This is an update on the status of the Mars Ice Mapper Measurement Definition Team. This presentation has been reviewed and determined not to contain export controlled technical data. It does not represent the views of the organizations that employ any of the members of the analysis team.
Approach to team composition and activities builds from prior experience.

Philosophy
• Draw from experience where possible, innovate where necessary

Key Precedents
• Mars 2020 Science Definition Team (M2020 SDT)
• Mars Sample Return Science Planning Group 2 (MSPG2)
• Human Landing Sites Study (HLS²)
Open Competitive Process

• August 2021: “Dear Colleague” letter and MDT Charter posted inviting international applicants
  ➢ 147 highly qualified applications received
• November 2021: Team selections finalized

Team Composition

• Expertise spread across planetary and science and human exploration
• 10 countries represented
• Diversity across gender and career stage

Additional information on MDT process at: https://science.nasa.gov/researchers/ice-mapper-measurement-definition-team
I-MIM MDT IMPLEMENTATION

Michèle Lavagna / Jeff Plaut, Co-Chairs
Recon/Science Measurement Definition Team differs from traditional SDT.

Traditional SDT Process:
- a Science Definition Team (SDT) defines mission objectives, observation requirements, and a notional payload suite

For I-MIM:
- Agency partners have agreed upon preliminary Mission Concept goals, objectives, and spacecraft/payload assumptions to reflect both common and unique national reconnaissance and science goals for Mars exploration
- The MDT brings together the traditional planetary science community AND users of the requirements-driven reconnaissance measurement data for human mission planning

MDT Ground Rules & Assumptions
- Core mission requirements are reconnaissance-driven
- Primary anchor payload is a compact-polarimetric L-band SAR/Sounder
- Agency partners are committed to maximizing return on investment through high value, investigation-driven supplemental science and mission-support objectives
I-MIM MDT: MEASUREMENT TRACEABILITY MATRIX (MTM) ROADMAP

Reconnaissance Goal → Reconnaissance Objective → Step 3 (Observations Needed) → Step 4 (Radar Mode/Data Product) → Step 5 (Functional Requirement)

- Provided by partner agencies
- Tasked to MDT
Ex Officio  
MARTIN BERGERON (CSA)  
MICHAEL MEYER (NASA)

MDT Executive Committee

<table>
<thead>
<tr>
<th>CANADA</th>
<th>ITALY</th>
<th>JAPAN</th>
<th>US</th>
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<tr>
<td>TIM HALTIG</td>
<td>RAFFAELE MUGNUOLO</td>
<td>TOMO USUI</td>
<td>MIKE KELLEY</td>
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MDT ORGANIZATIONAL STRUCTURE

Program Executive  
RICHARD (RICK) DAVIS

Facilitation / Technical Support
ELEANORA AMMANNITO, DAVID HOLLIBAUGH BAKER, TAKANORI IWATA, SATORU OZAWA, PATRICK PLOURDE, MICHELLE VIOTTI

Co-Chairs  
MICHÈLE LAVAGNA | JEFF PLAUT
ALI BRAMSON - Assistant Co-Chair

Logistics  
LAURA RATLIFF, ROB COLLOM

Independent Assessment Team
ENRICO FLAMINI
JIM HEAD
GORDO KOMATSU
RALPH LORENZ
MICHAEL MISCHNA
+ Possible Human Spaceflight Rep

Core Reconnaissance / Science Team

<table>
<thead>
<tr>
<th>AHARONSON</th>
<th>BRAMSON</th>
<th>GOLOMBEK</th>
<th>IESS</th>
<th>MIYAMOTO</th>
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<tr>
<td>ANDERSON</td>
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<td>GRANT</td>
<td>IMAMURA</td>
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<td>AD</td>
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Early Career Group

AOKI  
BUTCHER  
GENOVA  
HIBBARD  
LALICH  
SARGEANT  
STUURMAN
BICKEL  
GANESH  
HARRINGTON  
KUROKAWA  
NEROZZI

Team member nationality and description of expertise available at:  

Appointed by partner agencies  
Selected from applicants  
Appointed by partner agencies or selected from applicants
MDT STATEMENT OF WORK

Task 1: Core Reconnaissance Mission
• Provide detailed measurement requirements traceable to mission reconnaissance goal/objectives for anchor radar payload
• If radar payload is not uniquely capable of satisfying the reconnaissance objectives, identify measurements that are required and propose additional payload(s) to meet the requirements

Task 2: Potential Mission Augmentation Options to Maximize Return on Investment
• Define additional recon and science objectives that could be met with reference payload
• Assess and prioritize technical and scientific options for augmenting the core mission
• Feasibility assessment of supplemental payload(s) and/or modest modifications to recon payload(s)

Task 3: Concept of Operations
• Prepare a model operational concept based on findings from Tasks 1 and 2
1. Focus Groups: Organized by Recon Objective.
2. Human Mission Planning Experts:
3. Radar Experts:
4. All:

Define Questions and Observations Needed. (Radar/Human Mission Experts embedded in each.)
Validate key questions and observations needed.
Turn questions/observations into functional instrument requirements.
Generate recon traceability matrix that lead to mission requirements definitions.

