



Infusing SpecTRM in the TeamX environment

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Outline

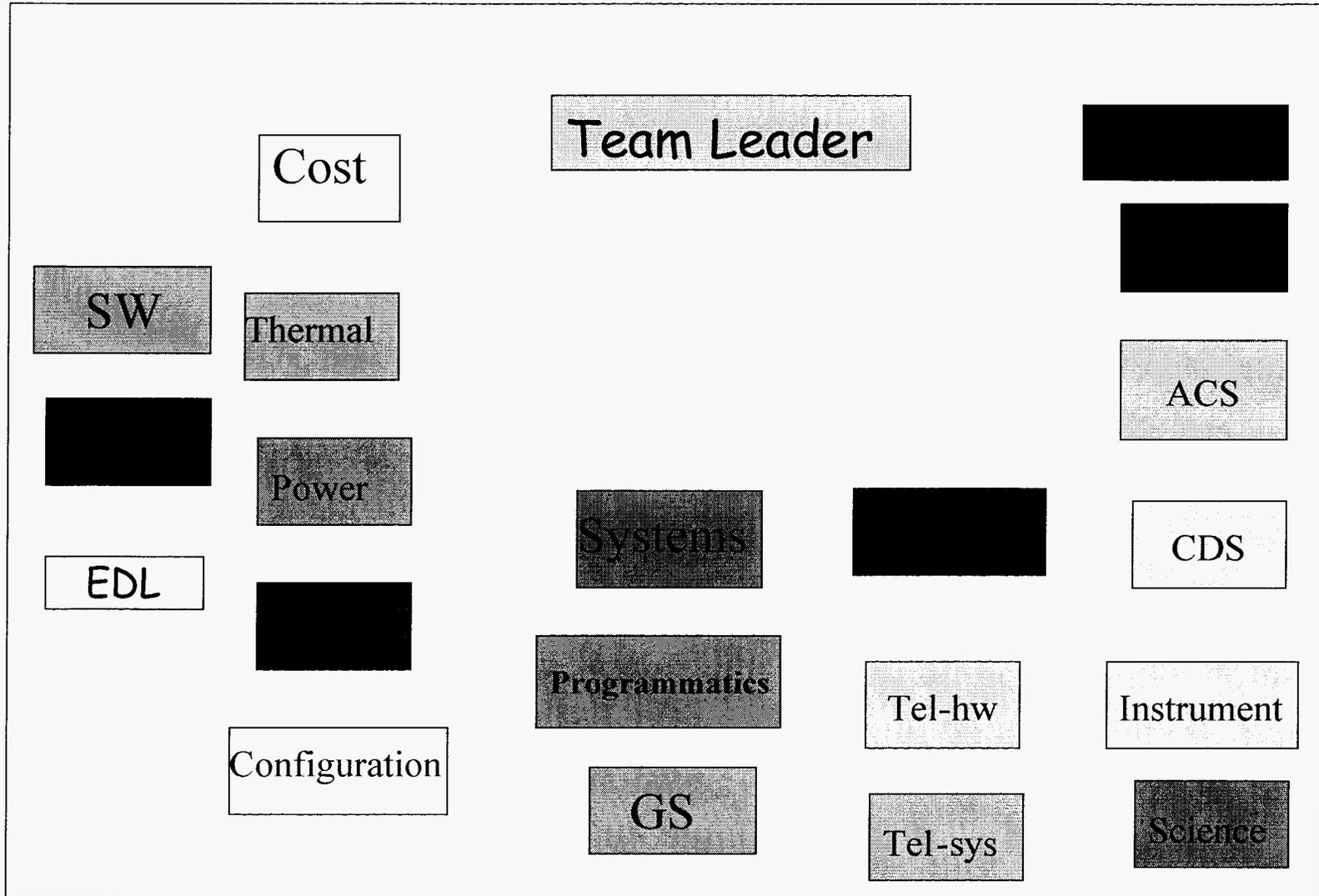
- Target Project/Application
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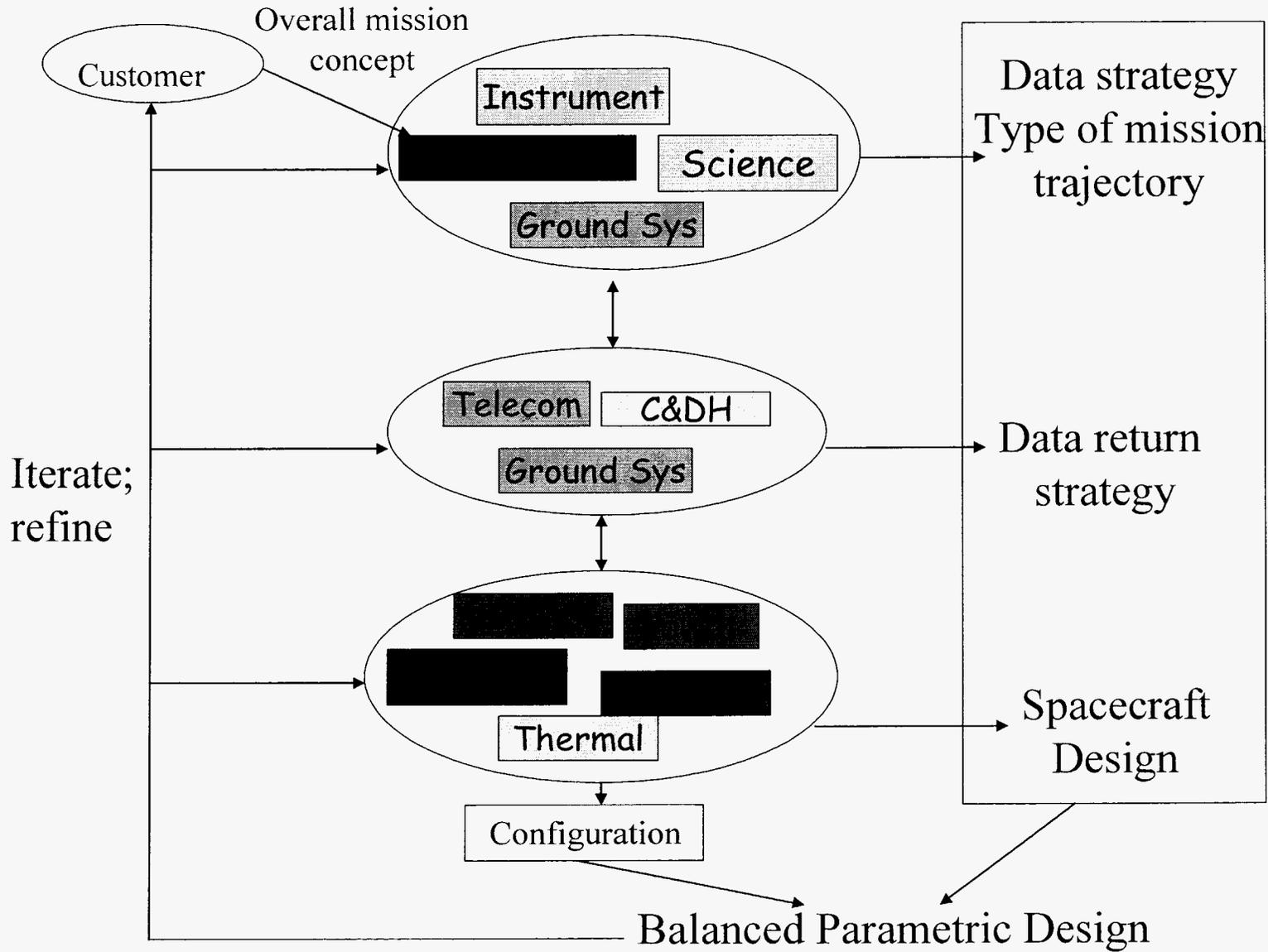


