RFI – Commercial Resupply Services (CRS2) to the ISS

NASA seeks information from industry to assist in addressing the Agency's need for a follow on capability for the commercial resupply services (CRS1) to the International Space Station. The information will facilitate NASA in its acquisition planning for future procurements. The primary purpose of this RFI is to inform industry of NASA's resupply service requirements and to collect information on key parameters that would help NASA refine and mature the follow on acquisition plan for procuring safe, cost effective, timely, and reliable ISS research and cargo resupply, disposal, and return services.

Period of Service

- NASA requires this service from 2017 through 2024. NASA may elect to have one contract or multiple contracts to meet the requirements. The contract(s) will take into account the lead time required to meet the above requirements.

Funds Available to Procure the Service

- NASA's budget to procure this service is anticipated to be between $1.0B and $1.4B per year. If the described services cannot be provided as defined within this budget range, NASA requests feedback on options to procure the required upmass and downmass for the defined budget. Identify which services would need to be modified or removed to stay within the available budget. For example, propose a different number of flights per year that still meets the required upmass and downmass required.

Capabilities Required of the Service

ISS requires delivery of pressurized and unpressurized cargo, return and disposal of pressurized cargo, disposal of unpressurized cargo, and ground support services for the end-to-end resupply mission. Specifics of each of these services are described below.

- Delivery of 14,250 to 16,750 kilograms (kg) per year of pressurized cargo.
    - Typical cargo characteristics are provided in SSP 50833, Rev A. The accommodation of the highest number of cargo types described in the document is sought.
    - The typical volume of the mass of cargo quoted above is 55 to 70 cubic meters (m^3) which must be accommodated.
    - The following items are included in the total upmass number above but are large or unique items which may require special consideration.
        - Delivery of 16-20 M01 bags per year.
        - Delivery of 32-40 M02 bags per year.
        - Delivery of 8-10 M03 bags per year.
        - Delivery of potable water for transfer to ISS.

    - The following items are included in the total upmass number above but require additional support from the service provider which must be accommodated. All of these items require a launch minus 24 hour (L-24h) late load capability.
        - Delivery of 24-30 powered lockers per year. These lockers include but are not limited to freezers and animal transport units. Each locker requires continuous power of 55 to 120 watts at 28 volts, cooling and two-way communications services. Data services including continuous telemetry of pressurized cargo environments (loads, acoustics, pressure, temperature, partial pressure O2, partial pressure CO2, etc.) are required during pre-launch, launch, free flight and return phases of the mission. Provide for the recording and dump of Loss of Signal (LOS) data.
        - Delivery of 24-30 conditioned stowage bags per year.
        - Delivery of 20-25 Cargo Transfer Bag Equivalents (CTBEs) of passive (non-powered) cargo per year.
- Delivery of 1,500 to 4,000 kg per year of unpressurized cargo comprised of 3 to 8 total items per year.
    - Standard unpressurized payloads would make use of the Flight Releasable Attachment Mechanism (FRAM) interface or the JAXA Experiment Module-External Facility (JEM-EF) interface. Occasionally, on the order of 1 to 5 times over the life of the contract, the service provider will be required to provide unique Flight Support Equipment (FSE) to accommodate non-standard payloads in terms of size and mass. The weight of the FSE is included in the cargo mass above.
    - Each unpressurized item requires continuous power of up to 250 watts at 28 volts and two-way communications services. Data services including continuous telemetry of unpressurized cargo environments (loads, acoustics, pressure, temperature, etc.) are required during launch and free flight phases of the mission.
    - Spacecraft induced contamination on the unpressurized cargo is required to be less than 130 Angstroms per year.
    - The ability to access unpressurized cargo at L-24h is required to allow for removal of optics covers and similar items.
    - The ability to accommodate gaseous purges for unpressurized payloads as a non-standard service is required.
- Return/disposal of up to 14,250 to 16,750 kg per year of pressurized cargo. This requirement is typically driven by volume limitations. It is not NASA's intent to drive the size of the spacecraft return capability greater than the upmass requirement dictates.
    - Typical cargo characteristics are provided in SSP 50833, Rev A. The accommodation of the highest number of cargo types described in the document is sought.