Co-Chairs

Output: Step 3
Observations Needed in Recon Traceability Matrix

Output: Steps 4 & 5
Data Product Type / Functional Req’ts

Output: Recon Traceability Matrix

Review by All

If radar cannot meet all observation requirements:

POTENTIAL EXPERTS FOR ANY ADDITIONAL PAYLOAD(S)/MEASUREMENTS NECESSARY TO MEET Req’TS-DRIVING MISSION RECON OBJECTIVES

Additional Measurements / Requirements Needed

Hi-res, advanced measurements for:
A  Human-led Ice Science; B  Ice-related ISRU
C  Human-class Landing/Launch; D  Civil Engineering

Human Mission Planning Experts

Output:
Validation of Steps 3-5 Products (and Prioritization at synthesis level, if needed)

Radar Experts
# NOTIONAL MDT SCHEDULE

## MDT Tasks 1-3 Phasing

<table>
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<tr>
<th>TASK</th>
<th>DEC</th>
<th>JAN 11</th>
<th>FEB 18</th>
<th>MAR 25</th>
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### Key Dates:
- **Nov 30**: Kickoff
- **Jan 11**: New Year Start
- **Feb 18**: Interim Report
- **Mar 25**: Near-final Summary
- **Apr 14**: Final Report*

*NOTE: The Final Report* is an estimate and may be subject to change.*
I-MIM Measurement Definition Team (MDT) was competitively selected from around the world

MDT Final Report expected in April and will be shared with the MEPAG community

Future opportunities on I-MIM Recon/Science Team after a potential Phase A start
Ice detection leads to eventual convergence in a future sustained human-robotic presence on Mars.

- Critical both for Mars reconnaissance-driven measurements for the human exploration of Mars and for planetary science priorities
- Human-exploration and science objectives will eventually converge when human explorers are able to live and work on the Martian surface,
AGENCY-LEVEL EXPLORATION-DRIVEN GOAL (DRIVES REQUIREMENTS)

Map and characterize accessible subsurface (top 10m) ice and its overburden in mid-to-low latitudes to support planning for the first potential human surface missions.

RECONNAISSANCE OBJECTIVES

In the Reconnaissance Zone (RZ*):

- **RO-1**
  - Where is the ice?
  - How much is there?

- **RO-2**
  - What is the nature of the regolith above the ice?

- **RO-3**
  - What specific considerations are required to characterize potential candidate sites for human exploration?

AGENCY-LEVEL SUPPLEMENTAL VALUE GOAL (MAXIMIZES RETURN ON INVESTMENT)

As possible, provide high-value science opportunities and high-priority mission-support capabilities that serve both reconnaissance and science.

SUPPLEMENTAL SCIENCE OBJECTIVES

- What additional scientific investigations can be conducted?

SUPPLEMENTAL MISSION SUPPORT OBJECTIVES

- What supplemental technologies / recon/science payloads could be included?

*RECONNAISSANCE ZONE (RZ):* Midlatitude, low elevation, terrain-favorable areas on Mars where human exploration is likely viable in terms of human-led surface science potential, in-situ resource utilization, engineering constraints associated with landing and surface operations, and other such factors.
Primary Payload
- L-band compact polarimetric SAR/Nadir SAR Sounder
Decades of EO SAR expertise through RADARSAT missions

Solar Arrays
- Potential contribution of Flexible Compact Array (FCA)
  Extensive expertise in solar arrays
  (Airbus Defence and Space Netherlands: > 85 space missions, 100% successfully deployed)

Spacecraft
- Spacecraft bus and operations
  Extensive spacecraft & SAR expertise
  (Hayabusa, Hayabusa2, MMX, ALOS L-band, GPM SAR)

Mission Architect / Mission Management
- Launch vehicle/services
- Potential high-altitude communications network
- Recon/Science Team Co-lead
  Decades of experience at Mars and in human spaceflight/mission architectures

Reflector Antenna/Boom and Communications Subsystem
- Communications Subsystem on SARbird
  Decades of Radar + Communications Expertise
  (Cassini, JUICE, Bepi Columbo)

Concept Team roles only; partners have not yet made formal commitment. Additional Partners are possible.