

National Aeronautics and Space Administration



Broad Agency Announcement Virtual Industry Forum

April 25, 2016

NextSTEP

Next Space Technologies for Exploration Partnerships

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www.nasa.gov/nextstep

Forum Purpose



- Provide an overview of the NextSTEP-2 Broad Agency Announcement, Appendix A released on April 19, 2016, which seeks proposals for deep space habitation system concepts and architectures and development of ground prototype habitat modules
 - <https://www.fbo.gov/index?s=opportunity&mode=form&tab=core&id=cc98f982cc85bc0c9d1461bc5edd9286>
- Provide background on NASA's Journey to Mars
- Address questions from potential respondents

Agenda



- Review Ground Rules
- Introductions
- Evolvable Mars Campaign Background
 - NextSTEP Phase 2 Objectives
- Appendix A Solicitation Overview
- Questions
 - Verbal questions during Q&A period of the forum
 - E-mail questions to: hq-nextstep-baa@mail.nasa.gov

QUESTIONS?

Press *1 to be added to the queue or email HQ-NextSTEP-BAA@mail.nasa.gov

Forum Ground Rules

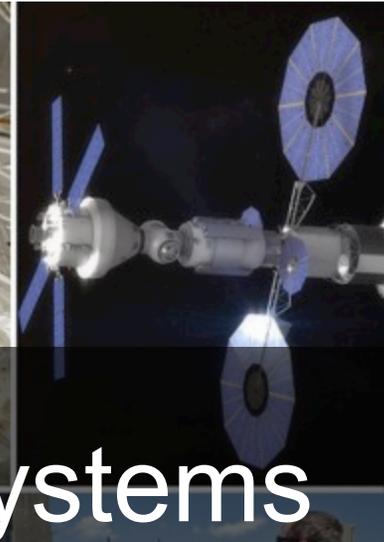


- NASA will address questions during this teleconference to clarify the content of the Announcement
- Please submit questions via webex chat. Questions asked orally in the meeting (not via chat) should be submitted in writing following the forum to <http://www.nasa.gov/nextstep>
- Potential respondents may also submit questions in writing to the following email address: hq-nextstep-baa@mail.nasa.gov
- Questions that require further assessment to address will be resolved as soon as possible after the forum, and the answers will be included in the Q&A log
- NASA will not provide evaluations, opinions, or recommendations regarding any suggested approaches or concepts
- The Announcement and written answers posted to the NextSTEP website take precedence over all verbal discussions, including this forum
- **Deadline for written technical questions is [Monday, May 2, 5pm EDT]**

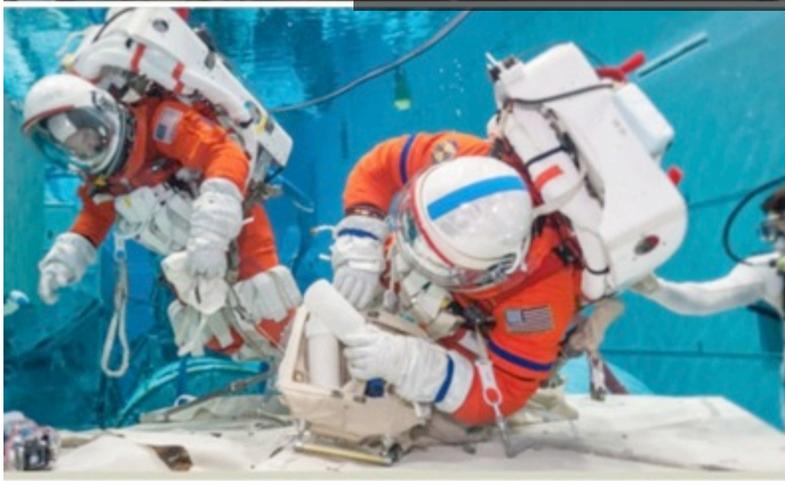
Key NASA Representatives



- **Jason Crusan**, Director of Advanced Exploration Systems (AES), Human Exploration and Operations Mission Directorate (HEOMD)
- **Doug Craig**, Strategic Analysis Manager, HEOMD/AES
- **Mike Ching**, Technical Advisor
- NASA Ancillary Staff Representatives



NASA Advanced Exploration Systems



Advanced Exploration Systems



CREW MOBILITY SYSTEMS

- Systems to enable the crew to conduct “hands-on” surface exploration and in-space operations, including advanced space suits, portable life support systems, and EVA tools.

HABITATION SYSTEMS

- Systems to enable the crew to live and work safely in deep space, including beyond earth orbit habitats, reliable life support systems, radiation protection, fire safety, and logistics reduction.

VEHICLE SYSTEMS

- Systems to enable human and robotic exploration vehicles, including advanced in-space propulsion, extensible lander technology, modular power systems, and automated propellant loading on the ground and on planetary surfaces.

FOUNDATIONAL SYSTEMS

- Systems to enable more efficient mission and ground operations and those that allow for more Earth independence, including autonomous mission operations, avionics and software, in-situ resource utilization, in-space manufacturing, synthetic biology, and communication technologies.

ROBOTIC PRECURSOR ACTIVITIES

- Robotic missions and payloads to acquire strategic knowledge on potential destinations for human exploration to inform systems development, including prospecting for lunar volatiles, secondary payloads on EM-1 and Mars 2020, instrument development, and research and analysis.

