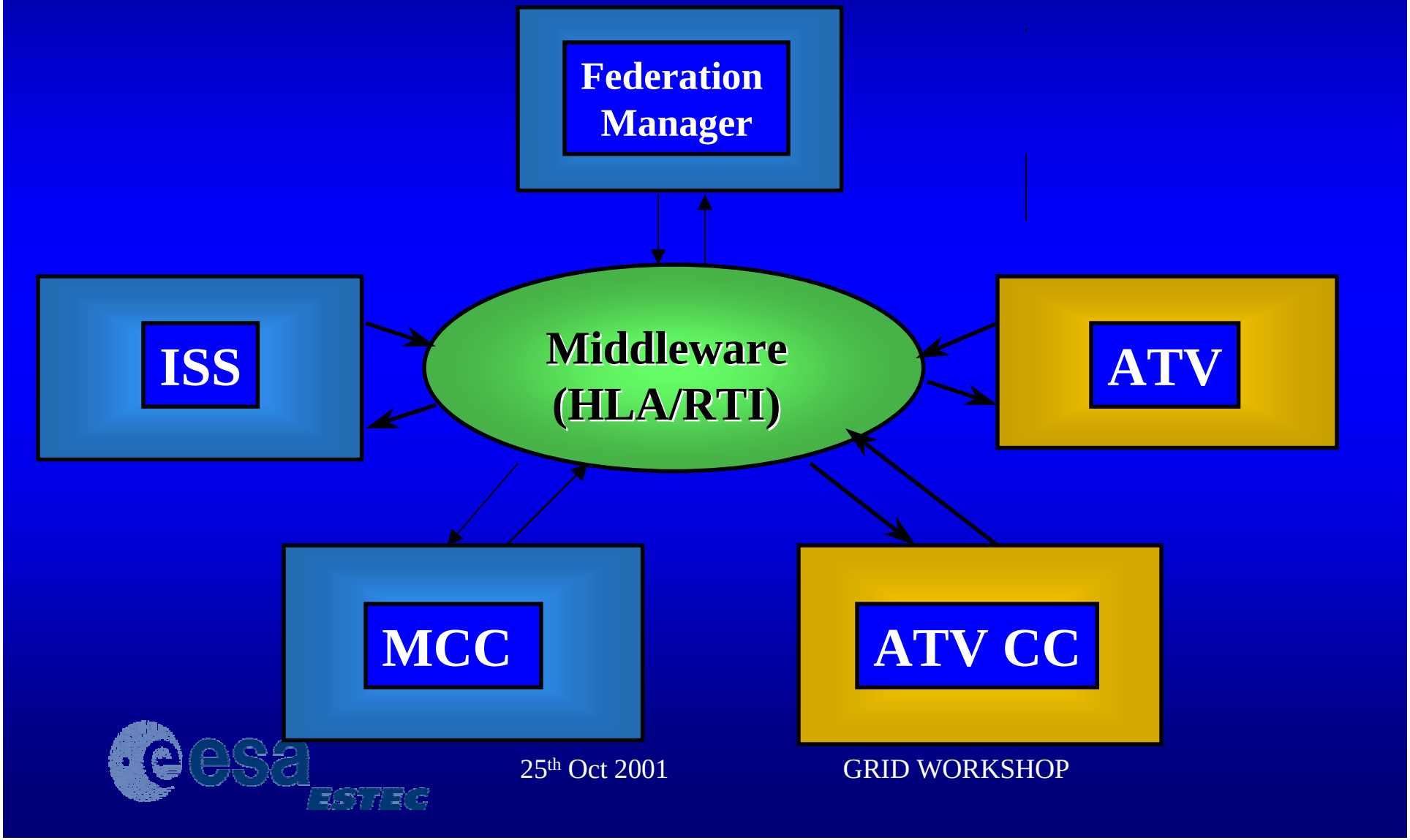
