COMMUNICATIONS SERVICES PROJECT

INDUSTRY DAY

A VIRTUAL EVENT MAY 11, 2021

Communications Services Project (CSP)

Announcement for Proposals (AFP)
NNC21AFP01R

INDUSTRY DAY BRIEFING

MAY 11, 2021

DISCLAIMER

All information provided during Industry Day is preliminary.
The Government anticipates a similar structure for the Final Announcement; however, **it is subject to change.**

In the event of any discrepancy between information you receive today and information in the final Announcement for Proposals (AFP), the final AFP is the controlling document.

The final AFP will take precedence over the draft AFP.

Asking questions:

- Throughout the day, **questions may be submitted via the WebEx chat function to "All Panelists".**
- The team will attempt to answer questions during the Q&A sessions as shown in the agenda.
- Remaining questions will subsequently be answered in writing and posted.

All questions received at Industry Day will be answered at the Industry Day event or in writing at a later time.

NASA will post the Industry Day presentations and the Q&A to the following website: https://beta.sam.gov. All questions will be posted without revealing the source of the question or any company proprietary information.

All other discussions, questions, and comments on the draft Announcement for Proposals (AFP) received from Industry, Industry feedback to the questions posed by NASA, or from the one-on-ones will be taken into consideration for the final AFP.

★ **All feedback on the draft AFP is due to Eric.T.Hartman@nasa.gov via email no later than May 21, 2021.**

Communicate Commercial Capability Development and Demonstration Announcement for Proposals (AFP) Content

Answer Questions from Industry

Obtain Industry Feedback prior to final AFP Release

Stimulate New Commercial Markets
NASA – Potentially One of Many Customers

INDUSTRY DAY AGENDA

TIME	SUBJECT	PRESENTER
11:30 – 11:35 AM	Kickoff Video	
11:35 – 11:45 AM	Welcome & GRC Overview	Dr. Marla Pérez-Davis
11:45 – 12:05 PM	CSP Purpose and Project Structure / Industry Day Objectives	Elias Naffah
Overview of CSP Capability Goals and References		
12:05 – 12:15 PM	CSP Capability Goals and References Architecture	James Nessel
12:15 – 12:30 PM	Capability Definitions, Mission Projections, and Goals	Thomas Kacpura
12:30 – 12:45 PM	Concept of Operations (ConOps)	Thomas Kacpura
12:45 – 1:15 PM	Spectrum Management	Glenn Feldhake
1:15 – 1:35 PM	Cyber Security	Dave Murnan
1:35 – 1:50 PM	Q&A	
Overview of the CSP Draft Announcement		
1:50 – 2:05 PM	Information for Participants / Proposal Submittal Information	Eric Hartman
2:05 – 2:20 PM	Volume II – Business Plan Overview	Thomas Kacpura
2:20 – 2:35 PM	Volume III – Technical Approach Overview	James Nessel
2:35 – 2:45 PM	Volume IV – Price Overview	Steve Vacco
2:45 – 3:00 PM	Q&A and Wrap-up	Elias Naffah

Welcome & GRC Overview

Dr. Marla Pérez-Davis

Center Director

CSP Purpose and Project Structure
Industry Day Objectives

PRESENTED BY:
Elias Naffah/CSP Project Manager

Commercial Cargo Program

"What I would like to do is to be able to buy [crew and cargo] services from industry…and utilize the market that is offered by the International Space Station's requirements"

– NASA Administrator Mike Griffin, June 2005

Commercial Crew Program

"Embrace the commercial space industry…by contracting with American companies to provide astronaut transportation to the Space Station."

– NASA's 2011 President's Budget Request

Low Earth Orbit (LEO) Commercialization

"Transition in a step-wise approach from the current regime that relies heavily on NASA sponsorship to a regime where NASA could be one of many customers of a low-Earth orbit non-governmental human space flight enterprise."

– NASA Transition Authorization Act of 2017

SATCOM Commercialization

"NASA will define the acquisition strategy for transitioning near-Earth NASA users to suitable commercially provided services."

"CSP… is being established to focus on demonstrating the feasibility of commercially provided data relay services."

– NASA's 2020 Budget

SATCOM is the logical Next Step for Commercialization of Space

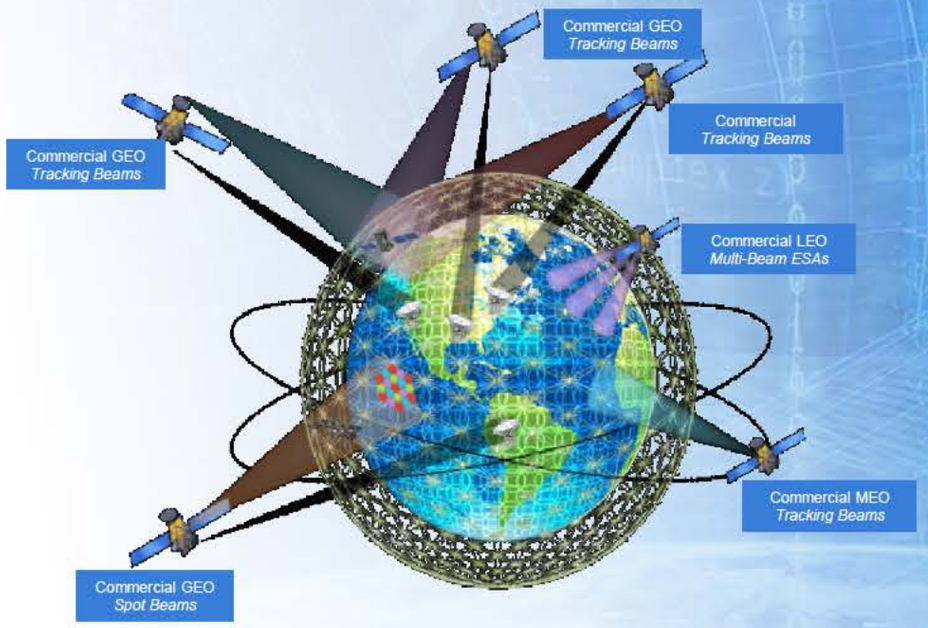
OP PLAN ENACTED REQUEST	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026	FY2027
Budget Authority by Fiscal Year (in $ millions) Total Budget*	**23.4**	**42.0**	**51.2**	**58.9**	**58.9**	**58.9**	**58.9**

The Communications Services Project (CSP) is being formulated to potentially:

- Demonstrate the feasibility of commercially-provided satellite communications (SATCOM) capabilities
- Acquire future commercial SATCOM services
- Phase out reliance on NASA-owned and operated systems

CSP will work with the commercial market to explore mutually beneficial opportunities.

- Bolster American Industry
- Reduce cost to NASA
- Maximize interoperability between government and commercial service providers while promoting a diverse and growing commercial market



Above: Future Space Communications Infrastructure

***NASA anticipates a total of up to $250 million spread over fiscal years 2021 - 2025 to be available for funding the agreement(s)**

** Information is pre-decisional and subject to change*
** Timelines are notional and subject to change*

NASA envisions a **3-phase strategy** for transitioning NASA's SATCOM traffic from government-owned and operated assets to commercial services:

PHASE 1: NASA's Mission Needs

Identify, characterize, and quantify NASA's future SATCOM needs, and interact with industry

- Identify future missions needing commercial communication services and break into suitable mission classes
- Develop the requirements for end-to-end service demonstrations that will prove the viability of the service(s)
- Identify possible missions to support these demonstrations

PHASE 2: Commercial Capability Development and Demonstrations

Establish partnerships with commercial satellite communications (SATCOM) companies to develop and demonstrate the feasibility of providing SATCOM capabilities that can be offered as a service for spacecraft users in near-Earth orbit, which could potentially include future NASA missions.

- Conduct demonstrations that will support potential missions
- Validate the performance of the demonstrations for suitability as services
- Identify the future services required and continue to conduct demonstrations to add capabilities

PHASE 2 is the focus of the Announcement

PHASE 3: Commercial SATCOM Services Acquisition

Acquire commercial SATCOM services from multiple providers

- Procure the services necessary for communications to support NASA missions through long term contracts and traditional procurements
- Support an integrated approach for mission communication systems and enterprise management (scheduling and data delivery)

These objectives of this announcement are to:

i. **Establish public-private partnerships ("PPPs") with multiple providers** that may eventually be able to offer commercial SATCOM services

ii. **Demonstrate and validate commercial SATCOM capabilities and evaluate feasibility** for potential future NASA mission needs

iii. **Stimulate the U.S. commercial communications industry** in order to adapt existing terrestrial communication technologies into space-based communication systems

iv. **Create a market for commercial space communication services that will be available to both Government and private-sector customers**

PPPs will demonstrate capability, stimulate industry and create new markets

Guidance:

- United States (U.S.) National Space Policy
- Fiscal Year (FY) 20 Appropriations
- FY 20 and FY 21 Congressional Justifications
- Office of Management and Budget (OMB) Direction

Informed by:

- Extensive Market Research and Industry Engagement since 2013
- Commercial Orbital Transportation System (COTS) and Commercial Crew Programs

Formulation Authorization Document:

