RECONNAISSANCE / SCIENCE

I-MIM MEASUREMENT DEFINITION TEAM

Humans to Mars Summit
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INTERNATIONAL
MARS ICE MAPPER MISSION
ASI – CSA – JAXA – NASA – NSO
• Many agencies have similar goals for both human exploration and science in their strategic plans related to ice for ISRU, and for the search for life and the geologic and climate history of Mars

• Highly leveraged cost-sharing partnership for affordability and achievability in the next decade
Anchor Payload

• Anchor payload is a polarimetric Synthetic Aperture Radar (SAR)

• Tailored for detection of shallow subsurface ice and characterization of surface properties

Measurement Definition Team (MDT)

• Internationally competed team of radar, human exploration, and planetary science experts

• Key Task: provide measurement requirements for SAR payload and identify potential complementary payloads required to assess candidate human landing sites
## WHERE IS THE HUMAN-ACCESSIBLE ICE ON MARS?

### 1. ICE PRESENCE AND CONCENTRATION
- Depth to Top of Ice Table (thickness of overburden)
- Ice Mass in Column of 10 m
- Nature of Ice/Overburden Transition
- Layering of Ice in Upper 10 m
- Candidate Ice Lenses in Overburden
  - Spatial Continuity of Ice (Patchiness)
  - Horizontal Distribution of Ice within 5 km Radius

### 2. LATERAL EXTENT & CONTINUITY OF ICE
- Solutes in Ice or Ice Matrix
- Rocks in Ice or Ice Matrix
- Ice Porosity
- Layering and Tilt of Lithics in Ice
- Presence of Liquids

### 3. NON-ICE CONSTITUENTS IN THE MATRIX
- Thermal Properties of Overburden (thermal inertia)
- Density of Overburden
- Load-bearing Capacity of Overburden
- Average/Bulk Porosity of Overburden
- Hardness of Overburden
- Stratigraphy/Interbedding

## CAN REGIONS OF HUMAN-ACCESSIBLE ICE SUPPORT SURFACE OPERATIONS?

### 4. OVERBURDEN PROPERTIES
- Surface Rock Size Distribution
- Lithology of Surface Cover
- Surface Morphology
- Surface Topography and Texture
- Ice Emplacement
- Ice Age
- Ice/Snow/Firn Grain Size and Density
- Surface Frost Thickness, Extent, Seasonality, Composition
- Temperature Profile
- Surface Environment
- Subsurface Diurnal or Seasonal Ice/Ice-soil Mixtures
- Presence/Volume of Methane Clathrates

## WHAT ADDITIONAL ICE SCIENCE IS POSSIBLE?

### 5. SURFACE CHARACTERISTICS
- Degree of Mass Wasting
- Aeolian Changes
- Depth to Bedrock

### 6. POST-LANDING SCIENCE
- Overburden Properties
- Post-landing Science

## LONG-TERM HMP ‘NICE TO HAVES’

### OVERBURDEN PROPERTIES
- Surface Seismicity
- Surface Impact Rate
- Surface Rock Fracture Toughness
- Surface Soil/regolith Angle of Internal Friction
- Surface Soil/regolith Permeability
- Degree of Mass Wasting
- Aeolian Changes
- Depth to Bedrock
I-MIM Provides Dual Reconnaissance and Science Benefits

To maximize return on investment, the MDT has identified significant scientific contributions that align with each partner Agency’s strategic goals for Mars exploration.

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<th>GEOLOGY</th>
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Radar Observations Meet Reconnaissance and Science Needs

- Most of the high-priority reconnaissance objectives can be met with the currently scoped radar instrument, along with a broad suite of additional science investigations

Other Measurements May be Necessary

- The MDT is evaluating the merits of complementary instruments, including high-resolution imaging and low frequency radar sounding capabilities

Human Landing Site Assessment is a Multi-Step Process

- Ice and geotechnical property mapping orbiter would be an important first step in a tiered human landing site selection process
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