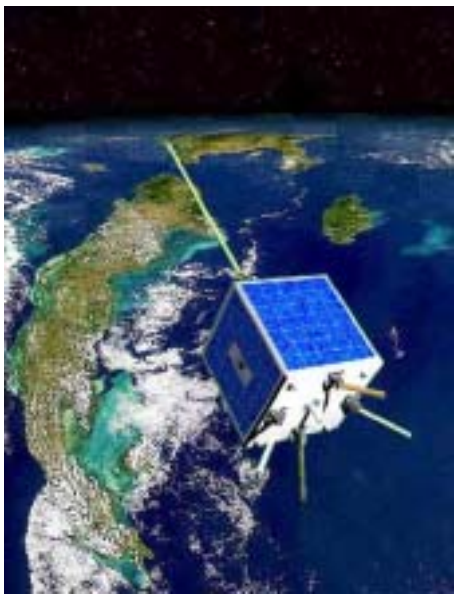
Applying Concurrent Engineering to the Joint Australian Engineering Satellite (JAESat)

Introduction

- AMSAT-NA micro-satellite
- Tried and tested
- ASRI & QUT began in 1997
- Collaboration with UNSW, UQ, CRCSS
- GPS for space, COTS
- Space solar cell dev. capability



Background

- 2 year project currently in 6th year
- 15 – 30 people
  - Variable education and background
  - Mostly undergraduates
  - 5 – 10 co-located in same city
- ASRI projects (SSRP, JAESat)
- QUT activities (SSRP, JAESat)

Background (Cont.)

- Problems:
  - Lack of clear requirements
  - Constant redesign and scope-creep
  - Limited (no) configuration management
  - Limited systems engineering approach
  - No information/knowledge management
  - Information (and technical) leakage

Background (Cont.)

- A new start:
  - Handover of PM to QUT
  - New workable SE approach
  - New students, dedicated academic champion
  - Co-location of team in Brisbane
  - Evolution of the Virtual Project Office

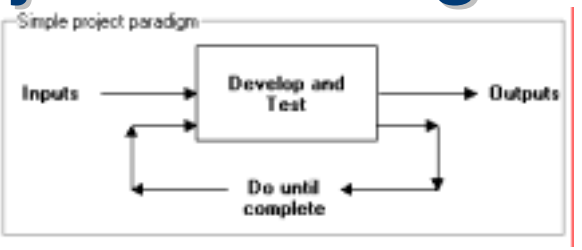
European Cooperation for Space Standardization

- Project management, systems engineering, product assurance
- Easily available
- Standard international units
- ECSS and satellite projects:
  - INTEGRAL, GOCE, NEGESAR, FBM
- Tailoring

ECSS and JAESat

- Immediate use made of:
  - Space environment models
  - Material and component lists
- Generic space project system implemented based on ECSS
- Information management – templates
- Project management – business processes

