National Aeronautics and Space Administration

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SOLAR SYSTEM&BEYOND

NF5 AO Status and Request for Community Input

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Today’s Presentation and Discussion

- PSD is working toward releasing the draft New Frontiers 5 AO in October 2021, followed by the final AO in October 2022.
- One of PSD’s goals for the NF5 AO is increased collaboration and communication with the community.
  - Experience has shown that earlier is always better when it comes to sharing and requesting feedback on AO policies.

NF5 Schedule and Engagement Plan

Event	Date
Community announcement of draft major parameters	Nov. 5, 2020
Engage with AGs	Fall 2020-Winter 2021
Public feedback on draft major parameters	Due Feb. 19, 2021
Community announcement of final major parameters	NLT March 2021
NF5 AO Town Hall (@ LPSC)	March 2021
Draft AO Released	October 2021 (target)
Final AO Released	October 2022 (target)

* NASA has not approved the issuance of the New Frontiers AO and this notification does not obligate NASA to issue the AO and solicit proposals. Any costs incurred by prospective investigators in preparing submissions in response to this notification or the planned Draft New Frontiers AO are incurred completely at the submitter's own risk

List of Mission Themes

- New Frontiers restricts proposals to a specified list of mission themes with associated science objectives
  - NASA does not dictate the mission architecture, just the science objectives
- NASEM Committee on Astrobiology and Planetary Science recently provided a letter report on this topic
- The draft list of mission themes is responsive to CAPS and the Decadal Survey:
  - Comet Surface Sample Return
  - Io Observer (pending Discovery selections)
  - Lunar Geophysical Network
  - Lunar South Pole-Aitken Basin Sample Return (pending Artemis landing site selection(s) and science objectives)
  - Ocean Worlds (only Enceladus)
  - Saturn Probe
  - Venus In Situ Explorer

DRAFT for Discussion

VISE Science Objectives

- Venus In Situ Explorer (VISE)
  - Understand the physics and chemistry of Venus's atmosphere through measurement of its composition, especially the abundances of sulfur, trace gases, light stable isotopes, and noble-gas isotopes;
  - Constrain the coupling of thermochemical, photochemical, and dynamical processes in Venus's atmosphere and between the surface and atmosphere to understand radiative balance, climate, dynamics, and chemical cycles;
  - Understand the physics and chemistry of Venus's crust;
  - Understand the properties of Venus's atmosphere down to the surface and improve understanding of Venus's zonal cloud-level winds;
  - Understand the weathering environment of the crust of Venus in the context of the dynamics of the atmosphere of Venus and the composition and texture of its surface materials; and
  - Search for evidence of past hydrological cycles, oceans, and life and constraints on the evolution of Venus's atmosphere.

Cost Cap

- PI-Managed Mission Cost (PMMC) for investigations is capped at a Phase A-D cost of $900M (FY22$).
  - The now-standard 25% minimum reserve on Phases A-D will be required within the PMMC.
  - Operations costs (Phase E and F) are not included in the PMMC cost cap but will be evaluated for reasonableness. Only costs related to spacecraft and science operations will be excluded from the PMMC cost cap.
  - Lower-cost investigations and cost-efficient operations are encouraged.
- NASA is concerned that excluding operations costs from the cap on the PMMC may encourage unbounded costs, complexity, and/or duration of the operational portion the missions (Phase E).
  - NASA is considering options to encourage the optimization of these parameters and welcomes feedback and additional ideas from the community that address this concern.

Other Draft Policies

- Step 2 Selections
  - NASA intends to select up to three proposals to proceed to Step 2 to conduct a mission concept study followed by down selection of up to one mission investigation to proceed into development. NASA will provide $5M (RY$) to each selectee(s) for this mission concept study.
- GFE/Tech Infusion
  - NASA is considering providing an incentive to infuse the Heat Shield for Extreme Entry Environment Technology (HEEET), a woven thermal protection system developed by NASA, into New Frontiers mission investigations.
- Launch Readiness Date
  - Mission investigations must be ready to launch between fall 2031 and fall 2033.