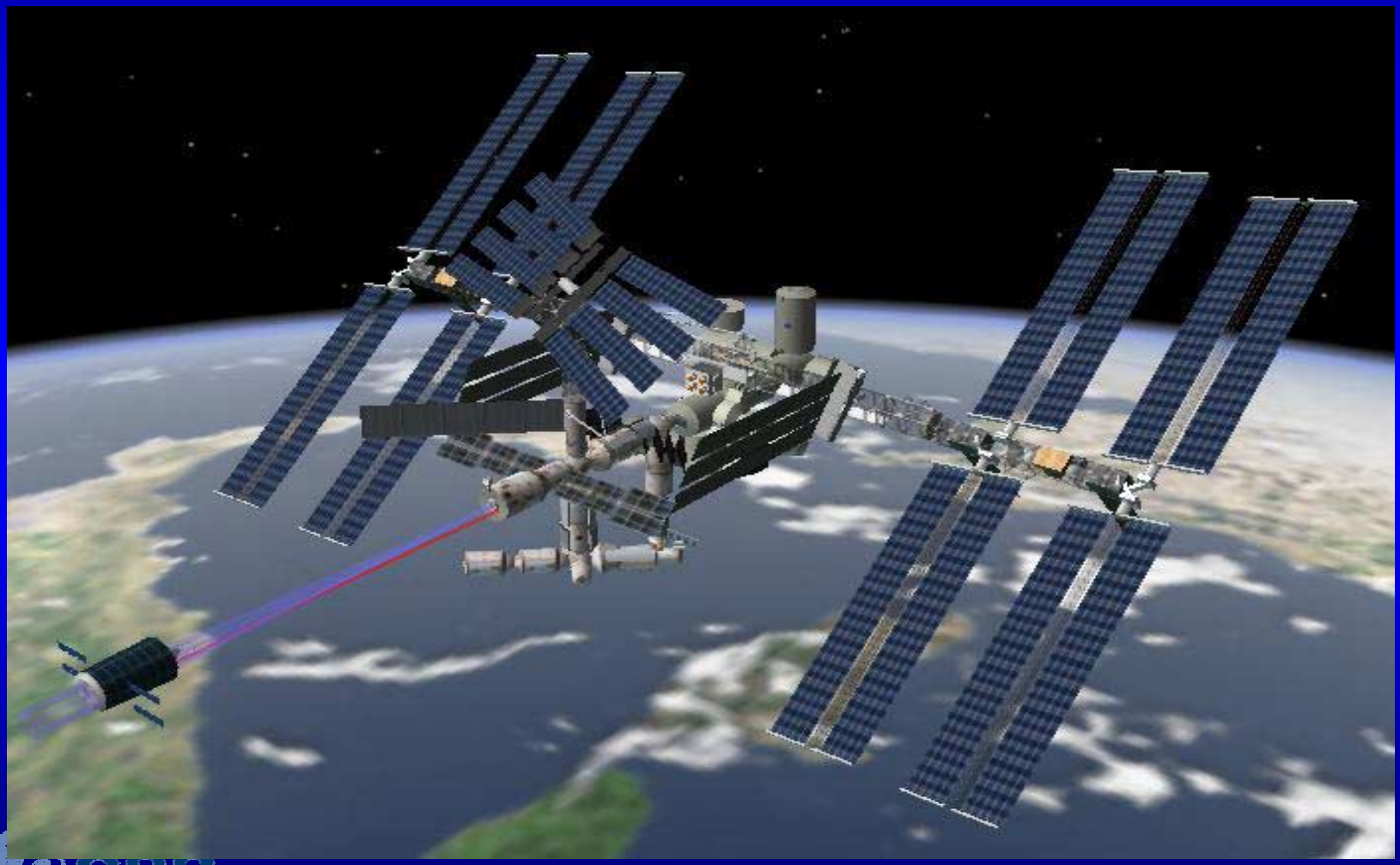