- Issued by HEOMD Associate Administrator (AA) on December 18, 2020

National Space Policy
Dated: December 9, 2020

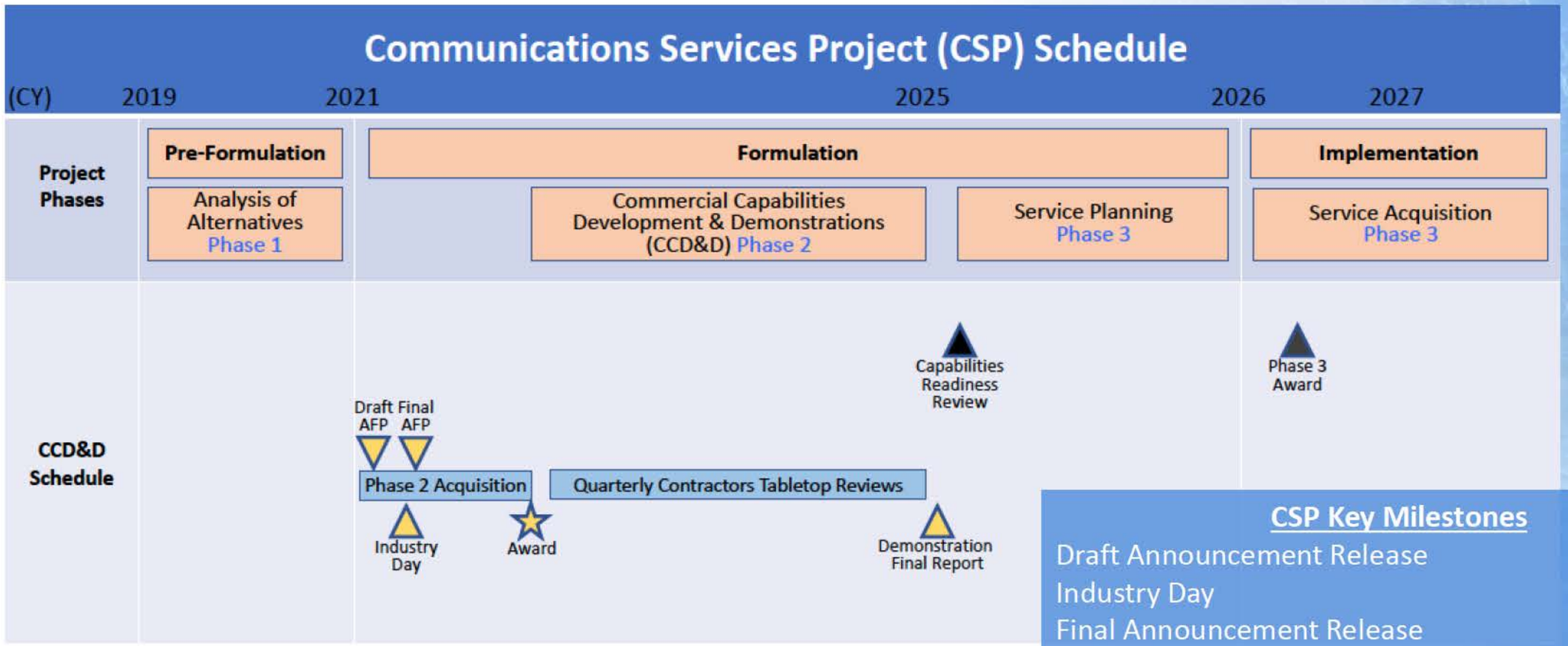
U.S. National Space Policy Principle

- "A robust, innovative, and competitive commercial space sector is the source of continued progress and sustained United States leadership in space. The United States remains committed to encouraging and facilitating the continued growth of a domestic commercial space sector that is globally competitive, supports national interests, and advances United States leadership in the generation of new markets and innovation driven entrepreneurship."

Commercial Space Sector Guidelines

- "To promote a robust domestic commercial space industry, departments and agencies shall:
- Purchase and use commercial space capabilities and services to the maximum practical extent…;
- Modify commercial space capabilities and services to meet government requirements when existing commercial capabilities and services do not fully meet these requirements…;
- Pursue potential opportunities for transferring routine, operational space functions to the commercial space sector where beneficial and cost-effective…"

CSP is based on U.S. National Space Policy and Agency Strategy



CSP Key Milestones

Draft Announcement Release	3Q FY21
Industry Day	3Q FY21
Final Announcement Release	4Q FY21
Demonstration Awards	1Q FY22
Initial Demonstrations	CY21-CY24
Initial Commercial Services Identified	3Q FY25
Transition to Service Acquisition	FY25-FY26

CSP Capability Goals and Reference Architectures

PRESENTED BY:
Dr. James Nessel/Chief, Advanced High Frequency Branch

- **CSP seeks to demonstrate commercial SATCOM capabilities that can be offered as services for spacecraft users in near-Earth orbit, which can potentially include future NASA missions.**

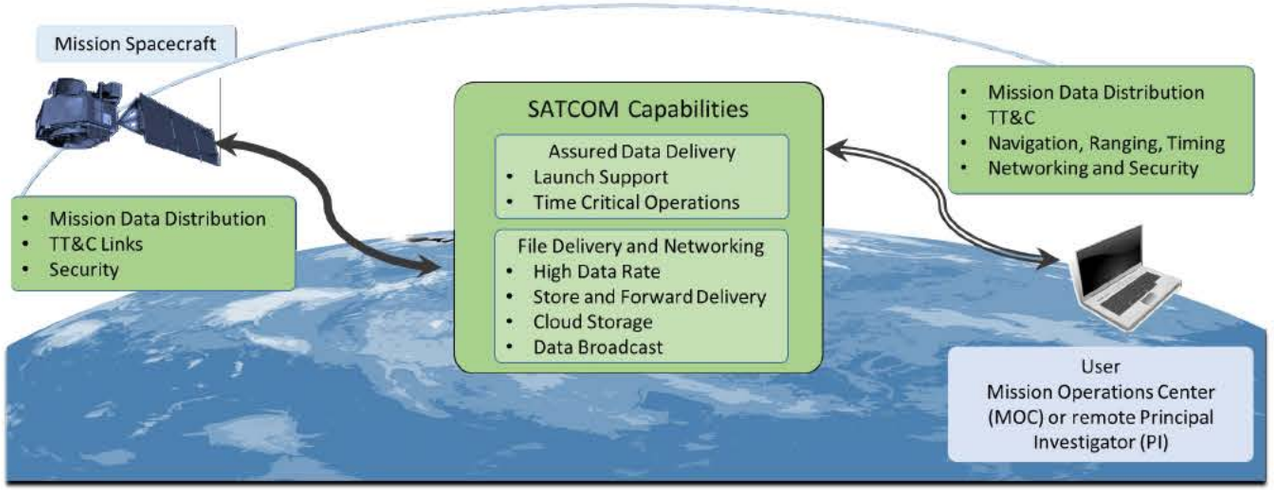
- **CSP is seeking demonstrations based on capabilities and interests of commercial service providers including adaptation of existing commercial infrastructure and terrestrial capabilities.**
  - NASA is not specifying system requirements or system concepts in the demonstration phase in order to open up the trade space, encourage innovations and efficiencies in system solutions
  - The objectives of the space flight demonstrations are broadly targeted for a general SATCOM market serving spacecraft.
  - Each participant must determine the system requirements for its proposed concept that best serves its target markets.

- **Demonstrate a portfolio of End-to-End commercial capabilities that may meet future NASA mission needs**
  - The demonstrations are risk reduction activities to develop multiple capabilities
  - Demonstrations are agnostic on technology, orbits, and data pathway
  - Demonstrations selected should be extensible for a class of missions
  - Minimize the need for NASA-unique capabilities. CSP seeks to potentially be one of many users.

End to End Demonstration of a Commercial Operational Capability

Demonstration Approach

- To facilitate U.S. private industry demonstration of commercial SATCOM capabilities with the goal of achieving robust, reliable, and cost-effective communications to spacecraft in near-Earth orbit



Defined Interfaces

- **Two Key Interfaces:** Service-Spacecraft, and Spacecraft-MOC
- Commercial services are composed of Ground, Space, and Mission Planning capabilities

Demonstration Concept

- **Establish multiple PPPs**
  - Shared resources, cost, and/or risk
- **Demonstrate a portfolio of End-to-End commercial capabilities that may meet future NASA mission needs**
  - The demonstrations are risk reduction activities to develop multiple capabilities
  - Demonstrations are agnostic on technology, orbits, and data pathway
  - Demonstrations selected should be extensible for a class of missions
  - Minimize the need for NASA-unique capabilities. CSP seeks to be one of many users
- **Capabilities demonstrated in Phase 2 can be considered for the end-to-end services acquisition in Phase 3**

Demonstrations will provide performance validation, operational constructs and acquisition models needed to enable use of commercial services by private-sector and Government customers

CSP is not providing a specific target spacecraft or MOC for demonstrations

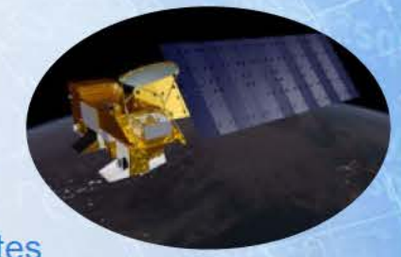
- **Suitable representative mission spacecraft**
  - Should include the user commercial communication system aboard.
- **Suitable representative mission user**
  - Mission Operation Center (MOC)/Principal Investigator (PI) Site.
- **Use of NASA Spacecraft or MOC**
  - Need endorsement from the NASA mission.
  - May impose additional interface requirements.
  - Will not be viewed favorably or unfavorably.

All non-reimbursed costs associated with the use of Government resources will be considered part of the overall NASA funding contribution to the participant.

DEMONSTRATION REFERENCE MISSION USE CASES

Launch Support
- Launch Vehicle
- SLS, Vega
- 8 - 10 Missions Per Year
- 24 kbps – 1 Mbps Forward (FWD) Data Rate
- 10 kbps – 5 Mbps Return (RTN) Data Rate

Low Data Rate Routine Missions
- Long Duration
- TT&C of Satellites
- 35-40 Missions Per Year
- 0.1 kbps –16 kbps FWD Data Rate
- 0.1 kbps – 4 Mbps RTN Data Rate



Launch and Early Operation Phase (LEOP)
- Short Duration
- Commercial Crew/Cargo to ISS*, Satellites
- 11-14 Missions Per Year
- 250 bps – 2 kbps FWD Data Rate
- 1 kbps – 10 kbps RTN Data Rate

*Requires a higher rating for human spaceflight

High Data Rate Routine Missions
- Long Duration
- ISS, Gateway, Science Data Return
- 35-40 Missions Per Year
- 4 Mbps – 600 Mbps RTN Data Rate

Contingency
- Services as needed
- Satellites
- 16 Missions Per Year
- 250 bps – 4 kbps FWD Data Rate
- 0.5 kbps – 40 Mbps RTN Data Rate

Terrestrial Support
- Short and Long Duration
- High-Altitude Balloons, Antarctic
- 10-15 Missions Per Year
- 100 kbps – 7 Mbps FWD Data Rate
- 4 Mbps – 600 Mbps RTN Data Rate

Mission reference documents (Announcement Appendices D-F) have been compiled by NASA summarizing past and present service usage data, as well as future projected mission needs.

- **Appendix D**
  - SCaN Future Mission Space Communication and Navigation Needs (CSP-L3-404)
- **Appendix E**
  - SCaN Network User Data Volume (CSP-L3-406)
- **Appendix F**
  - SCaN Network Utilization Data (User Tech Data) (CSP-L3-004)

This reference data is provided in the following appendices as context to support service offering planning and capability definitions.

The SCaN Future Mission Space Communication and Navigation Needs document (CSP-L3-404) lists the NASA use case groups and provides context for types of missions in the Near-Earth domain which are germane to commercial industry support.

