CIS-RFI-0002

COMMERCIALIZATION, INNOVATION AND SYNERGIES OFFICE

Request for Information (RFI)

Lunar Communications Relay and Navigation Services

Released: October 1, 2020

Responses Due: October 30, 2020

National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, MD

CHECK THE TECHNICAL DATA MANAGEMENT SYSTEM (TDMS) AT:
https://ipdtdms.gsfc.nasa.gov/.
PRIOR TO USE TO VERIFY THAT THIS IS THE CORRECT VERSION

Lunar Communications and Navigation Relay Services
Request for Information (RFI)

Effective Date: October 1, 2020

Concurred by:

ROBERT MENRAD Digitally signed by ROBERT MENRAD Date: 2020.10.01 17:30:49 -04'00'

Robert J. Menrad Date
Associate Director, Exploration and
Space Communications Projects Division
GSFC/Flight Projects Directorate

Approved by:

SUSAN CHANG Digitally signed by SUSAN CHANG Date: 2020.09.30 21:02:41 -04'00'

Sue Chang Date
Director, Network Services Division
HQ/SCaN Program Office

Reviewed by:

DAVID ISRAEL Digitally signed by DAVID ISRAEL Date: 2020.10.01 14:52:00 -04'00'

David J. Israel Date
Architect, Exploration and Space
Communications Projects Division
GSFC/Flight Projects Directorate

Reviewed by:

ANDREW PETRO Digitally signed by ANDREW PETRO Date: 2020.09.30 14:43:37 -04'00'

Andrew Petro Date
Network Services Division
HQ/SCaN Program Office

Reviewed by:

LANETRA TATE Digitally signed by LANETRA TATE Date: 2020.10.01 17:11:29 -04'00'

LaNetra C. Tate, Ph.D. Date
Associate Program Manager, Exploration
and Space Communications Projects Div.
GSFC/Flight Projects Directorate

Preface

This document is under configuration management by the Goddard Space Flight Center (GSFC)/Exploration and Space Communications Projects Division (ESC), Code 450.0, Configuration Control Board. This document will be changed by Documentation Change Notice (DCN) or complete revision. Proposed changes to this document must be submitted to the ESC's Commercialization, Innovation and Synergies (CIS) Office along with supportive material justifying the proposed change. Comments or questions concerning this document and proposed changes shall be addressed to:

Via USPS:

Configuration Management Office
Attn: Ms. Rae Roe
Commercialization, Innovation and Synergies Office
Goddard Space Flight Center
8800 Greenbelt Road
M/S: 450.0/B12, C200
Greenbelt, Maryland 20771-2400
USA

Via email:

(Email: Rae.A.Roe@nasa.gov)

Change Information Page

List of Effective Pages	
Page Number	***Issue***
Title	Baseline
i through iii	Baseline
1-1 through 1-3	Baseline
2-1 through 2-1	Baseline
3-1 through 3-4	Baseline
4-1 through 4-1	Baseline
5-1 through 5-1	Baseline
6-1 through 6-2	Baseline
7-1 through 7-1	Baseline
8-1 through 8-2	Baseline
A-1 through A-1	Baseline

Document History			
Document Number	***Status/Issue***	***Effective Date***	***CR Number***
CIS-RFI-0002	Baseline	10/01/2020	ESC-CCR-0106

Change History		
Revision	***Effective Date***	***Description of Change***
Baseline	10/01/2020	Initial Release

Contents

Section 1. Introduction

1.1 Purpose

In this Request for Information (RFI), NASA is seeking information from potential providers of space communications relay and navigation services in support of the Artemis program and its planned missions to the Moon. The information gathered through this request will be used in planning NASA's strategy for potential solicitations for lunar communications relay and navigation services.

The purpose of the communications relay services would be to assist in transporting data between a spacecraft on the surface of the Moon and ground stations on Earth in situations where a direct link between the spacecraft on the Moon and Earth ground stations is not practical or when having the option for a relay link is advantageous. NASA is also interested in position, navigation, and timing services in support of lunar missions.

