

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>		1. CONTRACT ID CODE	PAGE OF PAGES 1 1
2. AMENDMENT/MODIFICATION NO. 03	3. EFFECTIVE DATE 07/20/2012	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable)
6. ISSUED BY NASA/John F. Kennedy Space Center Office of Procurement MAIL CODE OP KENNEDY SPACE CENTER FL 32899	CODE KSC	7. ADMINISTERED BY (If other than Item 6) NASA/Kennedy Space Center Office of Procurement MAIL CODE OP KENNEDY SPACE CENTER FL 32899	CODE KSC
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)		(x) 9A. AMENDMENT OF SOLICITATION NO. NNK12438241R	
		x 9B. DATED (SEE ITEM 11) 06/29/2012	
		10A. MODIFICATION OF CONTRACT/ORDER NO.	
		10B. DATED (SEE ITEM 13)	
CODE	FACILITY CODE	11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS	

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers  is extended.  is not extended.  
Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

**13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.**

CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

**E. IMPORTANT:** Contractor  is not,  is required to sign this document and return \_\_\_\_\_ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)  
The purpose of this Amendment 03 is to answer questions received from potential offerors, add a new clause to the RFP and add a change to the RFP addendum section. (See Attached)

The time for receipt of offers remains August, 3, 2012 at 3:00 PM, EST as established by Amendment 02.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) Jan Pirkle	
15B. CONTRACTOR/OFFEROR  (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA  (Signature of Contracting Officer)	16C. DATE SIGNED

The purpose of this amendment is to make following changes:

- A. The questions submitted from potential offerors as well as the answers provided by the NASA technical team are hereby provided and identified as Attachment A.
  
- B. The following FAR Clause is hereby added to the Request for Proposal. Section 2 – Addendum to 52.214-4, Contract Terms and Conditions – Commercial Item is modified to add the following clause:

**52.227-17 Rights in Data-Special Works. (Dec 2007)**

(a) *Definitions.* As used in this clause-

"Data" means recorded information, regardless of form or the media on which it may be recorded. The term includes technical data and computer software. The term does not include information incidental to contract administration, such as financial, administrative, cost or pricing, or management information.

"Unlimited rights" means the rights of the Government to use, disclose, reproduce, prepare derivative works, distribute copies to the public, and perform publicly and display publicly, in any manner and for any purpose, and to have or permit others to do so.

(b) Allocation of Rights.

(1) The Government shall have-

(i) Unlimited rights in all data delivered under this contract, and in all data first produced in the performance of this contract, except as provided in paragraph (c) of this clause.

(ii) The right to limit assertion of copyright in data first produced in the performance of this contract, and to obtain assignment of copyright in that data, in accordance with paragraph (c)(1) of this clause.

(iii) The right to limit the release and use of certain data in accordance with paragraph (d) of this clause.

(2) The Contractor shall have, to the extent permission is granted in accordance with paragraph (c)(1) of this clause, the right to assert claim to copyright subsisting in data first produced in the performance of this contract.

(c) Copyright-

(1) Data first produced in the performance of this contract.

(i) The Contractor shall not assert or authorize others to assert any claim to copyright subsisting in any data first produced in the performance of this contract without prior written permission of the Contracting Officer. When copyright is asserted, the Contractor shall affix the appropriate copyright notice of 17 U.S.C. 401 or 402 and acknowledgment of Government sponsorship (including contract number) to the data when delivered to the Government, as well as when the data are published or deposited for registration as a published work in the U.S. Copyright Office. The Contractor grants to the Government, and others acting on its behalf, a paid-up, nonexclusive, irrevocable, worldwide license for all delivered data to reproduce, prepare derivative works, distribute copies to the public, and perform publicly and display publicly, by or on behalf of the Government.

(ii) If the Government desires to obtain copyright in data first produced in the performance of this contract and permission has not been granted as set forth in paragraph (c)(1)(i) of this clause, the Contracting Officer shall direct the Contractor to assign (with or without registration), or obtain the assignment of, the copyright to the Government or its designated assignee.