STRATEGIC OPERATIONS, INTEGRATION, AND STUDIES

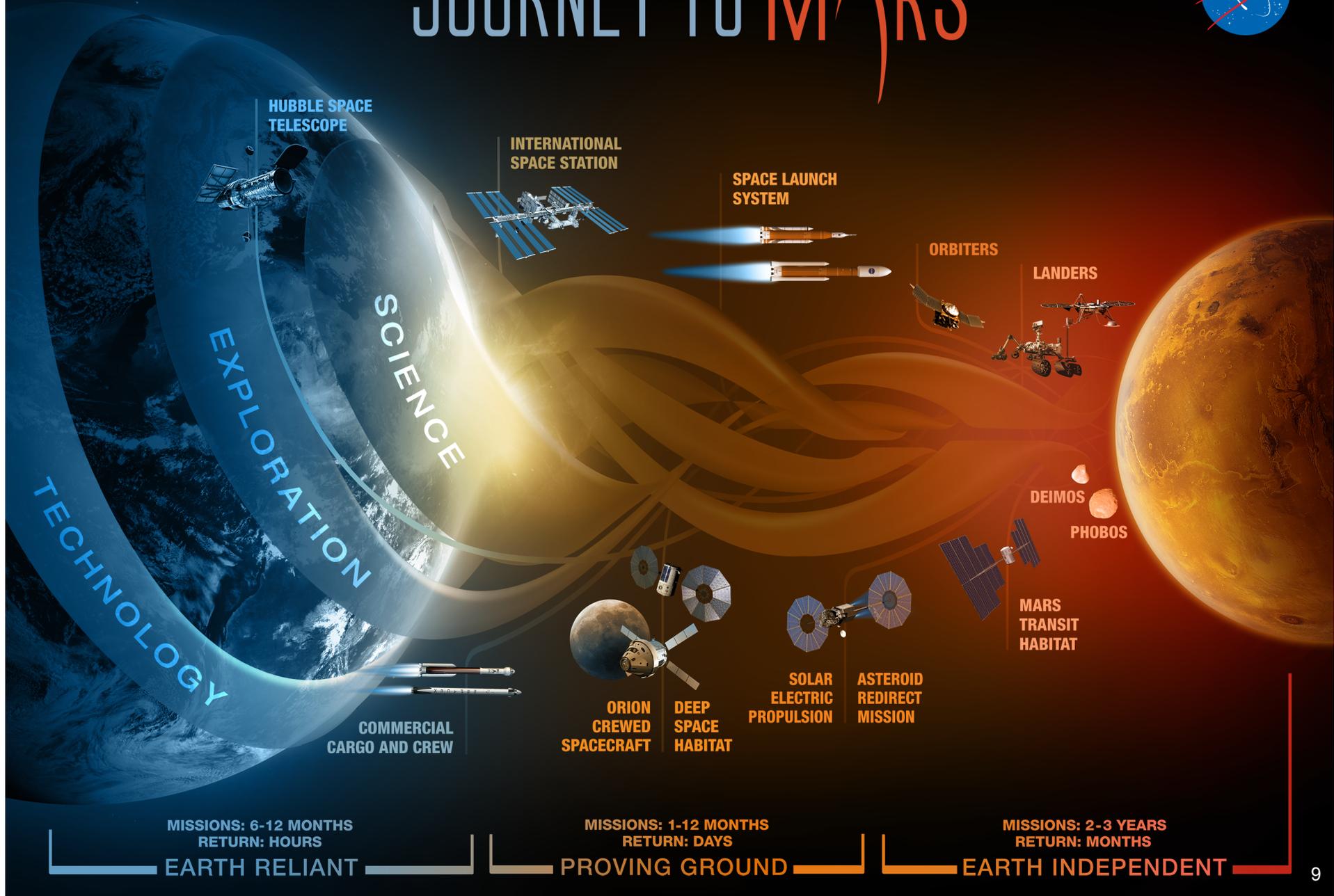
- Responsible for the management oversight of the HEO architecture and strategic planning, including mission and systems analysis and international coordination. Conduct studies and analyses to translate strategy into developmental (technology and capability) priorities and operational efficiencies.

NextSTEP-2 Omnibus Broad Agency Announcement (BAA)



- Umbrella BAA solicitation covering multiple areas of research by AES
 - Original Release April 19, 2016: NNHZCQ001K
 - Effective through December 2017
- Specific Research Opportunities announced periodically as Appendices
- Umbrella BAA document contains information relevant to all Appendix solicitations
 - Information may be augmented by or superseded in Appendices
 - May result in awards of grants, cooperative agreements (CA), or contracts
 - Eligibility requirements, proposal instructions, proposal review information
- Appendices contain details specific to the research being sought
 - Funding, expected number/type of awards (grant, CA, contract)
 - Proposal instructions where it may differ from the omnibus
- First Appendix released April 19
 - Appendix A: Habitat Systems: NNHZCQ001K-Habitat

JOURNEY TO MARS



MISSIONS: 6-12 MONTHS
RETURN: HOURS
EARTH RELIANT

MISSIONS: 1-12 MONTHS
RETURN: DAYS
PROVING GROUND

MISSIONS: 2-3 YEARS
RETURN: MONTHS
EARTH INDEPENDENT

Strategic Principles for Sustainable Exploration

- FISCAL REALISM: Implementable in the *near-term with the buying power of current budgets* and in the longer term with budgets commensurate with economic growth;
- SCIENTIFIC EXPLORATION: *Exploration enables science and science enables exploration*; leveraging scientific expertise for human exploration of the solar system.
- TECHNOLOGY PULL AND PUSH: Application of high TRL technologies for near term missions, while focusing sustained investments on *technologies and capabilities* to address the challenges of future missions;
- GRADUAL BUILD UP OF CAPABILITY: *Near-term mission opportunities* with a defined cadence of compelling and integrated human and robotic missions, providing for an incremental buildup of capabilities for more complex missions over time;
- ECONOMIC OPPORTUNITY: Opportunities for *U.S. commercial business* to further enhance their experience and business base;
- ARCHITECTURE OPENNESS AND RESILIENCE: Resilient architecture featuring multi-use, evolvable space infrastructure, minimizing unique developments, with each mission leaving something behind to support subsequent missions;
- GLOBAL COLLABORATION AND LEADERSHIP: Substantial *new international and commercial partnerships*, leveraging current International Space Station partnerships and building new cooperative ventures for exploration; and
- CONTINUITY OF HUMAN SPACEFLIGHT: *Uninterrupted expansion of human presence into the solar system* by establishing a regular cadence of crewed missions to cislunar space during ISS lifetime.