Use Case Groups	Description	Canonical Examples
Human Space Flight	Includes use cases for LEO operations and servicing. Key: Human spaceflight operations	LEO: International Space Station (ISS)
Near Earth Robotic - LEO Science	Use cases cover the range of likely data volumes; platforms range from micro-satellites to large, multi-instrumented spacecraft Key: Data volume variations	Low data volume users (e.g., micro-sat) to ultra-high data volume (e.g., NASA-ISRO Synthetic Aperture Radar (NISAR))
Near Earth Robotic - GEO & Near Earth	Robotic spacecraft operating in geosynchronous Earth orbit, highly elliptical orbits, cislunar region, or at S-E L1 or L2	GEO: Solar Dynamic Observatory (SDO) Elliptical: Magnetospheric Multiscale (MMS) Lagrange: JWST
Near Earth Robotic - Low Latency & Complex Needs	Use cases cover scenarios requiring low latency or complex transport of data Key: Low latency or complex needs	Science alert: SWIFT Weather: Joint Polar Satellite System (JPSS-1), and Global Precipitation Measurement (GPM)
Mission Operations	Use cases covering key operational scenarios including LEOP, emergency support, end of life, and routine Mission Telemetry, Tracking and Command (TT&C)	Applies to most spacecraft missions
Launch Events	Short-duration events and platforms with sub-orbital and orbital launch trajectories	Expendable launch vehicle launch from specific launch sites, e.g., Cape Canaveral, driving geographic coverage
Terrestrial & Aerial	Various atmospheric (e.g., balloons & aircraft) & ground platforms with unique needs	Seasonal long-duration (days) science balloons in the southern polar region

The document describes the use case groups and provides NASA mission examples.

The SCaN Network User Data Volume (CSP-L3-406) document provides the total usage of NASA space communication services provided to NASA missions.

User	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Total
AIM	9513	8105	7202	6616	6675	8337	8154	13265	11647	11887	15313	11765	118479
Aqua	5899	5763	6406	6007	5829	5732	4638	5840	5805	6036	5771	5792	69518
Atlas V	0	0	0	0	0	0	0	628	0	0	75	165	868
Aura	3658	3264	4289	3828	3424	3123	2689	3178	3397	4408	3164	3305	41727
BRTS	2624	2628	3240	1516	2804	2764	1360	920	699	844	496	1812	21707
Delta IV	33												
Dragon	22												
FGST	36												
GPM	177												
HST	173												
ICESat-2	3												
ICON	0												
ISS	410												
HTV	0												
JPSS-1	0												
Landsat-7	3												
Landsat-8	5												
Landsat-9	0												

"Wall Clock Minutes" of SR access per month, by mission

Mission*	AS1	AS2	AS3	MG1	KUS	PDL	WG1	WG2	WG3 (UHF)	WG4 (VHF)	WS1	WS4 (UHF)	WS5 (VHF)	AGO (SA1)	AGO (SA2)	AGO (SA3)	Hart (HBK1)	Hart (HBK2)
ACE	0	0	0	0	0	0	0	0	0	0	1,995	0	0	0	0	0	0	0
AIM	3,133	0	2,010	0	0	0	2,224	0	0	0	0	0	0	0	0	0	0	0
Aqua	7,787	11,457	3,117	0	0	0	123	0	0	0	0	0	0	0	0	0	0	0
Aura	7,249	11,274	3,210	0	0	0	7,982	0	0	0	0	0	0	0	0	0	0	0
COBE	0	0	0	0	0	0	685	0	0	0	0	0	0	0	0	0	0	0
COSMIC-1A	0	0	0	4,371	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COSMIC-6F	0	0	0	4,759	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cygnus 10	0	0	0	0	0	0	2,649	1,393	0	0	0	0	0	0	0	0	0	0
Cygnus 11	0	0	0	0	0	0	2,547	3,425	0	0	0	0	0	0	0	0	0	0
DSCOVR	0	0	0	0	0	0	0	0	0	0	4,763	0	0	960	0	1,860	0	0
Orion EM-1	0	0	0	0	150	150	0	0	0	0	0	0	0	0	0	0	0	0
FGST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GOES	0	0	0	0	0	0	1,410	0	0	0	0	0	0	2,085	0	90	0	0

Minutes of DTE access per ground station, by mission

The SCaN Network Utilization Data (User Tech Data) (CSP-L3-004) document provides service use data on the current SCaN communications service type and usage broken down by each NASA mission.

Key Mission Data in Appendix F Includes:

- Command, Telemetry, and/or Tracking Services Used
- Science Data Service Provided
- Space Relay Uplink and/or Downlink Data Rates
- Direct to Earth Uplink and/or Downlink Data Rate
- Orbit Regime
- Nominal Space Relay Events and Service Time Per Day
- Number of Missions per Year
- Doppler
- Ephemeris
- Mission Operation Center Location
- Security Operation Center Location
- Service Start and End Dates

NORAD ID	Use Case	Command Service Used	Telemetry Service Used	Tracking Service Used	Science Data Service Provided	S-Band Uplink Data Rate (DTE)	S-Band Downlink Data Rate (DTE)	S-Band FWD Data Rate (SR)	S-Band RTN Data Rate (SR)	X-Band Uplink Data Rate (DTE)	X-Band Downlink Data Rate (DTE)	Ku-Band FWD Data Rate (SR)	Ku-Band RTN Data Rate (SR)	Ka-Band Uplink Data Rate (DTE)	Ka-Band Downlink Data Rate (DTE)	Ka-Band FWD Data Rate (SR)	Ka-Band RTN Data Rate (SR)	Orbit Regime
24912	Near Earth Robotic - GEO and Near Earth	Y	Y	Y	Y	1 kbps	0.434 - 76.284 kbps	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	LI
33304	Near Earth Robotic - LEO Science	Y	Y	Y	Y	2 kbps	2 Mbps	2 kbps	4 kbps	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	LEO
27424	Near Earth Robotic - LEO Science	Y	Y	Y	Y	2 kbps	16.384 kbps, 524.288 kbps	SA: 125 bps, 250 bps, 500 bps, 1000 bps MA: 125bps	SA + MA: 1.024 kbps, 4.096 kbps 16.384 kbps	N/A	15 Mbps, 150 Mbps	N/A	N/A	N/A	N/A	N/A	N/A	LEO
	Launch Events	N	Y	Y	N	N/A	N/A	N/A	75 kbps, 250 kbps	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Varies
	Launch Events	N	Y	Y	N	N/A	N/A	N/A	307.2 kbps/400 kbps 307.2 kbps/1.2Mbps 307.2 kbps/2.4Mbps 307.2 kbps/3.2Mbps 307.2kbps/4.8Mbps	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Varies
28876	Near Earth Robotic - LEO Science	Y	Y	Y	Y	2 kbps	16.384 kbps, 524.288 kbps	SA: 125 bps, 250 bps, 500 bps, 1000 bps MA: 125bps	SA + MA: 1.024 kbps, 4.096 kbps 16.384 kbps	N/A	15, 150 Mbps	N/A	N/A	N/A	N/A	N/A	N/A	LEO
	Human Space Flight	Y	Y	Y	N	N/A	N/A	80.96 kbps, 64 kbps, 144 kbp	20.48 kbps, 102.4 kbps, 234.56 kbps	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	LEO
	Near Earth Robotic - LEO Science	Y	Y	Y	Y	1.193-50.986 kbps	256 kbps-4 Mbps	1-8 kbps	2-16 kbps	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	LEO-Inclined
	Human Space Flight	Y	Y	Y	N	2 kbps, 500 kbps	3 Mbps, 6 Mbps	250 bps, 2 Kbps	8, 16, 16.797 or 31.972 kbps	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	LEO
	Launch Events	N	Y	Y	N	N/A	N/A	N/A	I-Ch./Q-Ch. 307.2 kbps/400 kbps 307.2 kbps/1.2Mbps 307.2 kbps/2.4Mbps 307.2 kbps/3.2Mbps 307.2kbps/4.8Mbps	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Varies
	Near Earth Robotic - LEO Science	Y	Y	N	Y	1.193-50.986 kbps	256 kbps-4 Mbps	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	LEO-Polar
	Human Space Flight	Y	Y	Y	N	N/A	N/A	24 kbps	10 kbps, 32 kbps, 256 kbps	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	LEO
	Human Space Flight	Y	Y	Y	Y	144kbps	500kbps	144kbps	144kbps	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	LEO

Capability Definitions, Mission Projections and User Goals

PRESENTED BY:
Thomas Kacpura/CSP Deputy Project Manager

Two primary communications service capabilities are being sought through this announcement:

Assured Data Delivery Capability

- Provide assured access to spacecraft for critical data transmissions.
- Includes spacecraft/instrument commanding and critical telemetry information with time-sensitive delivery requirements.
- Links are generally lower data rate, latency intolerant, bi-directional, and require near 24/7 access.

File Delivery and Networking Capability

- Provide ability to deliver telemetry data to a MOC/PI.
- Links typically support larger data file transmission (higher data rates) but can tolerate higher latencies making it ideal for transport via store and forward or burst mode, if necessary.

Additional Capabilities: NASA is also interested in stimulating additional or enhanced capabilities that could be offered/ demonstrated by participants, including, but not limited to: Tracking/Navigation Services, Direct Satellite-to Satellite(s) messaging, Demand Access Services, Real-Time Video Services (Human Spaceflight)

Industry should propose demonstrations based on their capabilities and interests

For each capability, several user goals have been identified and are intended for demonstrating comparable performance to the existing NASA systems.

- Demonstrations do not need to meet every goal.
- Participants should select goals based upon their business thrusts and interests and plans for offering future commercial SATCOM services.
- Participants should use industry processes and standards.
- Demonstrations should result in the offering of a service, providing a balance between a reliable, robust, and cost-effective service for any space user.
- CSP desires potentially to be one of many users of the proposed service.
- NASA will not fund existing capabilities.

ASSURED DATA DELIVERY CAPABILITY USER GOALS

The following goals support the demonstration of Assured Data Delivery Capability communication services:

- **GOAL.1.001:** Ability to close communication links for user spacecraft orbiting in the range of 200 to 1000 km; for launch vehicles from the pad to disposal; and for terrestrial/balloons.
- **GOAL.1.002.** Ability to support user spacecraft with an inclination of 0 to 180 degrees.
- **GOAL.1.003:** Ability to maintain link availability of > 98% over a 30-day calendar period of operation.
- **GOAL.1.004:** Ability to return user spacecraft telemetry data between 0.12 Gigabytes (GB)/Day to 9.2 GB/Day. Return Link Data Volume min/max values are based on single missions.
- **GOAL.1.005:** Ability to forward user spacecraft telemetry data between 1.25 Megabytes (MB)/Day to 177.5 MB/Day. Forward Link Data Volume min/max values are based on single missions.
- **GOAL.1.006:** Ability to ensure maximum Bit Error Rate (BER) of 10^{-5}.
- **GOAL.1.007:** Ability to perform make-before-break connectivity, or break-before-make with a minimum possible time loss during handover.
- **GOAL.1.008:** Ability to provide a minimum latency with reliable connectivity at near-24/7 availability.
- **GOAL.1.009:** Ability to provide varying quality of service based on user needs. Quality of service is defined by throughput, total transmission delay, availability, priority, bit error rate, and packet loss. It should include error checking, security, and service latency considerations.

