The ESA Concurrent Design Facility (CDF)

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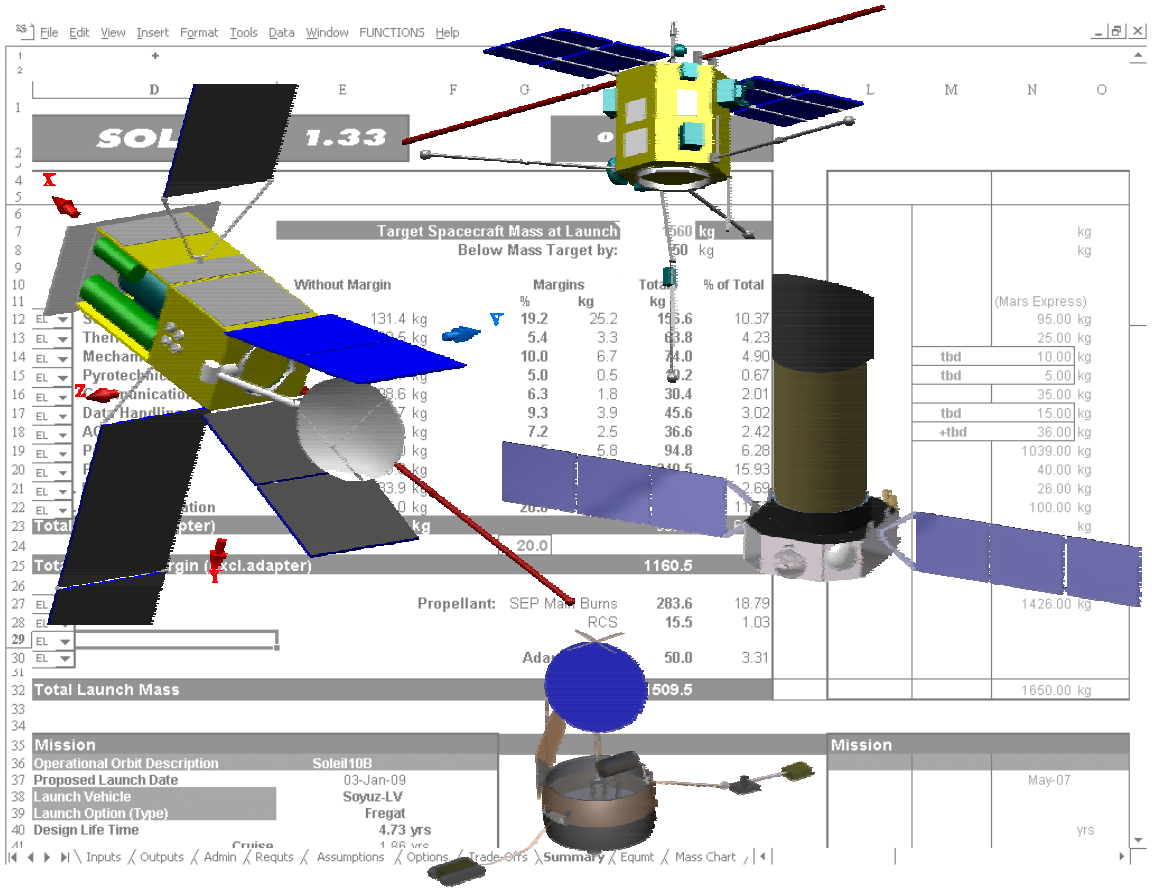
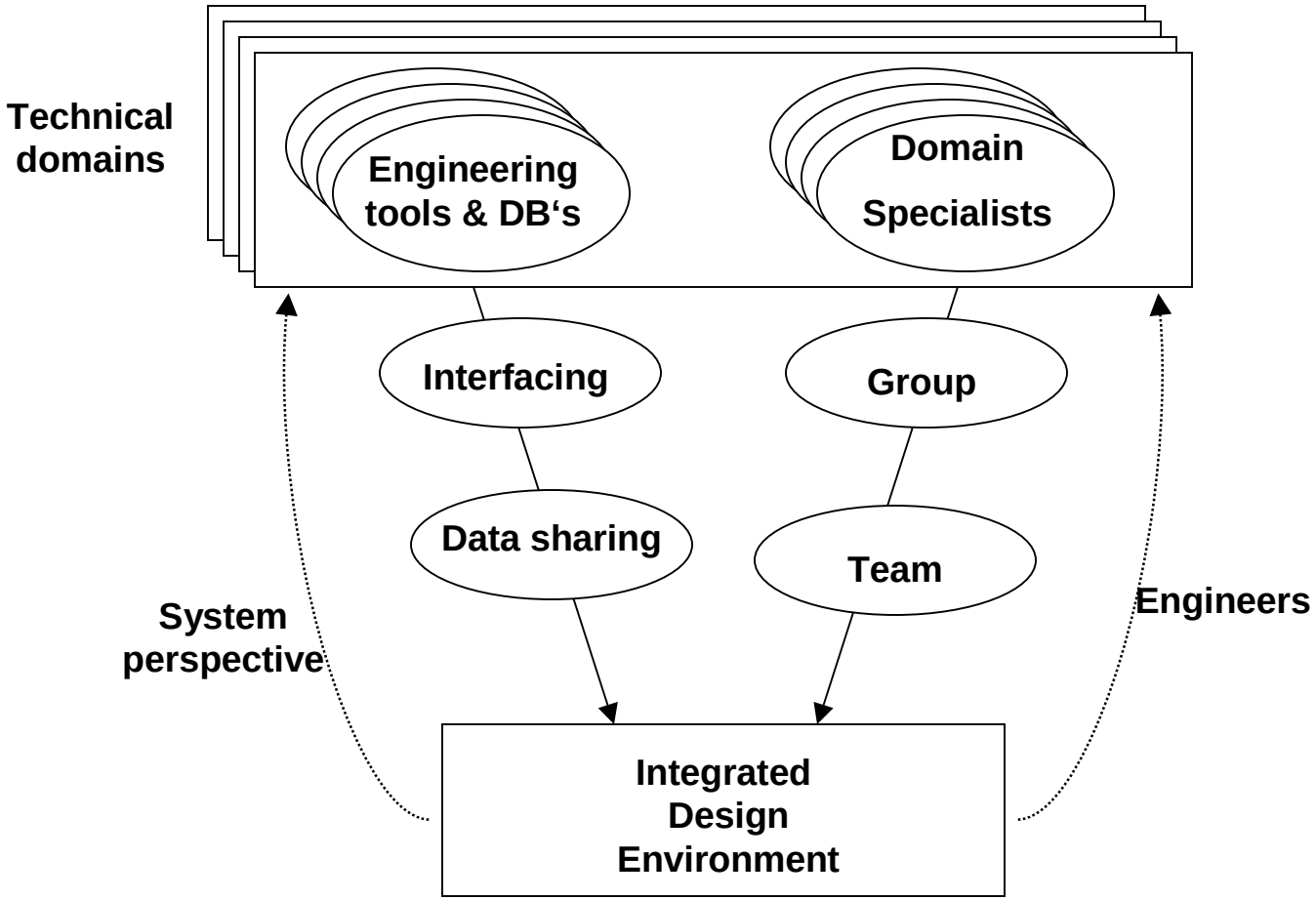


