National Aeronautics and Space Administration

Astrophysics Probe (APEX) Pre-proposal Conference
Space Communications and Navigation (SCaN) Overview

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Agenda

Space Communications and Navigation (SCaN) Overview

AO Considerations and Pointers

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SCaN is Responsible for all NASA Space Communications

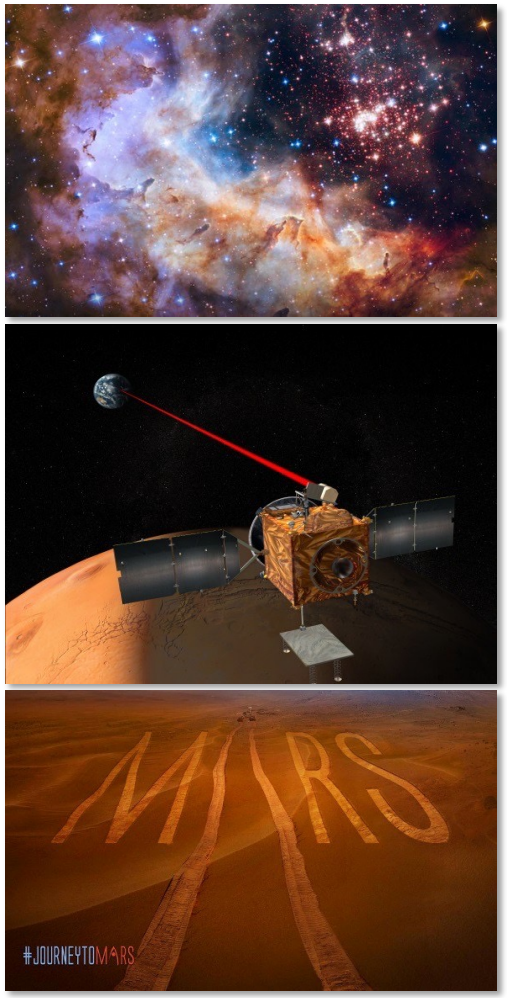
Responsible for Agency-wide operations, management, and development of all NASA space communications capabilities and enabling technology (NPD 8074.1).

Expand SCaN capabilities to enable and enhance robotic and human exploration.

Manage spectrum and represent NASA on national and international spectrum management topics (NPD2570.5E).

Develop space communication standards as well as Positioning, Navigation, and Timing (PNT) policy.

Represent and negotiate on behalf of NASA on all matters related to space telecommunications in coordination with the appropriate offices and flight mission directorates.



Supporting Over 100 Missions

SCaN supports over 100 space missions across all mission life cycles with the two (NSN and DSN) networks

- Which includes every US government launch and early orbit flight

Earth Science

- Earth observation missions – Global observation of climate, Land, Sea state and Atmospheric conditions.
- Aura, Aqua, Landsat, Ice Cloud and Land Elevation Satellite (ICESAT-2), Orbiting Carbon Observatory (OCO-2)

Heliophysics

- Solar observation-Understanding the Sun and its effect on Space and Earth.
- Parker Solar Probe, Solar Terrestrial Relations Observatory (STEREO)
- Voyager 1 & 2 (deep space heliospheric physics).

Astrophysics

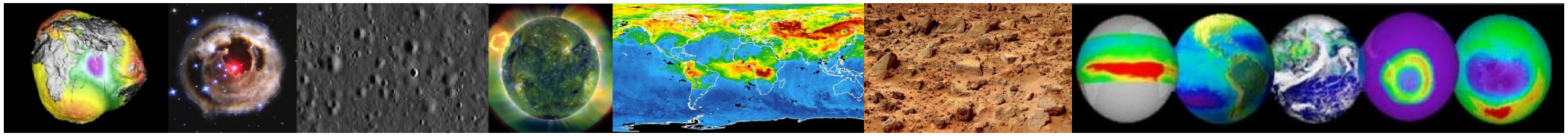
- Studying the Universe and its origins.
- Hubble Space Telescope, Chandra X-ray Observatory, James E. Webb Space Telescope (JWST), Roman