Project Management

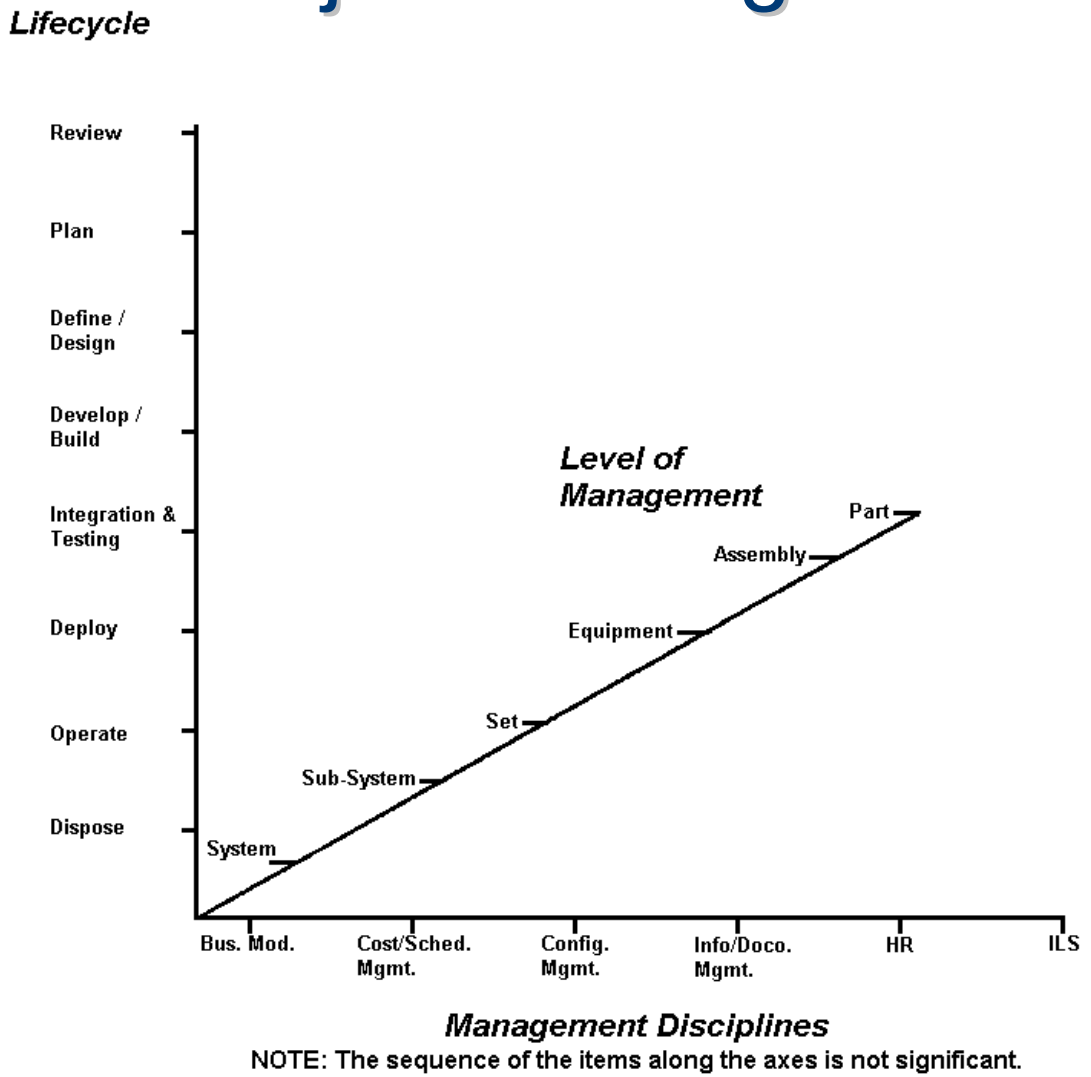


- Original paradigm
- Waterfall paradigm
- Prototyping/Phasing

ECSS Phase[1]	JAESat Phase
0 – Mission Analysis/Needs Identification	0 – Review
A – Feasibility	A – Plan
B – Preliminary Definition	B – Define/Design
C – Detailed Definition	C – Develop/Build
D – Production and Ground Qualification Testing	D – Integration and Testing
E – Utilization	E – Deploy, Operate
F – Disposal	F – Dispose

[1] European Cooperation for Space Standardization (1996) 'ECSS-M-30, Space Project Management – Project Phasing and Planning', ESTEC, Revision A, 19 April 1996.