CDF: what is it?

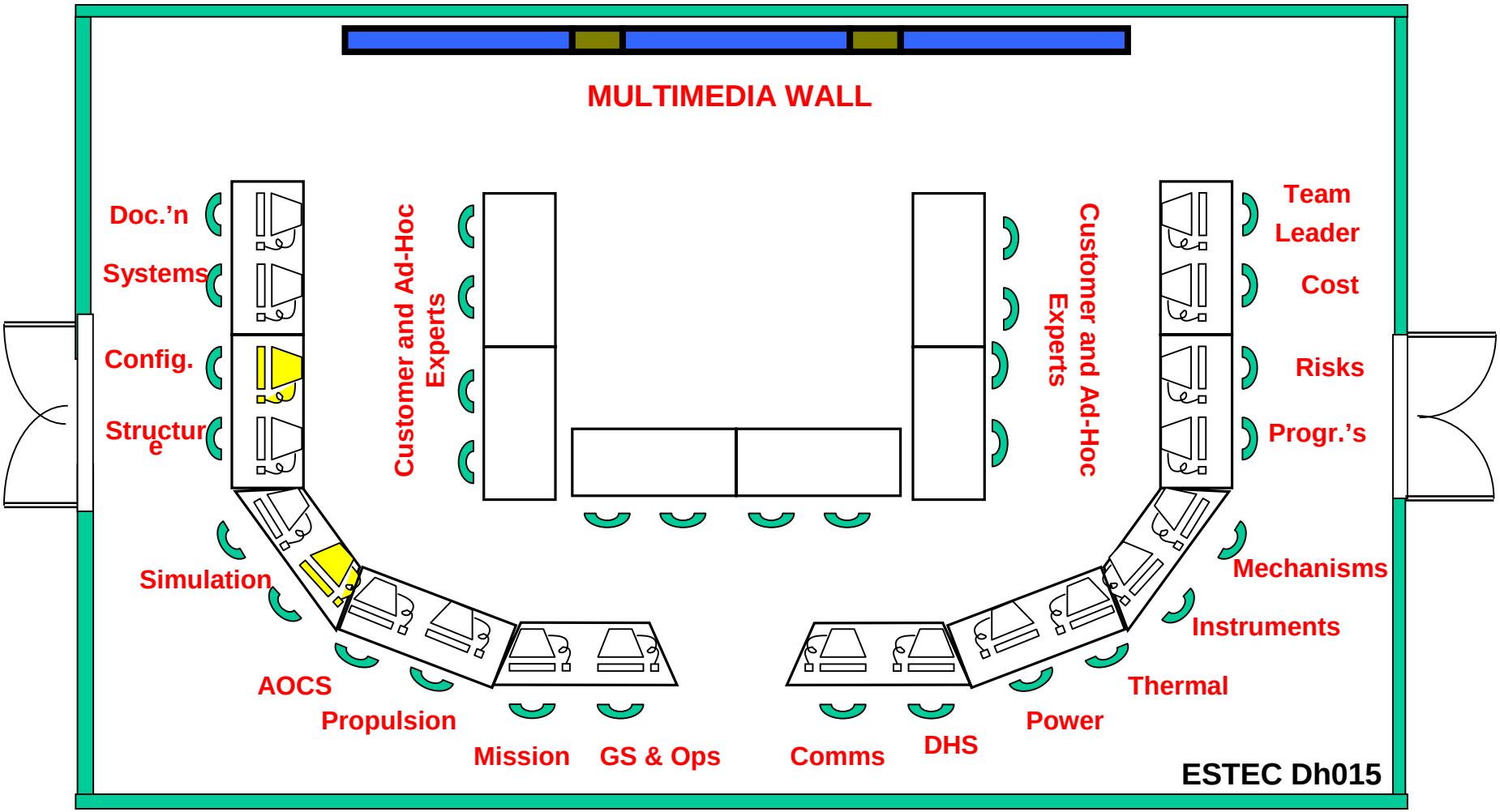
- **An integrated design environment for interdisciplinary applications**
- **initially (Nov.1998) conceived for the assessment and conceptual design of future space missions (i.e. internal pre-phase A / level 0 studies)**
- **featuring:**
  - **team orientated (concurrent) collaborative engineering**
  - **integration of tools, project data, mission and system models**
  - **model driven, on-line, real-time design**
  - **co-operation, interaction, iterations**

The approach

- **Re-organisation of existing tools and human resources in a more effective (i.e. “concurrent”) way**



The ESTEC CDF layout

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Activities performed:

- 20 (potential) future missions studied and designed at pre-Phase A (conceptual) level (internal studies).

  3 of which selected and industrial Phase A initiated !!!!
- 5 reviews of Industrial Phase A studies (internal + Industry)
- 1 joint study with NASA/JPL/PDC-Team X (Distributed Concurrent Engineering)
- ISS o/b facilities/experiments accommodation studies - Teaming with/supporting Industry in Phase A

