# Welcome to the
# Johnson Space Center
# U.S. Deorbit Vehicle (USDV)
# Industry Day

**December 7, 2022**
**Virtual via Microsoft Teams**
**9:00 AM Central Time**

**Submit Industry Day Questions through the QR code**

# Welcome to the U.S. Deorbit Vehicle Industry Day

**Ashley Chaves**
**Contracting Officer**

**Submit Questions through the QR code**

# Agenda

| Speaker | Subject |
|---|---|
| Ashley Chaves, Contracting Officer | Welcome to Industry Day, Introductions |
| Eric Schell, Office of Procurement | Welcome |
| Robert Watts, Small Business Specialist | Small Business Introduction |
| Dana Weigel, Bill Spetch, Rebekah Anchondo, and Teresa Tan | Technical Overview |
| Ron Diftler, JSC Partnership Office | NASA Facilities and Resources |
| Ashley Chaves, Contracting Officer | Procurement Details and Schedule |
| ***All Industry Day questions submitted; ~15-minute break*** | |
| Ashley Chaves, Contracting Officer | Question & Answer Period |

# Disclaimer

- These slides are for information and planning purposes only. No solicitation exists at this time.
- This presentation shall not be construed as a commitment by the Government or as a comprehensive description of any future requirements.
- If a solicitation is released, it will be synopsized on the Government-wide point of entry (GPE), as defined by FAR 2.101.

# Goals of Industry Day

- Promote competition on the proposed acquisition
- Develop Industry's understanding of the Government's objectives and Concept of Operations
- Provide Industry with the opportunity to meet with the Government early enough in the procurement process to provide input into the U.S. Deorbit Vehicle (USDV) procurement strategy
- Encourage offerors to submit questions and comments electronically via an email to the Contracting Officer, or via the Q&A application during Industry Day.
  - The Government will respond officially to all questions submitted by posting them to the Government-wide point of entry (GPE) and USDV websites.

# Industry Day Logistics

- A copy of this presentation has been posted on the U.S. Deorbit Vehicle (USDV) website at: https://www.nasa.gov/jsc/procurement/usdv
- Please ensure microphones are muted during the presentation.
- Please use the Microsoft Teams chat feature for audio and video connection issues only.
- Clarifications and questions on Industry Day content will be answered in the Question-and-Answer period.

**Submit Questions through the QR code**

# Responses to Questions

- Please submit all questions via the Q&A application link provided: https://johnson.cnf.io/sessions/pzfb/#!/dashboard *(QR code below)*
- Questions are encouraged.  Industry is requested to submit the questions timely to ensure NASA receives them.
- NASA will take a ~15-min break during this presentation to review the questions received before returning to the meeting to answer them.
- Questions will be addressed verbally by NASA during the Questions and Answer period of the presentation and subsequently posted to both the GPE and the USDV  Procurement website.
- Verbal answers will not be considered official.
- If a difference exists between verbal and written responses to questions, the written responses shall govern.

**Submit Questions through the QR code**

# Welcome

## Eric Schell, Executive Officer
## Office of Procurement

**Submit Questions through the QR code**

# Welcome

## Robert Watts, Small Business Specialist
## Office of Procurement

**Submit Questions through the QR code**

# Office of Small Business Programs
# Johnson Space Center Contact Information

- Main phone number: (281) 483-4512
- Robert Watts, Senior Small Business Specialist
- Monica Craft, Small Business Specialist
- Tumarrow Romain, Small Business Specialist
- All emails should be sent to: jsc-industry-assistance@mail.nasa.gov

- Location: Building 1, Suite 453
- Address:
  NASA Johnson Space Center,
  Industry Assistance Office
  Mail Code: BA
  2101 NASA Parkway
  Houston, TX 77058-3696

# Technical Overview

Dana Weigel, Deputy Manager, ISS Program
Bill Spetch, Manager, ISS Vehicle Office
Rebekah Anchondo, ISS Vehicle Office
Teresa Tan, Executive Officer, ISS Safety Review Panel