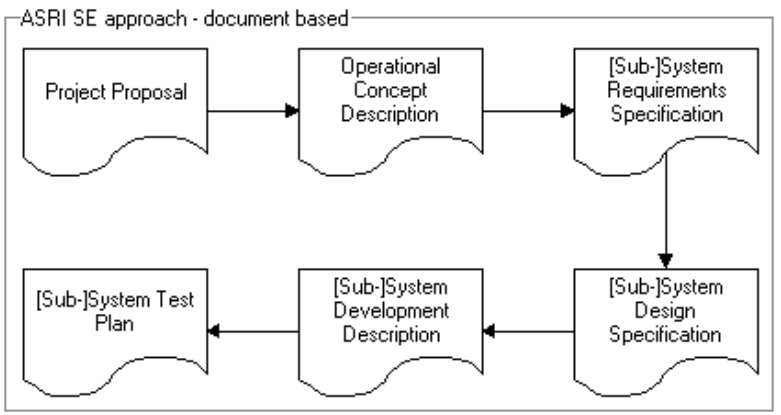
Project Management model

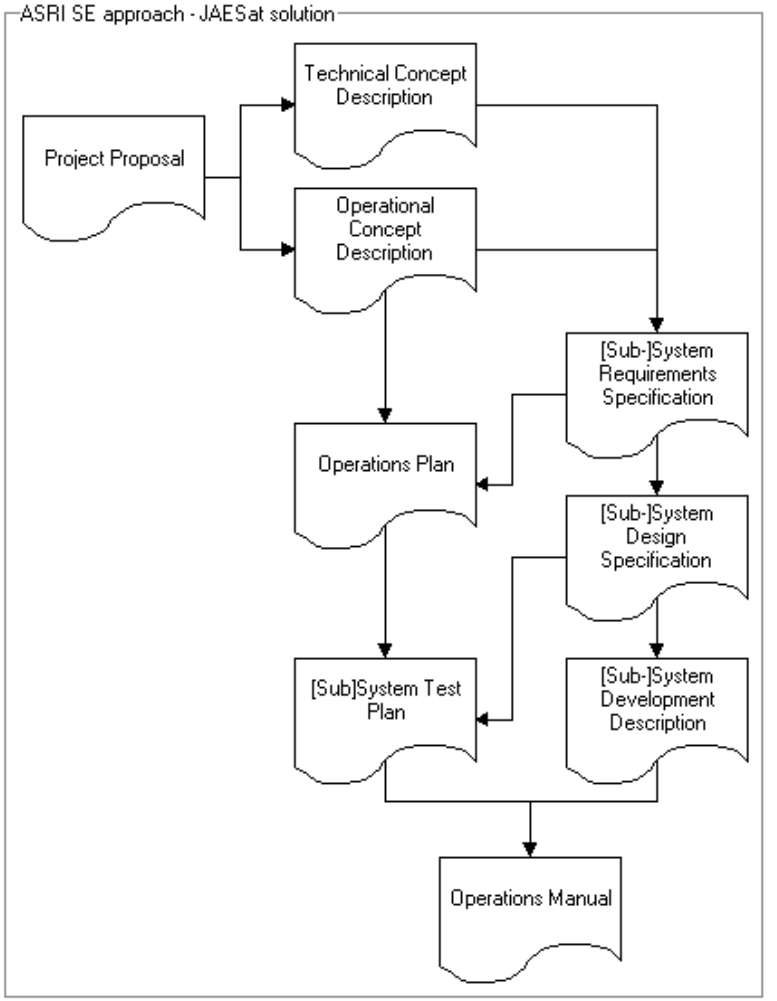


NOTE: The sequence of the items along the axes is not significant.