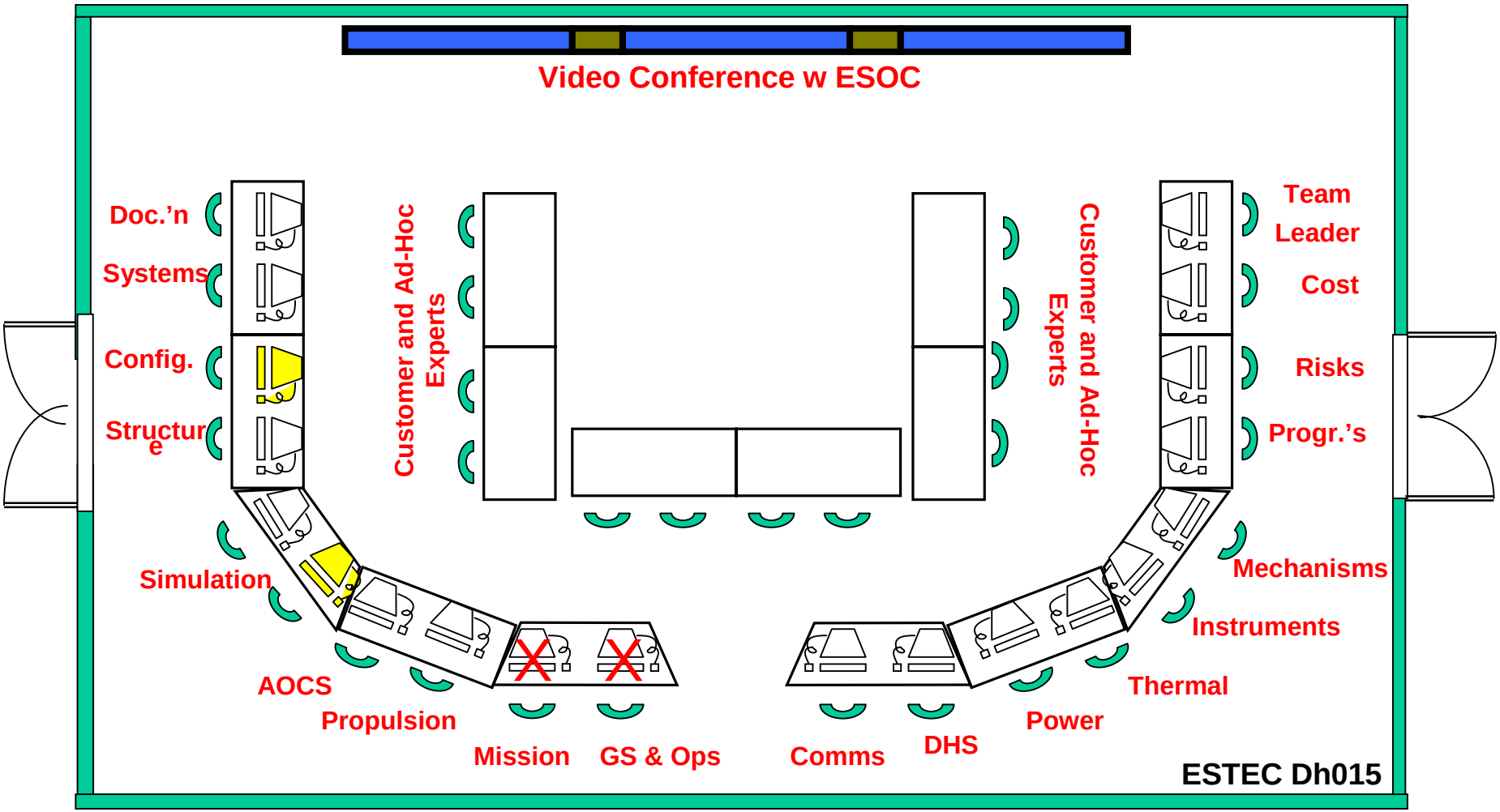
Performances (typical pre-Phase A study):

- Study duration (Design phase): 3-6 weeks (cp. 6-9 months!)
- Design sessions:
  - 6 to 10/study, 4 hour/session, bi-weekly frequency

CDF: status

- **The CDF has become a functioning, operational and accepted component of the ESA in-house mission design assessment process.**
- **The CDF has become a reference design centre for ESA internal design applications and developments, space (and non-space) European industry, national space agencies and academia.**
- **The problem was not to recognise the paradigm shift, but to adapt it and make it accepted in our organisation… and culture - breakthrough !!!!**

The ESTEC CDF layout



Distributed Concurrent Design for the STEP project

STEP a multi-national project where the payload is provided by NASA (Stanford), the Service Module by ESA