DRAFT for Discussion

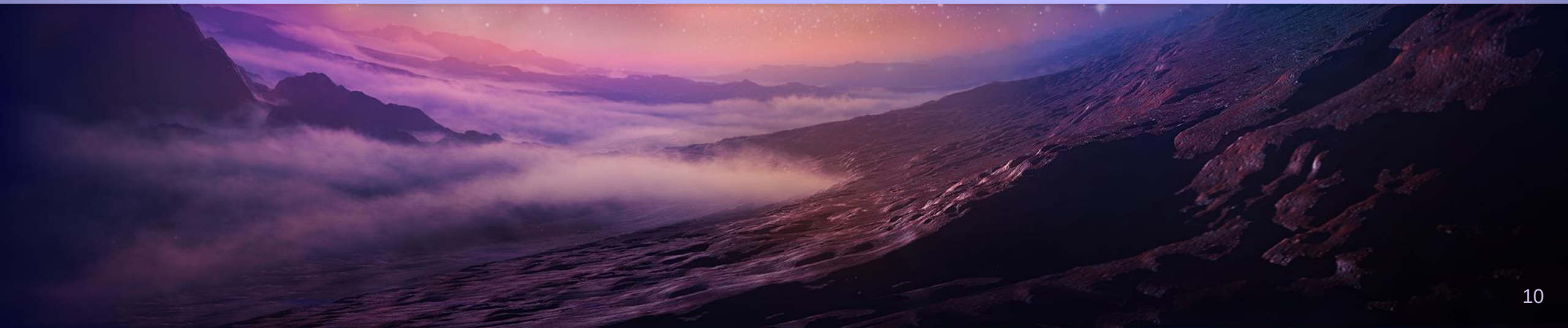
Other Draft Policies

- Launch Vehicle
  - A standard launch performance capability will be defined and provided as GFE and its cost will not be included in the PMMC. The cost of mission specific and special launch services, such as for a higher performance launch vehicle or the use of nuclear materials, will be included within the PMMC.
- Contributions
  - The value of foreign contributions remains constrained as was done for recent New Frontiers and Discovery Program AOs. The total value of foreign contributions may not exceed one-third of the PMMC for phases A-D, and the value of foreign contributions to the science payload may not exceed one-third of the total payload cost.

Other Draft Policies

- Nuclear Power Sources
  - Mission investigations may utilize radioisotope power systems (RPS) provided by NASA. Radioisotope Heater Units (RHUs) are also available for use. The cost for these RPS and/or RHUs and associate specialized launch services will be included within the PMMC. Information on these costs, the performance characteristics of the units, and the number of units available for use will be made available at a later date.
- Additional Opportunities
  - Student Collaborations, Science Enhancement Options, and Technology Demonstrations are deferred to the Step-2 mission concept study. Though deferred, information on these opportunities will be provided no later than the AO release date.

Thank You!



CAPS New Frontiers Report

- PSD requested CAPS evaluate changes in scientific understanding and external factors that would warrant reconsidering four of the mission themes for NF5
- Summary of target body findings:
  - Ocean Worlds (Enceladus): retain, since changes in scientific understanding and/or external factors do not warrant reconsideration;
  - Ocean Worlds (Titan): remove Titan, since Dragonfly addresses preponderance of the science objectives and for programmatic balance;
  - Trojan Tour and Rendezvous: remove, since Lucy addresses the preponderance of the science objectives;
  - Io Observer: remove if IVO selected by Discovery, if science objectives remain so similar; retain if not selected by Discovery or science objectives significantly changed;
  - Lunar Geophysical Network: retain, since changes in scientific understanding and/or external factors do not warrant reconsideration
- SMD places great weight on the CAPS report and respects their role as the keepers of the Decadal Survey; community announcement coming soon