(2) *Data not first produced in the performance of this contract.* The Contractor shall not, without prior written permission of the Contracting Officer, incorporate in data delivered under this contract any data not first produced in the performance of this contract and that contain the copyright notice of 17 U.S.C. 401 or 402, unless the Contractor identifies such data and grants to the Government, or acquires on its behalf, a license of the same scope as set forth in paragraph (c)(1) of this clause.

(d) *Release and use restrictions.* Except as otherwise specifically provided for in this contract, the Contractor shall not use, release, reproduce, distribute, or publish any data first produced in the performance of this contract, nor authorize others to do so, without written permission of the Contracting Officer.

(e) *Indemnity.* The Contractor shall indemnify the Government and its officers, agents, and employees acting for the Government against any liability, including costs and expenses, incurred as the result of the violation of trade secrets, copyrights, or right of privacy or publicity, arising out of the creation, delivery, publication, or use of any data furnished under this contract; or any libelous or other unlawful matter contained in such data. The provisions of this paragraph do not apply unless the Government provides notice to the Contractor as soon as practicable of any claim or suit, affords the Contractor an opportunity under applicable laws, rules, or regulations to participate in the defense of the claim or suit, and obtains the Contractor's consent to the settlement of any claim or suit other than as required by final decree of a court of competent jurisdiction; and these provisions do not apply to material furnished to the Contractor by the Government and incorporated in data to which this clause applies.

(End of clause)

- C. Page 3 of the Request for Proposal, Section 1 Supplies and/or Services Provided – Addendum to the Statement of Work is modified as follows:

SOW previously read:

3.2.2.10 All materials, metallic and non-metallic, exposed to N<sub>2</sub>O<sub>4</sub>, N<sub>2</sub>H<sub>4</sub>, or MMH shall be evaluated by NASA in order to determine whether they are compatible with the commodity. If the materials selected by the vendor have not been tested for compatibility, a material that is known to be compatible with the commodity shall be selected by NASA as a substitute.

- D. SOW modified to read:

3.2.2.10 All materials, metallic and non-metallic, exposed to N<sub>2</sub>O<sub>4</sub>, N<sub>2</sub>H<sub>4</sub>, or MMH listed in this specification have been evaluated by NASA, using the Materials and Processes Technical Information System (MAPTIS), in order to determine whether they are compatible with the commodity. Any materials, metallic and non-metallic, exposed to N<sub>2</sub>O<sub>4</sub>, N<sub>2</sub>H<sub>4</sub>, or MMH, that are listed as the option of the vendor to select, or alternate materials to those listed in this specification, shall require NASA approval via a material usage request. The vendor material usage request will be evaluated by NASA, using the Materials and Processes Technical Information System (MAPTIS), in order to determine whether they are compatible with the commodity. The vendor shall select materials that have been tested for compatibility with the commodity in accordance with NASA-STD-6001 Test 15 and rated "A" in MAPTIS. If the materials selected by the vendor have not been tested in accordance with NASA-STD-6001 Test 15 or are not rated "A" in MAPTIS, alternate material(s) that are rated "A" in MAPTIS for compatibility with the commodity shall be recommended by NASA as a substitute. Any untested and non MAPTIS A rated material suggested by vendor would be the responsibility of the contractor to fund testing to complete such efforts in accordance with NASA -STD-6001 Test 15, and also demonstrate a feasible plan for meeting integrated project schedule deadlines if test were successful or if test failed.