The following goals support the demonstration of File Delivery and Networking Capability communication services:

- **GOAL.2.001:** Ability to close communication links for user spacecraft orbiting in the range of 200 to 1000 km; for launch vehicles from the pad to disposal; and for terrestrial/balloons.
- **GOAL.2.002:** Ability to support user spacecraft with an inclination from 0 to 180 degrees.
- **GOAL.2.003:** Ability to maintain link availability of > 98% over a 30 calendar day period of operation.
- ➢ **GOAL.2.004:** Ability to provide service volume per day per mission of at least 1GB. Service volume per day is the product of data rate per transmission, the average number passes per day, and the average time the pass is connected in hours.
- **GOAL.2.005:** Ability to ensure a maximum Bit Error Rate (BER) of 10^{-5}
- **GOAL.2.006:** Ability to perform make-before-break connectivity, or break-before-make with a minimum possible time loss during handover.
- ➢ **GOAL.2.007:** Service Latency (Tolerance category or total time): For file transfer, the capability is latency tolerant. Latency is dependent on individual mission needs, but the goal is to minimize latency to highest extent practicable.

NASA will also consider capabilities outside the two primary communications capabilities identified. Additional capabilities include, but are not limited to:

- **GOAL.3.001:** Ability to provide communication services to multiple user spacecraft orbiting in close proximity, including Automated Rendezvous and Docking (AR&D), satellite servicing, visiting vehicles, and/or formation flying missions.

- **GOAL.3.002:** Ability to provide for emergency demand access request to the MOC and/or direct satellite-to-satellite(s) relay links (i.e., without routing through MOC/ground station) to support, for example, critical event messaging from one satellite to one or more other satellites or ground stations.

- **GOAL.3.003:** Ability to provide File Delivery Capability with <100 msec latency. The goal is to deliver the best possible real time video, for events of interest (e.g., Commercial Cargo/Crew visiting the International Space Station (ISS) can obtain <100 msec latency). It is recognized that there are physical and technology limitations to this goal.

- **GOAL.3.004:** Ability to transmit tracking parameters to the spacecraft. Tracking parameters may include the following: orbit determination products, definitive ephemeris, predictive ephemeris, range, range rate, and Doppler. Service providers should be able to accommodate a range of pointing/vector algorithms/data sets that conform to communication data standards that allow for accurate pointing for communication/navigation elements of a mission.

SERVICE CAPABILITY MISSION PROJECTIONS

Assured Data Delivery Service Mission Projections			
		Present (Jan 2020 – Dec 2022)	Near-Future (Jan 2023 – Dec 2027)
Mission (Count)	Direct to Earth (DTE)	22 - 26	49 - 85
	Space Relay (SR)	19 - 23	
	Launch Events	33 - 45	>20
Passes Per Day (Per Mission)		1 - 16	1 - 16
Service Time Per Year (Minutes)		702-525,600	≤ 525,600

File Data Delivery and Networking Service Mission Projections			
		Present (Jan 2020 – Dec 2022)	Near-Future (Jan 2023 – Dec 2027)
Mission (Count)	Direct to Earth (DTE)	20 - 24	40 - 76
	Space Relay (SR)	12 - 16	
Passes Per Day (Per Mission)		1 - 25	1 - 25
Service Time Per Year (Minutes)		89,840 - 525,600	≤ 525,600

- Passes per day provides a minimum and maximum range based on individual missions for DTE services.
- Service time per year provides a minimum and maximum range based on individual missions for SR services.
- **Note:** Near-Future mission counts have not been categorized by service type because missions determine which service to use later on in their life cycle.

Reference Concept of Operations

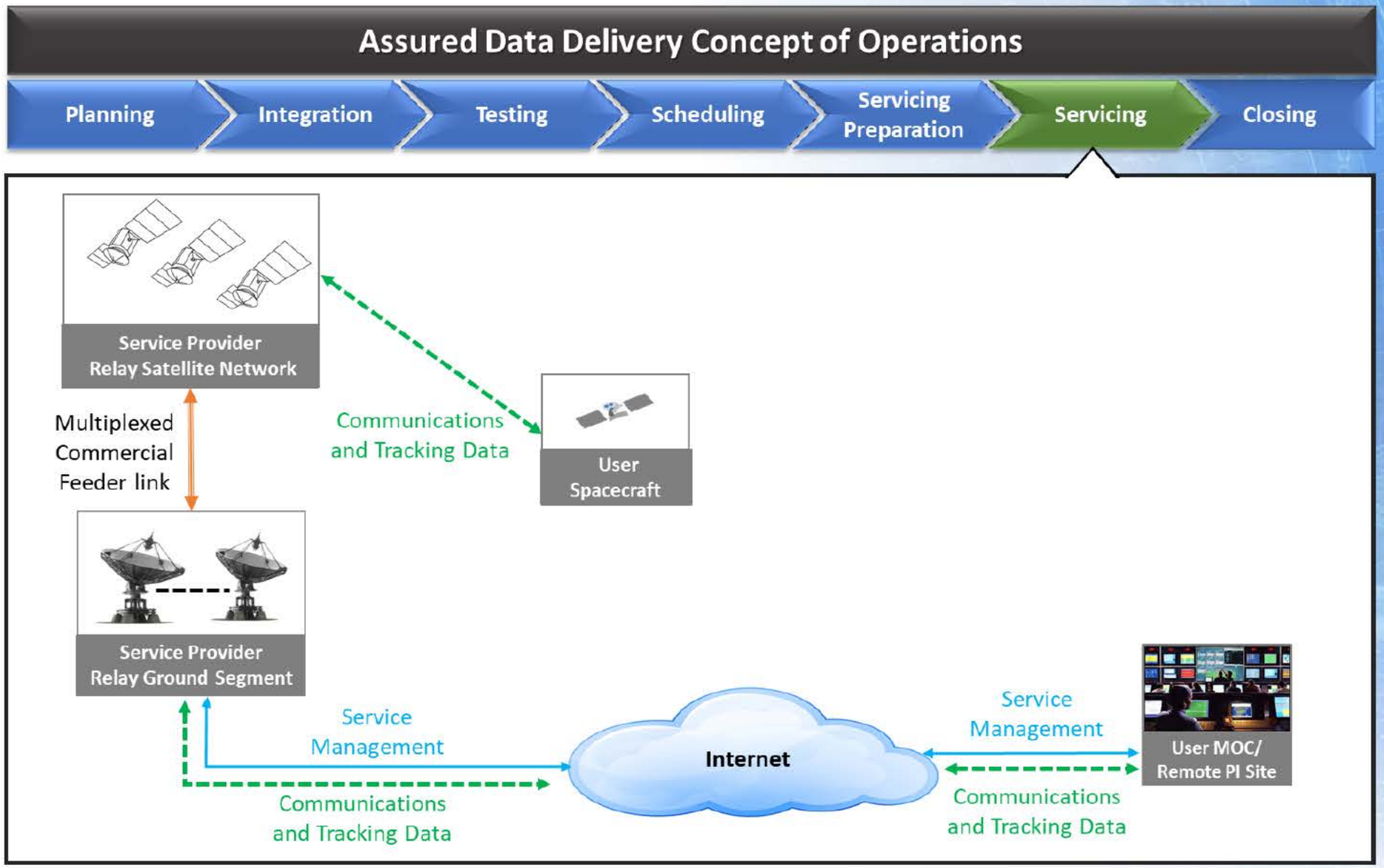
PRESENTED BY:

Thomas Kacpura/CSP Deputy Project Manager

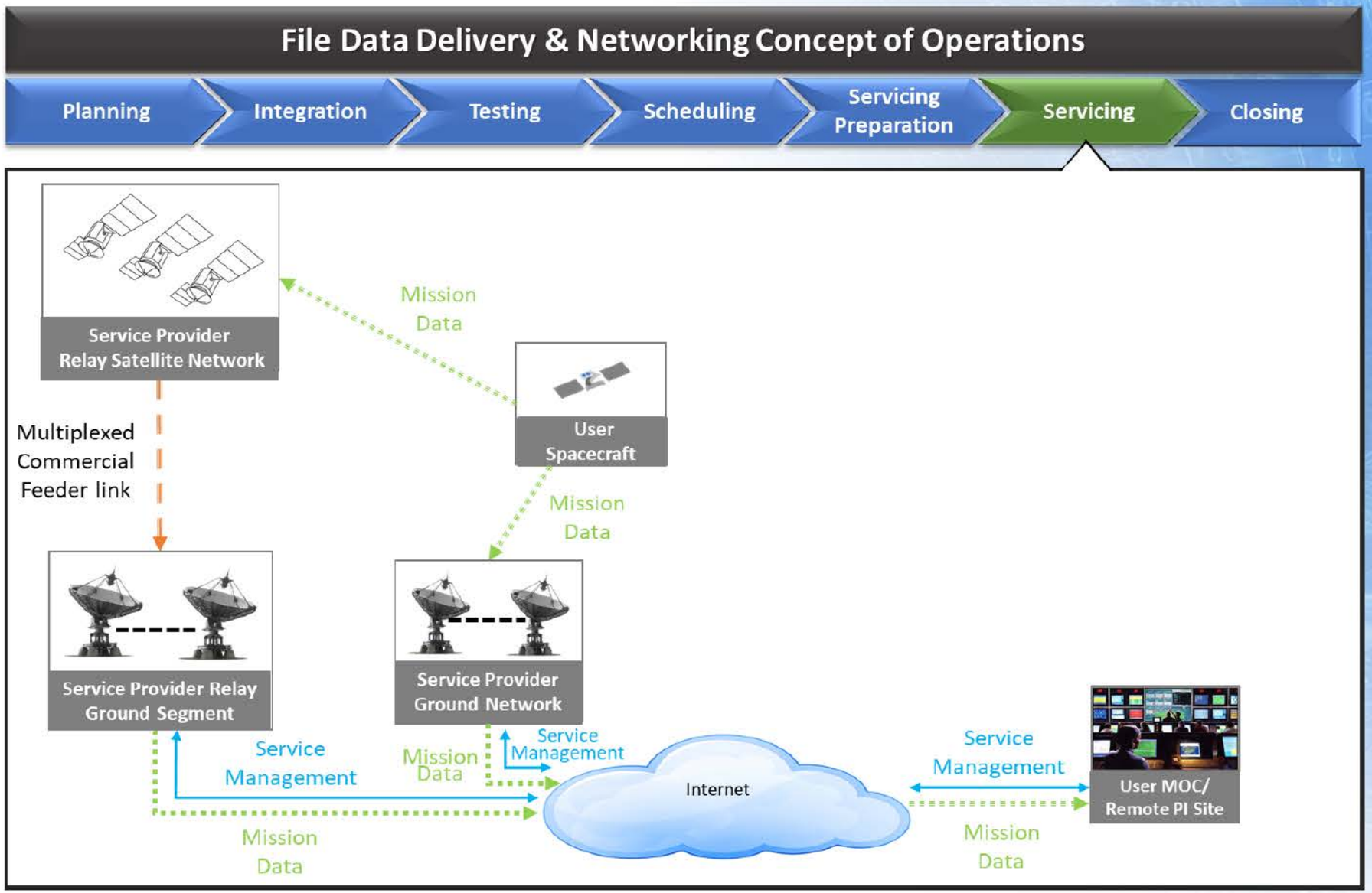
To support the announcement, a reference architecture ConOps was developed for each of the capabilities. This provides the participants and users insight on how the commercial services potentially could be used by Government or private-sector consumers. The ConOps also supports the participants to formulate and propose a set of milestones that represent the progress of significant technical, programmatic and business development events in the capability development and demonstration.

