



# JPL's Approach to Developing and Proposing PI-Led Mission Concepts

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**National Academies' Committee on Increasing  
Diversity and Inclusion in the Leadership of  
Competed Space Missions**

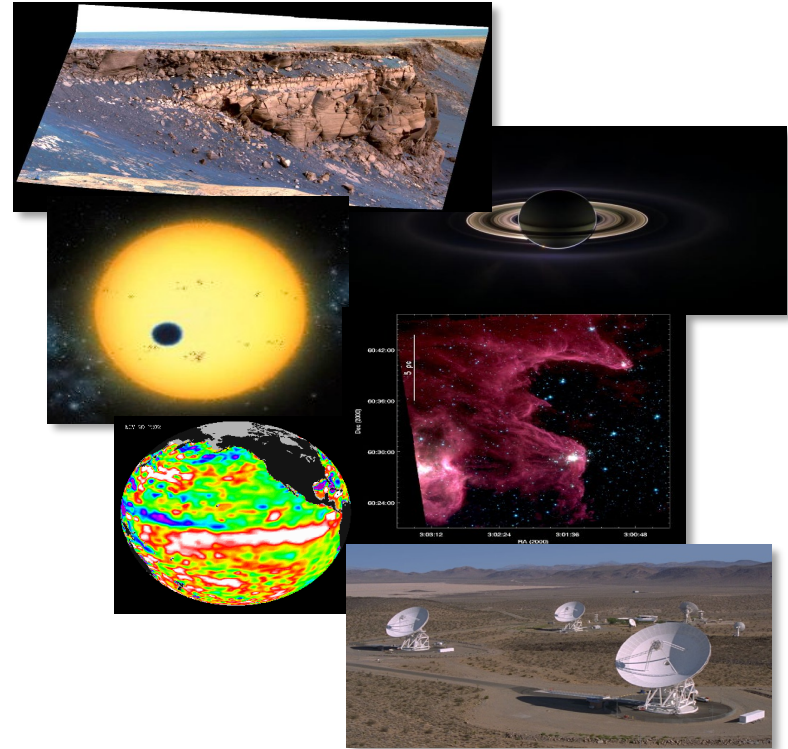
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**Jet Propulsion Laboratory**  
California Institute of Technology

# JPL is part of NASA and Caltech

- Federally-funded Research and Development Center (FFRDC) managed by Caltech for NASA
- JPL's mission for NASA is *robotic* space exploration
  - Mars
  - Solar System
  - Exoplanets
  - Astrophysics
  - Earth Science
  - Interplanetary network



# Who We Are

## Kelley Case

M.S. Mathematics (Claremont Graduate University)

15+ years of Mission and Instrument concept formulation experience, including the current and previous NRC Decadal studies for Earth Science, Planetary, and Astrophysics

