

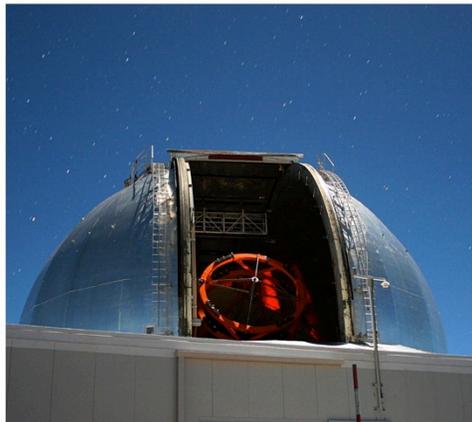
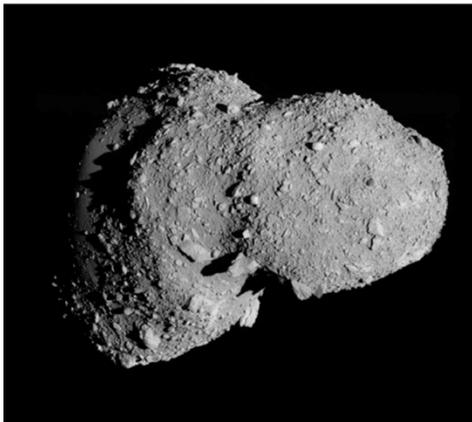
National Aeronautics and Space Administration



# NASA Asteroid Initiative

## Ideas Synthesis Continuation

Michele Gates, NASA Headquarters



November 20, 2013

# FY14 Asteroid Initiative



Both sets of activities leverage existing NASA work while amplifying participatory engagement to accomplish their individual objectives and synergize for a greater collective purpose.