Evolvable Mars Campaign – Study Activity

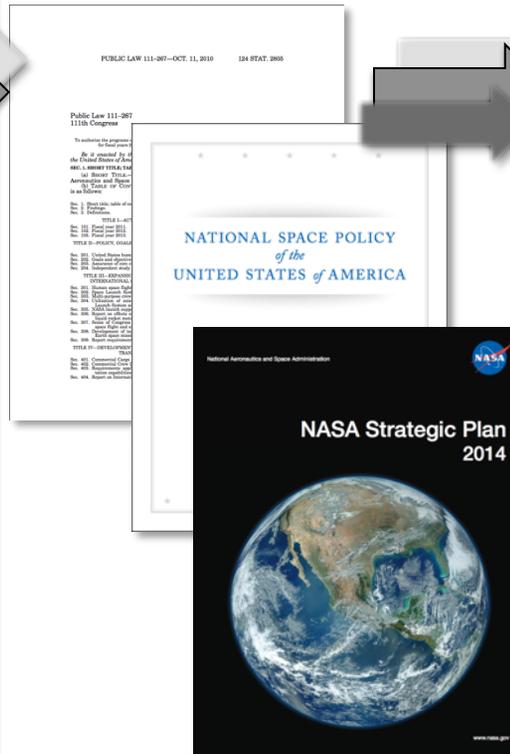


Body of Previous Architectures, Design Reference Missions, Emerging Studies and New Discoveries



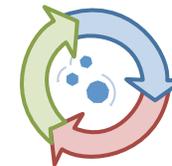
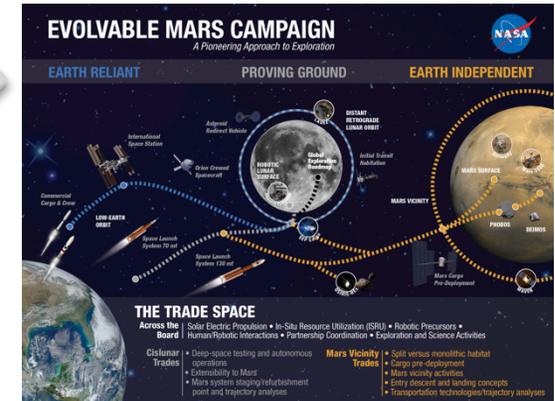
- Internal NASA and other Government
- International Partners
- Commercial and Industrial
- Academic
- Technology developments
- Science discoveries

2010 Authorization Act, National Space Policy, NASA Strategic Plan



- Establish capacity for people to live and work in space indefinitely
- Expand human presence into the solar system and to the surface of Mars

Evolvable Mars Campaign



- An ongoing series of architectural trade analyses to define the capabilities and elements needed for a sustainable human presence on Mars
- Builds off of previous studies and ongoing assessments
- Provides clear linkage of current investments (SLS, Orion, etc.) to future capability needs

Evolvable Mars Campaign

EMC Goal: Define a pioneering strategy and operational capabilities that can extend and sustain human presence in the solar system including a human journey to explore the Mars system starting in the mid-2030s.

- Identify a plan that:
 - Expands human presence into the solar system to advance exploration, science, innovation, benefits to humanity, and international collaboration.
 - Provides different future scenario options for a range of capability needs to be used as guidelines for near term activities and investments
 - In accordance with key strategic principles
 - Takes advantage of capability advancements
 - Leverages new scientific findings
 - Flexible to policy changes
 - Identifies linkages to and leverage current investments in ISS, SLS, Orion, ARM, habitation module, technology development investments, science activities
 - Emphasizes prepositioning and reuse/repurposing of systems when it makes sense
 - Use location(s) in cis-lunar space for aggregation and refurbishment of systems

Internal analysis team members:

- ARC, GRC, GSFC, HQ, JPL, JSC, KSC, LaRC and MSFC
- HEOMD, SMD, STMD, OCS and OCT

External inputs from:

- International partners, industry, academia, SKG analysis groups

EVOLVABLE MARS CAMPAIGN

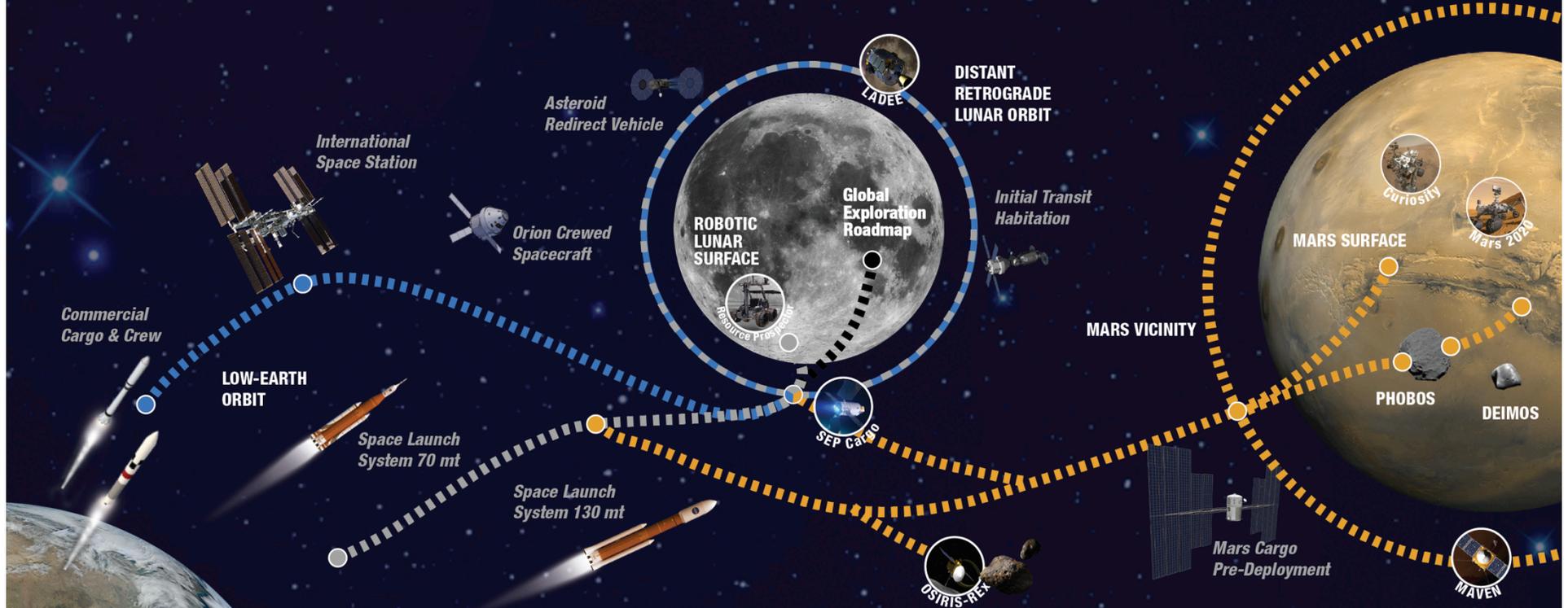
A Pioneering Approach to Exploration



EARTH RELIANT

PROVING GROUND

EARTH INDEPENDENT



THE TRADE SPACE

Across the Board | Solar Electric Propulsion • In-Situ Resource Utilization (ISRU) • Robotic Precursors • Human/Robotic Interactions • Partnership Coordination • Exploration and Science Activities