Illustration to reference scenario: final approach to docking



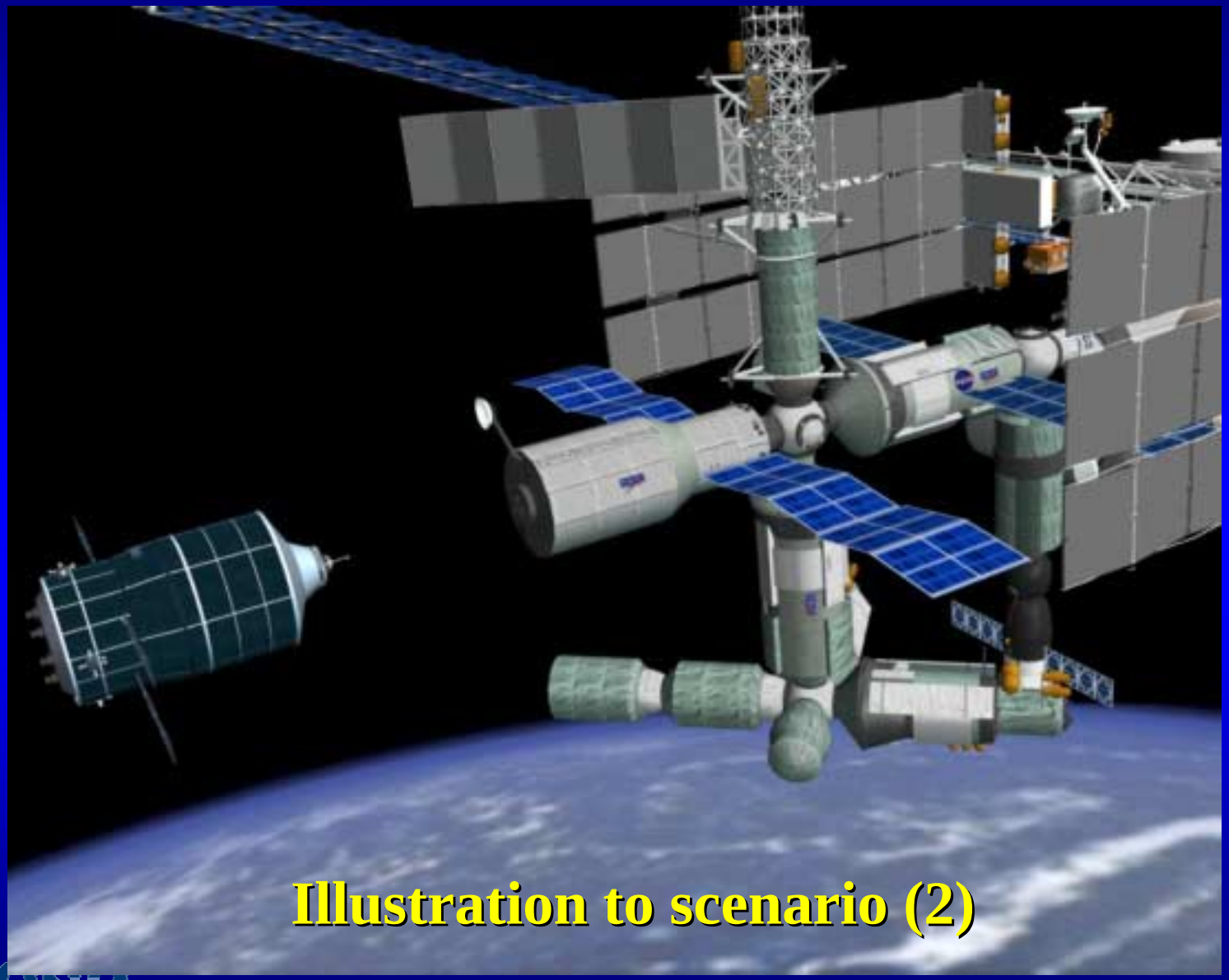


Illustration to scenario (2)