3 joint sessions, where the 2 teams were required to

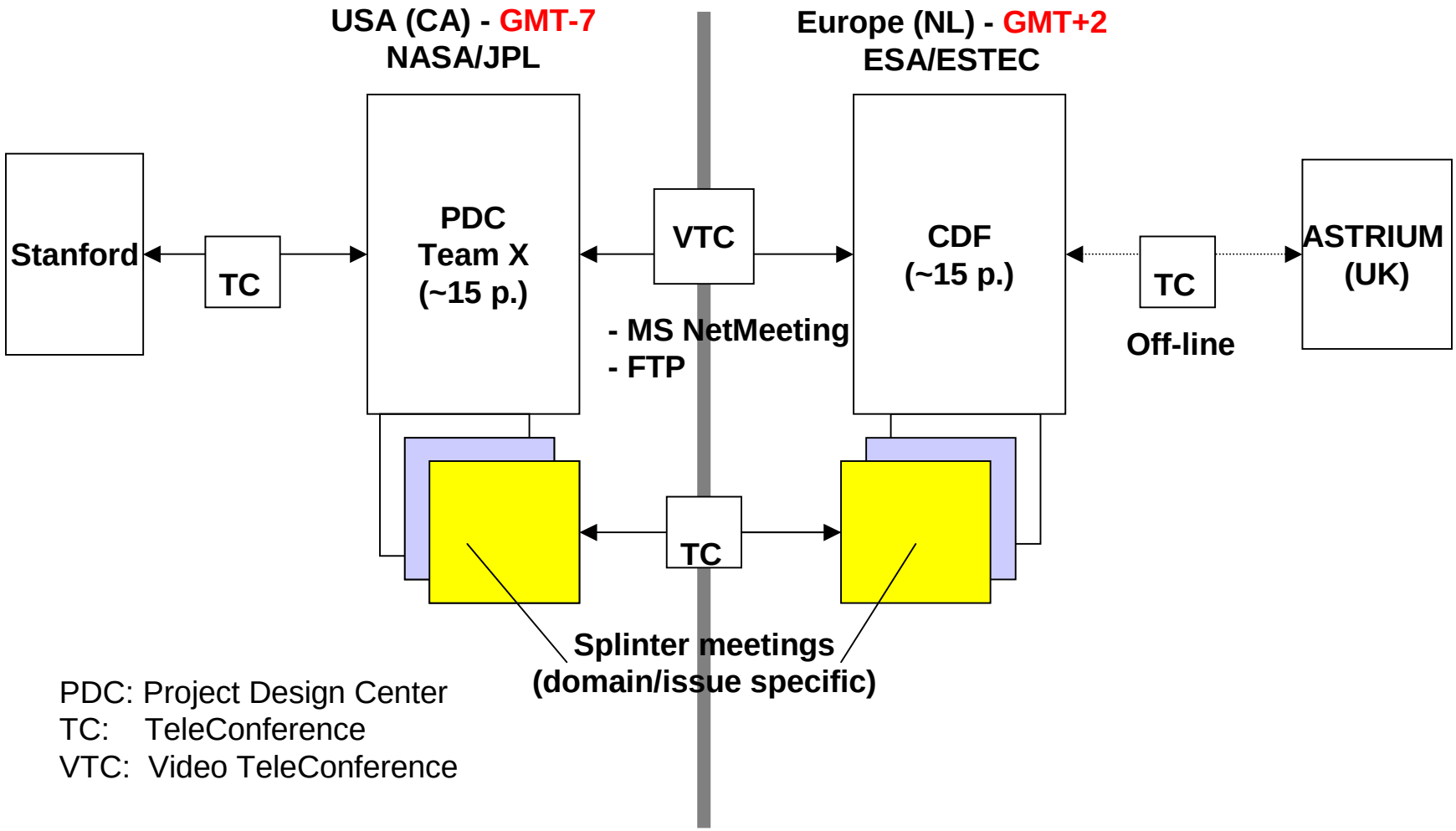
… analyse:

- **Design baseline**
- **Critical issues**
- **Interfaces**

… produce (mutually agreed):

- **Conceptual design iterations and finalisation**
- **Interface Control Document**
- **System requirements**

CDF/PDC Team-X
Joint Design Sessions
STEP Study (June 2001)



