

# Exploring the Relationship between Project Selection and Requirements Analysis



---

Mark Bergman, Gloria Mark  
Information and Computer Science Dept.  
University of California, Irvine

[mbergman@ics.uci.edu](mailto:mbergman@ics.uci.edu), [gmark@ics.uci.edu](mailto:gmark@ics.uci.edu)



# Initial Project Formation

---

- First, Project Selection
  - Determine project choices
  - Choose a project to fund and develop
- Then, Requirements Analysis
  - Determining stakeholders' wants, needs, and constraints for a project
  - Requirements Analysis traditionally follows Project Selection
- How does Project Selection relate to Requirements Analysis?
  - Project Selection decisions frame subsequent Requirements Analysis



# Research Questions

---

- In practice, does the order of first determining project choices, making project selection and then performing requirements analysis hold?
- If not, what are possible procedural relationships between project choice construction, project selection and requirements analysis?
- How are they similar or different to current requirements analysis views?



# Research Methods

---

- Project Selection and Requirements Analysis have been studied individually, but not together
  - Project Selection has been examined empirically
  - Almost no *in situ* Requirements Analysis studies
- Apply Ethnographic Methods to study initial project formation *in situ*
  - 5 months (2-3 times weekly) of on site participant observation
  - 46 individual semi-structured interviews and 34 semi-formal and formal group meetings
  - 5 detailed technical presentations
  - Hundreds of related documents



# The Field Site

---

- The New Millennium Program (NMP) at the Jet Propulsion Laboratory (JPL): A group in a NASA (National Aeronautics and Space Administration) research laboratory located in Southern California
- The NMP program's mission: Space flight validate new technologies that are deemed important to NASA's future science missions
  - This includes maturing new technologies (TRL 3 → TRL 7)
- NMP Selection Process: Choosing which new technologies to validate
- Each new technology candidate can become the basis of a new project – a validation mission
  - NMP selection process is a highly developed form of *in situ* initial project formation