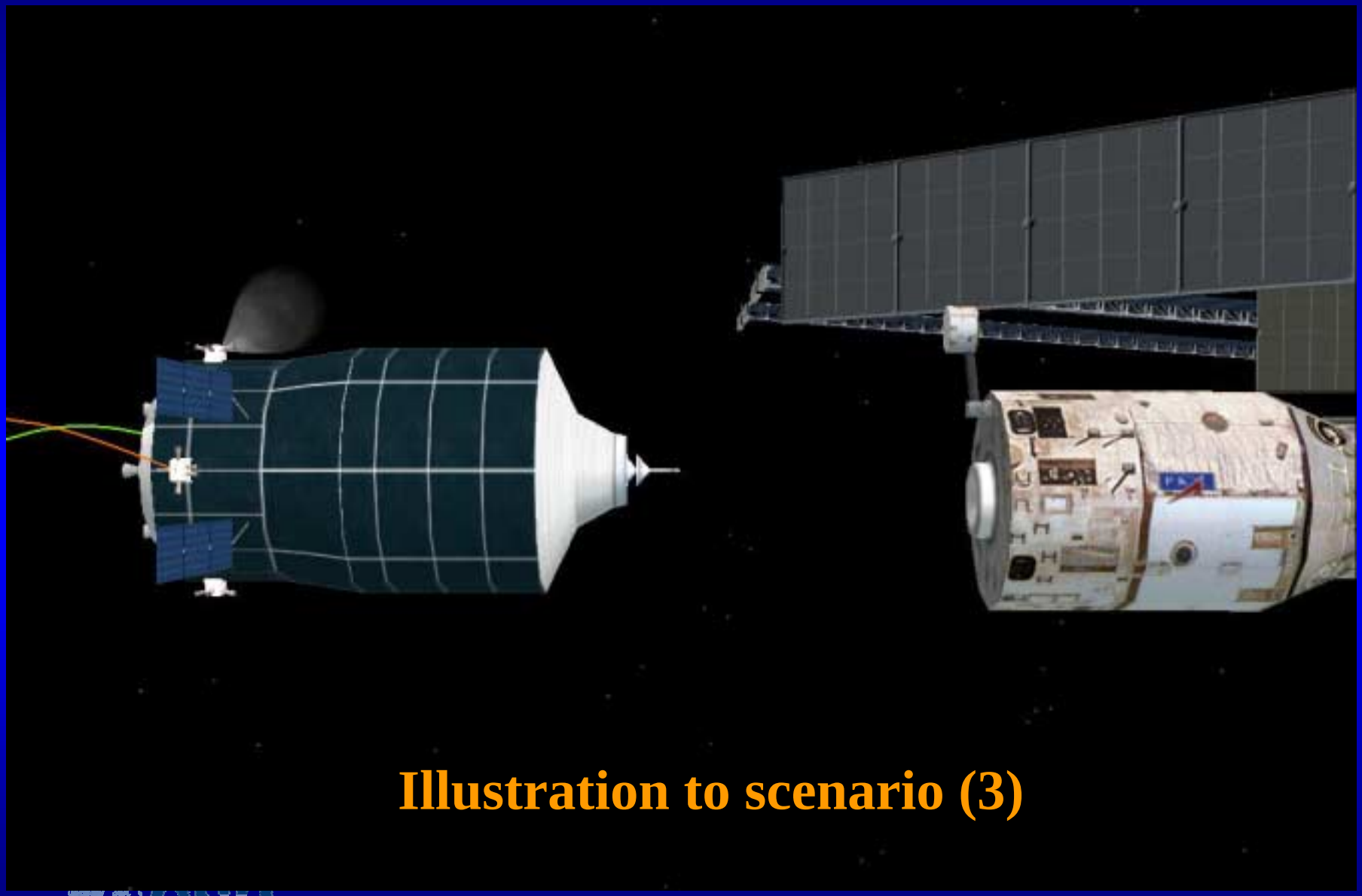


Illustration to scenario (3)