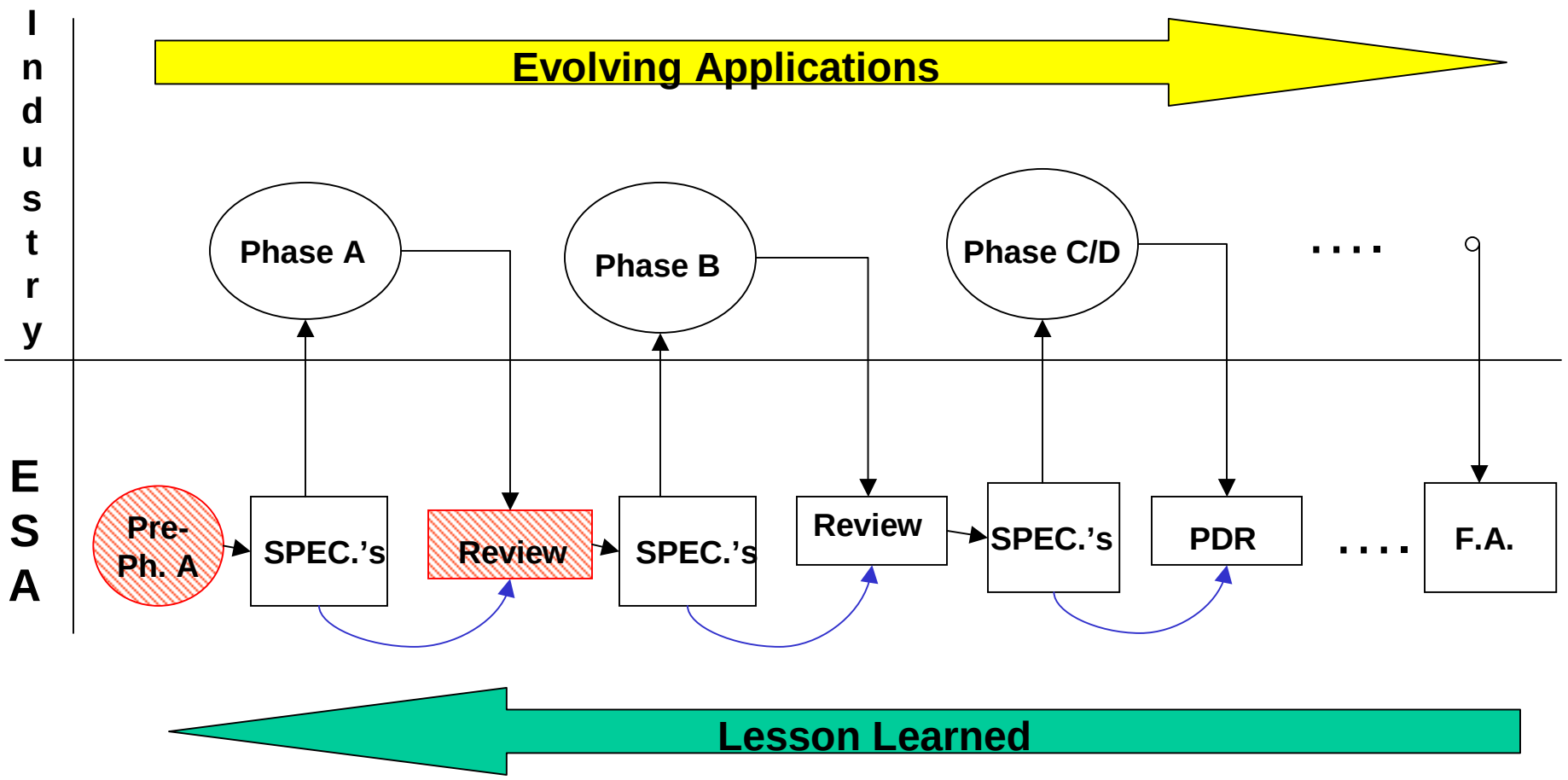
PDC: Project Design Center
TC: TeleConference
VTC: Video TeleConference

The future

Other possible applications of the Concurrent Engineering method and CDF facility in the ESA context could be:

- **System requirements definition,**
- **Instrument conceptual design,**
- **Training,**
- **New technologies verification at mission/system level**
- **Human space flight missions,**
- **Launchers**
- **….**
- **extend to later phases of the Project life cycle**