Planetary

- Exploring our solar system's content and composition
- Mars Atmosphere and Volatile Evolution (MAVEN), InSight, Lunar Reconnaissance Orbiter (LRO)

Human Space Flight

- Human tended Exploration missions, Commercial Space transportation and Space Communications.
- Exploration missions, Soyuz, Commercial crew, International Space Station (ISS) and Visiting vehicles (Soyuz, SpaceX, Boeing, Sierra Nevada)



NASA Networks Span the Globe

Evolving Commercial Market

In the 1980s the commercial space communications market was in its early stages…

Today, private and public space sector activities are flourishing; existing commercial services exist to serve customers located on or close to Earth

Creates an opportunity for NASA to develop a near- Earth service portfolio with multiple vendors

- Robust and flexible architecture for the user community; not reliant on a single vendor
- Contribute to market stimulation and growth
- Savings in infrastructure, ongoing operations, and maintenance costs to NASA

NASA SCaN's approach: Pursue commercial services in accordance with the market

- Direct-to-Earth service is an established commercial market with multiple vendors
- Space-Based Relay service for space users is an emerging market → validation needed and is being managed through the Communications Services Project (CSP)

Obtaining services through commercial providers allows NASA to focus on the domains and technologies where commercial services do not yet exist

- Expect NASA continued investment in infrastructure to support missions to the Moon, Mars and other destinations

Vibrant Commercial Ground Station Market *Already Exists*

SCaN's Support to NASA's Proposal Process

SCaN supports NASA's proposal process by:

- Providing documentation outlining SCaN's services, and the cost of using those services, intended to assist in the preparation of proposals, to be released with the request for proposal (e.g. Space Communications and Navigation (SCaN) Mission Operations and Communications Services (MOCS) Document).
- Interacting with proposers as early in their development process as possible to begin pre-mission planning and analysis activities.
- Assisting user missions with procuring services from other non-SCaN network entities and partners, including but not limited to other NASA organizations, other government agencies and international and commercial partners.

It is the responsibility of SCaN's Mission Commitment Office (MCO), along with the Commercialization, Innovation, and Synergies (CIS) Office and the Customer Interface Management Office (CIMO) to facilitate this process on behalf of the SCaN Networks.

Changing Landscape

NASA's networks are at a cross-roads of supply and demand;

- DSN is seeing increasing pressure – large number of missions with more in the pipeline.
- Artemis program reliance on DSN represents a new additional load to be balanced.
- Underlying maintenance and sustainment requires that SCaN also balances mission needs/usage with necessary downtime.
- Tracking and Data Relay Satellites are aging, and the constellation is naturally declining-- more recent failures of increased pressure on pace of transition to commercial alternatives.

Requirements appearing in AO language are trying to reflect / accommodate some of these challenges and encourage good stewardship and use of all of NASA's networks.

Best practices are informed by NASA's mission portfolio and are intended to avoid negative impacts to not just the proposing mission, but to the entire portfolio. Examples:

- Use of planned Lunar Exploration Ground Segment (LEGS) assets for cislunar missions is recommended to allow the DSN assets to be used primarily for missions beyond 2M km from Earth.
- Minimizing contact time
- Use of greater mission autonomy and thereby less reliance on the networks
- Implementation of capabilities that more efficiently use network resources

SCaN Considerations in the APEX AO - 1

Section 5.2.7.2 (SCaN Usage) has several new requirements that Proposers should be aware of.

Requirement 39. Requirement 39. Missions operating beyond GEO altitude and within 2 million kilometers of Earth shall be compatible with the Lunar Exploration Ground Segment (LEGS).

Requirement 40. Astrophysics Probe missions shall be designed to the maximum extent possible to be able to perform routine operations without any use of the DSN. These restrictions do not apply to station hand-offs, critical event coverage, safe mode or other emergency services, or navigation observations (e.g., delta differential one-way ranging or delta-DOR).

Requirement 41. Proposals for missions that will use the DSN for routine operations shall include a justification of the necessity of the DSN for achieving the scientific potential of the mission, to include a discussion of what changes designing without the DSN would incur on the mission concept (science, spacecraft design, operations, and cost).