While open to a variety of approaches, the general assumption is that NASA would obtain these communications relay and navigation services for its missions through a commercial fee-for-service contract or partnership. NASA does not necessarily anticipate developing and operating dedicated, government-owned lunar communications relay spacecraft.

Through this RFI, NASA would like to learn about:

- The range of potential US and foreign commercial service providers
- How rapidly potential service providers could deploy initial relay capabilities
- The performance characteristics of initial relay and navigation services and future capabilities
- Approximate cost of relay services and approaches for service agreements
- Potential for partnerships and options for financing the development and operations of relay services.

In this RFI, NASA is providing reference information for responders on:

- Summary of potential NASA user needs, in particular for early missions
- Summary of spectrum usage constraints
- Description of the LunaNet interoperability standards and concept of operations.

1.2 Background

NASA has well-established networks for communications with spacecraft on missions beyond the Earth, including those operating at the Moon. It is NASA's intent to improve the communications and navigation capabilities to support the more ambitious lunar activities of the Artemis program with an affordable and sustainable infrastructure that would include communications relays and enhanced navigation services.

NASA is seeking information on potential providers of communication relay and navigation services from any potential sources to support NASA's science and human exploration missions at the Moon. Two missions are driving NASA's initial interest in relay services. One is a science mission to the far side of the Moon, planned for launch as early as the second quarter of 2024. A second mission that may require relay services is a planned human exploration mission to near the South Pole of the Moon in 2024.

Beyond the two early missions described above, the demand for relay services is likely to exist for additional lunar missions undertaken by NASA and by others. Communications relay or navigation service capabilities could become part of an infrastructure enabling general expansion of robotic and human activities on the Moon. Relay and navigation service providers might find a market for their services beyond NASA's missions and the potential for an expanding market could be enhanced if interoperability is factored into the design of these systems from the beginning. Relay services, if properly managed, also have the potential to reduce the peak demands on Earth ground stations, which is another benefit of their use. Relay assets may also include position, navigation, and timing services, which could further reduce demand on Earth-based tracking stations.

The Gateway will provide high and low rate data relay capability for multiple users when it reaches its planned Near Rectilinear Halo Orbit (NRHO). NASA does not expect to rely on this capability for missions in 2024, as Gateway may not have reached its NRHO operational orbit. After the Gateway is operating at the Moon, NASA expects that there will still be a demand for additional relay services since there may be multiple lunar missions needing relay services in various surface and orbital locations, which may exceed Gateway's capabilities.

1.3 Range of Acceptable Approaches

NASA is open to creative technical solutions, operational strategies, and management approaches as long as they meet the needs of the mission users and comply with spectrum requirements, interoperability goals, and other constraints. The range of possibilities include:

- Size, type, and number of relay satellites
- Characteristics of relay satellite orbits or locations
- Lifetime of satellites and subsystems
- Communications and navigation assets hosted on other spacecraft as an alternative to the use of dedicated satellites
- Provision of selected services, partial coverage, and partial capacity with planned expansion from initial capability to more complete services
- Relay launch and delivery methods including rideshares
- Earth ground station utilization strategies
- Innovative fee structures
- Public-private partnerships, international agreements, exchanges for in-kind contributions, and innovative financial arrangements.

NASA will consider partnering approaches, including procurements under the Federal Acquisition Regulation (FAR) as well as agreements under its other transaction authority. Potential partnerships could include funded, unfunded, reimbursable, cost-sharing or cooperative

agreements, and could also be used in conjunction with, or to complement traditional procurement approaches for the development, operations, and maintenance of the space communications relay and navigation capabilities.

NASA prefers that service providers use commercial or other ground stations as much as possible and especially avoid use of the NASA Deep Space Network assets, to maximize their availability for deep space missions. However, if the use of a NASA ground station is critical to enabling more a complete service, that use may be considered for negotiation.

NASA will consider negotiating a partner's access to NASA's ground stations, technical expertise, facilities, test analysis or data, aspects of risk mitigation, or other resources. However, the use of additional government resources such as facilities, services, and government-developed technologies will require the negotiation of a government task agreement with NASA.