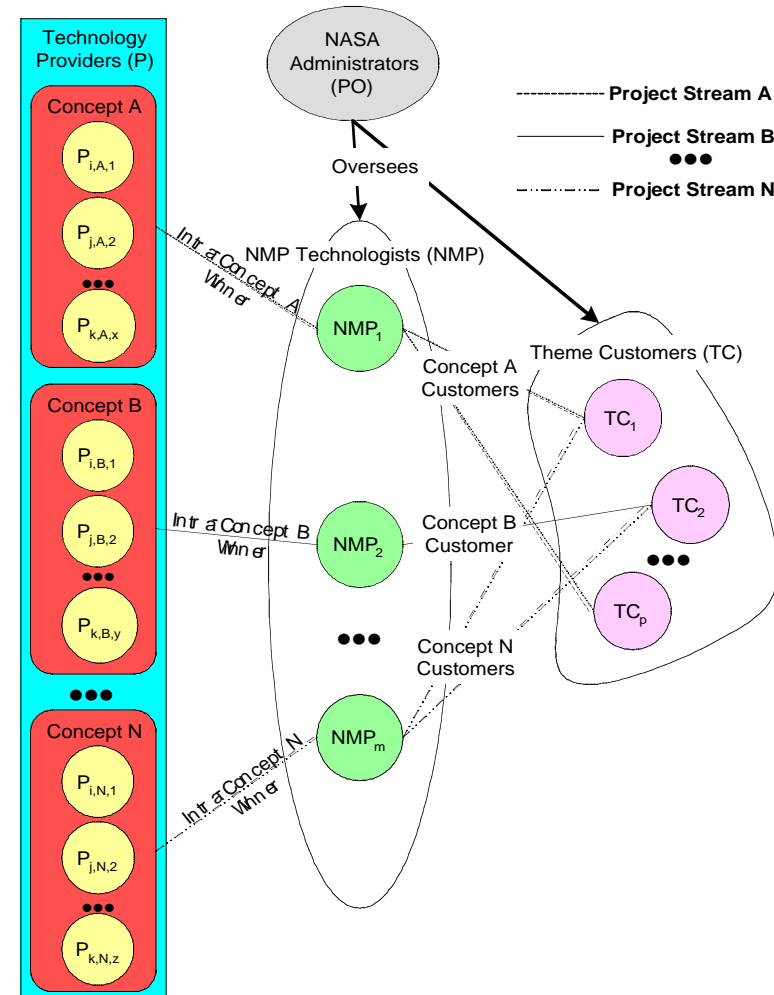


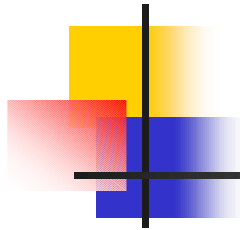
# Roles and Requirements

Lab Roles	Description	General Requirements Profile
NASA Administrators	NASA upper level decision makers with the authority to assign organizational resources to implement their decision	<p>Wants, needs and constraints tend to be general, somewhat vague, and usually conflicting</p> <p>Want broadly applicable array of new technologies to become available for NASA wide science mission usage, while minimizing cost</p> <p>Constrained by budgetary and policy guidelines from the US Congress</p>
Mission Themes	Planners, designers, scientists, builders, and managers of science mission space systems	<p>Technically explicit and precise in their needs and constraints</p> <p>Want new technology that would lower future science mission system costs or enable experiments</p> <p>Constrained by tight budgets and project deadlines</p>
Technology Providers	Builders of new aerospace related technologies	<p>Have very precise constraints and usage guidelines while providing specific, semi-customizable technical functionality</p> <p>Want their technologies space flight validated, likely creating a long term revenue stream, while minimizing technology development costs</p> <p>Constrained by VAL award amounts and project deadlines</p>
NMP Technologists	Assist and promote the technology and project selection process	<p>Want new technologies to space flight validate</p> <p>Want to balance and satisfy the needs of the administrators and themes, while validating as many providers' technologies as possible</p> <p>Constrained by allotted project cycle budgets and given deadlines</p>

# Roles and Project Selection

Process Role	Lab Role
PO: Process Owners/ Principals	NASA Administrators
$TC_p$ : Theme Customers	One of $p$ Mission Themes
$P_i$ : Technology Providers	One of $i$ Technology Providers
$NMP_m$ : Process Actors/Agents	One of $m$ NMP Technologists
Concept N	One of $N$ Competing General System Candidates
$P_{i,N,x}$	One of $x$ Competing Technologies for Concept N from Provider
Project Stream N	One of $N$ Candidate Project Plans, Project Plan N is for Concept N