**Submit Questions through the QR code**

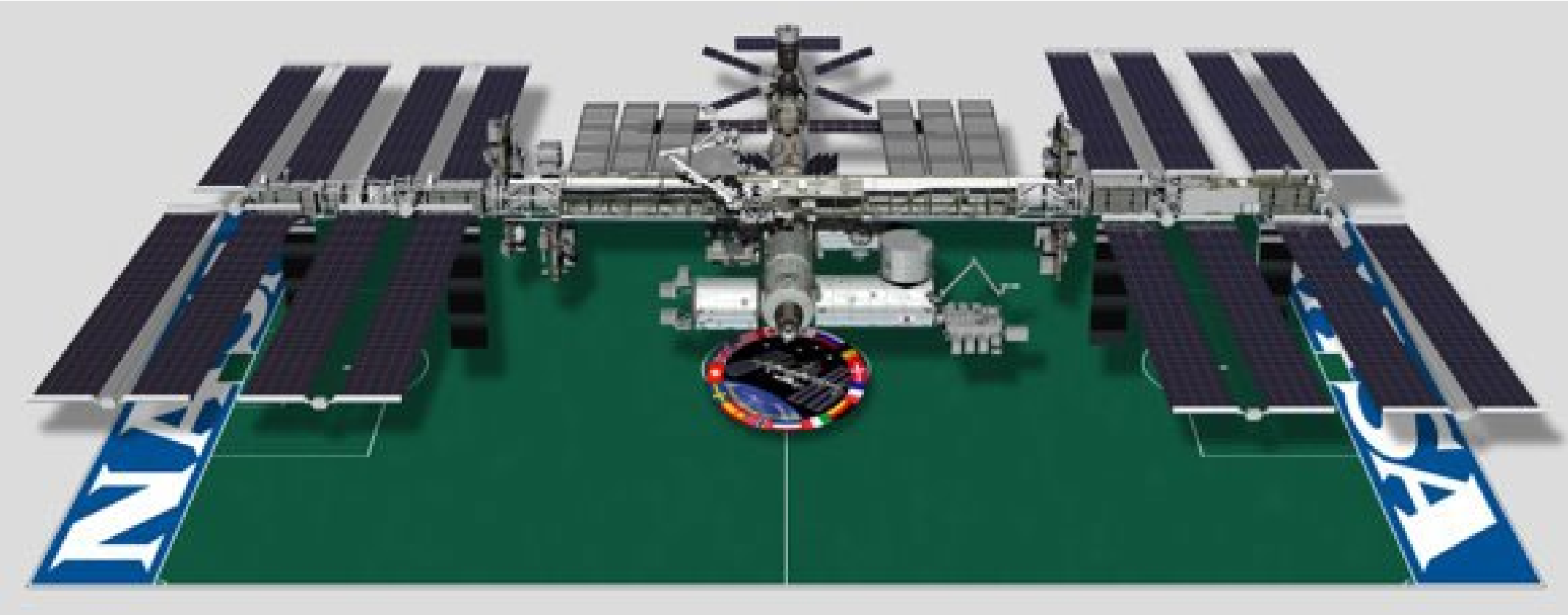
# ISS Introduction

Dana Weigel, Deputy Manager
International Space Station Program

Submit Questions through the QR code

# International Space Station Program

- For over 2 decades the International Space Station (ISS) has been a world-renowned laboratory in Low Earth Orbit
  - ISS weighs ~450,000 kgs and is 357 ft long (about the size of a football field)
  - Over 3000 experiments conducted by over 4400 investigators representing 109 countries/areas



# ISS Deorbit Introduction

- ISS planned end of life is 2030
- Upon completion of the ISS mission, the vehicle must be deorbited in a controlled manner
  - Due to its size, the ISS represents a significant risk to the public if it is allowed to deorbit in an uncontrolled manner
- Given the risk to public safety associated with deorbit of the ISS, the USDV must continue to function in the case of failures and complete the reentry burn
  - High reliability is a must as fault tolerance will only provide so much
  - Reliability is key and use of flight proven systems or robust testing is critical
  - System must fail functional