Planning	Integration	Testing	Scheduling	Servicing Preparation	Servicing	Service Accounting	Closing
In this stage, initial service planning, communication analysis, and resource identification is performed to establish feasibility of the service demonstration.	The service provider plans and documents all integration processes for the communication terminal to the user spacecraft.	In this stage, end-to-end testing is carried out on the ground prior to the commercial service flight demonstration.	In this stage, service providers detail the process users must carry out in order to request and schedule services.	In this stage, the service provider (and partners, if any) prepares to provide services to the user spacecraft.	In order to perform assured services to the user spacecraft, the user mission operation center sends commands and/or data into encrypted forward data to the spacecraft.	During the operations to provide agreed-upon services, the service provider delivers the service accounting data at agreed-upon intervals to the spacecraft user.	In this stage, services are closed out. The service provider delivers and presents a final report of the demonstration service operations to the CSP Team.

During Assured Data Delivery, communications and tracking data are delivered from the user spacecraft to the user MOC/remote PI site and from the User MOC/remote PI site to the user spacecraft via the service provider relay satellite network.



During File Data Delivery and Networking, mission data are delivered from the user spacecraft to the user MOC/Remote PI site via the service provider relay satellite network or the service provider ground network.



Operational requirements are defined to ensure that the capability demonstration validates an end-to-end operational service capability.

★ **Important Points to Note:**

- It is intended that the demonstration should be as close to the operational service as possible; any differences should be noted.
- The duration of the demonstration as proposed by the service provider needs to be sufficient to verify key performance parameters of the capability.
- Evidence of meeting these operational requirements shall be provided in the appropriate milestone(s) defined by the participant.

Compliance with the following operational requirements must be part of any end-to-end demonstration:

✓ Demonstrate an appropriate level of security	[REQ_ID 001-007]
✓ Provide and demonstrate a mission planning function	[REQ_ID 008]
✓ Demonstrate the flow of communication and data through the interfaces using appropriate industry practices and standards	[REQ_ID 009]
✓ Demonstrate compatibility by testing as appropriate for the spaceflight certification	[REQ_ID 010]
✓ Demonstrated provisioning of performance metrics to enable service quality assessment and cost accountability	[REQ_ID 011]
✓ Demonstrate a plan on how the future service-level-agreements will be structured after the capability development and demonstration phase	[REQ_ID 012-013]
✓ Demonstrate a full end-to-end service, along with transition plans for user terminal used in demonstration	[REQ_ID 014-015]
✓ Demonstrate the ability to coordinate regulatory/spectrum management issues	[REQ_ID 016]

Spectrum Management

Obtaining Regulatory Recognition for Satellite-to-Satellite Links in Fixed-Satellite Service Frequency Bands

PRESENTED BY:

Glenn Feldhake/International Spectrum Program Manager

To ensure sufficient high quality radio frequency spectrum is available to enable the success of NASA's Vision, Mission and Goals. The Spectrum Management Program ensures:

- All NASA activities comply with national and international rules and regulations applicable to the use of the electromagnetic spectrum,
- Facilitates securing spectrum and orbital resources (both domestically and internationally) needed to enable aeronautical and space mission requirements, and
- Supports the vital work of all NASA Mission Directorates.

Satellite-to-satellite operations result in different spectrum challenges depending on the radio services involved

- Space-based relay (SBR) operations are allowed today within certain frequency bands allocated to Space Research (SRS), Earth Exploration-Satellite (EESS), Space Operations (SOS) and/or Inter-satellite (ISS) services
- ITU-R is in various stages of exploring regulatory issues with using other satellite services (Fixed-Satellite (FSS) and Mobile-Satellite (MSS) services) to support future satellite-to-satellite operations

Participants should demonstrate their understanding of regulatory / spectrum management issues to enable provisioning of future communication services to users

- **Near-term spectrum management approach for securing regulatory licensing for demonstration under the announcement**
- **Long-term spectrum management approach for addressing domestic and international regulatory considerations in an operational context**
  - Regulatory recognition for satellite-to-satellite link operations in the frequency bands being proposed
  - Government versus non-government use of spectrum domestically

- There are no fixed-satellite (FSS) or mobile-satellite service (MSS) allocations with “(space-to-space)” direction indicators
- There are no FSS or MSS allocations shared with the inter-satellite service (ISS)
- The U.S. Government generally does not give contracts to companies to do things that are not in conformity with international law
- Even if the U.S. Government did…those operations would be completely unprotected

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- Therefore, the Treaty needs to be revised.

International Radio Regulations (= Treaty)

- Four volumes; ~2,400 pages
- Renegotiated every 3-4 years

Administered by the International Telecommunication Union (ITU)

- Specialized agency of the United Nations
- U.S. Delegations managed by the State Department

Renegotiated at a World Radiocommunication Conference (WRC)

- Most recent 28 Oct-22 Nov 2019
- Next WRC will take place in 2023
- U.S. Delegation led by an Ambassador appointed by the President
- Delegation is mix of government and industry who serve as technical advisors to the Ambassador

Topics on the table are called "Agenda Items"

- WRC-23 Agenda Item 1.17 addresses space-to-space links in some bands used by commercial FSS operators
- Preliminary agenda for WRC-27 includes Agenda Item 2.8 addressing space-to-space links in some bands used by commercial MSS operators

WRC-23 AI 1.17: to determine and carry out, on the basis of the ITU-R studies in accordance with Resolution 773 (WRC-19), the appropriate regulatory actions for the provision of inter-satellite links in specific frequency bands, or portions thereof, by adding an inter-satellite service allocation where appropriate.

- **The resolves of Resolution 773 (WRC-19) call for:**
  - Development of technical and operational characteristics of non-GSO user space stations
  - Identification of spectrum requirements for transmissions between space stations
  - Conduct of sharing and compatibility studies with existing primary services
  - Determination of technical conditions and regulatory provisions for satellite-to-satellite operations, including new Inter-Satellite Service allocations

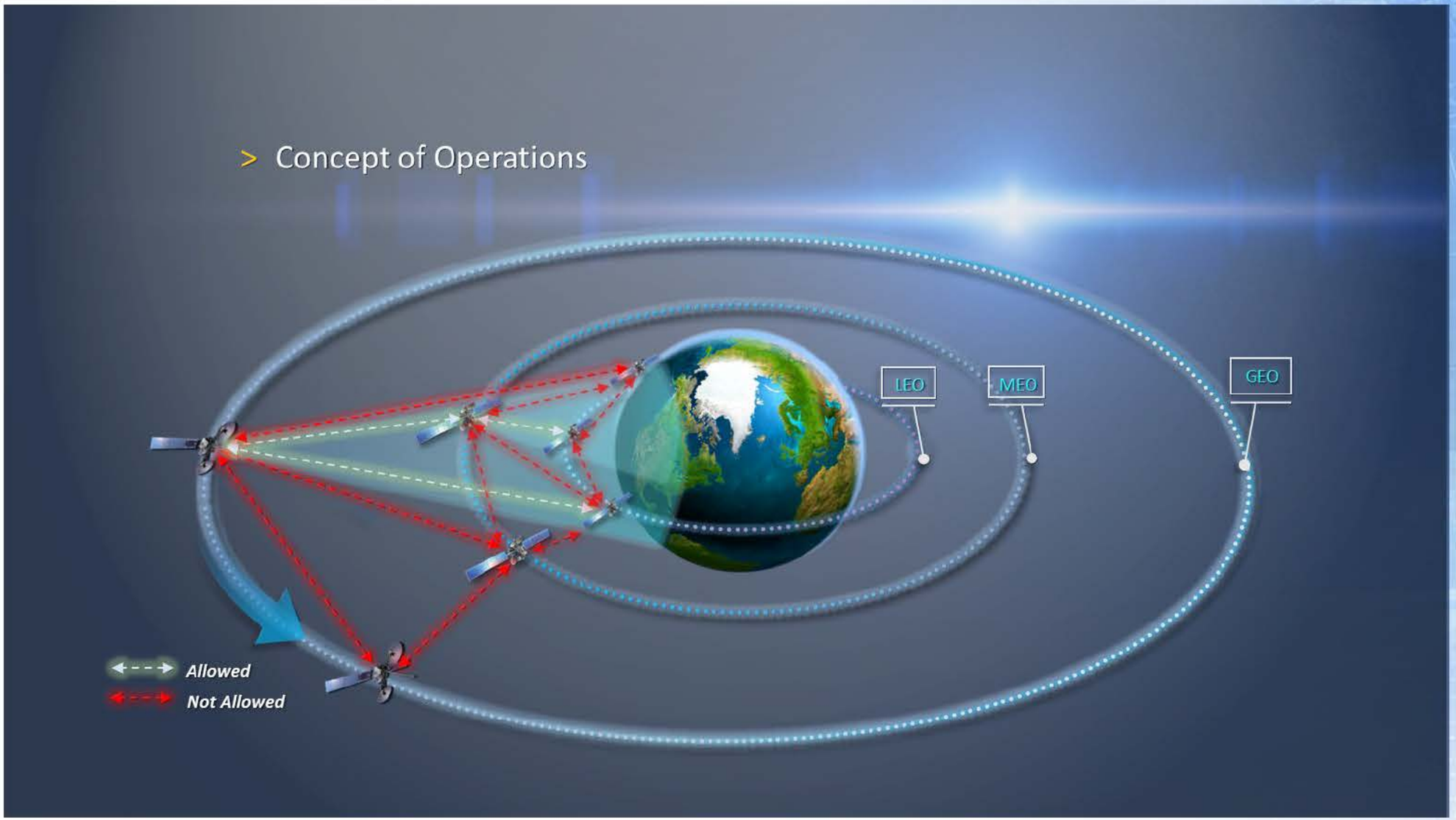
- **Frequency bands under consideration** – 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz