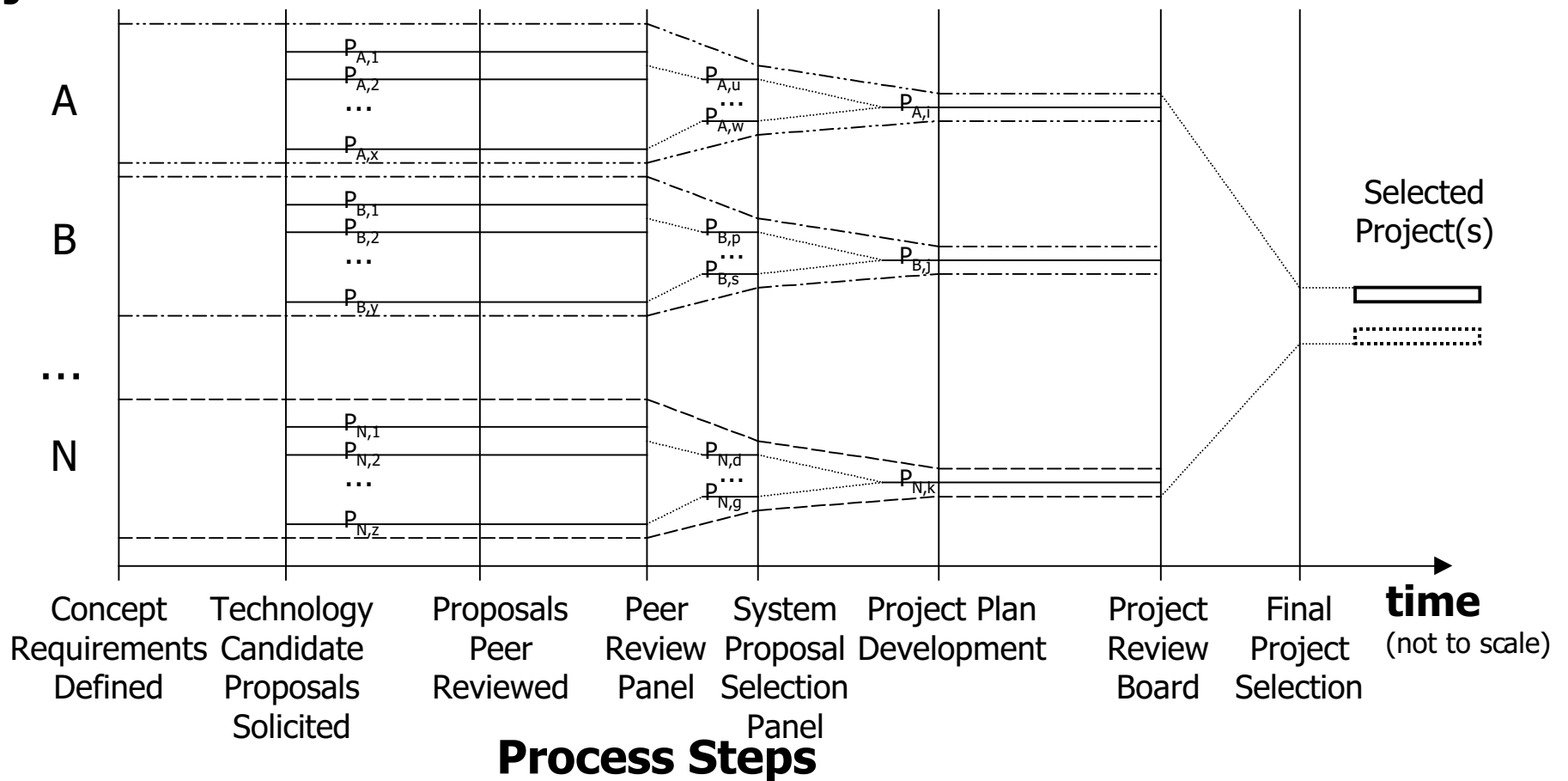




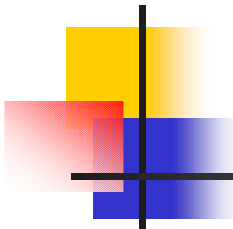
# Project Selection Process

## Project Streams

- ~9-10 mo. per project selection cycle
- 6 mo. used in project plan development







# Relationship Between Project Selection and Requirements Analysis

---

- Initial project streams (concepts) defined by Theme Customer's requirements
- Competition between technology candidates informs and refines project stream requirements
  - Early identification of *wanted* and *undesired* existing technological capability, costs and constraints
  - Technology selection frames project definition and tightens project requirements
- Competition between project streams also refines each project's requirements
  - Project level requirements are used in project selection decision, especially negative requirements



# Multiple Parallel Competitive Requirements Analysis (MPCRA)

---

- Relationship between project choices, selection and requirements analysis is bidirectional, *not* unidirectional
  - Projects created and selected requirements
  - Requirements identified and framed projects, and informed project selection
- Found multiple parallel competitive requirements paths, not just one
  - Refutes traditional requirements analysis – single project path
  - Outcome could be multiple projects, as opposed to the traditional assumption of one
- Extensive, multi-step, well-documented, open, competitive process built consensus for final project selection