    - The typical volume of the mass of cargo quoted above is 70 to 90 m3 because on orbit packing is less efficient than ground packing.
    - The following items are included in the total return/disposal capability required but are large or unique items which may require special consideration.
        - Return/disposal of 16-20 M01 bags per year.
        - Return/disposal of 32-40 M02 bags per year.
        - Return/disposal of 8-10 M03 bags per year.
        - Disposal of urine or urine brine.
    - The following items are part of the total return capability required but require additional support from the service provider.
        - Return of 24-30 powered lockers per year. The same power and data services as described above are required for the return flight.
        - Return of 24-30 conditioned stowage bags per year.
        - Return of 20-25 CTBEs of passive cargo per year.
- Disposal of 1,500 to 4,000 kg per year of unpressurized cargo comprised of 3 to 8 total items per year.
    - Standard unpressurized cargo for disposal would make use of the Flight Releasable Attachment Mechanism (FRAM) interface or the JAXA Experiment Module-External Facility (JEM-EF) interface. Occasionally, on the order of 1 to 5 times over the life of the contract, the service provider will be required to support the disposal of non-standard payloads in terms of size and mass and unique flight support equipment may be required. The weight of the FSE is included in the cargo mass above.
- Ground support services will be required for the end-to-end ISS resupply mission.
    - Standard services must be provided at the launch and landing sites for payloads and cargo processing. These could include off-line laboratories appropriate for support of life sciences and other research. NASA has appropriate laboratories which it maintains at the Kennedy Space Center (KSC) which will be made available if KSC is used as the launch or landing site.
    - Standard ground support equipment required to maintain, protect, and load pressurized and unpressurized cargo.
    - The service provider shall provide their own operations control center needed for launch and on-orbit operations.

Operational Concept Envisioned for the Service

The following section describes the ideal operations concept for the cargo services as a part of the overall ISS program.

- Services are required to be provided in 4 to 5 missions per year and the capabilities described above are required to be distributed across the year. The following dates are

the ideal dates based on other ISS vehicle traffic, crew rotations, beta cut-outs and research timelines.

- For 4 missions per year, missions are requested to launch in the following windows:
  - January 16-31
  - April 16-30
  - June 16-30
  - October 1-15
- For 5 missions per year, missions are requested to launch as above with the addition of a flight in the August 8-21 timeframe.
- NASA has a strong preference for use of existing launch facilities.
- Mission mated capability must be 45 to 75 days.
- A Launch on Need (LON) capability is required within 2 months of the previous flight.

- ISS interfaces
  - ISS interfaces are provided in SSP 50808, Rev. E, International Space Station to Commercial Orbital Transportation Services Interface Requirements Document.
  - ISS will maintain the capability to support a berthing and a docking capability as physical interfaces to the ISS. Service providers must be compatible with both prime and backup attachment ports. Berthing will be to a Common Berthing Mechanism (CBM). Docking will be to the new ISS Docking Adapter (IDA). If providers propose utilizing a docking capability to provide the cargo services, the provider should include a description and schedule associated with incorporating a docking system into their design. NASA prefers cargo vehicles to berth since some cargo items are larger than what can be accommodated through the docking adapter, for instance an M03 bag. If docking is proposed, the providers should consider methods of transferring cargo through the docking adapter.
  - Service providers will include the systems necessary to conduct rendezvous and proximity operations to the ISS and to support on-orbit attached operations. The provider shall use the Common Communications for Visiting Vehicles (C2V2) as the communication system to the ISS.
- Cargo delivery, loading, transfer, return packing, and unloading concept of operations
  - Cargo delivery and loading schedule
    - 50% of the cargo will be provided for loading at Launch minus 30 days (L-30d).
    - 30% of the cargo will be provided for loading at L-7d.
    - The remaining 20% of the cargo (including the powered lockers, conditioned stowage, and passive cargo described above) will be provided for loading at L-24h to L-48h.

        - The ability to remove or replace the powered lockers, conditioned stowage and passive cargo loaded at L-24 hours within a 24 hour launch scrub turnaround is required.
        - Designs which minimize the need for use of packing materials to meet a pre-defined configuration (such as rectangular bags) are preferred.
    - Cargo transfer concept of operations
        - Cargo which was loaded at L-24 hours shall be able to be transferred to ISS within 96 hours of the L-24 hour handover.
        - Creative methods of packing, unloading and repacking should be considered to efficiently use on board crew time.
        - End-to-end transfer of unpressurized cargo shall be accomplished with ISS robotics systems. Extra-Vehicular Activity (EVA) shall not be required.
    - Cargo return packing/unloading schedule
        - Cargo for return or disposal will be loaded as it is available on orbit.
        - The powered lockers, conditioned stowage and passive cargo will be loaded on orbit at undock minus 24 to 48 hours.
        - Post-landing, returned cargo designated as critical (which will be approximately 20% of the cargo and will include most of the powered lockers, conditioned stowage and passive cargo) should be turned over within 6 hours of landing. Capabilities must exist to maintain spacecraft support services to the cargo until turnover to NASA.
        - The remaining cargo must be returned within 2 weeks.

Response Requested

Responders are invited to provide information regarding transportation capabilities that meet some or all of the NASA requirements noted above. Provide any clarification on cost, technical, or schedule drivers or restrictions, and any suggestions to improve mission flexibility, research accommodations, and reliability.

In responding to this RFI, NASA asks potentially interested vendors to submit information on the following subjects. Please number your answers to match the question numbers below.