- **Studies under the responsibility of ITU-R Working Party 4A** (Efficient Orbit/Spectrum Utilization for FSS and Broadcasting-satellite service (BSS))

WRC-27 AI 2.8: to study the technical and operational matters, and regulatory provisions, for space-to-space links in the frequency bands [1 525-1 544 MHz], [1 545-1 559 MHz], [1 610-1 645.5 MHz], [1 646.5-1 660.5 MHz] and [2 483.5-2 500 MHz] among non-geostationary and geostationary satellites operating in the mobile-satellite service, in accordance with Resolution 249 (WRC-19)

- **The resolves of Resolution 249 (WRC-19) call for:**
  - Development of technical and operational characteristics of non-GSO user space stations
  - Identification of spectrum requirements for transmissions between space stations
  - Conduct of sharing and compatibility studies with existing primary services
  - Determination of technical conditions and regulatory provisions for satellite-to-satellite operations, including new or revised MSS allocations or the addition of ISS allocations, on a secondary basis

CONCEPT OF OPERATIONS AS SUPPORTED BY US IN CONTRIBUTIONS TO ITU-R WP4A



GUIDING PRINCIPLES OF CONCEPT OF OPERATIONS AS SUPPORTED BY US IN CONTRIBUTIONS TO ITU-R WP4A

Satellite-to-satellite link transmissions will comply with the same directionality indicators as in the existing FSS allocations (Earth-to-space = from lower altitude user to higher altitude service provider, space-to-Earth = from higher altitude service provider to lower altitude user)

Non-GSO user space stations will operate at a lower orbital altitude than that of the host GSO or non-GSO FSS service provider space station and in a manner that should resemble typical user earth stations of the FSS service provider network.

- Limit operations to within the antenna beam coverage of the GSO or non-GSO FSS service provider space station
- Produce the same received power flux density at GSO or non-GSO service provider space station from non-GSO user space station as the power received from the provider's associated earth stations
- Utilize active power control capabilities to compensate for the varying free-space path loss as they orbit
- Utilize steerable antennas with tracking capability to communicate with GSO or non-GSO FSS service provider space station
- Comply with equivalent off-axis effective isotropic radiated power (e.i.r.p.) density limits as earth station terminals when communicating with a GSO FSS service provider space station (i.e. Recommendation ITU-R S.524 for terminals in a GSO system)
- Comply with applicable equivalent power flux density (EPFD) limits in the portions of the Ka-band where these limits apply when communicating with a non-GSO FSS service provider space station

Technical

- NASA studies are overseen by the NASA Spectrum Analysis Center
- Defining overall "Spectrum Requirements"
- Many different sharing scenarios have been defined for AI 1.17
- Focusing on sharing scenarios to demonstrate compatibility
- Taking lead in US efforts in USWP4A

Regulatory

- Developing "Preliminary Views" for United States
- Socializing issues with regulators around the Americas (CITEL)
- Proposals to revise the Treaty will come later as study results are agreed

Outreach

- Working with satellite industry representatives
  - Operators are still defining their positions
  - Do not impose restrictions on their existing operations
- Aligning positions with other Federal agencies
- Aligning positions with other space agencies (SFCG)

Technical work for WRC-23 AI 1.17 is being carried out in ITU-R WP4A

- **US preparatory work is being addressed in USWP4A Chaired by Clay DeCell (FCC)**
- **NASA is co-authoring contributions to WP4A in concert with several US satellite companies**
  - Conducting sharing studies
  - Developing draft text for Conference Preparatory Meeting (CPM) Report
  - Examining regulatory provisions to protect incumbent services

To become involved in USWP4A

- Contact Clay DeCell (Clay.DeCell@fcc.gov) and ask to be added to USWP4A list serve

To become involved in study efforts in USWP4A addressing AI 1.17

- Contact Wayne Whyte (Teltrium Solutions, LLC) at wwhyte@Teltrium.com

Cybersecurity

PRESENTED BY:

David Murnan/GRC Chief Information Security Officer

NASA Cybersecurity Challenge…

Ensure comprehensive, end-to-end Cyber Resiliency in the proposed Commercial Space Communications solution that can potentially meet NASA's future needs.

Proposal Opportunity…

Demonstrate and/or provide representation/certification for how the proposed solution will protect electronic information from unauthorized modification, disclosure or destruction consistent with the Federal Information Security Modernization (FISMA) Act of 2014 and NIST 800-53 Security and Privacy Controls for Federal Information Systems and Organizations Revision 4 or Revision 5, during the demonstration phases and ongoing.

Holistic approach to cybersecurity risk management consistent with the NIST Cybersecurity Framework

- **All elements of the service are documented,** including the infrastructure to support the service
- **Appropriate Cybersecurity controls are selected, implemented and documented**
- **Systems are kept up-to-date** on security patching, vulnerability scanning is performed, and any residual risk is mitigated or risk accepted
- **Penetration testing is performed** to identify any weaknesses in the system
- **Periodic assessment of system controls effectiveness are conducted**
- **Supply chain risk management is implemented**
- **Cybersecurity Risk Management is integrated** into the System Development Lifecyle

NIST Special Publication 800-37, Guide for Applying the Risk Management Framework

- A holistic and comprehensive risk management process
- Integrates the Risk Management Framework (RMF) into the system development lifecycle (SDLC)
- Provides processes (tasks) for each of the six steps in the RMF at the system level

NIST National Institute of Standards and Technology U.S. Department of Commerce

- Demonstrate an appropriate level of cybersecurity to communication links, on both terrestrial link to the MOC and space link to the spacecraft.

- Selection of a NASA mission or MOC for the demonstration will require additional cybersecurity requirements, including an interconnection security agreement, which details the technical and procedural requirements.

- The participant shall demonstrate protection against unauthorized access, reducing vulnerabilities of command, control and telemetry systems, protecting against communications jamming and spoofing, protecting ground system from cyber threats, promoting adoption of appropriate cybersecurity hygiene practices, and managing supply chain risks.

- The participant shall demonstrate penetration testing of end-to-end Space Communications Service that validates the cybersecurity effectiveness of the implementation (either directly, or via evidence/plans of penetration testing).

- The participant shall afford NASA the opportunity to conduct cybersecurity assessments and penetration tests on the end-to-end Space Communications service.

- The participant shall demonstrate how the cyber resiliency posture, post award, will be continuously monitored, managed and communicated to NASA.

- The participant shall afford NASA on-site access to the facilities, installations, operations, documentation, databases and personnel used in the creation and performance of this service for testing and assessment of cybersecurity controls.

- **Completion of Appendix C - Cybersecurity Questionnaire is required as part of the proposal.**

- **Identifies Critical Controls to evaluate the provider's cybersecurity posture and ability to deliver a cyber resilient service.**

- **Cybersecurity artifacts in addition to the questionnaire and in support of the provider's cybersecurity capability are welcome, including but not limited to:**
  - System's Authorization to Operate
  - Independent cybersecurity audits and/or assessments
  - IT Security Management Plan
  - Systems Security Plan
  - Listing of unsatisfied controls
  - Residual Risk Acceptances
  - Supply Chain Risk Management Controls
  - Continuous Monitoring audit/assessment artifacts
  - Vulnerability Scanning Reports
  - Patching status
  - Penetration testing results
  - Cyber incident reporting

From Space Policy Directive 5, section on Principles

"Space systems and their supporting infrastructure, including software, should be developed and operated using risk-based, cybersecurity-informed engineering. Space systems should be developed to continuously monitor, anticipate, and adapt to mitigate evolving malicious cyber activities that could manipulate, deny, degrade, disrupt, destroy, surveil, or eavesdrop on space system operations. Space system configurations should be resourced and actively managed to achieve and maintain an effective and resilient cyber survivability posture throughout the space system lifecycle."

A comprehensive, end-to-end cyber resilient service benefits all customers of commercial space communications.

Reference Links

Space Policy Directive 5 Cybersecurity Principles for Space Systems

Federal Information Security Modernization Act of 2014

NIST 800-53 Rev. 4 Security and Privacy Controls for Federal Information Systems and Organizations

NIST 800-53 Rev. 5 Security and Privacy Controls for Federal Information Systems and Organizations

NIST 800-37 Risk Management Framework for Information Systems and Organizations

NIST 800-137 Information Security Continuous Monitoring (ISCM) for Federal Information Systems and Organizations

FIPS 199 Standards for Security Categorization of Federal Information and Information Systems

FIPS 200 Minimum Security Requirements for Federal Information and Information System

FIPS 140-2 Security Requirements for Cryptographic Modules

FIPS 140-3 Security Requirements for Cryptographic Modules

Q&A

CSP Draft Announcement Overview

MAY 11, 2021

Information for Participants
Proposal Submittal Information

PRESENTED BY:

Eric Hartman/CSP Agreements Officer

- **Agreement Type:** Funded Space Act Agreement(s). Not bound by Federal Acquisition Regulation (FAR) or the NASA FAR Supplement (NFS) since this announcement will not result in the award of a contract

- **Place of Performance:** Contractor's site and Government facilities if requested in proposal (and subsequently granted)

- **Type of Competition:** Full and open competition

- **Eligible Participants:** U.S. Companies (other eligibilities noted within section 4.2 of the draft AFP). Failure to demonstrate ability to meet these eligibility requirements at time of award will deem the Participant's proposal not compliant and therefore the proposal will be eliminated from further evaluation.