## Below are the responses to questions/clarifications submitted by prospective offerors.

1. Section 3.2.1.3 lists maximum expected operating pressure (MEOP) as 500 450 (See Addendum to RFP Page 3) PSIA on liquid side with 0 PSIA on fluid side, as well as gas side MEOP being 500 450 (See Addendum to RFP Page 3) PSIA with 0 PSIG on liquid side. We need to understand this requirement. *Response: Based on system operation, this 450 PSIG MEOP is an operating condition and is a required performance characteristic for possible limited failure mode cycles as further clarified in table below:*

Operational Scenario	Max Delta Pressure	Controlled or Rapid Press Change Rate	Cycles per Lifetime Use	~ Stroke Use
Nominal client checkout and refuel ops	<50 psid	Controlled	425	5 to 15%
Special client checkout and refuel ops	<100 psid	Controlled	100	5 to 15%
Bellows for backup fluid transfer	< 260 psid	Controlled	900	Full range
Gas side failure mode	< 450 psid	Controlled	1	Full extended
Liquid Side failure mode	< 450 psid	Controlled	1	Full compressed

**Operational Pressure Cycle Summary Table**

- 1a. Section 4.1.6.1 defines a pressure cycle with a 50 PSID maximum. *Response: The 50 PSID delta is the largest normal repetitive use operation planned. Test in section 4.1.7 per cycle test defined in 4.1.6.1 is required to verify the fatigue life of the bellows, used to address reliability with a 4 times safety factor added to planned operations.*
- 1b. Why is the MEOP so much greater? *Response: These are two different requirements, operational versus reliability testing. The MEOP stated covers all operational modes possible over the expected life use, including upset conditions. Reference Operational Pressure Cycle Summary Table in Question 1 responses for the anticipated cycles of the higher delta pressure operational failure mode cases.*
- 1c. The delta P across the welded bellows would be a major design driver, especially in the bellows extended position, that would have a major impact on cost, envelope, and weight. Looking at the functionality and purpose of the accumulator, we would like to discuss this requirement, and the possibility of proposing a design intended for a pressure balanced situation between the gas and fluid side, when the bellows is in the extended condition. Welded bellows withstand higher pressures in the nested condition, so we could potentially have a delta P while nested, but we believe further discussion is warranted to ensure the delta P requirement is necessary. *Response: The MEOP differential pressure across the bellows is based on one of the operational scenarios and is not associated with the life cycle testing. During this scenario, the internal (liquid) maximum pressure will be 450 PSIA while extended at its stop limit, or conversely the external (gas) pressure could reach 450 PSIA while nested at its stop limit for a one time potential, but not likely operational failure mode scenario.*
2. The accumulator drawing in the specification depicts bellows guides installed the entire length of the bellows. This is outside of our typical bellows to housing interface design. We would like to ask if we could take exception to this requirement. Our preferred method would be to incorporate provisions that we have qualified on space station, commercial flight, and military flight that involves bellows guides installed on the moveable end, or sweeper, of the bellows, along with sweeper L/D, and potential coatings as required to insure smooth and continuous bellows operation during all flight requirements. If the bellows guides along the entire stroke is the preferred method, then we would be glad to support that route as well. *Response: The sketches shown in technical specification are notational concepts depicting required usable volume between upper and lower use stops. See SOW paragraph 2.4, a proven design that meets or exceeds the requirements enveloped in specification K0000113580-SPC can be submitted and would be evaluated by the government for acceptability. If*

*a coating is applied on the sliding contact surface, the coating shall not generate gas or particulate contaminants and must be compatible to continue functional use if exposed to N2O4, N2H4, and MMH permeated vapors into this gas side cavity (reference tech spec 3.3.15)*