Cislunar Trades |

- Deep-space testing and autonomous operations
- Extensibility to Mars
- Mars system staging/refurbishment point and trajectory analyses

Mars Vicinity Trades |

- Split versus monolithic habitat
- Cargo pre-deployment
- Mars vicinity activities
- Entry descent and landing concepts
- Transportation technologies/trajectory analyses¹³

Evolvable Mars Campaign – Strategy Development



Updated Information



- System performance
- Reliability
- Destination information
- Cost, schedule, etc.



JOURNEY TO MARS

Human Mars Missions are challenging Everything we are doing now to send the first human pioneers to the Martian system

TRADE STUDIES

Architectural trade analyses defining capabilities for human Mars missions.
Major Study Questions (A-N) • System Maturation Team Capability information • Existing Program Data



CAPABILITIES REQUIRED

Earth to space transportation • Habitation • In-space transportation • Destination systems

COMPLEXITIES AND CHALLENGES

Risk Areas • Programmatic Dependencies



FLIGHT TEST OBJECTIVES

Earth Reliant • Proving Ground • Earth Independent

IMPLEMENTATION STRATEGIES AND DECISIONS

Transportation • Working in space • Staying Healthy



PROGRAMS AND PROJECTS

International Space Station • Asteroid Redirect Mission • Habitation

Summary Results



- The Journey to Mars requires a resilient architecture that can embrace new technologies, new international / commercial partners, and identify agency investment choices to be made in the near, mid and long term.
- Regardless of which path is ultimately selected, there are a set of common capabilities required to be developed by NASA and its partners over the next 5 to 10 years
- Deep-space habitation serves as initial starting point regardless of implementation or destination



Habitation System Goals



System	Includes	Today	Mars Goal
Life Support	Air revitalization, water recovery, waste collection and processing	42% recovery of O ₂ from CO ₂ ; 90% recovery of H ₂ O; <6 mo MTBF for some components	>75% recovery of O ₂ from CO ₂ ; >98% recovery of H ₂ O; >2 yr MTBF
Environmental Monitoring	atmosphere, water, microbial, particulate, and acoustic monitors	Limited, crew-intensive on-board capability; rely on sample return to Earth	On-board analysis capability with no sample return; identify and quantify species and organisms in air & water
Crew Health	exercise equipment, medical treatment and diagnostic equipment, long-duration food storage	Large, cumbersome exercise equipment, limited on-orbit medical capability, food system based on frequent resupply	Small, effective exercise equipment, on-board medical capabilities, long-duration food system
EVA	Exploration suit	ISS EMU's based on Shuttle heritage technology; not extensible to surface ops	Next generation spacesuit with greater mobility, reliability, enhanced life support, operational flexibility
Fire	Non-toxic portable fire extinguisher, emergency mask, combustion products monitor, fire cleanup device	Large CO ₂ suppressant tanks, 2-cartridge mask, obsolete fire products. No fire cleanup other than depress/repress	Unified fire safety approach that works across small and large architecture elements
Radiation Protection	Low atomic number materials including polyethylene, water, or any hydrogen-containing materials	Node 2 CQ's augmented with polyethylene to reduce the impacts of trapped proton irradiation for ISS crew members	Solar particle event storm shelter based on optimized position of on-board materials and CQ's with minimized upmass to eliminate major impact of solar particle event on total mission dose

NextSTEP BAA – Habitation Systems



The following are the type of missions that could be supported by the NextSTEP BAA habitation systems that ultimately lead to a shakedown cruise:

- Long Duration Exploration Systems Testing
- Automation, Tele-operations, and Robotics
- In Situ Resource Utilization (ISRU) Demonstration Missions
- Human Research in Deep Space
- Logistics Support
- General Science
- Human Assisted Sample Return (e.g., Asteroid Redirect Mission)