# ISS End of Life Concept of Operations

**Bill Spetch, Manager**
**ISS Vehicle Office**

**Submit Questions through the QR code**

# ISS End of Life Concept of Operations

- NASA will notify USDV of the needed launch date one year in advance.
  - The USDV will provide a contingency capability to deorbit ISS earlier than the planned end of life should it become necessary
  - To support this capability, the USDV would enter a dwell period until launch call up

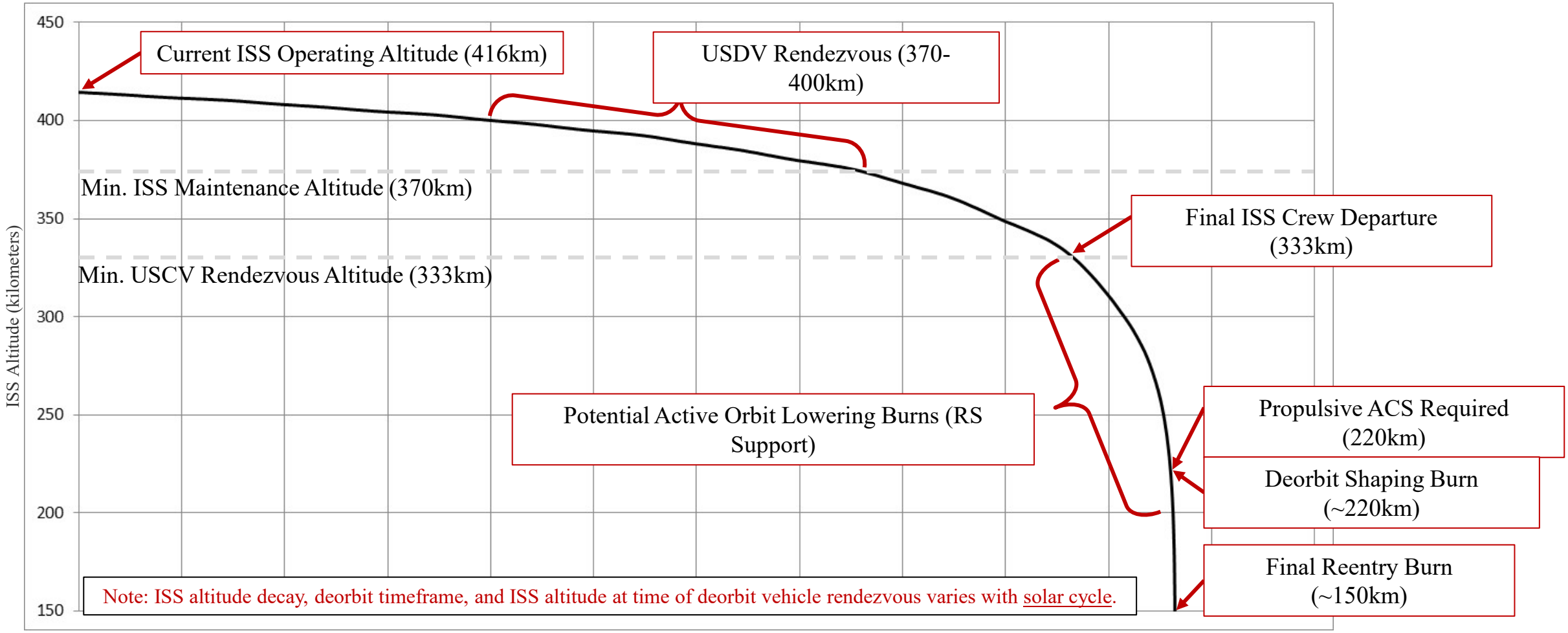
- USDV will dock to ISS Node 2 Forward approximately 1 year prior to reentry
  - ISS is designed to be maintained by crew and thus the plan is to dock the USDV prior to the ISS final crew departure
  - 1 year ensures deorbit vehicle arrival prior to ISS dropping below reasonably maintainable altitude
  - Current ISS operating altitude ~416 km; deorbit vehicle arrival above ~370-400 km