Some lessons learned

General:

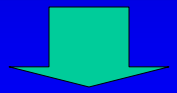
Distributed simulation technology based on HLA appears to be an appropriate solution for Collaborative Engineering tasks (including connecting of hardware-in-the-loop simulations), and interactions between different groups of operators (Training tasks)

Cost issue:

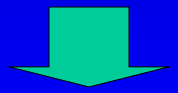
From the cost point of view, implementation of a distributed simulation system can save considerable budget by reducing amount of hard- and software to be exchanged between partners that need interoperability. Effort to transform background simulation applications into HLA-compliant federates was reasonable.

ADL. Basic Concepts...

- Distance **Learning Vs** Distributed **Learning**



Synchronous technology

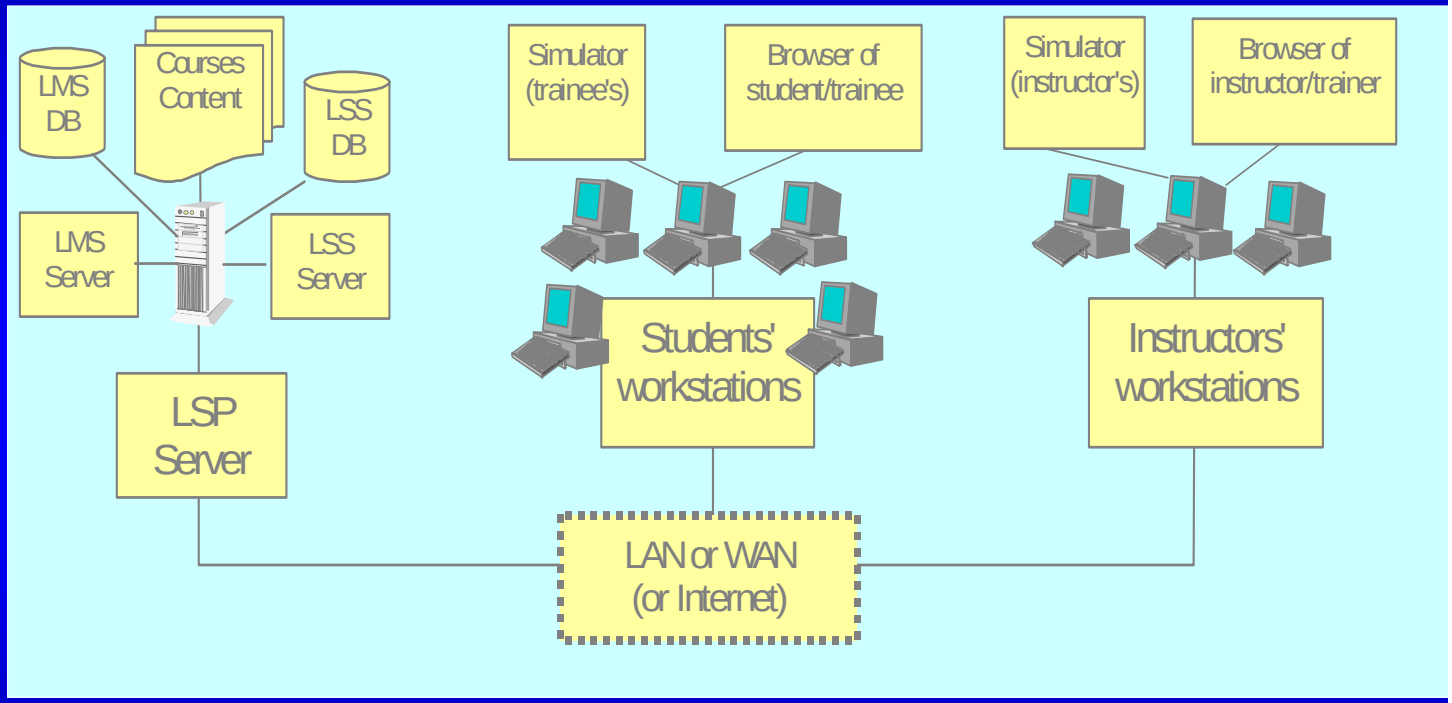


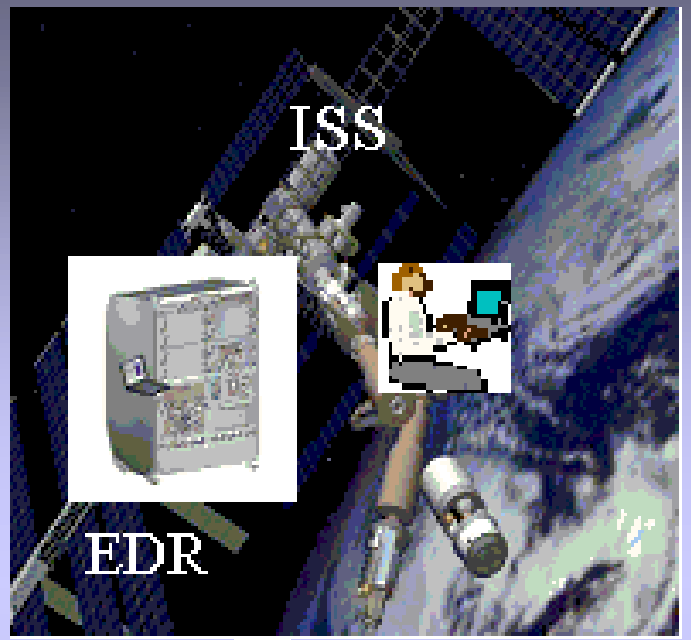
Asynchronous technology

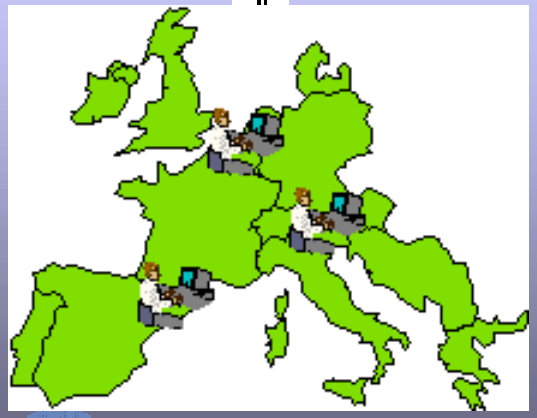
- BASED IN IEEE Standards and COTS technology:
  - SCORM (Sharable Content Object Reference Model)
  - LMS (Learning Management System)
  - SCO (Sharable Content Object)

Learning System Prototype

- **LSP Server**:
  - LMS Server and Data Base
  - LSS Server and Data Base
  - Course contents
- **Student & Instructor WS:**
  - Web Browser+Java Applet
  - Simulator application component