Section 2. LunaNet Architecture

NASA's objective is to create an open, evolvable communications and navigation architecture in cislunar space with different commercial, government, and international organizations providing services to many user missions. To enable that architecture, a framework, referred to as LunaNet, is being developed with a common set of standards, protocols, and interfaces in support of interoperability and compatibility between service providers and service users. These standards are based on previous work by the Interagency Operations Advisory Group (IOAG) and the Consultative Committee for Space Data Systems (CCSDS).

The minimum set of standards and protocols is captured in *HEOMD-003, Volume 2 International Communication System Interoperability Standard - Revision A*, which is provided as an attachment to this RFI.

LunaNet is a network-centric architecture, as opposed to traditional link-centric communications architectures. LunaNet will interface with existing ground networks and will include elements on Earth (ground stations and network control centers), in Earth orbit (relays that may serve lunar users as well as other missions), in lunar orbit (dedicated communication relay spacecraft and relay payloads on user mission spacecraft), and the lunar surface (base station terminals and local network nodes). LunaNet is expected to include three categories of services: Networking Services for data transmission; Position, Navigation, Timing Services; and Detection and Information Services providing measurements and alerts.

NASA will expect service providers to comply with the LunaNet architecture standards to the greatest extent possible, while providing services required by the initial missions in the 2024 timeframe, as described in this RFI. NASA will consider the use or adoption of alternative commercial standards if they support a larger business case and if they meet or exceed the performance of standards identified in this RFI. Respondents should carefully review the *Preliminary Summary of the LunaNet Architecture and Concept of Operations* document included as attachment to this RFI.

Section 3. Mission User Needs

3.1 Lunar Mission Needs

NASA is interested in communications relay and in position, navigation and timing services for any of the science and human exploration missions that could benefit from these capabilities. These missions include science missions to various areas of the Moon including polar regions, where communication directly to Earth may be difficult and a relay might be beneficial, and missions to the far side, where a relay would be essential. NASA has plans for at least two science payload deliveries to the lunar surface each year beginning in 2021. Among these payload deliveries, about one per year is planned for polar regions starting as early as 2022, and occasional far side science payload deliveries are planned, starting in 2024.

These payload deliveries will generally employ one of the Commercial Lunar Payload Services (CLPS) vendors. The task order for each CLPS delivery will be awarded on a case-by-case basis and, therefore, the landing vehicles and their operators will vary. Payloads, and their associated data requirements will also vary. The general communications requirements described below for the initial far side science payload deliveries are expected to be typical for other near side, polar, or far side science payload deliveries in this timeframe.

Missions involving rovers might benefit from relay capabilities in almost any location on the Moon since a rover might be unable to maintain continuous contact with Earth as it moves through different terrain on the surface. Compared to Earth stations, a relay satellite would typically be much closer to the user, so that shorter link length means that missions using a communications relay might be able to operate with smaller, less powerful transmitters and receivers. Spacecraft orbiting the Moon, especially small satellites, might also benefit from relay and navigation services. In particular, orbiting science missions might benefit from precise timing and position information.

A series of human exploration missions is planned for the lunar South Pole region and possibly other locations on the Moon, and these missions, including rovers and other associated surface elements, may make use of relay and navigation services. The initial human exploration mission to the South Pole region is planned for 2024, and more ambitious missions are expected to follow on an approximately annual basis. The communications requirements outlined below for the initial human exploration mission are expected to be typical for other human missions in this timeframe. In later years, a Lunar Base Camp is planned for sustained operations at a site near the South Pole. Stationary and mobile assets on the lunar surface may also support or compliment relay and navigation services for science and human exploration missions. A helpful reference for NASA's human exploration program plans including lunar exploration is the *Artemis Plan*, which was issued in September 2020 and can be found at this link: https://www.nasa.gov/sites/default/files/atoms/files/artemis_plan-20200921.pdf.

