Asteroid Redirect Mission

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The Future of Human Space Exploration

NASA’s Building Blocks to Mars

- Pushing the boundaries in cis-lunar space
- Developing planetary independence by exploring Mars, its moons, and other deep space destinations

U.S. companies provide affordable access to low Earth orbit

Mastering the fundamentals aboard the International Space Station

The next step: traveling beyond low-Earth orbit with the Space Launch System rocket and Orion crew capsule

- Missions: 6 to 12 months
  - Return: hours
- Missions: 1 month up to 12 months
  - Return: days
- Missions: 2 to 3 years
  - Return: months

Earth Reliant | Proving Ground | Earth Independent
Asteroid Redirect Mission

Asteroid Identification:
Ground and space based near Earth asteroid (NEA) target detection, characterization and selection

Asteroid Redirect Robotic Mission:
High power solar electric propulsion (SEP) based robotic asteroid redirect to lunar distant retrograde orbit

Asteroid Redirect Crewed Mission:
Orion and Space Launch System based crewed rendezvous and sampling mission to the relocated asteroid
Asteroid Redirect Mission
Builds on Investments Already Being Made by NASA

• ARM integrates several building blocks of human space exploration to initiate deep space exploration
  – ISS experience
  – Orion and SLS
  – SEP and other technologies

• Contributes significantly to the extension of the human exploration of space beyond LEO in an affordable and sustainable way
  – Operate 1000 times farther than LEO for the first time in 4 decades.
  – Longer duration beyond LEO crewed mission than ever
Near Earth Object Identification – Key Assets

Catalina Sky Survey
- University of Arizona – Tucson

Utilize Radar (Goldstone and Arecibo) increased time for NEO observations.
- Goldstone Radar
- Arecibo Observatory

NEOWISE reactivated and dedicated to NEO Search & Characterization
- JPL Sun-synch LEO

NASA InfraRed Telescope Facility (IRTF)
- Increase On-call for Rapid Response.
- Improve Instrumentation for Spectroscopy and Thermal Signatures.
Asteroid Redirect Mission: Two Robotic Capture Options
Asteroid Redirect Crewed Mission Overview

Deliver crew on SLS/Orion

EVA from Orion to retrieve asteroid samples

Orion Docks to Robotic Spacecraft

Return crew safely to Earth with asteroid samples in Orion
Asteroid Redirect Mission Provides Capabilities For Deep Space/Mars Missions

**In-space Power and Propulsion:**
- High Efficiency Solar Arrays and SEP advance state of art toward capability required for Mars
- Robotic ARM mission 40kW vehicle components prepare for Mars cargo delivery architectures
- Power enhancements feed forward to Deep Space Habitats and Transit Vehicles

**EVA:**
- Build capability for future exploration through Primary Life Support System Design which accommodates Mars
- Test sample collection and containment techniques including planetary protection
- Follow-on missions in DRO can provide more capable exploration suit and tools

**Crew Transportation and Operations:**
- Rendezvous Sensors and Docking Systems provide a multi-mission capability needed for Deep Space and Mars
- Asteroid Initiative in cis-lunar space is a proving ground for Deep Space operations, trajectory, and navigation.