# ISS End of Life Concept of Operations

- ISS altitude will naturally lower over the course of months to 1 year until the USDV performs a series of final deorbit burns
  - Decrewing of ISS should occur as late as possible to mitigate ISS maintenance risks
  - The Russian Segment is prime for providing attitude control, altitude maintenance, active lowering of ISS altitude, and debris avoidance however USDV will have the capability to perform these functions in a contingency scenario
  - The USDV will be responsible for the delta-v necessary for controlled reentry (including final orbit shaping), as well as attitude control at lower altitudes

- NASA will identify the target reentry for an uninhabited area of the ocean with a capture perigee of 50 km, ensuring a debris footprint of less than 6,000 km
  - For all deorbit operations, NASA will perform the analysis to determine burn targets and durations the USDV will execute

# Con Ops – Nominal Deorbit Timeline




- Decrew ISS as late as possible to minimize crit system risk
- Russians provide attitude control, altitude maintenance and debris avoidance up to the final deorbit activities

~1 year

# Con Ops – Orbit Lowering Strategy

- Propulsive attitude control is required at altitudes below 220 km. Beyond this point, CMGs can no longer control attitude
- USDV will establish an elliptical orbit of 220 x 165 km through a series of burns to minimize duration of propulsive attitude control (~17 m/s)
- Final deorbit burn initiated and completed prior to reaching altitudes of concern for ISS systems such as avionics function or appendage separation
- Final burn will target 30 m/s within 30 minutes
  - Supports perigee of 50 km
  - Guarantee atmospheric capture
- The thrust for deorbit operations is bounded by the limits that ISS structure can tolerate (maximum thrust), and the thrust necessary to complete the reentry burn of 30 m/s within 30 minutes (minimum thrust)

| ISS Altitude (km) | | Approximate Time to Reentry | Description |
|---|---|---|---|
| Apogee | Perigee | | |
| 270 | | 40-50 days | Phase repeat orbit (4-day ground track repeat). Natural orbital decay for ISS from this altitude is expected to be approximately two months. |
| 220 | | 3-4 days | ISS attitude control accomplished via thrusters only. ISS Control Moment Gyros (CMGs) are no longer able to provide attitude control. Initiate shaping burn to establish a 220 x 165 km elliptical orbit. |
| 220 | 165 | 3-4 days | Performing initial shaping burn at 220 km reduces total duration on propulsive attitude control. Will naturally decay until perigee reaches approximately 145 km before performing final burn. |
| 170 | 150 | ≤ 2 orbits | Approximate altitude of final deorbit burn. NASA plans no more than two orbits with perigees below this value. |
| | 130 | < 1 orbit | Estimated minimum operational altitude of USOS external avionics and systems. |
| | 110-120 | | Altitude at which US solar arrays and radiators are expected to separate (based on observed Mir re-entry). |
| | 84-100 | | Estimated module rupture altitude. [TBC] |
| | 70-75 | | Maximum allowable vacuum perigee that will cause ISS fragments to lie within a 6000 km footprint [TBC]. |
| | 50 | | Guaranteed capture. 50 km vacuum perigee is the NASA Std 8719.14 requirement for re-entry targeting in all new NASA programs. |

# ISS End of Life – Alternate Options Considered

- Boost ISS to a stable parking orbit
  - Typical parking orbits are above 40,000 km
    - Requires greater than 3900 m/s delta V as compared to ~47 m/s for deorbit
  - Total propellant required for this would be over 900,000 kg
    - Equivalent to the payload capacity of ~150-250 ISS cargo vehicles
- Partial disassembly of ISS elements for return or disposal
  - ISS has complex hardware and avionics integration and would require significant investment for removal of any elements.
  - Would require multiple vehicle launches and returns/disposals to support
  - No transportation system to safely deorbit or return modules exists today
    - Development of this capability is more complex than the USDV due to complexity of disassembly ops and surviving entry and landing for a return case

Alternate concepts were evaluated and determined not to be feasible.