CDF in the ESA context



Idea for GRID application related to CE

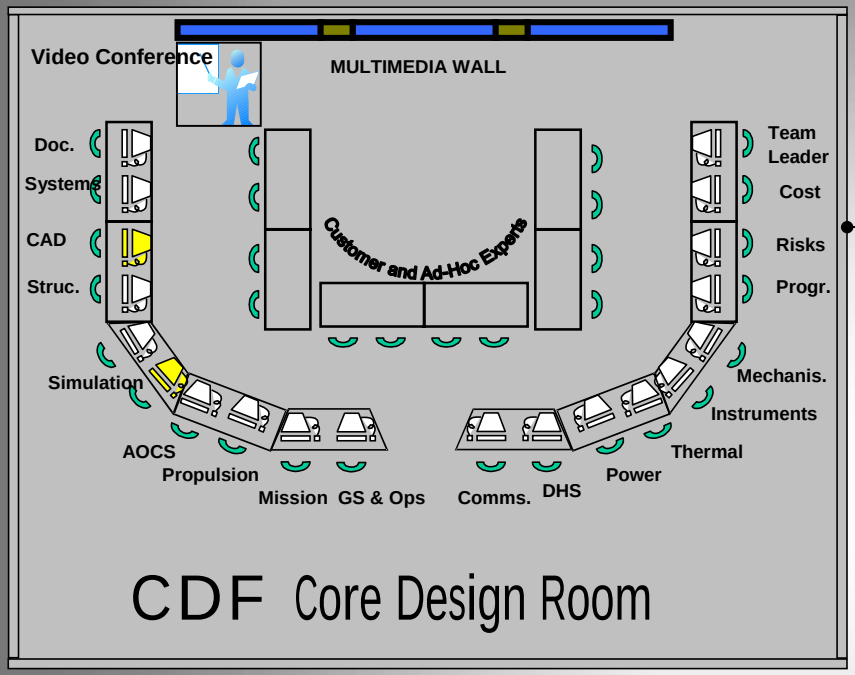
***Concurrent* and *collaborative* have to become also *Distributed*, *i.e.* not only "across technical disciplines" but also "across companies and organisations" and throughout the project life cycle**

- **Distributed Concurrent Development**
  - application of CE to later phases of space projects (phase B, C/D) within the ESA's role in the project development (e.g. project reviews)
  - adapting the same principles to the more complex scenario
  - need for a specific IT infrastructure providing both enhanced connectivity and security ensuring project data protection
  - GRID might have a main role in this infrastructure

Other ideas for GRID applications related to CE

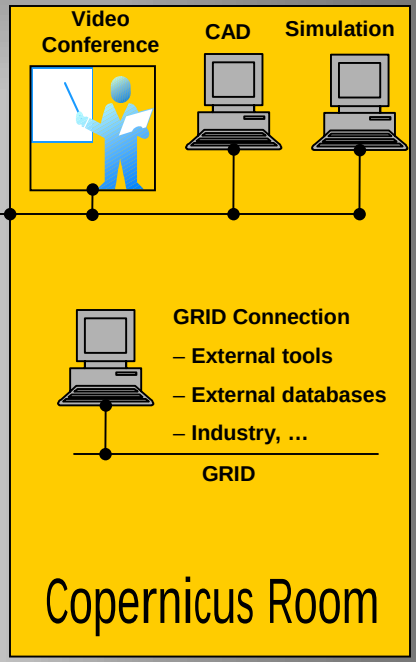
- **Virtual Team**
  - virtual collocation
- **Virtual Design Facility**
- **Distributed Design Support**
  - remote databases…i.e. distributed European missions/equipment DB
  - distributed engineering tools (models, simulations, optimisation , ….)
  - Integration/interface of tools and databases used in Industry and in the Agency
- **CDF Smart Advisor**
  - able to “follow” the design process, “interpret” the design issues, browse the internet (in background), find, sort and provide support information

Demo of Distributed Collaborative Engineering



Network (GRID)

Example of GRID utilisation for CDF design session involving several disciplines in a distributed scenario



GRID can represent the means to implement an effective and secure distributed collaborative engineering infrastructure / environment involving different Agencies, Industry, and Academia

- Dedicated and secure networks will allow the participation of external entities (including their tools and data bases) in the design process
- Distributed processing / storage will allow the utilisation of computing intensive tools and distributed data bases (e. g. space environmental models, ESA Virtual Archive,…)
- High speed networks will allow the real time utilisation and sharing of remotely located engineering tools