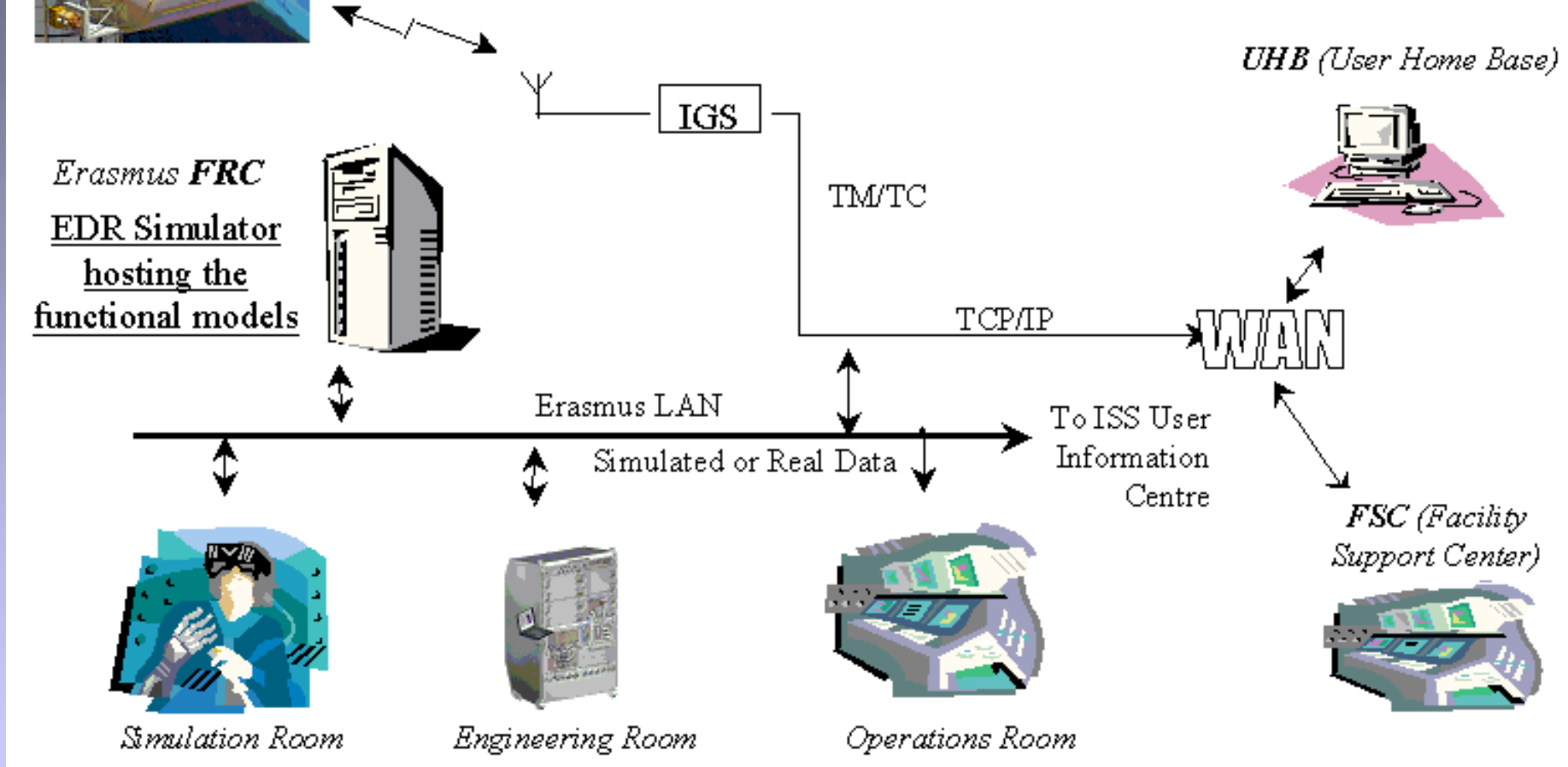




- European Drawer Rack (EDR) is a payload to be operated onboard the International Space Station (ISS)
- EDR usage needs training of astronauts and ground personnel - engineers, researchers and managers

PILOT Demostration SCENARIO

EDR Hardware System Structure



Need for distance learning and distributed interactive simulation in space programmes

- Groups of **experts** working within the same project or even on the same system or payload are **geographically distributed**
- Only minor part of **skills** requires use of **complex simulators** (regular **student** workstation/laptop could cover many tasks)
- **Certification** of staff is required to deal with space operations
- Learning «through doing» is an important element. However, emerging **ADL**-compliant systems are **not** designed for online **distributed simulations**

Results

- Evaluation of use in EDR
- Support to the Education Office
- Support to SSETI office (Students Satellite)