- Innovation Foundry Concept Manager
- Concept Design Methods Chief



## Sabrina Feldman

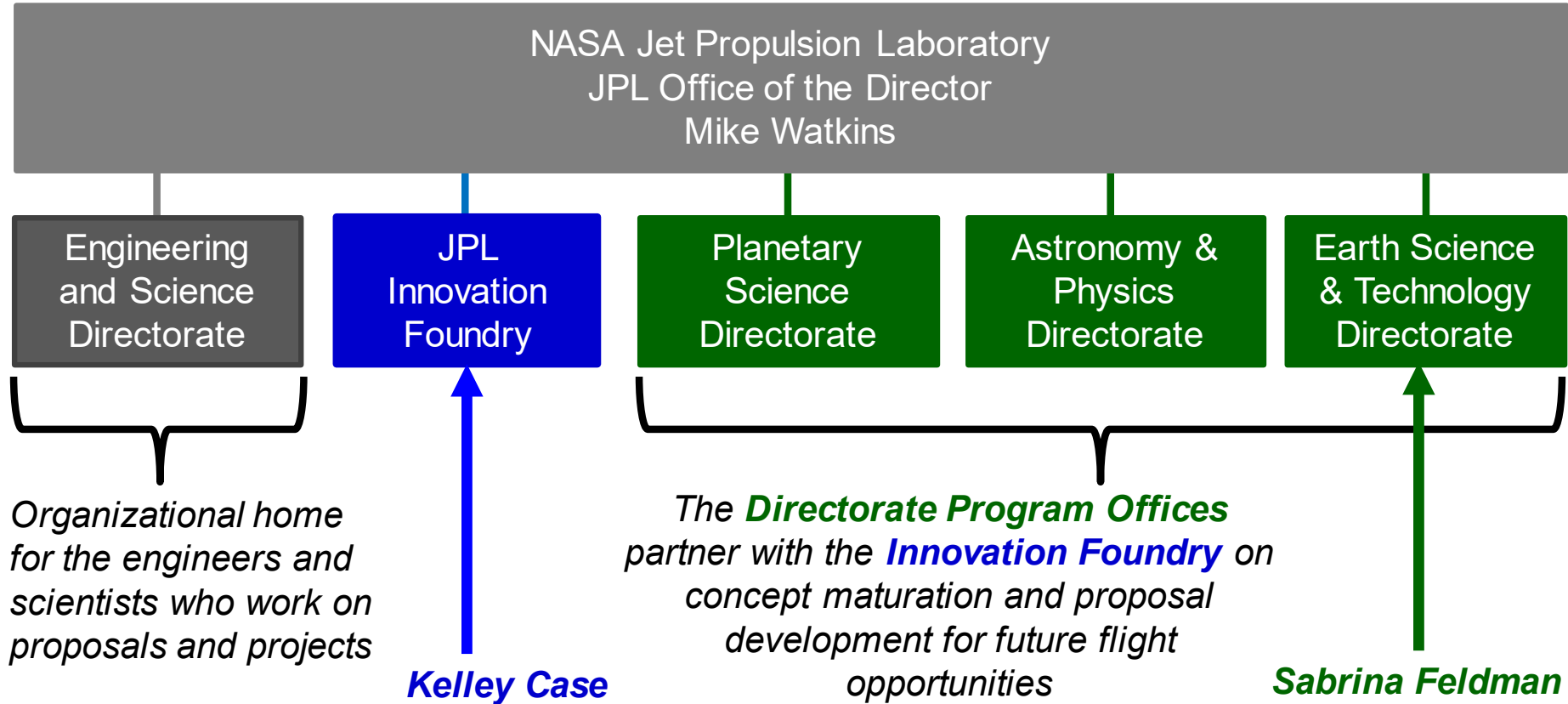
Ph.D. Physics/Astrophysics (U.C. Berkeley, 1996)

22 years of Planetary, Astrophysics, and Earth flight proposal experience, including:

- Program Manager, JPL Planetary Science Instruments Office (2014-2020)
- Deputy Program Manager, JPL Earth Science Research & Mission Formulation Office (2020-now)



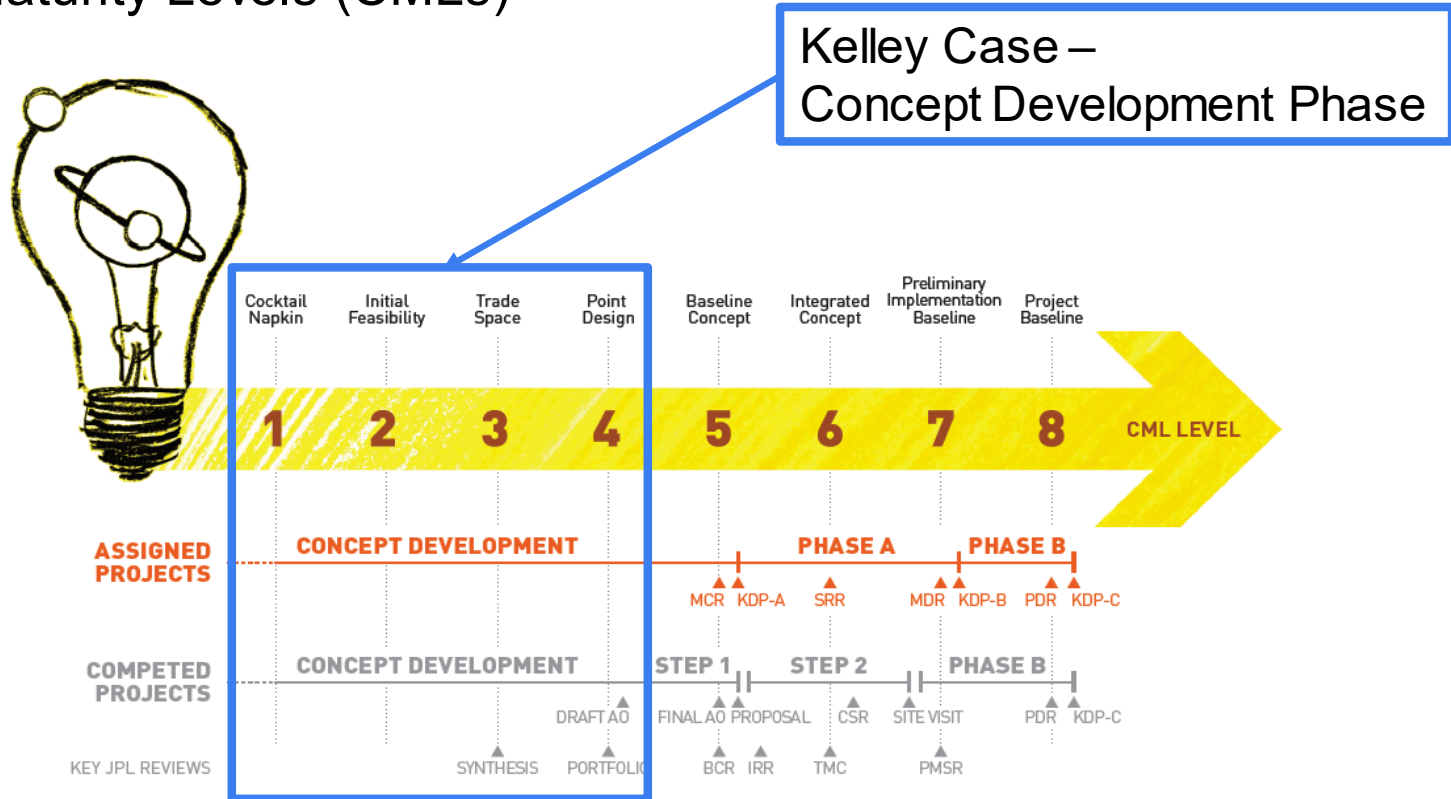
# *How we fit into the (simplified) JPL Cosmos...*