- **NASA will accept no more than one proposal per company or team of companies. A company may be a team member or sub-participant on other proposals**
- **Proposal page limits are described below**

Volume No.	Section No.	Title	Page Limit
I		Executive Summary	2
II		Business Plan	25
	B1	Capability Development and Demonstration Business Plan	
	B2	Operational Service Feasibility Plan	
III		Technical Approach	25
	T1	Demonstration Concept	
	T2	Service Operational Construct	
IV		Price	No Page Limit
Appendix 1		Proposed Funded Space Act Agreement	No Page Limit
Appendix 2		Supplemental Business Data	No Page Limit
Appendix 3		Cybersecurity Questionnaire	No Page Limit

- NASA will conduct an evaluation of proposals that are compliant with the announcement to assess the levels of confidence in the proposed Business Plan and Technical Approach in accordance with the below table. The Price Volume is not numerically scored nor receives a confidence rating.

- Business Plan, Technical Approach, and Price are all of equal importance

Color	Criteria
B	**Very High Level of Confidence**: The proposal section is very highly effective and there is a very high likelihood of successful execution.
G	**High Level of Confidence:** The proposal section is highly effective and there is at least a high likelihood of successful execution.
W	**Moderate Level of Confidence:** The proposal section is moderately effective and there is at least a moderate likelihood of successful execution.
Y	**Low Level of Confidence:** The proposal section has low effectiveness or there is a low likelihood of successful execution.
R	**Very Low Level of Confidence:** The proposal section has very low effectiveness or there is a very low likelihood of successful execution.

- Participants must submit a copy of the proposed FSAA with the proposal.
- Any proposed changes to the draft FSAA template shall be highlighted and rationale provided for the proposed change.
- Any proposed changes to the standard terms will be evaluated for acceptability and presented to the Selection Authority. Unacceptable changes to standard terms can impact a participant's selection.

- **To promote innovation in the development and demonstration phase of the CSP, the following IP considerations are offered:**
  - NASA will not obtain rights in participant's background intellectual property.
  - NASA may request a participant's data arising from work under the participant's agreement with NASA. Such data will be used only to evaluate participant's performance and validating the objectives of CSP under the funded agreement.
  - NASA does not anticipate development of new technology. However, for any inventions made by participants in performance of work under a participant's agreement, upon petition by a participant, NASA will grant an advanced waiver of title to such inventions to the participant. NASA will retain only a government purpose license to use waived inventions, but will refrain from NASA-use for a period specified in the participants agreement with NASA.

- The Selection Authority will select a portfolio of proposal(s) that best meets the goals and objectives of the announcement. Considerations regarding the selection of the portfolio will include capability coverage, levels of confidence, risk spread, market stimulation, price and NASA budget.

- NASA reserves the right to select for award multiple, one, or none of the proposals received in response to this announcement.

- NASA intends to evaluate and select for award, based on initial proposals, without conducting further due diligence. However, the government reserves the right to conduct further due diligence if deemed in the best interest of the government. Accordingly, each participant should submit its initial proposal using the most favorable terms from a price, technical, and business standpoint.

Volume II: Business Plan Overview

PRESENTED BY:

Thomas Kacpura/CSP Deputy Project Manager

- This section describes the participant's plan for operating a sustained, profitable entity that may supply the market with SATCOM services for potential future use by NASA and other space-based customers.
- To address this market, the participant will determine whether to provide a business plan for the entire corporation or for a division within the corporation.

The subsections of the business plan section are:

- Capability Development and Demonstration Business Plan
- Operational Service Feasibility Plan

The business plan allows CSP to understand the financial plan to the Capability Development and Demonstration as well as the proposed resulting operational service.

Business Approach

- **Management Approach**
  - Top-level management team and key personnel for this effort
  - Teaming arrangements including respective roles and contributions to the effort
  - Key resources such as personnel, facilities and other assets, including intellectual property
- **Financing Plan**
  - Proposed approach for the financing of the new capability and conducting the demonstration
- **Demonstration Business and Financial Schedule**
  - Schedule of the major elements for the proposed new capability to be developed and the demonstration
- **Risk Management**
  - Top business and financial risks associated with the capability development and the demonstration and risk mitigation strategy
- **Commitment to Small Business**
  - Work that will be performed by small businesses

These elements of the requested business plan allow insight into the full financial plan.

Performance Milestones & Success Criteria

- **The participant shall provide proposed performance milestones for the Capability Development and Demonstration including:**
  - Descriptive title,
  - Entrance / exit criteria,
  - Objective success criteria,
  - Rationale, and
  - Planned achievement dates (month and year).

- **Milestones should represent the progress of significant technical and business development events in the demonstration project.**

- **At least one milestone per calendar quarter should be proposed.**

The AFP requests the participant propose series of incremental milestones based on objective criteria for fixed-price performance milestone payments.

Funded *milestones* are used in funded SAAs as the sole basis for incremental payments and as a measure of progress.

Milestones are proposed by the participant to meet their business and technical plans.

- Pre-negotiated to meet available budget phasing and periodic performance progress assessments.
- Payment milestones remain fixed, regardless of the actual cost incurred by the participant.
- Milestones can be programmatic, technical, or financial.

NASA will negotiate and finalize the milestones.

- NASA may negotiate milestone criteria, price and schedule with selected participant(s).
- The number of milestones will be sufficient for NASA to monitor progress and incentivize continued performance (At least 1 / quarter).

INDUSTRY DEMONSTRATION MILESTONES (NOTIONAL)

NASA Life-Cycle Phases	Pre-Phase A Concept Studies	Phase A Concept &Tech Dev.	Phase B Prelim. Design & Tech Completion	Phase C Final Design & Fab.	Phase D System Assembly, I&T, Launch and Checkout		Phase E Operations and Sustainment
Demonstration Life-Cycle	Concept Development, Teaming & Financing Arrangements	Mission Planning	Baseline Mission, Procure Launch Services, Commit Commercial Services	Payload, Ground Systems Engineering & Development	Spacecraft Integration, Ground System Integration, Launch Site Operations	Launch	Capability Demonstrations
Activity Timeframe	Launch minus (L–) 3 yrs.	L – 2 to 3 yrs.	L – 2 to 3 yrs.	L – 1 yrs. to 3 mos.	L – 3 mos. to 10 days	L – 10 days	L+6 mos.

Sample Milestones

Technical Milestones

- Capability Complete (Flight payload, Ground system, Modifications to existing service)
- Demonstration Readiness Complete (Spaceflight Testing, Integrated end to end system testing, Ground Demo)
- Successful Launch
- Demonstration Complete

Programmatic Milestones

- Project Management Plan Review
- Demonstration Concept and System Requirements Review
- Preliminary Design Review
- Critical Design Review

Business Milestones

- Detailed Teaming Plan
- Detailed Financing Plan
- Financing obtained for Capability Development
- Financing obtained for Demonstration

The milestones should follow the lifecycle of the proposed effort, using Industry best practices as appropriate.

Participant performance evaluated using Milestone Reviews

Suggested topics include, but are not limited to:

- Provide milestone information from the entrance / exit criteria on how the success criteria was met
- Review approach for the upcoming milestones
- Current risk assessment: Any arising difficulties and reaction plan
- Review financial performance

Milestone reviews will be conducted to assess the milestone progress.

- **Business Models**
  - Service Offering and Market Analysis
  - Operational Services Schedule
  - Operational Services Risk Management

- **Acquisition Models**
  - The service acquisition model describes how a user can acquire the service.
  - This acquisition model is coupled to the capabilities that will be offered for the service and should include terms and conditions that a potential service buyer would negotiate with the supplier, along with projected prices for the operational service.
  - The participant shall provide and describe an example Service Level Agreement (SLA) for each capability that is demonstrated and will be offered, which describes the prices and terms for a user of the service.
  - Options that impact the cost or quality of service shall be discussed.

The operational service feasibility plan addresses the business and acquisition models for the operational service resulting from the demonstration.

Volume III: Technical Approach Overview

PRESENTED BY:
Dr. James Nessel/Chief, Advanced High Frequency Branch

Overview

- **Volume III: Technical Approach is divided into 2 sections:**
  - **T1: Demonstration Concept**
  - **T2: Service Operational Construct**

- Objective is to understand the details of the demonstration approach and how the demonstration ties to an operational service capability. This includes:
  - CONOPs of the end-to-end service being demonstrated
  - Proposed user terminal hardware and architecture of the service capability(ies).
- Demonstration shall address major aspects of the final end-to-end service concept and the resulting operational service for each capability proposed.

This section shall describe the participant's technical approach to the capability development and demonstration of commercial SATCOM capabilities with the goal of achieving robust, reliable, and cost-effective communications

Feasibility of Concept

- Describe the architecture, capabilities, system specifications, and CONOPs being demonstrated
- Describe the user terminal (size, weight and power (SWaP), specifications, development approach) and spacecraft being used for the demonstration.
  - Assumption is that proposer provides their own platform for the demo. If a NASA mission is used, then additional requirements may be imposed on the service to meet mission needs.
- Discuss all known operational and technical risks associated with the service and how the demonstration will address these issues
- Describe industry practices and standards being used, in particular, the impact on the user
- Define the elements of the service that already exist today and those that require additional development to support a space-based user demonstration. Include current TRLs and path toward development.
- Describe the safety and mission assurance approach

Define the demonstration approach with the key technical risks relevant to an operational service that are being addressed.

Summary of Performance

- Describe the expected performance of the service capabilities being demonstrated and how they address the identified goals established for each capability

Spacecraft and Mission Operation Center (MOC) Integration Approach

- Describe all relevant Spacecraft interfaces being demonstrated
  - Include the approach for selecting and integrating a user terminal; the operation, verification, and certification of the communications system; interfaces between user terminal and spacecraft/on-board equipment
- Describe all relevant MOC interfaces being demonstrated
  - Include details on the user access schemes for the service and the MOC, and all relevant data flows

What is the anticipated performance of the demonstrated service and how will a user interface with it?

Operational Constructs with Summary of Planned Performance

- Describe the operational constructs of the service architecture, capabilities, features, system specifications, and CONOPs for the offered service.
- Describe the expected performance of the operational service being offered, as they relate to the capability goals and reference missions.
- Describe the approach to implementing cybersecurity in the operational service that is consistent with NASA's current approaches and how it will be validated through the demonstration.
- Describe the approach for licensing and spectrum management during the demonstration period and how the approach applies to plans for the operational service.

What will the final operational service offering look like?

Performance Validation (from Demonstration)

- Describe how the demonstration validates the performance of the planned operational service capabilities
- Identify what, if any, performance parameters cannot/will not be demonstrated and provide assessment of risks in not demonstrating these

Near Earth Mission Compatibility

- Describe how the planned operational service will meet the goals and objectives identified in the announcement
- Discuss any variances and additional technical work required to transition from the demonstration phase to a fully operational service and the approach to using lessons learned from the demo to develop the operational service

How will the lessons learned from the demonstration help to transition to a fully operational service?