Transition from ISS to Cislunar Space: Framework



Today

Phase 0: Exploration Systems *Testing on ISS*

Ends with testing, research and demos complete*

Asteroid Redirect-Crewed Mission Marks Move from Phase 1 to Phase 2

Proving Ground Phase 1: *Cislunar Flight Testing* of Exploration Systems

Ends with one year crewed Mars-class shakedown cruise

Proving Ground Phase 2: *Cislunar Validation* of Exploration Capability

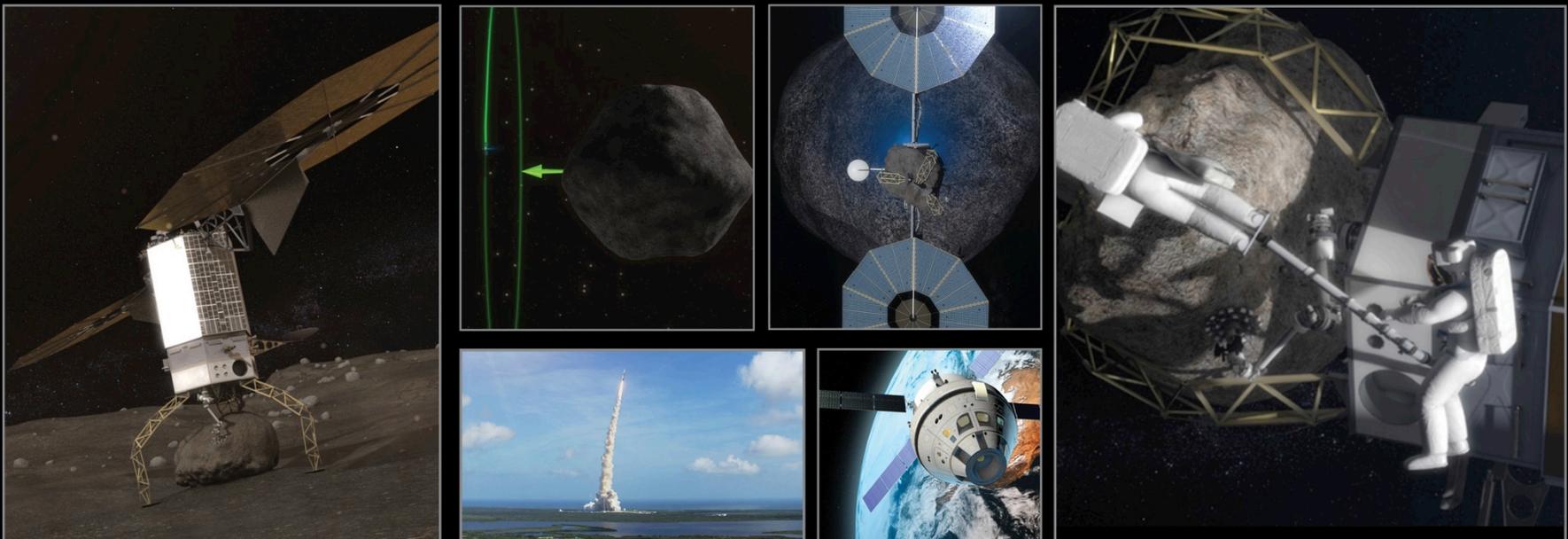
Mid-2020s

2030

*There are several other considerations for ISS end-of-life



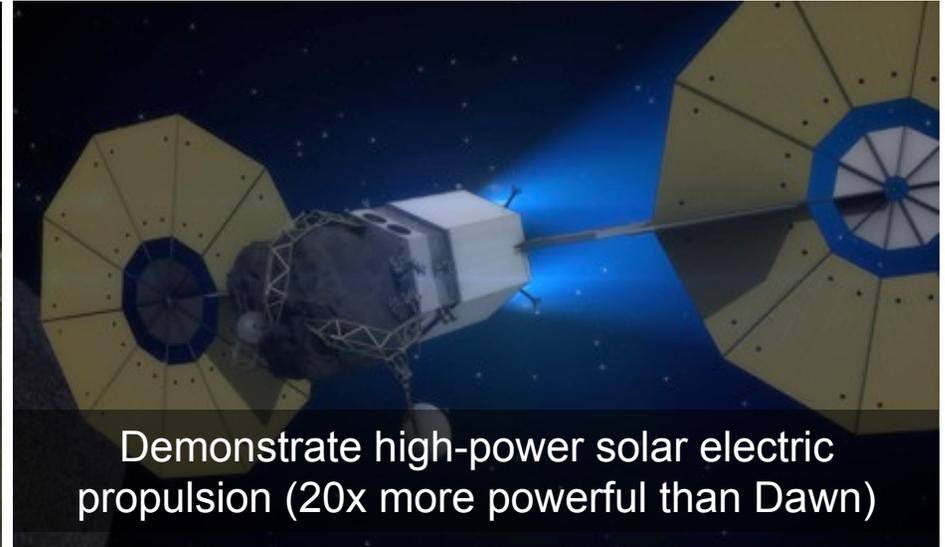
Asteroid Redirect Mission: Working in Remote Environments



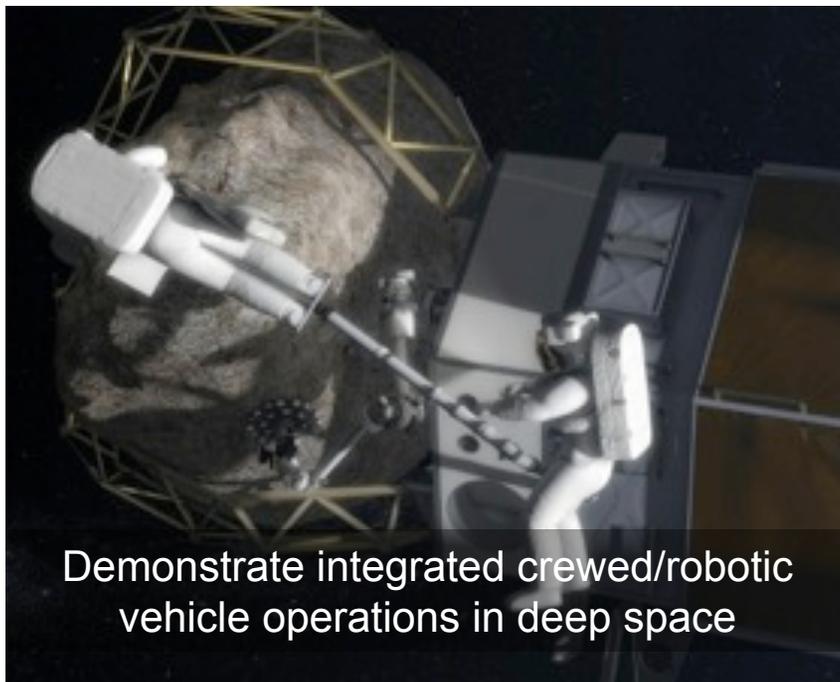
ARM Objectives in Support of Human Exploration



Demonstrate advanced autonomous proximity operations in deep space and with a natural body



Demonstrate high-power solar electric propulsion (20x more powerful than Dawn)



Demonstrate integrated crewed/robotic vehicle operations in deep space



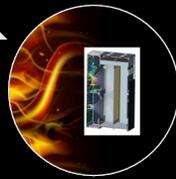
Demonstrate astronaut EVA in deep space, and sample selection, handling, and containment on just the second extra-terrestrial body in history