1. Company Information

a. Company name, point of contact name, phone number, e-mail address.
b. Size of business; average annual revenue for past 3 years and number of employees; ownership; whether they are large, small, small disadvantaged, 8(a), Woman-owned, Veteran Owned, Service Disabled Veteran Owned, Historically Underutilized Business Zone and Historically Black Colleges and Universities/Minority Institutions; number of years in business; affiliate information: parent company, joint venture partners,

potential teaming partners, prime contractor (if potential sub) or subcontractors (if potential prime).

c. Major development activities underway related to this transportation service. More specially, briefly describe your company, products, services, history, and ownership. In particular, describe any projects you have been involved in that are similar in concept to what is described in this RFI, including previous work performed with NASA

d. Provide sufficient information to determine if your company qualifies as a United States commercial provider of space transportation services as defined in Public Law 105-303, Commercial Space Act of 1998, meets the U.S. National Space Transportation Policy of 2004, and the Iran-Syria Non Proliferation Act.

2. ISS Cargo/Re-supply Transportation Services Capability

Provide a description of current and planned capability:

a. Indicate whether your interest is as a prime or subcontractor.

b. Launch site/infrastructure - include launch and landing sites, facilities and corresponding acquisition plans. (e.g. Are you partnering with other institutions, and if so, what is the current state.)

c. Production/annual launch capability - include general description of manufacturing/production template, vehicle processing flows and turnaround, and number of flights and upmass/downmass that optimally may be accommodated in a year.

d. Plan and schedule to begin executing these commercial cargo services.

e. Estimated lead time from mission authorization to proceed (ATP) to launch including a top level project milestone schedule for developing, testing, and delivering the services

f. Estimated maximum duration capability for vehicles attached to ISS.

3. Safety, Programmatic, and Technical Risk

a. Describe the safety, programmatic, and technical risks you consider to be the drivers from a program execution perspective and any mitigating actions that may be appropriate for NASA to consider in its planning.

b. Provide suggestions for accommodating launch date flexibility (late determination of launch date, changes in launch date, launch on need capability, etc.) and for accommodating cargo manifest flexibility (late definition of cargo, changes in cargo content, etc.) while minimizing cost impacts.

c. Provide feedback on the application of, or elements within, the following NASA policy directives - NPD 8610.7, Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions and NPD 8610.23, Launch Vehicle Technical Oversight Policy (http://nodis3.gsfc.nasa.gov). As a result of these policies, what could be changed or eliminated without increasing launch risk? What items are driving service cost without adding significant benefit? Discuss risks and benefits to NASA and the supplier for any of your proposed changes in these oversight/insight policies.

d. Suggest ways NASA can incentivize a service supplier to provide safe, cost effective, and reliable services.

4. Acquisition Terms and Conditions

Responders are invited to provide suggestions on what terms and conditions are beneficial for industry and NASA for this service. The current CRS contracts are FAR part 12 Commercial, Indefinite Delivery Indefinite Quantity (IDIQ) contracts with Firm Fixed Price (FFP) task orders.

a. Identify any barriers to market entry including minimum contract value, technical constraints, and minimum period of performance in regards to the ISS life cycle ending 2024.
b. Describe and provide rationale for the desired type of pricing in a fixed price service contract. Address any known or potential risks associated with your recommended arrangement and provide any appropriate mitigation techniques.
c. Suggest terms and conditions to implement the incentive approaches described in your response to Section 3.
d. Provide comments on unique ways mission success could be measured for ISS cargo missions. Note: Due to on orbit timeline constraints, specific cargo condition may not be immediately verified upon receipt on the ISS.
e. Provide any other recommendations regarding payment schedules, milestone events, and any related cash flow implications.
f. Provide recommendations for commercial service contract terms and conditions
g. Provide an overall Rough Order of Magnitude (ROM) for the overall cost per mission including 1) a payment schedule 2) cost of your proposed services.

Background

The Technical Library includes the following restricted documents:

1. CRS 1, Request for Proposal
2. SSP 50833, Rev. A, International Space Station Program Cargo Transport Interface Requirements Document
3. SSP 50808, Rev. E including final Document Change Notices 146B, 150, 151A, and 152A, International Space Station to Commercial Orbital Transportation Services Interface Requirements Document
4. 50808 DCN 0146B
5. 50808 DCN 0150
6. 50808 DCN 0151A
7. 50808 DCN 152A

Any interested parties are invited to submit a request for the restricted documents to Contracting Officer.

Response Preparation and Transmittal:

This is a request for information only. It is not a commitment to procure these services or request for proposals. NASA will not reimburse any costs incurred for preparation or submission of information in response to this RFI.

NASA reserves the right to share all information received in response to this RFI throughout NASA and to use all information submitted in response to this RFI in NASA's formulation of one or more solicitations seeking competitive proposals on contracts for or related to the requirements described herein. NASA does not wish to receive any competition sensitive data that requires protection. However, if it is necessary to submit competition sensitive data to answer any of the questions in this RFI, that data should be clearly marked as sensitive. Although information contained herein represents current program content and acquisition planning, it is subject to change.

Questions concerning this RFI shall be submitted via email to Omar K. Collier at omar.k.collier@nasa.gov. Electronic submission of the responses is due close of business March 21, 2014 to omar.k.collier@nasa.gov. Questions and responses shall reference this RFI. Please limit responses to 20 pages or less.