# USDV Requirements Overview

Rebekah Anchondo
ISS Vehicle Office

**Submit Questions through the QR code**

# USDV Requirements Overview

- SSP 51101 USDV Systems Requirements Document (SRD) defines the requirements for the USDV to deliver a robust and reliable ISS deorbit service
- USDV SRD and safety requirements apply to the entire USDV mission beginning to LV separation
- Key functions required of the USDV:
  - Transit and dock to ISS
  - Impart a total of 57 m/s for translational maneuvers

| Maneuver | Delta-V (m/s) |
|---|---|
| Debris Avoidance/Orbit Phasing Burn Reserve | 2 |
| Deboost – Altitude Lowering Reserve | 8 |
| Orbit Shaping Burn(s) – Perigee Lowering | 17 |
| Reentry Burn (completed in 30 minutes) | 30 |

  - Attitude Control of ISS integrated stack
  - Detect Attitude and Translational Faults
  - Communication between USDV and USDV control center

# USDV Requirements Overview

- USDV must account for the following constraints:
  - Function during and after exposure to ISS Environments for at least 1 year
  - Operate independent of ISS services for 4 days during the deorbit sequence
    - Higher risk posture of ISS functionality below this altitude
  - Limit thrust loads for translational maneuvers at ISS interface
  - Limit loading from attitude control and translational maneuvers such that it does not cause ISS components to exceed limit loads
    - Complex ISS structure requires close collaboration on integrated controller development to ensure USDV propulsive control does not cause loads exceedances
- ISS interfaces are unchanged and well defined, and are levied in the SSP 51101 USDV SRD

# Safety & Reliability

Teresa Tan, Executive Officer
ISS Safety Review Panel

**Submit Questions through the QR code**

# Safety and Reliability

- Reliability of a first flown unique vehicle is key and relies on flight proven systems or robust testing
- Using existing ISS Safety Review Process with significant focus on reliability on the USDV
  - Reliability Data will be a key part of the deliverables and safety assessment
  - USDV participation in Probability Risk Assessment (PRA) is also critical
- Implementation of standard two fault tolerant (2FT) to a catastrophic hazard is required
  - For USDV mission, fail safe means fail functional. Mission success = public safety
- Lack of ability to meet 2FT will have rigorous reliability standards focusing on testing of margins in the environments (natural and induced), flight pedigree, number of qualification units tested, testing to failure, life cycle tests, etc.
- NASA will institute thorough insight/oversight model into safety critical items and processes
- Heritage hardware with flight proven history in relevant environments has the highest reliability

# Launch Vehicle and Operations Requirement Summary

Dana Weigel, Deputy Manager
International Space Station Program

Submit Questions through the QR code

# Launch Vehicle

- Launch vehicle will be required to have an LSP Cat 3 certification
- Current generation of Category 3 Launch Vehicles is phasing out, with replacements in early development
  - Presents a challenge with launch vehicle selection this early
- Options under consideration for the Launch Vehicle procurement strategy:
  - USDV contractor to provide full range of services including Launch Services Program (LSP) Category 3 certified Launch Vehicle
  - USDV procured separately, with NASA utilizing NASA Launch Services II (NLS II) contract to provide the Launch Vehicle

# USDV Operations

NASA is seeking industry feedback for multiple operations concepts for the USDV

- **Option 1: Services: End-to-End Operations**
  - Government procures the USDV as a service, including operation and real-time flight control of the USDV
  - NASA insight and approval over USDV operations and integrated ISS/USDV operations
- **Option 2: Services: Support to NASA Operations**
  - Government procures the USDV as a service, but NASA operates and performs real-time flight control of the USDV, with contractor providing real-time engineering support.
  - NASA develops USDV operations products, performs USDV crew / flight controller training and performs USDV real-time flight control
- **Option 3: Supply: Support to NASA Operations**
  - Government procures USDV as supply and NASA operates and performs real-time flight control of the USDV, with contractor providing real-time engineering support.
  - NASA develops USDV operations products, performs USDV crew / flight controller training and performs USDV real-time flight control