Deep-Space Habitation Development Strategy

Proving Ground Phase 0: SYSTEMS DEVELOPMENT AND TESTING ON ISS / LEO



Bigelow
Expandable
Activity Module



Spacecraft
Fire Safety

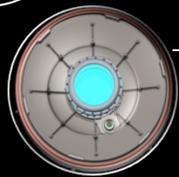


Logistics
Reduction

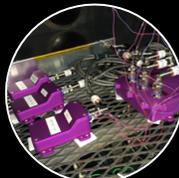
Advanced Explorations System Projects



Life Support
Systems



Docking
Hatch



Radiation
Detection



Advanced
Avionics



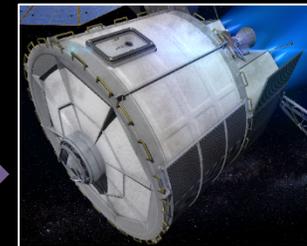
EVA

Proving Ground Phase 1: DEEP SPACE TESTING



Initial Cislunar
Habitation

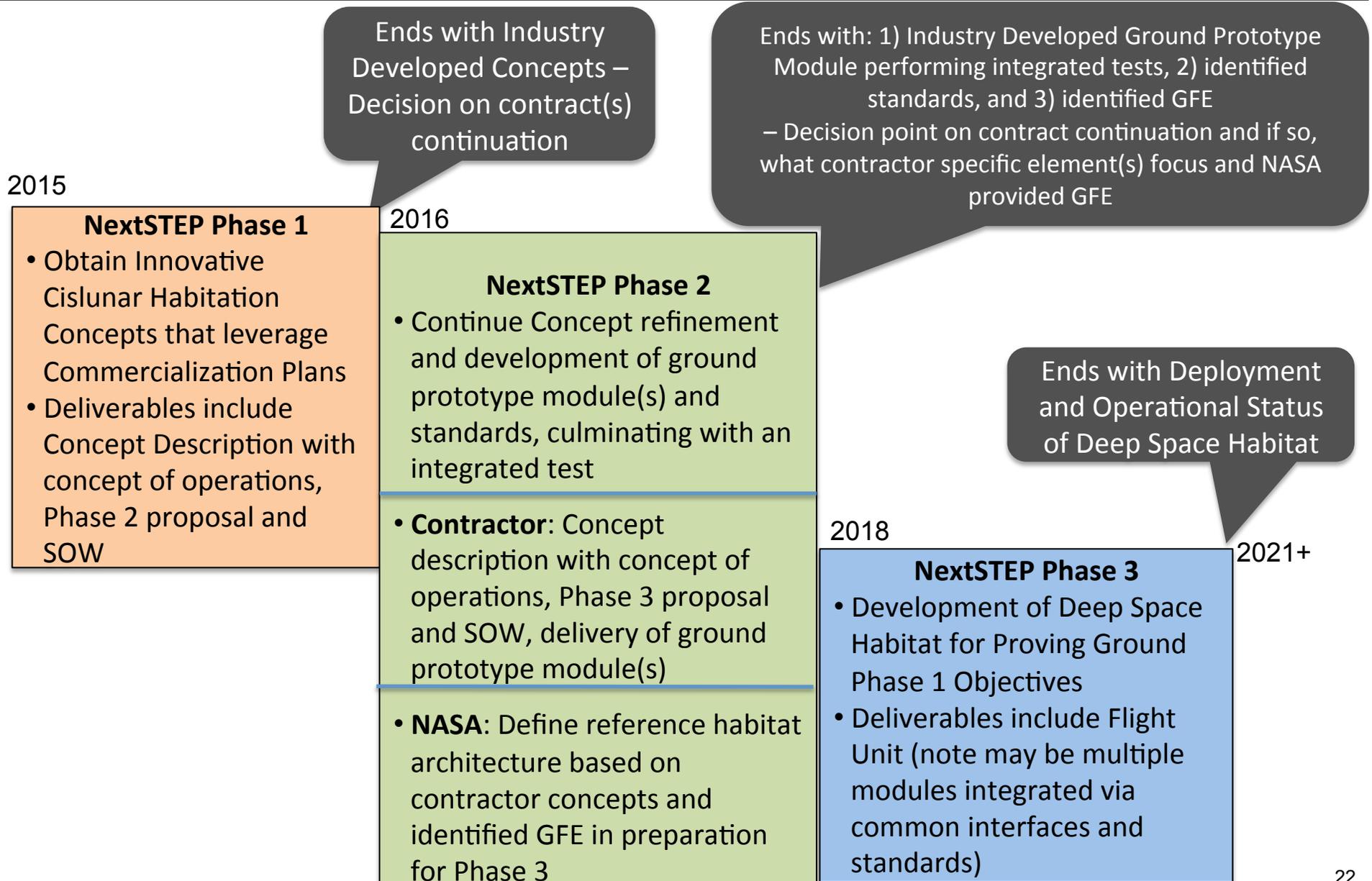
Proving Ground Phase 2: DEEP SPACE VALIDATION



Long Duration
Habitation

**Shakedown
Cruise**

NextSTEP BAA Habitat Development Approach



Action – Begin NextSTEP BAA Habitation Systems Phase 2 by August 2016



NASA Received an action to accelerate NextSTEP BAA Phase 2 start to FY16

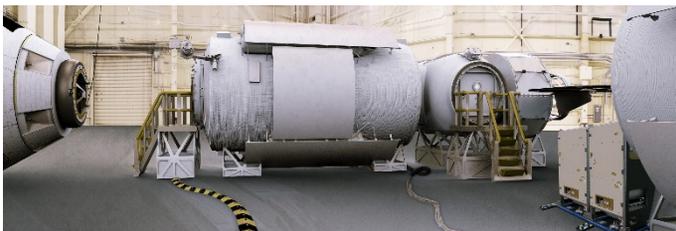
- Phase 2 to start Aug 2016 with FY16 funds
 - Phase 2 PoP: Aug 2016 - June 2018 split into options
 - Currently projected FY16 & 17 funding: \$65M (in addition to the \$7.4M FY16 funding used for phase 1)
 - Expected to carryover funding for both years
- Provide “on ramp” opportunity for additional industry partners
 - Using NextSTEP #2 umbrella BAA – Appendix A covering habitat concepts
 - Proposer to deliver Phase 2 Proposal and SOW (same content as required for the Phase 1 contractors)

NextSTEP BAA Habitation Phase 2 - Goal



- Develop long duration deep space habitation capabilities that lead towards a deep space transit habitat and can be flown on SLS flight(s) (or alternative launch vehicles) starting by the early to Mid 2020s
- Advance the long duration deep space habitation system concepts and mature the design and development of the integrated system(s) to achieve a high level of fidelity
 - From appropriations bill: “Develop prototype deep space habitation module within the advanced exploration systems program no later than 2018.”
 - NASA interprets this as direction as to develop/test a full size ground prototype unit by the end of Phase 2 to support first flight opportunities in Early to Mid 2020s
- Potential for different capabilities from domestic and international suppliers will require standards and common interfaces for aggregation. NASA led standards working group will be implemented during Phase 2.