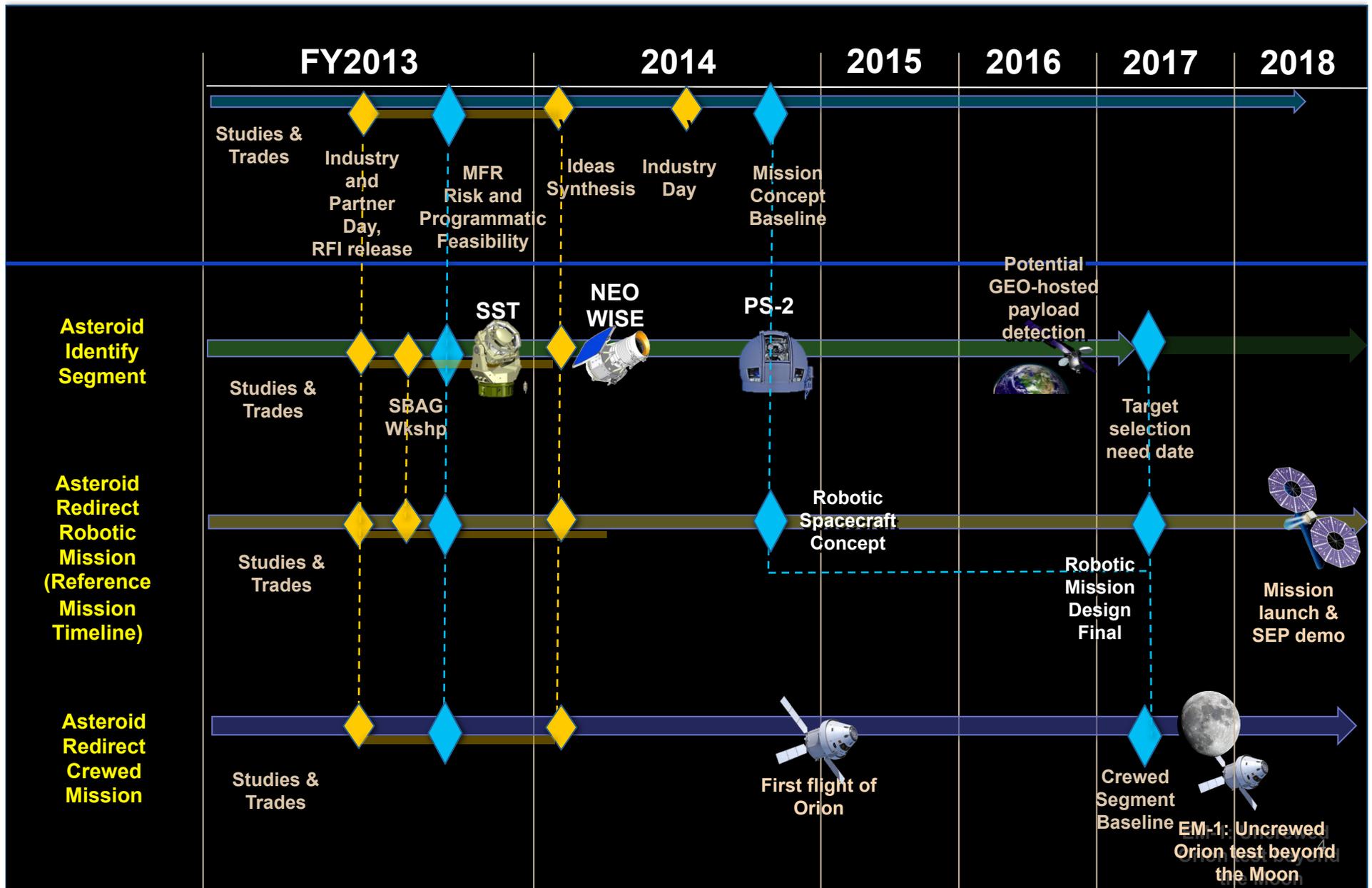
# Asteroid Grand Challenge



**Find all asteroid threats to  
human populations  
and know what to do about them**



# Asteroid Redirect Mission Strategy



# Preliminary Asteroid Redirect Mission Objectives for Option Integration



- **Primary Objectives**

- **Human Exploration in the mid-2020's that Prepares for Future Exploration**

- Initial use of systems and components, operational experience beyond LEO, crew risk reduction

- **Technology Demonstration: Advanced Solar Electric Propulsion**

- High power, long lifetime
- Enables future deep-space human exploration and enables multiple applications for Nation's aerospace community

- **Enhanced Detection and Observation of Near Earth Asteroids for Planetary Defense**

- **Secondary Objectives**

- **Asteroid Deflection Demonstration/Proof of Concept for Planetary Defense**

- **Science**

- **Partnership Opportunities (International and Commercial)**

- **Ground Rules**

- **Affordability**

- **Manageable Technical Risk Tolerance**

- **Programmatic Viability**

# NASA Asteroid Redirect Mission Internal Studies



## Reference robotic mission concept

- To redirect a small near Earth asteroid and potentially demonstrate asteroid deflection
- Study led by the Jet Propulsion Laboratory

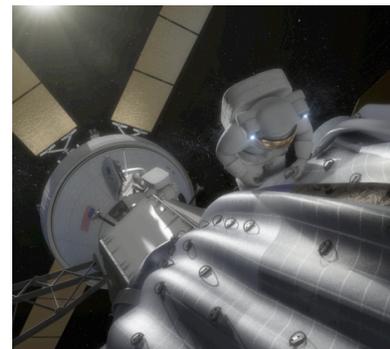


## Alternate robotic mission concept

- To redirect a small mass from a larger asteroid and potentially demonstrate asteroid deflection
- Study led by the Langley Research Center

## Crewed Mission

- Crew rendezvous and sampling for either concept
- Led by the Johnson Space Center