# JSC Partnering Overview

## Ron Diftler, JSC Partnership Office

**Submit Questions through the QR code**

# NASA Partnership Office Objectives

- Partner with industry and academia using public/private partnerships to create products/services that meet NASA and industry needs
  - Balance industry needs and NASA partnership roles to manage program risk and reduce lifecycle costs
  - Earlier engagement provides opportunity to build trust and have meaningful conversations that leads to valued relationships
- Provide simple and responsive process for industry to work with NASA in support of US Government proposals
- Use Technology Programs, Technology Transfer and Space Act Agreements (SAAs) to develop trusted relationships to support industry needs
- Work with stakeholders to provide JSC competencies –people, processes, tools, and facilities to support product development and community/STEM needs

# Early Engagement on Potential GTAs for USDV

- We understand industry is establishing their approach for development and delivery of their service/product when the acquisition process is formally initiated
- JSC wants to engage industry as early as possible in this process to provide timely solutions to industry needs – draft Government Task Agreements (GTAs)
- Our objective is to listen to industry needs/risks and provide awareness into JSC's capabilities that could meet their needs
- Offerors have time to balance the capabilities of their industry team and NASA to create their proposal
- NASA does not want to be in the critical path of system development or delivery of services, but to provide guidance and support

# Engagement Process

- Offerors may contact the NASA Center USDV Partnership Lead (PL) to understand NASA Center Capabilities (people, processes, tools and facilities) and request an estimated cost using the GTA form
- The NASA Center USDV Partnership Lead will:
  - coordinate the request with the Contracting Officer and the technical POC for partnerships to assure the request is appropriate
  - coordinate the GTA requests with Program and Performing Organizations
  - return costed GTAs to offerors as early as possible for consideration

# Procurement Details & Schedule

## Ashley Chaves, Contracting Officer

The procurement strategy for USDV is still being developed. All details and comments discussed in the following charts are tentative and subject to change prior to the release of the Draft RFP.

**Submit Questions through the QR code**

# Procurement Details

- This is not a follow-on procurement; no current contract exists.
- NAICS Code: 336414, Guided Missile and Space Vehicle Manufacturing
- Small Business Size Standard: 1,250 employees
- PSC Code: V126, Transportation/Travel/Relocation- Transportation: Space Transportation/Launch
- A Request for Information (RFI) related to the USDV procurement was released on August 19, 2022. Reference: 80JSC022ISSDeorbit.
- The contemplated Period of Performance is 8 years.
- The Government is contemplating multiple contract type
  - Industry input is requested in RFI #3 concerning acquisition strategy

# Questions to Industry

- Responses to RFI #3 are requested by December 21, 2022, at 3:00PM Central

**Submit Questions through the QR code**

# Procurement Schedule

- The Government does intend to issue a Draft Request For Proposal (RFP).

- Following the release of the draft RFP, Industry will have an opportunity to submit anonymous questions in writing so that the Government may officially respond.

- **Current Schedule**:
  - Draft RFP – March 2023
  - Final RFP release –May 2023
  - Pre-Proposal Conference –May 2023
  - Proposals due – 60 days after final RFP
  - Contract Award – November 2023
- The procurement schedule will be posted to the procurement website as soon as it is available.

# Question & Answer

## Ashley Chaves, Contracting Officer

**Submit Questions through the QR code**

# 3 Minute Break for Industry to Submit Questions

**Submit Questions through the QR code**

# 15 Minute Break

**Q&A Site Closed**
**For New Questions**

# Question and Answer Period

# One-on-One Communication with Industry

- December 7th - 8th, with Dec 9th reserved as a backup.
- No more than six (6) individuals may represent any party or team of parties.
- Only one meeting will be allowed per company.
- Meetings will not exceed 50 minutes in length.

# How to Get Connected

- USDV Procurement Website
  https://www.nasa.gov/jsc/procurement/usdv
- NASA/JSC Contract Opportunities
  https://sam.gov/
- JSC Procurement Website
  http://procurement.jsc.nasa.gov/
- JSC Partnerships Office
  https://www.nasa.gov/centers/johnson/partnerships/jsc-capabilities
- Industry Assistance Office, JSC Bldg. 1
  jsc-industry-assistance@mail.nasa.gov

**Thank you for attending!**

**Visit:**

**https://www.nasa.gov/jsc/procurement/usdv**