Compared to early missions, later science and human exploration missions will likely have more demanding data requirements and longer durations. Early missions are expected to be limited in duration by the unique day/night cycle experienced at most locations on the Moon. Having approximately 14 days of intense heat followed by 14 days of extreme cold and no sunlight will present a challenge for mission systems to operate for more than a single period of sunlight. Early missions may limit their surface operations to no more than approximately 12 days. However, as the technical challenges of surviving and then operating through the lunar night are overcome, mission durations may be extended indefinitely.

3.2 Initial Mission Needs

There are the two missions that drive NASA's initial interest in relay services. One is a science payload delivery to the far side of the Moon, planned for as early as the second quarter of 2024. This payload delivery would not be able to communicate directly with Earth ground stations, after landing, without a relay. A second mission that may employ relay services is a human exploration mission to near the South Pole of the Moon in 2024. For this mission, a direct link to Earth may be possible but may not be assured at all times and in all locations due to the effects of orbital mechanics and local terrain interference at particular landing sites. Having a relay satellite in an appropriate orbit would allow for more flexibility in mission scheduling and landing site selection and would provide more options in contingency situations.

In order to provide reliable service for these missions in 2024, it would be necessary for any relay capability to be in place and to have completed operational check-out well in advance of the mission timeframe. Therefore, space-based capabilities, intended to support the initial missions, should be those that would be ready for operation no later than 2023.

NASA is interested in initial relay capabilities that can meet the science and human exploration needs stated below, or some subset of those needs. While a system that can meet all needs from the beginning might be ideal, NASA is interested in capabilities that can be realistically deployed to meet these needs as completely as is practical in the given timeframe. NASA is open to solutions that meaningfully address a portion of the needs or in multiple approaches that could be combined to meet the overall needs.

3.3 Initial Far Side Science Mission

Since the payload for this initial mission has not yet been defined and the CLPS task order to deliver the payload has not yet been awarded, it is not possible at this time to define the exact data requirements or the characteristics of the communications system that would be transmitting and receiving data on the surface, beyond the very general statements provided below. Responders to this RFI are requested to provide information on the type of capabilities that could be provided to meet the needs, as generally stated. The responder can assume some flexibility for payload and lander systems to be adapted, if necessary, and to the extent practical, to make use of the service being offered.

The primary requirement to support the initial far side science payload delivery is to be able to transmit to Earth a data volume of up to approximately 4 gigabytes/day. A specific data rate is not

a critical requirement. Real-time transmission will be desirable, especially during critical operations or for tele-operation of payloads; however, in most periods, some latency in data transmission is acceptable. Uplink transmissions from Earth would require a lower data volume and be limited to commands but require minimal latency.

Note that the International Telecommunication Union Radio Regulations Articles 22.22 – 22.25 provide regulations governing radio frequency transmissions in the shielded zone of the Moon.

The reference landing site for this far side payload delivery is tentatively stated as the Schrodinger Basin at an approximate latitude of 75° South and longitude of 133° East.

The tentative timeframe for this payload delivery is April, May, or June of 2024. The mission duration is planned to be approximately 12 Earth days. The mission is planned to land when the site is in sunlight, so mission operations may be continuous throughout that period.

3.4 Initial Human Exploration Mission

A landing on the surface of the Moon with a human crew is planned for the timeframe of October, November, or December of 2024. A precise landing site has not been determined but it is expected to be on the near side at a latitude within 6 degrees of the South Pole.

The duration of the surface mission is expected to be approximately seven Earth days. Mission operations will be continuous; however, the data requirements will increase significantly during periods when the crew members are performing extravehicular activities (EVA) outside of their lander. An EVA may occur during each Earth day and last approximately 4 to 8 hours. During a typical surface mission day, there may be up to 20 hours of non-EVA time out of every 24 hours.

As with the science payload delivery, a full and detailed definition of the communications systems to be used by the mission is not possible at this time. There are several different potential commercial providers for the landing system to be used for the first mission and the provider has not yet been selected. Responders to this RFI are asked to provide information on the type of relay capability that they could provide to meet the needs, as generally stated. They can assume some flexibility for payload and lander systems to be adapted, if necessary, and to the extent practical, to make use of the services being offered.

