

# Defense & Resources Synthesis

The process to mitigate hazards or utilize resources will be strongly influenced & guided by science objectives and technology developments

- 1) Identify
- 2) Characterize
- 3) Assess
- 4) Formulate pathways forward
- 5) Test & demonstrate pathways
- 6) Implementation
- 7) Assess and iterate

# Planetary Defense – *key driving objectives*

- Determine the diversity of potential hazards
- Observe objects that haven't been observed yet
- Inform composition, structure, and evolution of the Solar System

# Resource Utilization – *key driving objectives*

- Develop space & planetary infrastructures that will enable ground-truthing
- Use resources to address more complex science objectives in-situ
- Inform geologic processes that create resource materials
- Inform composition, structure, and evolution of the Solar System

## *On the way to 2050:*

Develop and demonstrate a variety of techniques and technologies for prospecting, utilization, and planetary defense with a range of mission types and tools

These activities will enable the formulation of an adaptive pathway forward that can adjust to changing science objectives, motivations, and capabilities (e.g., in response to new discoveries)

# Exploration & Science

- Through synergies with driving science objectives, resources and hazards will be identified, quantified, and characterized
- Forward-moving strategies need to integrate various community roadmaps, as well as interagency, private/commercial partners, and international cooperation

# *[Possible]* Science Themes for the Next 35 Years

- Improved understanding of the composition and evolution of the Solar System through identification and characterization of potential resources and hazards
- What resources do we need and how do we identify & develop safe areas in the Solar System for long-term human habitation beyond low-Earth orbit (e.g., 100+ people, 1+ year)?

# *[Possible]* Daring Visions\*

\*As part of a science & technology path that can adapt to future capabilities and private/commercial infrastructures

## Activity (Planetary Defense)

## Science

Upgraded sky surveys (e.g., auto-surveys), hazard classification

Advanced monitoring and warning systems

Improved observation techniques (large telescopes, space/Moon-based telescopes, radar) to detect additional small objects

Demonstrations of mitigation strategies (kinetic, tractor)

Long-term strategy and plan for mitigating a variety of threats

**Knowledge of bodies > [140] m; structure and composition)**

Inform composition and evolution of the Solar System

## Activity (Resources)

## Science

Determine quantity and forms of key resources throughout S.S.: water (polar, subsurface, mineral-bound), oxygen, metals, building materials

Improved mapping and determinative techniques (ride-alongs, orbiters, rovers, in-situ, sample return)

Determine and demonstrate the potential uses: fuel, life-support, radiation defense, in-situ energy production, economic drivers

Use Moon as testbed for demonstrations (ISRU, and human expansion)

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Inform composition and evolution of the Solar System

**Expand sustainable human activities in space beyond low-Earth orbit**