Ground Prototype units delivered to NASA for testing and integration of NASA/AES developed capabilities



- Testing includes form, fit, volumetric, subsystem integration, and interface standards
- May use NASA-developed node/airlock and hab mockups for integration testing with contractor modules
- Ensures consistent test and interface verification approach, allows us to incorporate and test other AES subsystems, facilitates crew training and feedback on human factors, shows stakeholders progress

NextSTEP BAA Habitation - Phase 2 Objectives



- NASA expects proposals submitted to be based upon rigorous concept development, architecture and trade studies. Early milestones in proposals may include validation of concepts relative to NASA's long duration deep space habitation system strategy.
- Develop complete deep space long duration architecture designs
 - Evolvable, modular architecture, functional allocation options
 - Co-developed standards, common interfaces required to enable interoperability of the aggregate system
 - Testing approaches
- Mature the design of the overall deep space integrated system(s) and, at a minimum, develop a full size, ground prototype of the portion of your design that provides the majority of the habitation capabilities for form, fit, and partial function integration testing
- Achieve level of fidelity in concepts for confidence that protoflight vehicle(s)/modules can be produced for flight in the early to mid 2020s
 - Potential for different suppliers for the multiple capabilities needed with standard interfaces for aggregation. (e.g. service module from one, habitation from another, airlock from another)

NextSTEP BAA Habitation - Phase 2 Objectives (cont'd)



- Further define and develop deep space habitation capabilities that can be flown as co-manifested payloads on SLS Block 1B with an initial SLS co-manifesting capability of 4 – 6 metric tons starting in early-to-mid 2020s, or later in the 2020s on a cargo-only version of SLS, or on alternative launch vehicles. Note the habitation system concept can be separated into multiple integrated modules with distributed functions. If the habitation concept is not flown on SLS, provide details of the launch vehicle assumptions.
- Identify commercial capability development for LEO that intersects NASA long duration deep space habitation requirements along with any potential option to maximize the leveraging of commercial LEO advancements towards meeting NASA long duration deep space habitation needs.
- Provide information on company end-to-end development effort and ROM costs for flight development - companies to provide a proposal, SOW, and fully priced Appendix A efforts and ROM costs for subsequent phases for engineering and flight unit development.
- Determine the level of government furnished contribution to overall habitation and habitation systems (e.g. life support systems, power systems, etc...)

Potential GFE to Be Reviewed During Phase 2



• Environmental Control & Life Support Systems

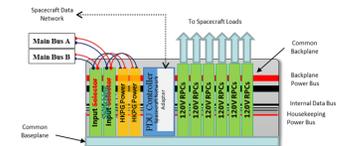
- Highly reliable, ISS-derived life support systems, including carbon dioxide removal, oxygen generation, waste water processing, trace contaminant control, and environmental monitoring for atmosphere, water and surfaces.
- Universal Waste Management System - development of compact toilet for smaller volumes of exploration vehicles
- Ground test bed for integrated ECLSS systems that could be linked to prototype habitat.



Integrated ECLSS test bed at MSFC

• Modular Power Systems

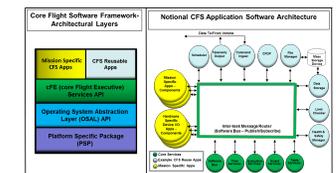
- Modular power systems standards and interfaces to provide commonality across a variety of exploration vehicles.
- Interchangeable modular power distribution units and power converters.
- Autonomous power system fault detection and recovery.
- Integrated modular power systems test bed at JSC that could be linked to prototype habitat.



Modular PDU

• Avionics and Software

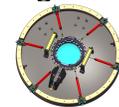
- Common avionics architectures based on an open source Time Triggered Ethernet data bus that can be used by a variety of exploration vehicles.
- High performance processors, voting flight computers, and wireless instrumentation.
- Core Flight Software certified for human missions.
- Integrated avionics and software test bed at JSC that could be linked to prototype habitat.



Core Flight Software

• Docking Hatch

- Prototype lightweight docking hatch that can be used as a standard interface between exploration vehicles



Exploration Docking Hatch

• Radiation Monitoring, Modeling, and Protection

- Development radiation sensors and concepts for storm shelters.



Radiation Assessment Detector

NextSTEP BAA Habitation Phase 2 Award Information



- Will award multiple contracts in Aug 2016. Funding levels depend on FY16 - FY18 appropriations and proposed content.
 - Will mitigate budget uncertainty with structured options from proposal and resulting structured CLINs on the contract that can be incrementally funded.
 - CLINs will be activated on availability of funding.
- An estimated \$65M will potentially be available in FY16 and FY17 with potential of additional funding in FY18.
- Estimated period of performance ~NTE 18 months with an additional 6 month no cost option period to support NASA test and negotiate potential follow on phase(s)
 - 18 months would mean going from Aug/Sep 2016 – April 2018
 - Follow-on activities in the 6 month no cost phase includes the shipment of selected contractor modules to NASA for integration and testing
- 30% minimum corporate contribution with at least half during the period of performance.
 - Only can look back one year for partner contribution

Schedule



<u>Event</u>	<u>Scheduled Date</u>
Provide SOW guidance and selection criteria	March
- Release NextSTEP BAA #2	April 19
- Industry Forum	April 25
Phase 2 Proposals and SOW due	June 15
Select/Negotiate Contracts	July
Sign/Award Contracts	Aug - Sep

QUESTIONS?

Press *1 to be added to the queue or email HQ-NextSTEP-BAA@mail.nasa.gov



Following are highlights of the detailed guidance provided in the NextSTEP-2 Omnibus BAA and Appendix A: Habitat Systems. NextSTEP proposers are encouraged to review the solicitation in detail and follow the guidelines provided in the omnibus and Appendix A.