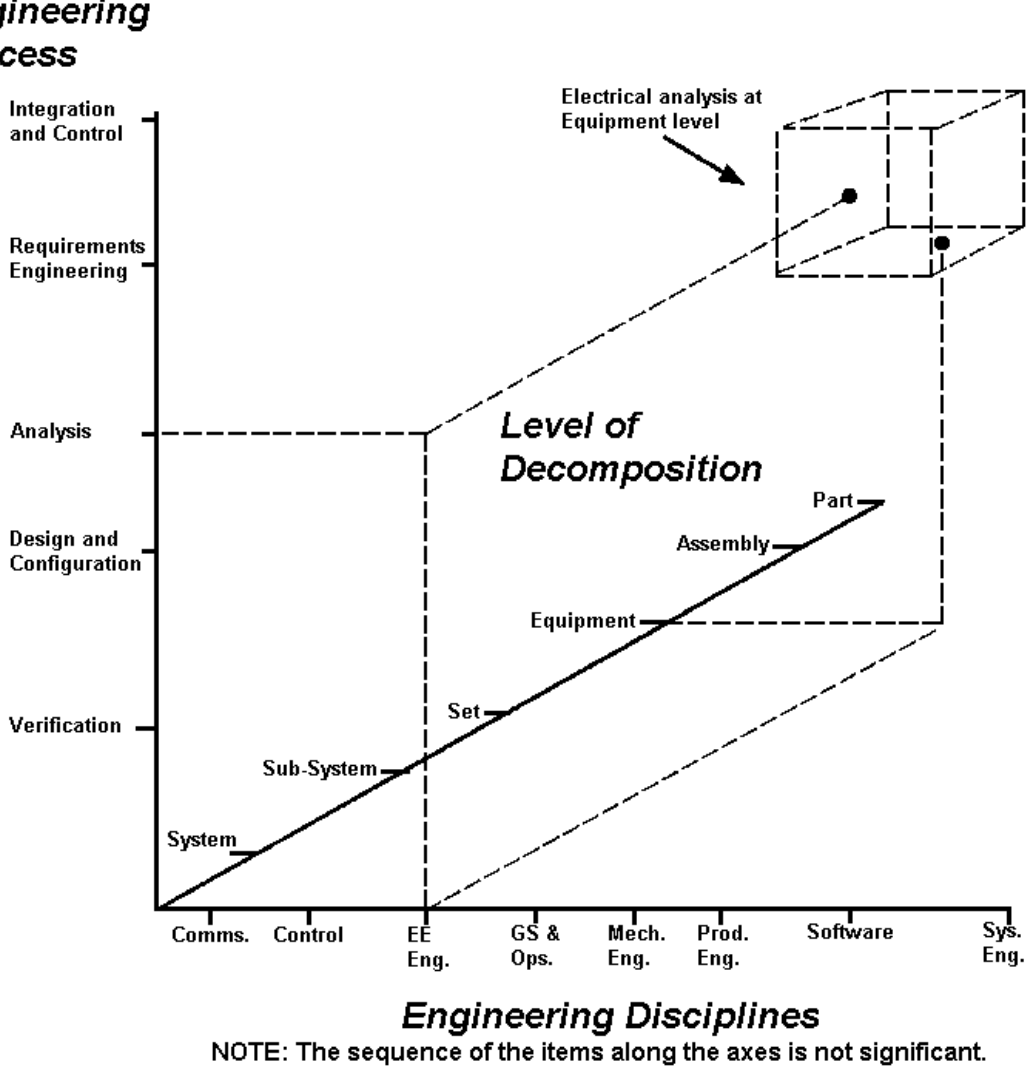
Systems Engineering

- Originally decentralised
- Document driven
- ECSS-inspired solution





Systems Engineering model



Concurrent Engineering

- Product designed concurrently with business processes
- Simultaneous coordinated engineering
- Improvements:
  - Decrease development time
  - Decrease engineering changes
  - Increase productivity
  - Increase overall quality

Concurrent Engineering (Cont.)

- Implementation
  - Working lean
  - Multi-disciplinary teams
  - Right-first-time methods
  - Parallel processing activities
  - Continuous constraint consideration
- Examples:
  - Concurrent Design Facility
  - NASA Systems Engineering for NEAR
  - Concept Design Center

Concurrent Engineering (Cont.)

- Reasons for consideration:
  - Already working lean
  - Have multi-disciplinary teams
  - Developing right-first-time methods
  - Already parallel process activities
  - Open discussions at meetings already enables continuous constraint consideration, just need to make it a focus

Concurrent Engineering work practices

- Maintain benefits gained during the concept design study
- Establish a reference group:
  - contains a representative of each team
  - assists with communication
  - acts as a change control board
- Core system modeled with design spreadsheets
  - on a central server
  - modification of data notifies other team members of changes
- Interface via a browser:
  - Plug-in applications (Word, Excel, Project, PDF, etc.).
  - email and face-to-face meetings