3. Are we locked in to support brackets as depicted in the drawing? We have other qualified designs that could offer weight and cost savings. Could we consider moving them closer to the end of the accumulator, or would that violate envelope? We have brackets and straps qualified on other similar programs, and we would like to ask if something similar could be considered for this proposal as well. *Response: Options in addition to baseline response will be considered to the tech spec baseline notional bracket interface design concept defined in Figure 1 of Specification K0000113580-SPC. The mounting brackets are only for supporting the EDU during testing and can be relocated or modified, if required. The mass of the brackets can be excluded from the maximum allowable mass of 3 kilograms. The external shape of the accumulator will be incorporated into computer models of the planned future flight-like module to verify center of gravity, space allocation, etc.*
4. Section 3.3.12 lists the bellows leak rate requirement of  $1 \times 10E-9$  tested on both sides of the bellows, at **750 625** (See Addendum to RFP Page 3) PSIA of He for 30 minutes. We need to understand what is driving this requirement. Testing to this requirement would create a delta P situation across the bellows that would be a major design concern. Could we propose leak checking at the operating pressure of (500 PSID?) with bellows in the nested position? Is there any margin in the leak rate requirement? *Response: The 625 PSIA requirement is a proof test (acceptance) value: 1.5 times the MEOP of 450. This is a requirement of ANSI/AIAA S-080 (and flight requirements AFSPCMAN 91-710). The leak rate test of  $1 \times 10E-9$  will assist in verifying integrity and quality of all welds.*
5. We have several similar qualified designs with a string potentiometer providing level sensing. Would there be any issues with an offeror proposing this technology for the level sensing requirement? *Response: See SOW para 2.3.1, an alternate level sensing method may be proposed in addition to the baseline requested version in the technical specification. However, an external system that can be maintained if the system fails, with no additional accumulator penetrations, is the preferred baseline at this time as stated in SOW.*
6. The Accumulator Specification is written around the procurement of two Engineering Development Units (EDU), for the NASA RESTOR Program. Section/Paragraph numbers noted herein are those of the Accumulator Specification. In accordance with 4.1.1, Table 1, one unit will be tested by the offeror and the second by NASA. *Response: All testing defined in Table 1, shall be performed by the vendor.*
7. The primary difference in the testing is that the offeror will perform the 1,700 bellows full cycles, per 4.1.7, while NASA will perform only the ten bellows limited cycles, per 4.1.8. *Response: Both tests to be performed by the vendor. The limited 10 cycle test is for acceptance testing to NASA planned engineering development article, whereas the 1,700 cycle test is for qualifying the design by performing on the vendor test article.*
8. The vendor will also perform Proof and Burst Pressure testing per 4.1.9 at the end of the Acceptance Testing. The second NASA unit is not required to see Burst testing. *Response: Correct, except all the testing defined in Table 1, shall be performed by the vendor.*
9. Relative to environmental testing per sections 3.2.1.8 thru 3.2.1.12 and sections 3.2.2.6 thru 3.2.2.9, these tests are stated as not applicable to EDU's. However, section 3.2.2.4 and section 3.2.2.5 dictate evaluation for side loads and vibration to withstand lateral loads of +/-2G and axial loads of +6/-2g force. Requirement for evaluation is not further defined within the drawing. We are requesting that the testing be further defined. *Response: The vibration requirements defined in sections 3.2.2.4 and section 3.2.2.5 are required to be incorporated into the design analysis. No test is required to be performed on the EDU Units.*