# Mission Integrated Planning Status



- **On-going study tasks issued to better understand technical and programmatic aspects.**
- **Fold in Request for Information (RFI) synthesis.**
- **Chartered a robotic concept integration team**
  - Assess the internal concepts and RFI synthesis recommendations against a set of mission objectives and figures of merit
  - Recommendations on FY14 activities
- **Consistent with Strategic Implementation Planning guidance, acquisition strategy foundation is to leverage on-going work**
- **Pursue partnerships and participatory engagement**
- **Internal status briefings Dec 17; February; April**
- **Spring 2014 Industry Day**
  - Share status and FY 14 plan updates
  - Communicate FY15 budget plan

# Asteroid Mission Advances Existing Policy Goals



- ***Advancing Exploration Path to Mars:*** Deep space operations , navigation, rendezvous and docking, Extra-Vehicular Activity, and inform and advance Mars exploration.
- ***Technology Development.*** This mission advances key technologies that will enable new capabilities throughout the aerospace community:
  - **High-power Solar Electric Propulsion :** enables multiple applications including orbital debris mitigation and satellite servicing
  - **Robotic Capture technology:** advances orbital debris mitigation, and satellite servicing applications
  - **Asteroid characterization and extraction:** Advances robotic techniques in extraction, mining, automated rendezvous and docking, in situ resource utilization and sample return
- ***Protect the Planet.*** Improvement of capabilities for asteroid detection, tracking and characterization will inform and advance planetary defense activities.
- ***New Industrial Capabilities.*** Demonstration mission could reveal potential for in situ resource utilization, leveraging existing private sector interests and investments and potentially create new markets.
- ***International and Commercial Cooperation:*** Enables expanded partnerships in trans-lunar space.
- ***Inspiration.*** This mission will send humans farther than they have ever been before and a first ever redirection of asteroid for exploration and sampling.

# Asteroid Initiative Request for Information



- **RFI released June 18; responses received July 18**
- **Areas of request:**
  - Asteroid Observation
  - Asteroid Redirection Systems
  - Asteroid Deflection Demonstrations
  - Asteroid Capture Systems
  - Crew Systems for Asteroid Exploration
  - Partnerships & Participatory Engagement
- **402 responses received**
- **Ideas Synthesis Meeting Sept 30; Nov 20-22**
  - Transparently explore the 96 highest rated responses
  - International, industry, science specifically invited
  - Meeting structured to provide input to planning

# Ideas Synthesis Meeting Objectives



- **The purpose of this workshop is to further examine and foster a broad discussion on these newest ideas and help inform NASA's planning activities.**
- **We will listen to, discuss, debate, and synthesize 96 of the RFI responses.**
- **NASA personnel will serve as leads in our discussions. We ask for your active participation - virtual participants too!**
- **Each session of the workshop will be streamed online, and virtual participants are encouraged to join the chat rooms and send questions to the session leads via Twitter.**
- **Seating is auditorium style for capacity reasons - the desire is two-way communication. We want to know what you think! We/ NASA have already read and discussed the RFIs.**
- **Mission and Grand Challenge planning will use the findings.**

# Session Leads Synthesis Outbriefs- Friday Morning



- 1. Session Purpose**
- 2. RFI Selection Process**
- 3. Agenda**
- 4. Key Topics Discussed**
- 5. Findings for Asteroid Redirect Mission Planning\***
  - Summary of the most promising ideas, including their innovativeness and potential for improving mission/system performance and affordability.
  - Any technology development needed to mature the ideas to the point where they can be incorporated into system designs.
  - Relationships or linkages between the ideas that could help with mission/system concept integration.
  - Further studies or next steps
- 6. Findings for Grand Challenge Planning\***
  - Summary of the promising ideas
  - Identification of overlap and synergy between the presented ideas
  - Prioritization of immediate actions

\* Some can be combined, if appropriate

The background of the slide is a dark, star-filled space. In the lower-left foreground, the curved, blue-tinted horizon of a planet is visible. The rest of the space is filled with numerous small, bright stars and some larger, fainter celestial objects. A horizontal band of slightly lighter, hazy space runs across the middle of the image, where the main text is located.

A DEEPER VISION, **A BOLDER MISSION**, ONE STEP AT A TIME

Step One:  
**2014**