# Formulation Life Cycle Milestones

## Concept Maturity Levels (CMLs)



# JPL's Architecture Team (A-Team)... The Place to Start



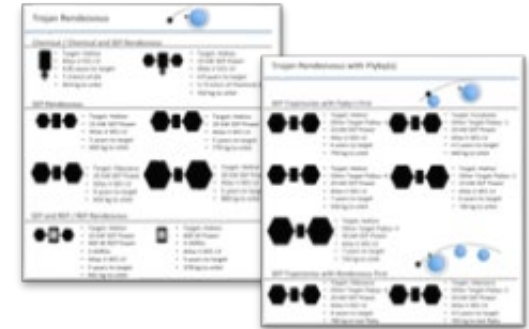
## Strategic Planning & Technology Roadmapping



## Science Community Engagement



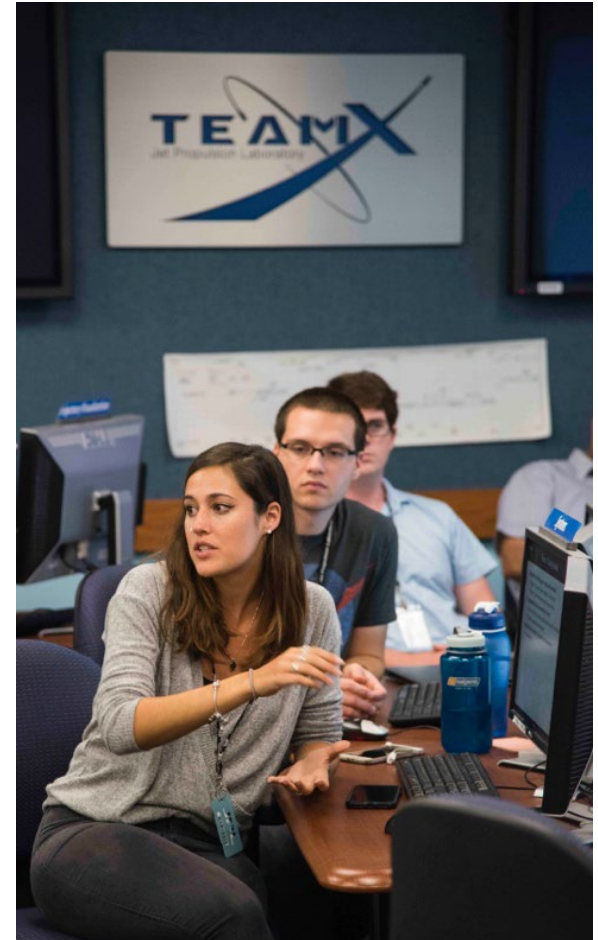
## Trade Space Exploration



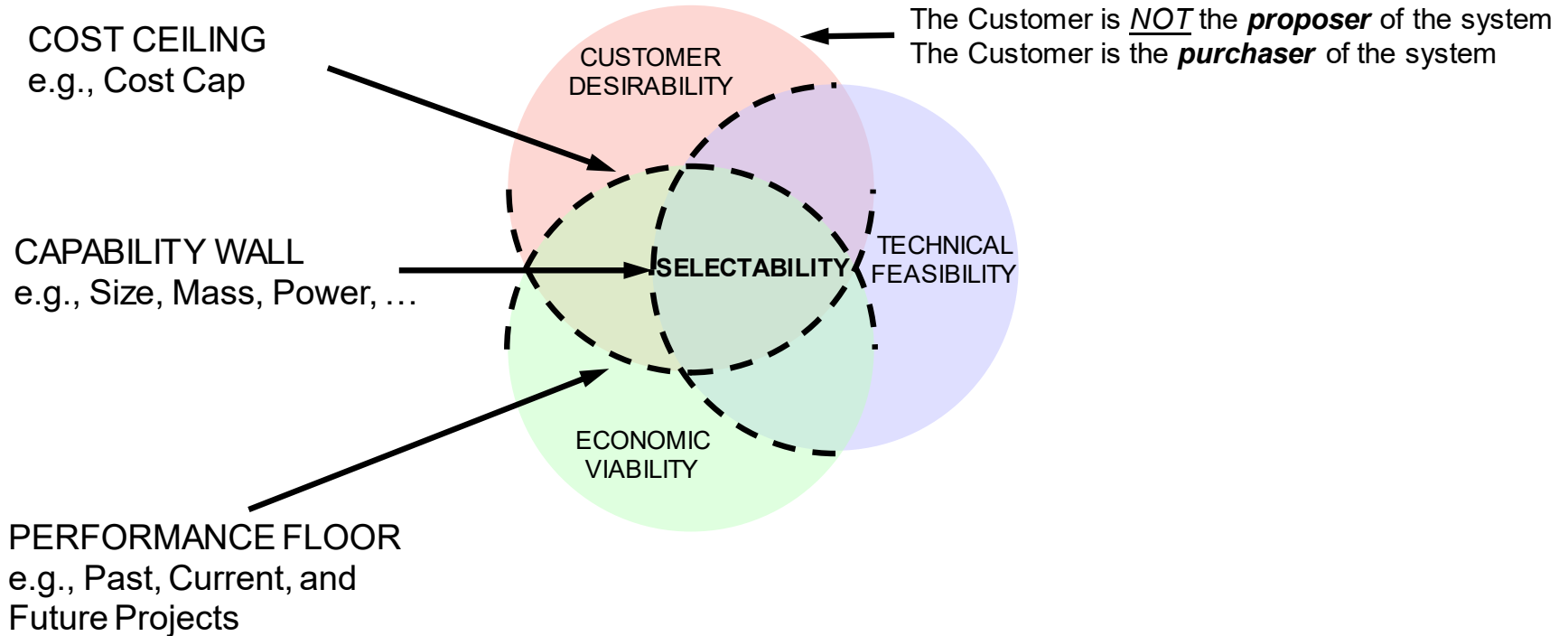
# Principles of Team X

## Concurrent Engineering Design

- Team X is a room full of peers
- By working together concurrently, we quickly and efficiently explore solutions
- Subject Matter Experts represent major subsystems of the spacecraft design
- Staffing is vetted by the “doing” organizations
- Work part-time on flight projects
- Customer team is part of the design process
  - Make informed design decisions based on real-time results