Tools

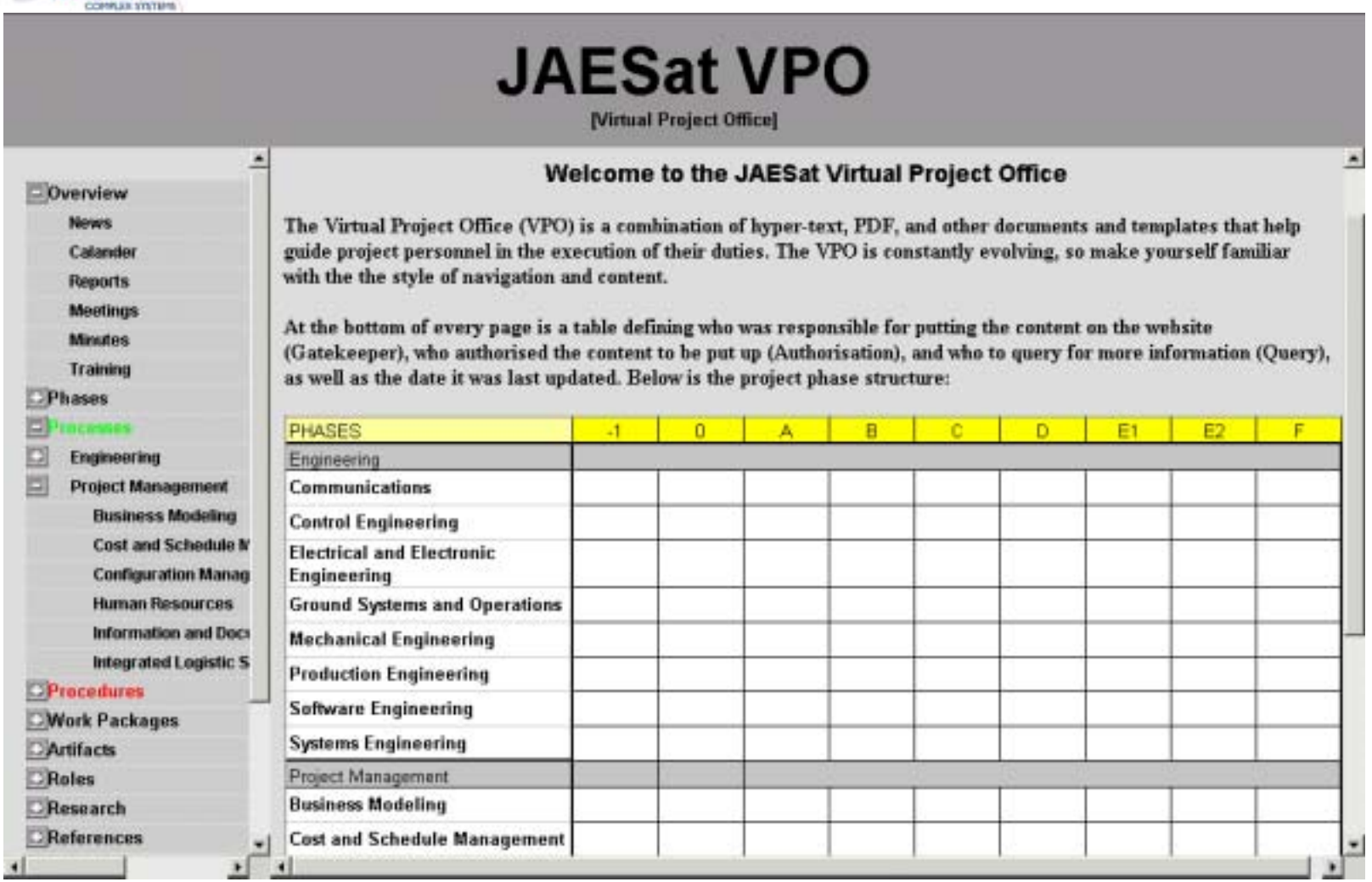
- Concurrent engineering environment
  - Client software requirements
  - Communication tools
  - Document management
  - CAD features
  - Other document features
  - Construction workflow applications
  - Time control
  - Project information
  - Links to other services
  - Security

Tools (Cont.)

- Standard Operating Environment (SOE)
- Solution is more than tools
- Project web
- Virtual project office

Tool	Function
Internet Explorer	Browser functionality and many plug-ins for associated applications
Email client	Outlook, Netscape, Pine, or Eudora
Microsoft Project	Provides functions such as scheduling and tracking tasks, communication of schedule information via email, notification of status updates, the ability to develop and generate reports, and the management of information on project resources, budget and costs.
Microsoft Office	Standard tool for word processing.
Microsoft Excel	Standard tool for spreadsheet applications, such as financial and design planning.
Microsoft PowerPoint	Standard tool for developing and presenting presentations.
Concurrent Versioning System (CVS)	Manages configuration of documents and files.
ArgoUML or ProxyDesigner	Unified Modeling Language (UML) viewers.
Protel	Assists in the design of circuit boards.
AutoCAD	Assists in the design of the structure.
DreamWeaver	Assists in the design and maintenance of the project web.

JAESat Virtual Project Office



Conclusion

- A common systems engineering approach is being established:
  - set phases and templates available
  - based on the ECSS
  - key deliverables are assessable.
- A concurrent engineering environment is being established:
  - Internet as the base operating environment
  - Central repository with configuration management
- Requirements engineering is to be complete early, by October.
- Co-location of team in the same city:
  - Regular meetings
- Keep project within the two year “lust-to-dust” timeframe
- Development and manufacturing during 2004
- View to have satellite ready for transportation by August 2005.

- Questions?