The general data rate and volume needs for the human exploration mission are significantly higher than for the science payload delivery, mainly due to the need for a large amount of video downlink. For this reason, a direct-to-Earth link is considered the primary approach for communications, when available. However, NASA is interested in a range of relay capabilities that might incrementally address some or all of the human exploration mission needs, beginning with this first mission in 2024. In general, real-time transmission is required for all data.

As a minimum backup capability, transmission of some voice and vehicle telemetry data would require a data rate of approximately 36 kilobits/second for both downlink and uplink. This level of service might be employed as a backup capability at any time throughout the surface mission or during descent to, or ascent from, the lunar surface.

A very minimal capability for video transmission would require a data rate of 5 to 10 megabits/second. For downlink, this rate would fall short of the capability needed for normal mission operations during an EVA or other critical activities but might be considered useful as a backup capability. However, this downlink rate might be satisfactory for mission operations during less active time periods and also for uplink of video from the Earth to the Moon at any time during the surface mission.

A downlink data rate of 20 to 30 megabits/second would be considered sufficient for a minimal level of mission operations during 8-hour EVA time periods. A downlink data rate of 40 megabits/second would be desired for normal mission operations during EVA periods and even higher data rates might be employed, if available.

Section 4. Spectrum Considerations

A NASA lunar spectrum management plan is being developed for missions operating in the lunar region to ensure compatibility with Earth-orbiting missions and compliance with international spectrum agreements. This spectrum management plan is expected to specify use of S-band and Ka-band space research service frequency allocations for crosslinks between the lunar surface and lunar orbiting elements, and X-band and Ka-band space research service frequency allocations for direct uplink and downlink communications with Earth. The X-band frequencies are designed to support simultaneous command, telemetry, and ranging services for multiple lunar region missions. Lunar relay-to-relay crosslinks should plan to use Ku-band and Ka-band space research service frequency bands. Dedicated position, navigation, and timing services may use L-band Global Navigation Satellite System allocations.

UHF space research service allocation is planned for crew during extravehicular activities in the lunar environment. For surface-to-surface links with high-data-rate capability, Ka-band is allowed but NASA also plans to leverage terrestrial wireless technology and equipment for non-time-critical and non-safety-critical data, including video.

International Telecommunication Union Radio Regulations Articles 22.22 - 22.25 provide regulations governing radio frequency transmissions in the shielded zone of the Moon.

In order to meet the higher bandwidth and data volume requirements of future missions, especially real-time video needs for human exploration missions, evolution of spectrum to different frequency bands will be addressed. NASA assumes optical communications will utilize 1550 nanometer C-band spectrum in alignment with optical communication technologies already demonstrated or in development.

NASA has established a Lunar Spectrum Manager (LSM) to lead spectrum coordination activities between lunar stakeholders, including NASA Mission Directorates, NASA Centers, Jet Propulsion Laboratory, and non-NASA organizations. The LSM is responsible for spectrum engineering and regulatory guidance support to lunar missions through advanced planning and pre-coordination and serves as the interface with non-NASA organizations to ensure spectrum compatibility with all lunar missions. The LSM will further facilitate increased awareness of lunar activities among stakeholders during the planning phases of their respective lunar projects.

Section 5. Security Standards

NASA will expect that service providers, that are engaged through future solicitations, will meet or exceed National Institutes of Standards and Technology (NIST) 800-53 standards or provide evidence of compensating controls to which NASA has the obligation to accept or provide additional measures to meet the standard. The service providers will need to provide an overview of the enterprise security architecture to include end-to-end data flows and use of multi-factor authentication in support of the following functions: tracking, telemetry, command and user data. The outlined approach shall include at a minimum, all functions identified in the NIST Cybersecurity Framework https://nvlpubs.nist.gov/nistpubs/CSWP/NIST.CSWP.04162018.pdf. This documentation shall cover the establishment of logical system boundaries and the isolation of communications to established ports, protocols and services to ensure segregation of NASA data from other users.

