

# Outer Solar System Exploration

## Outer Planet Program

### Workshop Report

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# Workshop Objective

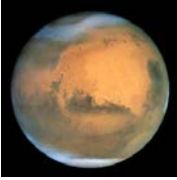
*Explore* the idea of an outer planets program – could the existence of a program architecture enhance our exploration of the outer solar system?

Meeting held at CalTech July 8-9

Many / most participants started out “agnostic” or skeptical, but with discussion we (all) started to see the advantages...

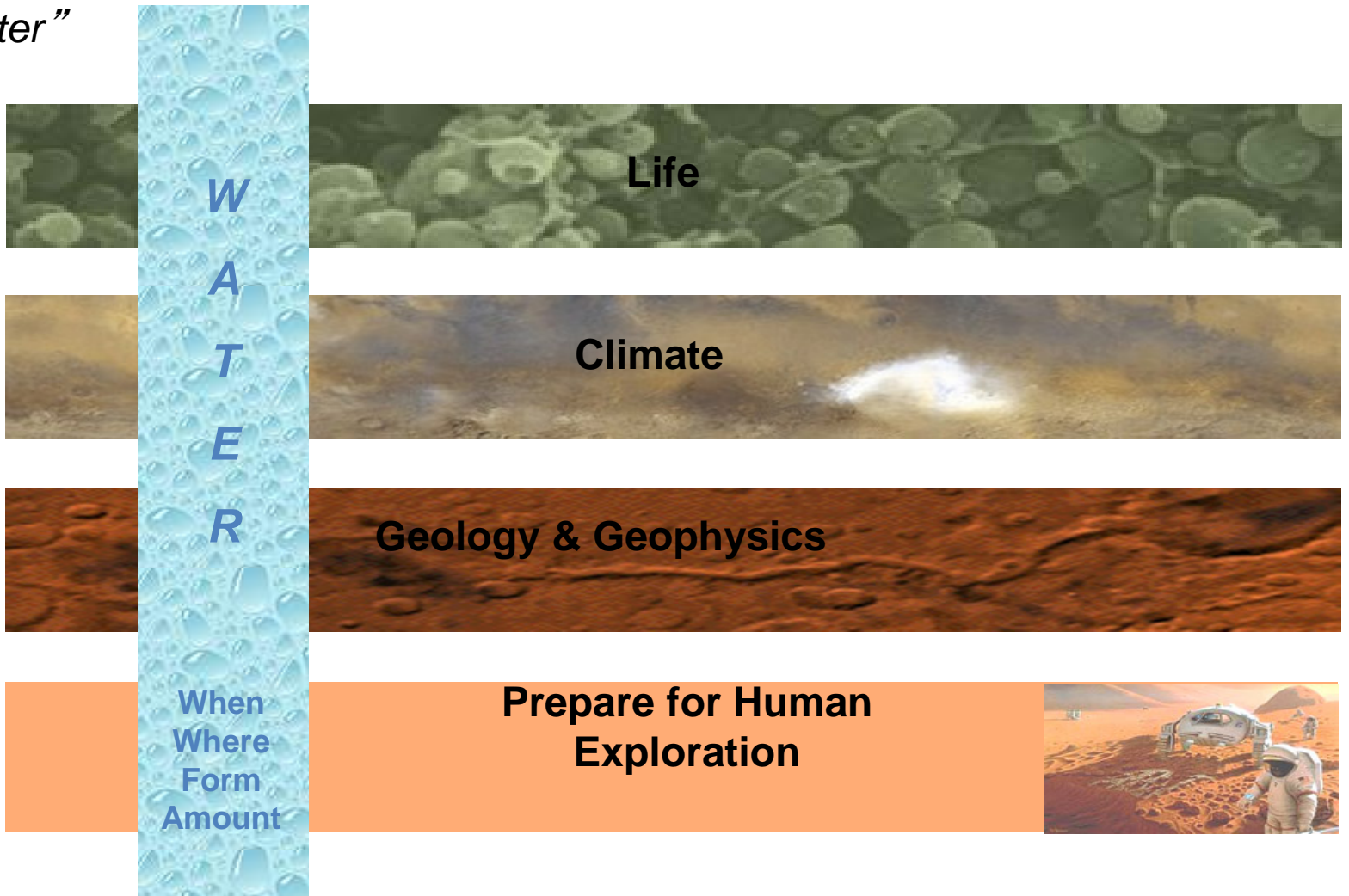
# Consider: The Mars Exploration Program

- Launched every opportunity up until MSL
- Mix of small and large missions
- Mix of competed and directed missions
- Theme / strategy for a long time was “Follow the Water”, follow-on habitability theme makes sense
- Very very good environment for nurturing students to become Co-I’s, training Co-I’s to become PI’s
- Excellent infrastructure (e.g. JMars, data-sharing across projects, data products for landing site selection by broad community, weather reports, relay, etc.)



# Mars Exploration Science Goals

*“Follow the Water”*



# Challenges for Outer Planets

Does a program for the outer planets make sense?

- Diversity of targets
- Long timescales
- Can we come up with a unifying theme(s)?
- We have the joy / dilemma of a target-rich outer solar system to explore – how do we corral our objectives and transition from target-based laundry lists of what we'd like to learn to a cohesive, describable vision that we can easily articulate?

# Possible Advantages of a Program Architecture

- Coherent technology development path with accountability
- Ongoing advocacy for pipeline of missions, not just one at a time
  - Need to think about how we sell our science goals – must be easy for public and staffers to understand – requires clear statements of what we want to accomplish
- Use of SLS as launch vehicle has potential for increased frequency of missions to the outer solar system – benefits us and the SLS program if the price tag is no more than our normal choice of launch vehicles
- Better overall infrastructure – Power, data (DSN)

# Outer Planets Program Structure

- Three components: HQ, OPAG, Program staff
  - OPAG brings together the collective wisdom of the Community to define a structured science content and strategy
  - Program personnel look after the Program on daily basis
- Similar to Mars exploration program a successful Outer Planet Program should use “program system engineering” to align strategies for:
  1. Science
  2. Technology
  3. Programmatics
- Mission queue is an output not input, subject to funding constraints

# Engaging our potential Supporters

- If we decide we should go forward the idea would be to go after additional funding – not just try to squeeze an outer planets program into the existing budget
- Increase cadence of missions by (for example)
  - Help SLS by filling in their manifest
  - Turn every other Discovery opportunity into an outer planets opportunity by beefing up budget
- Program requires public friendly/staffer friendly bumper sticker capturing the essence of the Program and articulating a strategy (similar to “follow the water” in the Mars Program)
  - Elevator speech



# Example Theme: How the giant planets created/built habitable worlds\*

*Two main “pillars”:*

- Origins
  - How did the Giant Planets mold the Solar System?
  - What factors lead to habitable zones in planetary systems – our own and the exoplanets?
  - Giant planets, and their environment, are natural laboratories for understanding early Solar System formation (Composition and structure of the giant planets)
- Habitability
  - Prebiotic chemistry that could lead to life
  - Abodes that could harbor life
  - Organics: primitive origin and modern synthesis (organic factory)
  - Places where organics/energy/water interact
  - Composition of oceans
  - -....

\* Concept developed at workshop

# Notional Example

The Origin and Evolution of the Early Solar System

The Role of Outer Planets in Creating Habitable Worlds

Icy Moons as Habitats

Comparative Study of Planetary Systems

Follow the  
methane

# Timing

- Step 1 – get feedback from OPAG
  - From now until January 2015 meeting
- Step 2 - If we think the proposal for a program has merit, then lay groundwork after the January OPAG meeting for recommendation to decadal study midterm review