Volume IV: Price Overview

PRESENTED BY:

Steven Vacco/Cost and Price Analyst

- **Firm-Fixed Price Award**
- **Significant cost share contribution required from the participant on award**
- **Price Analysis will be Conducted**

Price Volume Part 1: General Instructions

- Introduction
- Financial Capability to perform the agreement
- Sub-Participant Price Analysis
  - Major sub-participants having a contract value equal to or greater than 20% of the total agreement value must complete a full cost proposal

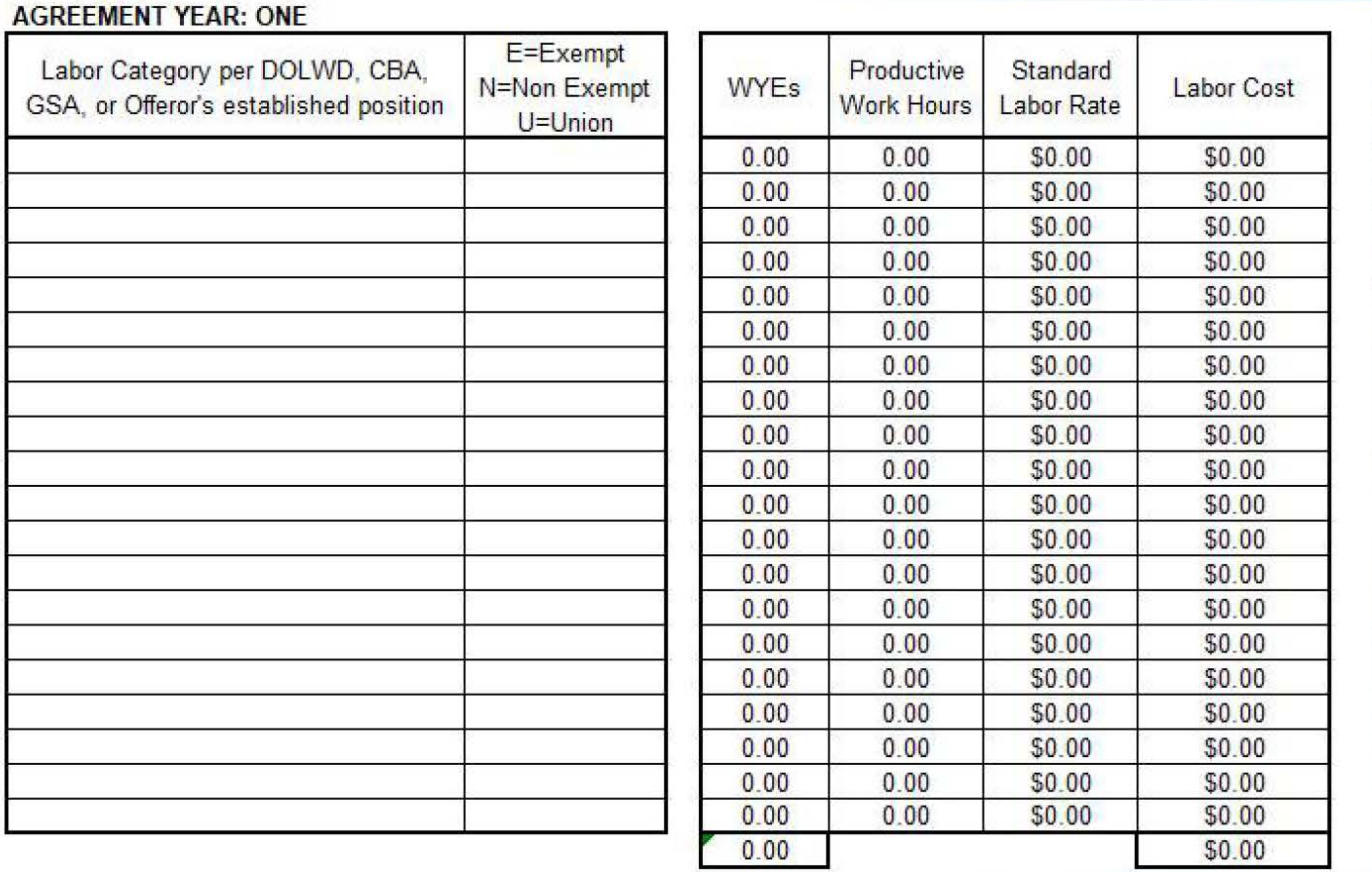
Price Volume Part 2: Price Templates

- Templates have pre-populated formulas
- Participant is responsible for the accuracy of these formulas and editing/correcting them as necessary
- Price and Labor Templates for each line item

FIRM FIXED PRICE

Elements	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Direct Labor Hours						
Straightime Hours	-	-	-	-	-	-
Overtime Hours	-	-	-	-	-	-
Total Hours	-	-	-	-	-	-
Direct Labor Dollars from Labor Tem	$ -	$ -	$ -	$ -	$ -	$ -
Overhead (List) Cost						
1. (Name & Description of Base)	$ -	$ -	$ -	$ -	$ -	
Fringe Rate	0.00%	0.00%	0.00%	0.00%	0.00%	
Fringe Cost	$ -	$ -	$ -	$ -	$ -	$ -
2. (Name & Description of Base)	$ -	$ -	$ -	$ -	$ -	
Overhead Rate	0.00%	0.00%	0.00%	0.00%	0.00%	
Overhead Cost	$ -	$ -	$ -	$ -	$ -	$ -
Total Overhead Cost	$ -	$ -	$ -	$ -	$ -	$ -
Direct Materials						
1. (Direct Material Description)	$ -	$ -	$ -	$ -	$ -	$ -
2. (Direct Material Description)	$ -	$ -	$ -	$ -	$ -	$ -
3. (Direct Material Description)	$ -	$ -	$ -	$ -	$ -	$ -
Direct Materials	$ -	$ -	$ -	$ -	$ -	$ -
Other Direct Costs (ODCs)						
1. (ODC Description)	$ -	$ -	$ -	$ -	$ -	$ -
2. (ODC Description)	$ -	$ -	$ -	$ -	$ -	$ -
3. (ODC Description)	$ -	$ -	$ -	$ -	$ -	$ -
Total Other Direct Costs	$ -	$ -	$ -	$ -	$ -	$ -
Sub Participant Costs						
1. (Sub Participant Name)	$ -	$ -	$ -	$ -	$ -	$ -
2. (Sub Participant Name)	$ -	$ -	$ -	$ -	$ -	$ -
3. (Sub Participant Name)	$ -	$ -	$ -	$ -	$ -	$ -
Total Sub Participant Cost	$ -	$ -	$ -	$ -	$ -	$ -
Material Handling (Pass through costs)						
1. (Description of Material Handling Base)	$ -	$ -	$ -	$ -	$ -	
M&H Rate	0.00%	0.00%	0.00%	0.00%	0.00%	
M&H Cost	$ -	$ -	$ -	$ -	$ -	$ -
G&A Cost						
1. (Description of G&A Base)	$ -	$ -	$ -	$ -	$ -	
G&A Rate	0.00%	0.00%	0.00%	0.00%	0.00%	
G&A Cost	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal	$ -	$ -	$ -	$ -	$ -	$ -
Facilities Capital Cost of Money (FCCOM)						
1. (Description of FCCOM Base)	$ -	$ -	$ -	$ -	$ -	
FCCOM Rate	0.00%	0.00%	0.00%	0.00%	0.00%	
FCCOM Cost	$ -	$ -	$ -	$ -	$ -	$ -
Total Estimated Price	$ -	$ -	$ -	$ -	$ -	$ -
Government Share	$ -	$ -	$ -	$ -	$ -	$ -
Participant Share	$ -	$ -	$ -	$ -	$ -	$ -

LINE ITEM LABOR COST TEMPLATES



AGREEMENT YEAR: ONE

Labor Category per DOLWD, CBA, GSA, or Offeror's established position	E=Exempt N=Non Exempt U=Union	WYEs	Productive Work Hours	Standard Labor Rate	Labor Cost
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00	0.00	$0.00	$0.00
		0.00			$0.00

Cost Elements within Indirect Rate Pool	Particpant Fiscal Year Prior Yr 3	Particpant Fiscal Year Prior Yr 2	Particpant Fiscal Year Prior Yr 1	Particpant Fiscal Year _____	Particpant Fiscal Year _____	Particpant Fiscal Year _____	Particpant Fiscal Year _____	Particpant Fiscal Year _____
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
				$ -	$ -	$ -	$ -	$ -
Total Pool Expenses				$ -	$ -	$ -	$ -	$ -
Application Base ($)				$ -	$ -	$ -	$ -	$ -
Participant FY Rate (%)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CONVERSION OF BURDEN RATE TO AGREEMENT YEAR				Agreement Year 1	Agreement Year 2	Agreement Year 3	Agreement Year 4	Agreement Year 5
Proposed Agreement Year Rate				0.00%	0.00%	0.00%	0.00%	0.00%

Proposal must provide three years of prior indirect pool, base and rate information

Cost Volume Part 3: Basis of Estimate

- Price narrative to support proposed estimates
- Link the Price Volume to the Business and Technical volumes

Q&A and Wrap-Up

PRESENTED BY:

Elias Naffah/CSP Project Manager

- **Are the due dates and page counts adequate?**
- **Are there any model FSAA clauses that raise concern? If so, what are the specific concerns?**
- **Are there any suggested modifications to the draft AFP and attachments that would facilitate the CSP public/private partnership?**
- **Does the current eligibility language overly restrict participation within the SATCOM industry?**
- **Are there any suggested changes to the draft AFP and attachments that could be clarified, streamlined, less constraining, or could enhance the performance of CSP, or could enhance the Participant's ability to leverage their capabilities? If so, please describe.**

What's Next?

- One-on-One discussions scheduled for May 12th and May 13th
- Industry Day Comments and Draft Announcement Comments Due on May 21, 2021
- The Final Announcement for Proposals is targeted for release in the 4Q FY21 timeframe.
- Proposal submittal date is targeted for 30 days after Final Announcement for Proposals release
- Selection and FSAA award(s) is planned for 1Q FY22

- ***In the event of any discrepancy between information you receive today and information in the final Announcement for Proposals (AFP), the final AFP is the controlling document.***

COMMUNICATIONS SERVICES PROJECT

INDUSTRY DAY

A VIRTUAL EVENT MAY 11, 2021