The service providers shall ensure that all systems are designed in accordance with industry best practices or international standards. The service providers shall ensure that all systems are designed to protect data-at-rest and (as requested) data-in-transit throughout the network using Federal Information Processing Standard 140-2 compliant methods.

NASA relies heavily on the separation of command and control data from the science data. While the data quality needs to be monitored by the servicing ground stations, the mission data should be treated as bent-pipe pass through bearer data where the service providers have no insight into the content of uplink and downlink data.

Security considerations are also addressed in the *Preliminary Summary of the LunaNet Architecture and Concept of Operations* document included as attachment to this RFI.

Section 6. Information Requested

NASA is interested in the following information regarding the communications relay and navigation services that could be available in support of lunar missions.

1. The characteristics of the flight elements, including:
   a. overall description of the satellite or satellites, mass, dimensions, power generation and storage, maneuvering capability, and expected lifetime;
   b. characteristics of the satellite subsystems, in particular the communications and navigation subsystems; and
   c. parameters of the orbit or orbits to be used by the relay and the duration of coverage that is possible for the particular far side and South Pole landing sites of interest, as described in this RFI.

2. Details on the uplink and downlink performance characteristics of the communications systems with respect to the anticipated user needs, particularly for the initial far side and South Pole missions described in this RFI and the extent to which your capability can meet any or all of those needs:
   a. performance for links between the relay and the user on the Moon;
   b. performance for links between the relay and Earth ground stations;
   c. extent to which the system can relay between the user and ground stations simultaneously;
   d. capability to store and forward data between the user and ground stations and the associated data storage capacity;
   e. number of separate users that can be serviced at the same time; and
   f. other relevant capabilities or constraints on operations.

3. While the focus of this RFI is on the initial far side science and human exploration missions, additional information would be of interest on the capability, with the same relay system, or with some variation of that system, to also provide communications relay and navigation services to missions at other sites on the Moon or to other spacecraft orbiting the Moon.
   a. extent of lunar surface for which coverage could be provided and the associated capabilities and performance characteristics;
   b. range of orbits accessible for relay service to orbiting spacecraft and associated capabilities and performance characteristics; and
   c. other relevant capabilities.

4. Description of any position, navigation and timing services that could be offered, including expected position and timing performance for both surface and orbiting users.

5. The government is exploring achieving Lunar communications services and capabilities through a commercial services approach. The offeror is requested to provide information related to price structure envisioned for these services.

6. Radio frequency bands to be used for the relevant links. Radio frequency usage must be in accordance with US government and international policies and regulations.

7. Details on the maturity of the satellite and its systems including, where applicable, evidence that the capability could be deployed and ready for operation by 2024, or earlier. The need for early availability of these capabilities implies that flight-proven or very mature systems are most likely to be appropriate for this application.

8. Description of the process of development, assembly, and testing of the satellite or satellites, the location of the facilities for these activities, and the source of funding. Ideally, service providers would arrange their own financing for all aspects of this process, however, options for partnerships and other funding arrangements might be considered.

9. Description of the ground segment including number and location of ground stations and necessary antenna characteristics and the plans for transmitting data between the ground stations and the mission operators on Earth. Ideally, service providers would arrange for their own ground station needs, however, partnerships with the US or other governments, commercial partnerships, or in-kind contributions by NASA or others, might be considered and negotiated for mutual benefit.

10. The intended means of satellite launch and insertion into the operational orbit, if known. Service providers would ideally arrange for their own space transportation, however, partnerships with the US or other governments, or in-kind contributions by NASA or others, might be considered and negotiated for mutual benefit.

11. Any other relevant information about communications relay and navigation services that could be offered, not covered in the items above.

12. Any additional background or reference information that responders might expect from NASA as part of a future solicitation.

Section 7. Information for Participants

This RFI is used solely to request information for planning purposes and does not constitute a solicitation. In accordance with Federal Acquisition Regulation (FAR) 15.201(e), responses to this RFI are not offers and cannot be accepted by NASA to form a binding contract. NASA is under no obligation to issue a solicitation or to award any contract on the basis of this RFI. However, the information received from this RFI may be utilized by NASA in developing future acquisition strategies.