Target Project/Application

- TeamX
 - The concurrent design team at JPL.
 - Produces Conceptual Space Mission Designs.
 - Mainly for the purpose of Feasibility Studies.
 - Duration of study is typically one to two weeks.
 - Final report includes equipment lists, mass and power budgets, system and subsystem description, and projected mission cost estimate.

Team X (at the Project Design Center)







Problem Statement



- Design Rationale not captured sufficiently well.
- Risk Assessment, Hazard Analysis, and Design Rationale not connected.
- TeamX currently has completed about 800 studies, yet, we often start from scratch, or adopt the design of one of the most similar studies in the library and make changes to it.
- Having a library of the elements of a design, and their rationale would allow TeamX to quickly adopt the relevant subsystem component designs and make changes to it to generate a new design.
- This could potentially make the design process a lot faster.
- It also provides the benefit of consistency between different designs.
- Moreover, our customers are asking for the rationale behind the design decisions, and this approach could help address that problem as well.

Definition of Terms

- Hazard: A state or set of conditions that, together with other conditions in the environment, will lead to an accident (loss event).
- Risk: A triplet <What can go wrong? What is the likelihood? What is the consequence?
- Design Options: A selection of alternatives available for the designer. For example, possible design options for a power source include Lithium Ion batteries, Nikad batteries, Solar Arrays.
- Design Decision: The decision to pick a design option for the design.
- Traceability: The explicit linkage between entities that represent the rationale for making decisions.



Current Approach to Design Rationale & Risk Assessment



- Design Rationale:
 - Reports
 - Each Engineer documents their major decisions and rationale in their reports.
 - System Engineer documents the high level decisions and corresponding rationale
 - Deputy System Engineer records and documents the action items, issues, and major decisions. This is included in the System Engineer's report.
- Risk
 - Risk Engineer manages the process of risk identification, assessment and generates the risk report.

SpecTRM approach

- SpecTRM provides the means of connecting the pieces of information and combining them systematically.
- SpecTRM emphasizes:
 - Finding errors early in development so they can be fixed with the lowest cost and impact on system design.
 - Tracing not only requirements, but also design rationale (including safety constraints) throughout system design and documentation.
 - Building required system properties into the design from the beginning rather than emphasizing assessment at the end of the development process when effective response is limited and costly.

Other Applications

- TeamX is the most rapid design team across JPL.
- Other teams have less stringent time constraints.
- If SpecTRM application in TeamX is successful, there is a very good chance that it might be adopted by other projects that are at the Conceptual Design stage.

Conclusions & Future Directions

- Case study conducted using SpecTRM in TeamX indicates that it's feasible and useful to use this software within the team environment.
- Several architectural/process changes need to be made in order to adopt this tool.
- Systems Engineers need to be trained to use this software.
- In order to make the best use of SpecTRM, we need to build libraries and knowledge-bases
 - *Of various subsystem module designs*
 - *Including the rationale and traceability.*
 - *Including linkage to the requirements.*