10. Will NASA perform these tests on the second EDU after Acceptance Testing? *Response: Vibe testing will be qualified under flight first article production unit test (a potential future contract), not part of EDU testing required per this solicitation*
11. In general, it appears that the current overall drawing requirements are written around proving the life of the Bellows and Magnetic Sensor. With no environmental testing, i.e. Vibration, Shock, Acceleration, etc... Why the need for a lightweight domed end configuration with the prescribed Mounting Brackets as depicted in Figure 1 and that has the weight controlled per section 3.2.2.11, as "maximum weight shall be approximately 3 Kilograms"? *Response: Options in addition to baseline response will be considered to the tech spec baseline notional dome and bracket interface design concept defined in Figure 1 of Specification K0000113580-SPC. The mounting brackets are only for supporting the EDU during testing and can be relocated or modified, if required. The mass of the brackets can be excluded from the maximum allowable mass of 3 kilograms. The external shape of the accumulator will be incorporated into computer models of the planned future flight-like module to verify center of gravity, space allocation, etc. The lightweight domed end is incorporated to baseline to ensure test validation of pressure container housing design burst and cycle life, similar to eventual flight unit.*
12. The first unit will not be exposed to the specified fluids at our facility. If there is no foreseen exposure, then these EDU's could be more economically produced by the use of more conventional alloys such as 300 Series CRES. *Response: Titanium material was selected to be compatible with the various fluids and is required for the vendor and NASA EDU fabrication of this solicitation, and eventually for flight unit production contract. The properties of Titanium when exposed to long term NTO was found to be a lower risk to the program as compared to CRES. The lessons learned from the methods of manufacturing and assembly processes, Vendor and NASA testing results of this EDU phase are of great value before committing to the flight unit development. NASA plans to perform EDU testing using NTO after receipt of NASA unit.*
13. Unless NASA intends to perform the Environmental requirements on their current EDU configuration, the cost of the EDU's could be reduced by allowing a simple flat ended "heavy" cylindrical housing around the Bellows separator. This is more than adequate to prove the life and reliability of the Bellows and Sensor. *Response: Options in addition to baseline response will be considered to the tech spec baseline notional dome design concept defined in Figure 1 of Specification K0000113580-SPC. The external shape of the accumulator will be incorporated into computer models of the planned future flight-like module to verify center of gravity, space allocation, etc. The lightweight domed end is incorporated to baseline to ensure test validation of pressure container housing design burst and cycle life, similar to eventual flight unit.*
14. With thought of cost for future flight units, the use of an alternate Titanium Alloy such as Ti Alloy xyz for the accumulator body, would accomplish this cost reduction goal. Alloy xyz has strength properties similar to TI 6AL-4V, but can more readily be cold formed resulting in simpler tooling and production cost. *Response: Ref Tech Spec section 3.2.2.10 Alternate titanium materials that meet the requirements for the EDU units can be submitted for NASA evaluation with bid submit as long as baseline cost and product are also submitted. Vendor may submit options along with price / schedule adjustments with bid for consideration.*
15. Per section 3.2.1.3, the Liquid side Maximum Expected Operating Pressure (MEOP) is 500 450 (See Addendum to RFP Page 3) psia with 0 psia on gas side. Gas side MEOP is 500 450 (See Addendum to RFP Page 3) psia with 0 psia on liquid side. This is further complicated by the Proof testing per section 4.1.5.1, where the differential pressure is now 1.5 times MEOP or 750 625 psia on either the Liquid or Gas side. *Response: The requirements as defined (corrected) above are correct. The 625 PSIA requirement is a proof test (acceptance) value: 1.5 times the MEOP of 450. This is a requirement of ANSI/AIAA S-080 (and flight requirements AFSPCMAN 91-710).*
16. Figure 1, on Sheet 9 in The Accumulator Specification shows the liquid to be internal to the bellows and gas to be external to bellows. For this type of application, this is the normal condition. With liquid internal, the liquid

ullage or unexpellable amount is minimized, therefore increasing the volume efficiency of the unit and the “wet” weight. This being the case, the bellows is required to withstand the ~~500~~ 450 (See Addendum) psid, and the ~~750~~ 625 (See Addendum) psid internal to external. *Response: Correct for limited upset condition failure mode case.*