Respondents are encouraged to provide information that is not constrained by limited/restricted data rights. However, if proprietary data is included in a reply, respondents should clearly and properly mark any proprietary or restricted data contained within its submission, so it can be identified and protected. Respondents are solely responsible for all expenses associated with responding to this RFI. NASA intends to evaluate all data received and responders may be contacted for further discussion on an as-needed basis.

Please note that NASA as well as support contractors and/or their sub-contractors working on behalf of NASA may be reviewing the information. Responses to this RFI will not be returned, and respondents will not be notified of the results of the review.

NASA does not intend to award a contract based on this RFI or to otherwise pay for the information solicited. The information provided is entirely voluntary and will not affect the ability to bid on future requirements. This RFI is for planning purposes only and shall not be considered as an obligation on the part of NASA to acquire any products or services.

No solicitation exists; therefore, do not request a copy of a solicitation. If a solicitation is released in the future, it will be synopsized on the Government Point of Entry website (https://beta.sam.gov/). It is the potential Respondent's responsibility to monitor these sites for the release of any solicitation or synopsis.

Section 8. Instructions for Submittal

Respondents are requested to provide the information as stated below.

8.1 RFI Response

1. A one-page summary that includes:
    a. Company's name, address, primary point of contact (POC), and telephone number;
    b. Company's Government size standard/type classification (Large, Small, Small Disadvantaged, 8(a), Woman-Owned, Veteran-Owned, Service-Disabled Veteran, Historically Underutilized Business Zone business);
    c. A description of the Company's specific capabilities that are relevant to the RFI requirements.

2. Response to the items listed in Section 6.

Responses must comply with the following requirements:

- Provide the electronic copy response in one searchable, unlocked PDF file with edit permission enabled.
- Use 12-point Times New Roman font where paragraphed, as well as single spaced pages.
- Provide a response to each item in Section 6 of this RFI.

Due to COVID-19 restrictions, in-person or mailed responses will not be accepted. Please submit responses via Email only to Antwan.G.Reid@nasa.gov and LaNetra.C.Tate@nasa.gov.

8.2 General Information

Agency:	National Aeronautics and Space Administration (NASA)
Announcement Title:	Lunar Communications Relay and Navigation Services RFI
Announcement Number:	GSFC-CIS-RFI-0002
Responsible Office:	Commercialization, Innovation and Synergies Office Exploration and Space Communications Projects Division Goddard Space Flight Center Greenbelt, MD 20771
Response Due Date:	October 30, 2020
Response Format:	Microsoft Word or Portable Document File (PDF) format Microsoft Excel format preferred for modeling and ground characteristic data. Provide company name with business and technical point of contacts at the front of the response.

Submit Responses to:	Antwan.G.Reid@nasa.gov and LaNetra.C.Tate@nasa.gov
Point of Contact:	Contracting Officer: Antwan G. Reid Telephone: 301-286-8420 Email: Antwan.G.Reid@nasa.gov
RFI Questions:	Submit questions regarding this RFI via Email to: Antwan.G.Reid@nasa.gov. The subject line of the email should read "CIS: Lunar Communications Relay and Navigation Services RFI Question" as well as the name of the organization/company submitting the question. NASA intends to respond to questions received by email on an individual basis. Questions and Answers will not be made public.
Website:	The Announcement as well as current news and other information may be obtained and downloaded over the Internet at Contract Opportunities: https://beta.sam.gov/.

Appendix A. Abbreviations and Acronyms

CCSDS	Consultative Committee for Space Data Systems
CLPS	Commercial Lunar Payload Services
EVA	Extravehicular Activity
FAR	Federal Acquisition Regulation
HEOMD	Human Exploration and Operations Mission Directorate
IOAG	Interagency Operations Advisory Group
LSM	Lunar Spectrum Manager
NASA	National Aeronautics and Space Administration
NIST	National Institutes of Standards and Technology
PDF	Portable Document File
POC	Point of Contact
RFI	Request for Information
UHF	Ultra-high frequency
US	United States