Requirement 42. Proposals for missions that will use the DSN shall be able to perform routine operations without more than one DSN 34-m antenna.

SCaN Considerations in the APEX AO - 1

Requirement 43. Proposals for missions that use more than eight (8) hours per week of DSN apertures for routine operations should include a justification for the reasonableness of this usage, to include a description of how the mission concept minimizes the required contact time.

Requirement 44. (Deferred until Step-2) Proposals shall address conformance to the applicable maximum channel bandwidth limit(s).

Requirement 45. If use of NASA's SCaN network services is proposed, costs for services, as described in the SCaN MOCS document, including the cost of any development but excluding recurring NSN per-minute/per-pass and DSN aperture fees, shall be included in the PI-Managed Mission Cost and the proposal's cost plan.

Requirement 46. Cost estimates for recurring NSN per-minute/per-pass and/or DSN aperture fees shall be included in the proposal as a decrement to the Adjusted AO Cost Cap. Cost estimates for additional recurring NSN per-minute/per-pass and/or DSN aperture fees required for the GO data shall be broken out separately in the proposal and separately included as a decrement to the Adjusted AO Cost Cap.

Requirement 47. If non-NASA networks are used, a cost plan for the use of services shall also be included in the PI-Managed Mission Cost.
NASA

SCaN Considerations in the APEX AO - 1

Requirement 48. (Deferred until Step-2) Proposals shall specify all critical events for the proposed mission and shall discuss the technical approach, required resources, and implementation concepts for providing critical event telemetry.

Lastly, no new missions will be allowed the use of NASA's Tracking and Data Relay Satellite Services (TDRSS) network. Support of the Agency's goal of moving to commercial providers of communication services, means that SCaN is actively working to validate commercial alternatives for TDRSS-like capabilities.

Due to the number of new requirements, and the rapidly evolving commercial landscape, Proposers are strongly urged to contact the SCaN Mission Commitment Office early in the development of their concepts

Essential Documents

SCaN Produces a Mission Operations and Communications Services Document (MOCS) to:

- Assist in responses to AO/BAA/RFPs issued by NASA
- Describe NASA's communications and navigations services to potential users
- Provide instructions on how to interface with SCaN to determine service integration
- Recent Updates:
  - > Added Spectrum Management to MCO Service Summary
  - > Detailed Launch Vehicle support services

The MOCS document can be accessed via the AO Library to directly at the link below:

https://www.nasa.gov/sites/default/files/atoms/files/scan-mocs-0001-rev_4_final.pdf

New NSN Users' Guide (Feb 2023). All other older NEN users' guides are now obsolete.

Spectrum Access & Authorization

All NASA missions that require the use of the electromagnetic spectrum shall follow the U.S. spectrum regulatory rules/processes as referenced in NASA spectrum policy

- NPD 2570.5: Sets forth NASA policy and responsibilities for obtaining approval for the use of the spectrum for any NASA mission, project, or other activity.
- NPR 2570.1: NASA Spectrum Management Manual provides guidance on the use of radio frequency (RF) spectrum.
- Spectrum Guidance for NASA Small Satellite Missions, although targeted for smallsats, provides useful information applicable to all space missions.
- See: www.nasa.gov/directorates/heo/scan/spectrum/policy_and_guidance.html

All missions/projects using RF spectrum must be certified/authorized by the appropriate regulatory authority

- For missions under effective control of NASA, NASA/Spectrum is responsible for securing spectrum certification/authorization from the federal regulator (NTIA).
- Missions must provide the necessary information for preparing the certification and authorization submissions.

All missions should contact their associated Center Spectrum Manager (NASA/Center-led missions) as early as possible

- Any project with no clear NASA Center lead may contact NASA National Spectrum Manager: Bryan Rhodes (NASA/GRC): bryan.a.rhodes@nasa.gov.

SCaN Points of Contact

Missions desiring use of SCaN services should make contact with the SCaN Mission Commitment Office as early in the concept and design phase process as possible.

In order to begin the mission commitment process, missions should send their questions, concerns or services requests to the following e-mail address: exploration-enabled@lists.hq.nasa.gov

- Missions may also contact the SCaN Program Office Mission Commitment Office for more general questions.