17. Virtually no practical bellows configuration can withstand this level of internal differential pressure. The ~~450~~ 500 and ~~625~~ 750 psid on the external or gas side, and with the bellows fully compressed, is acceptable for a relatively small amount of repetitive cycles. Therefore, during normal system operation, is this a real condition, where loss of pressure on one side is expected? (See further comments in 17 of this document) *Response: The MEOP differential pressure across the bellows is based on one of the operational scenarios and is not associated with the life cycle testing. Based on system operation, this 450 PSIG MEOP is an operating condition and is a required performance characteristic for possible limited failure mode cycles as further clarified in table above in Question/answer #1.*
18. 3.2.4. Bellows Cycling Pressures. With reference to this document, during the bellows cycle testing, per sections 4.1.7 and 4.1.8, the differential pressure is allowed to be controlled such that only the pressure required to perform full compression stroke of the bellows, equivalent to the 1.2 Liter displaced volume, is imposed. (This is anticipated to be no more than xx psid.) If this is simulating future Flight System operation, then why the extremely high differential pressure test requirements per section 3.2.1.3? *Response: The 50 PSID delta is the largest normal repetitive cycle use operation planned. Test in section 4.1.7 per cycle test defined in 4.1.6.1 is required to verify the fatigue life of the bellows, used to address reliability with a 4 times safety factor added to planned operations. These are two different requirements, operational versus reliability testing. The MEOP stated covers all operational modes possible over the expected life use, including upset conditions. Reference Operational Pressure Cycle Summary Table in Question 1 responses for the anticipated cycles of the higher delta pressure operational failure mode cases. The MEOP differential pressure across the bellows is based on one of the operational scenarios and is not associated with the life cycle testing. During this scenario, the internal (liquid) maximum pressure will be 450 PSIA while extended at its stop limit, or conversely the external (gas) pressure could reach 450 PSIA while nested at its stop limit for a one time potential, but not likely operational failure mode scenario.*
19. Under the characteristics section 3.2.1.3, 3.2.1.13, & 3.2.1.14 and Bellows Cycle Test 4.1.6 Liquid and gas side operating, proof, & burst differential pressures, are you requiring the bellows to handle those differential pressures? *Response: The MEOP differential pressure across the bellows is based on one of the operational scenarios and is not associated with the life cycle testing. Based on system operation, this 450 PSIG MEOP is an operating condition and is a required performance characteristic for possible limited failure mode cycles as further clarified in table above. See answer #1*

STATEMENT OF WORK  
FOR

Accumulator, Engineering Development Units for  
NITROGEN TETROXIDE, HYDRAZINE AND  
MONOMETHYLHYDRAZINE

Date: May 15, 2012

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EDDR #126662: NASA KSC Export Control Office (321-867-9209)

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## **1.0 PURPOSE AND SCOPE**

### **1.1 Purpose**

An accumulator is needed for engineering development and testing purposes. The accumulator will be used to dampen the output of a fluid pump, transfer fluid and decrease/increase fluid line pressure to a spacecraft in geosynchronous orbit and to accommodate thermal compensation of fluid in space.

### **1.2 Scope**

This statement of work (SOW) defines the effort for the design, fabrication, testing, and delivery of two Engineering Development Unit (EDU) accumulators per Specification K0000113580-SPC Accumulator, Nitrogen Tetroxide, Hydrazine, and/or Monomethylhydrazine Service.

The Contractor shall provide all resources and materials necessary to design, fabricate, test and deliver the items below in accordance with the contract that includes this SOW and the K0000113580-SPC specifications. This SOW does not replace the requirements noted on the specification K0000113580-SPC.

## **2.0 Requirements**

The Contractor shall meet the following requirements contained in this SOW and the NASA technical procurement specifications for the performance of this procurement.

The contractor shall manufacture and verify two (2) EDU accumulators per this contract. The requirements for performance, interfaces, design and construction, quality assurance, and acceptance testing are provided in procurement specification K0000113580-SPC. These specifications call on other compliance and reference specifications for their various requirements.

One (1) Vendor EDU accumulator, shall be identified with serial number AB-EDU-C-001, and shall be utilized by the Contractor as a first article test unit to verify the design, construction, and to perform the tests as defined in Table 1, Acceptance Test Matrix in Specification K0000113580-SPC. Upon completion of the testing, the EDU will be delivered to NASA. This unit will not be used in service or test program by NASA.

A second NASA EDU accumulator, shall be identified with serial number AB-EDU-N-002, and shall be manufactured and delivered to NASA upon the completion of the Tests defined in Table 1, Acceptance Test Matrix in Specification K0000113580-SPC and upon completion of the contractor EDU acceptance test. This unit will be used in test program with commodities and pressure as stated in K0000113580-SPC.