Science Objectives (1 of 5)

- Proposed missions must address a *preponderance* of the science objectives, with preponderance defined as *superiority in number or influence*
- Comet Surface Sample Return
  - Acquire and return to Earth for laboratory analysis a macroscopic comet nucleus surface sample;
  - Characterize the surface region sampled; and
  - Preserve sample complex organics
- Ocean Worlds (Enceladus)
  - Assess the habitability of Enceladus' ocean; and
  - Search for signs of biosignatures and/or evidence of extant life
- Saturn Probe
  - Determine noble gas abundances and isotopic ratios of hydrogen, carbon, nitrogen, and oxygen in Saturn's atmosphere; and
  - Determine the atmospheric structure at the probe descent location

Science Objectives (2 of 5)

- Lunar South Pole-Aitken Basin Sample Return
  - Elucidate the nature of the Moon's lower crust and/or mantle by direct measurements of its composition and of sample ages;
  - Determine the chronology of basin-forming impacts and constrain the period of late, heavy bombardment in the inner solar system, and thus, address fundamental questions of inner solar system impact processes and chronology;
  - Characterize a large lunar impact basin through "ground truth" validation of global, regional, and local remotely sensed data of the sampled site;
  - Elucidate the sources of thorium and other heat-producing elements to understand lunar differentiation and thermal evolution; and
  - Determine the age and composition of farside basalts to determine how mantle source regions on the Moon's farside differ from the basalts from regions sampled by Apollo and Luna

Science Objectives (3 of 5)

- Venus In Situ Explorer
  - Understand the physics and chemistry of Venus's atmosphere through measurement of its composition, especially the abundances of sulfur, trace gases, light stable isotopes, and noble-gas isotopes;
  - Constrain the coupling of thermochemical, photochemical, and dynamical processes in Venus's atmosphere and between the surface and atmosphere to understand radiative balance, climate, dynamics, and chemical cycles;
  - Understand the physics and chemistry of Venus's crust;
  - Understand the properties of Venus's atmosphere down to the surface and improve understanding of Venus's zonal cloud-level winds;
  - Understand the weathering environment of the crust of Venus in the context of the dynamics of the atmosphere of Venus and the composition and texture of its surface materials; and
  - Search for evidence of past hydrological cycles, oceans, and life and constraints on the evolution of Venus's atmosphere.

Science Objectives (4 of 5)

- Io Observer
  - Study Io's active volcanic processes;
  - Determine melt fraction of Io's mantle;
  - Constrain tidal heating mechanisms;
  - Study tectonic processes;
  - Investigate interrelated volcanic, atmospheric, plasma-torus, and magnetospheric mass-and energy-exchange processes;
  - Constrain the state of Io's core via improved constraints on whether Io generates a magnetic field; and
  - Investigate endogenic and exogenic processes controlling surface composition

Science Objectives (5 of 5)

- Lunar Geophysical Network
  - Determine the distribution and origin of lunar seismic activity. Understanding the distribution and origin of both shallow and deep moonquakes will provide insights into the current dynamics of the lunar interior and its interplay with external phenomena (e.g., tidal interactions with Earth).
  - Determine the global heat-flow budget for the Moon and the distribution of heat-producing elements in the crust and mantle in order to better constrain the thermal evolution of our only natural satellite.
  - Determine the size of structural components (e.g., crust, mantle, and core) making up the interior of the Moon, including their composition and compositional variations to estimate bulk lunar composition and how they relate to that of Earth and other terrestrial planets, how the Earth-Moon system was formed, and how planetary compositions are related to nebular condensation and accretion processes.
  - Determine the nature and the origin of the lunar crustal magnetic field to probe the thermal evolution of the lunar crust, mantle, and core, as well as the physics of magnetization and demagnetization processes in large basin-forming impacts.

New Frontiers AO Process