Eligible Participants



- **U.S. private-sector** entities including companies, universities, and non-profit organizations are eligible to submit proposals. Foreign institutions may participate as team members and will be subject to the NASA guidelines for foreign participation
- U.S. federal, state, and local government entities, including National Laboratories, Jet Propulsion Laboratory (JPL) employees, NASA Civil Servants and Federally Funded Research and Development Centers are not eligible to submit proposals
- **Proposers must show a minimum of 30% corporate contribution or matching** to the overall effort (overall effort = CR + Government resources)
 - Half of corporate contribution must be in the form of direct labor, travel, consumables or other in-kind contributions during the PoP
 - Other forms of corporate contribution such as investment in special facilities or equipment, tooling or other prior **private** investment, including Independent Research and Development (IRAD) are deemed acceptable for this effort if occurring within past 1 year

Phase 2 Contract Structure and Schedule (notional)



- **18-month development effort comprised of 12-month base and 6-month option 1.**
 - Phases 2a and 2b
 - Option provides flexibility to match work with available government resources and funding
- **3-6 month no-cost extension**
 - Provides period of government test and evaluation of results from Phases 2a and 2b
 - Allows for transition to potential follow on phases
- **Government Testing**
 - At the end of Phase 2a, certain modules will be designated for additional government test
 - Contractors shall price a CLIN/option for developing a shipping concept, preparing and packaging designated modules for shipping

Deliverables



- Focus is on data deliverables and development of selected hardware
 - Architecture design with functional allocation, interfaces and common standards
 - Hardware/software design documentation (including safety and health plans)
 - Contractor ground prototype test results
 - Final reports of integrated performance
 - Development of selected full size ground prototype modules
- In addition to the fixed price performance based milestones, contractors should propose routine deliverables as well as the technical data and engineering reports on the development:
 - Quarterly project status/technical briefings (past quarters activities, upcoming activities, risks retired, financials, other)
 - Quarterly technical reports (NASA intends to provide a format)
 - Monthly progress/status reports (NASA will provide an abbreviated format)
 - Bi-weekly telecons with NASA
- Participation in NASA-led standards and common interface working group
- Contract requirements documents:
 - Safety/Health plans
 - Technology invention reports

Milestones



- Contracts will be incrementally funded with payments made based on milestone achievements
- Technical Milestones mark substantive technical achievements where risks have been bought down or retired
 - Exemplars are Technical Reviews (ie, MCR, SRR, PDR, CDR, TRR), Completion of sub or system development, integration, or testing, Key Decision points in the lifecycle
 - Must have associated entrance/success criteria
 - Products or deliverables documenting evidence of successful achievement
- Payment Milestones
 - Must have evidence of successful achievement. Generally are tied to achievement of specific technical milestones
 - May occur no more than 1 per month and at least 1 per quarter
 - Shall be clearly traceable to the proposed WBS and CLIN structure of the proposal
 - The Government may select to activate or delay a subset of CLINs contained in the negotiated contract
- Milestones typically have a number, description, date, success criteria, payment amount (for Payment Milestones)

Additional Guidance



- The proposals shall identify all requests for Government furnished equipment, property, facilities or in-kind contributions required for successful completion of each CLIN
 - GFP/GFE must identify specific resources with pre-coordinated full account costing by the identified resource
 - Government tasks must be captured as separate SOW items
 - Potential areas for GFE include but not limited to Modular Power Systems, Avionics and Core Flight Software, Autonomous Systems, Delay Tolerant Networking, ECLSS
- Proposals should describe how the proposed system is on the path to a Mars class deep space transit habitat
- If choosing to launch on SLS, need to fit within 4-6MT. If not, need to include other launch vehicle assumptions, including SLS cargo version.
- Phase 2 deliverables shall include ground prototype module(s), Proposal and SOW for Phase 3 milestones (and schedule), deliverables and price
- NASA will provide ongoing technical expertise via TIMS or other forums to provide lessons learned and expertise. Proposal shall include an estimate of requested subject matter experts and/or documentation
- The contractors shall support an interface working group lead by NASA
 - Known requirements at this time include: NDS docking, exploration atmospheric environment, – links will be provided to reference materials

Proposal Content (1 of 3) – See Appendix A for details



- **Cover Page, Title Page**
- **Section I: Executive Summary (2-4 pages)**
 - No proprietary content (publicly releasable)
- **Section II: Proof of Eligibility**
- **Section III: System Concept (sections III-IV 15 pages)**
 - Concept description and how it functions
 - How concept addresses objectives/requirements
 - Anticipated improvements in Technology Readiness Level (TRL)
- **Section IV: Technical Approach**
 - Approach and schedule for designing, analyzing, and testing
 - Plans to mature key technologies, critical risks/mitigation plans

Proposal Content (2 of 3)



- **Section V: Business Addendum**
 - Business overview
 - Define customer/partnership model
 - List business case(s) that are leveraged by the hardware development
 - Identify overlap between LEO and cislunar capabilities/technologies and how investing in cislunar supports/enables LEO commercial activities
 - Overview of end-to-end development schedule with estimated price
 - Business risks
- **Section VI: Capabilities (2 pages)**
 - Evidence of existing capabilities for designing and developing space-qualified systems applicable to the BAA objectives
- **Section VII: Intellectual Property (1 page)**
 - Approach for data rights and inventions
 - Describe how approaches meet the objectives outlined under Section 2.3, Intellectual Property

Proposal Content (3 of 3)



- **Section VIII: Price Proposal (no limit)**
 - Overall Firm fixed price
 - Content and format contained in omnibus BAA and Appendix A
 - Relationship of corporate resources to the price
 - GFP/GFE resources
- **Attachments:**
 - Quad chart showing an overview of the proposal (template enclosed)
 - Draft Statement of Work
 - Resumes
 - Corporate Resources Documentation
 - Key facilities and equipment
 - Requested GFP/GFE
 - Supporting concept/architecture studies

Questions



- Questions in this forum may be submitted in two ways:
 - Verbal/chat questions during Q&A period of the forum
 - E-mail questions to: hq-nextstep-baa@mail.nasa.gov
- Please limit questions to clarifications of this BAA
- Questions that require further assessment to address will be resolved as soon as possible after the forum, and the answers will be posted to the NextSTEP website: <http://www.nasa.gov/nextstep>
- Any published responses to questions posted at the NextSTEP website will supersede oral discussions during this forum

QUESTIONS?

Press *1 to be added to the queue or email HQ-NextSTEP-BAA@mail.nasa.gov

Conclusion



Thank you for your participation today

This presentation will be posted to the
NextSTEP website:

<http://www.nasa.gov/nextstep>

Please submit questions about this Announcement no
later than May 2, 5pm EDT to:

hq-nextstep-baa@mail.nasa.gov

Ask questions now by pressing *1