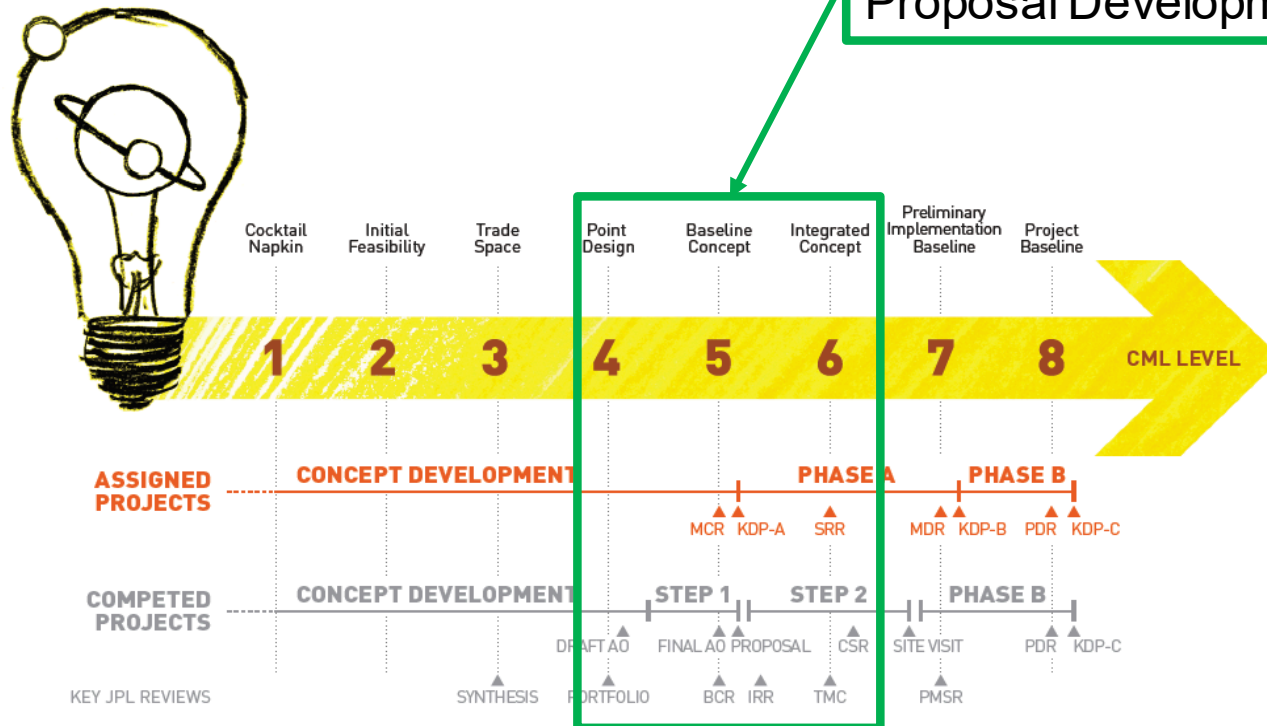
# What the customer really needs





# Formulation Life Cycle Milestones

## Concept Maturity Levels (CMLs)



Sabrina Feldman –  
Proposal Development Phase

# **Proposal development begins after there is a “stable” Baseline Concept**

*Proposal portfolio selection process is based on NASA Evaluation Criteria:*

- A. Scientific Merit of the Proposed Investigation**
- B. Scientific Implementation Merit and Feasibility of the Proposed Investigation**
- C. Technology, Management, and Cost Feasibility of the Proposed Mission Implementation**

# Final portfolio decisions take into account:

1. Individual concept merit – how strong is each concept on its own?
2. Overall portfolio balance – how diverse are the concepts as a group?
  - ***Scientific diversity*** – do the concepts address a range of NASA strategic goals and objectives?
  - ***Team diversity*** – do our proposal teams reflect a broad spectrum of the community, including people with diverse backgrounds and experiences? Is there a balanced mix of early-, mid-, and senior-career scientists?
  - ***Heritage vs. novelty*** – are we offering concepts based on flight-proven science measurement techniques, technologies, and system/spacecraft approaches? Does our portfolio also include concepts that showcase innovative science and technology approaches, e.g. concepts that seem clever, exciting, “outside the box”?

# Step 1 and Step 2 Proposal Activities

- JPL has a standard organizational process for Step 1 and Step 2 proposal campaigns, augmented by Program Office-specific processes
- Step 1 mission concepts undergo a standard set of reviews, including:
  - Baseline Commitment Review
  - Science/Technology/Management/Cost Proposal Review
  - “Excellence” Proposal Review
  - Directorate Management Council Review
- The Innovation Foundry supports these and other activities, including:
  - Proposal Storyboard Workshops
  - Independent Technology Readiness Level Assessments
  - Science Traceability Matrix Workshops

# Some proposals ultimately lead to flown investigations...





# Summary

## Diversity Awareness and Opportunities

- NASA is increasingly considering team diversity during evaluation
  - Diversity awareness was exposed at OPAG in 2017
- NASA Opportunities to learn more about concept formulation and proposal development exist:
  - NASA Planetary Science Summer Seminar:
    - <https://pscischool.jpl.nasa.gov/>
  - NASA PI Launch Pad:
    - <https://science.nasa.gov/researchers/pi-launchpad>



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