All test fixtures specifically built for the work performed to meet the requirements of this SOW or related specification shall be delivered to NASA upon completion of the contract. This includes any test articles that may fail initial acceptance tests, such that NASA may perform additional malfunction inspection / analysis of the failed unit.

The detailed requirements are specified in the following paragraphs of this Statement of Work (SOW).

**2.1 Applicable Documents**

The following documents are applicable to this SOW:

Specification Number	Description
K0000113580-SPC *	Procurement Specification – Accumulator EDU – Nitrogen Tetroxide, Hydrazine and Monomethylhydrazine
ANSI/ISO/ASQ 9001-2000	American National Standard Quality Management Systems Requirements
ANSI/ISO/ASQ Q10012	Measurement Management Systems - Requirements for Measurement Processes and Measuring Equipment - First Edition

\* The specification specific revision levels, amendments, and approval dates and/or revision levels are defined in Appendix C.

**2.2 Precedence**

If any of the documents invoked herein are changed during the period of performance of the Contract/Purchase Order, the Contractor shall not use the later issue without prior written approval of the Contracting Officer.

**2.3 Request for Quote (RFQ) Response**

In addition to the RFQ Response, the following is also required.

**2.3.1 Position Sensor Instrumentation**

Position sensor instrumentation shall be per Specification K0000113580-SPC.

It is preferred to have the bellows positioning sensor design (i.e. magnet) internal to the accumulator with external measuring device. The minimum accuracy required is 10% in the baseline bid response. If a greater accuracy than 10% as specified in Specification can be achieved, the contractor shall define a separate itemized quote for the additional accuracy level that can be achieved. The contractor shall define the recommended design in the proposal bid

response and include the following for the baseline sensor and any proposed options: If the accuracy specified in Specification K0000113580-SPC cannot be achieved, the contractor shall define the accuracy that can be achieved. The contractor shall define the recommended design in the proposal and include the following:

- A. Define the voltage and current requirement, wire size, etc. for the selected sensor.
- B. Define /quantify the Electromagnetic interference (EMI) effect on the selected sensor.
- C. Define/quantify the EMI emitted by the selected sensor.
- D. The method of retaining the external sensor to the accumulator shall be identified an approved by NASA. If an adhesive bonding is recommended, the type and any special process, i.e. cleanliness/surface roughness, temperature application, cure time, etc. shall be provided.
- E. If position sensor utilizes an internal magnetic device, the contractor shall provide the method of encapsulation.
- F. The contractor shall provide to NASA, one each of the electrical connector that interfaces with its mating half, mounted on the position sensor mounting bracket.

### **2.3.2 Alternative Weld Inspection**

If welds for non-category A type joints cannot be radiographically inspected as required on Specification K0000113580-SPC, provide a proposed alternative/equivalent weld inspection methodology with the RFQ response. All welds on pressure containing parts must be 100% Non-Destructive Evaluation (NDE) volumetric inspected or equivalent methods ensuring similar quality such as automated recorded parameter processes and alternative high precision NDE.

### **2.4 General**

The contractor shall provide signed/stamped certified drawings and engineering analysis as required by specification K0000113580-SPC.

The contractor shall provide the fabrication and assembly documentation for each EDU to NASA for review and concurrence prior to start of fabrication.

If a component was previously qualified / test certified for another government agency and meets or exceeds the requirements enveloped in specification K0000113580-SPC, the contractor shall provide the specific component information (analysis or testing) to the NASA Contracting Officer in detail for review when providing the bid for this contract.

The contractor shall fabricate and perform Non Destructive Evaluation (NDE), acceptance tests, cleaning, certification, shipment preparation, packaging and delivery of the Hardware item to KSC as defined in Specification K0000113580-SPC.

NASA reserves the right to witness and inspect any part on a non-interference basis and inspect any part during the construction, fabrication, assembly and test period at the Contractor or Contractor's suppliers / subcontractor's site.

The contractor shall provide the NASA CO/ COTR any technical requirements and specifications for a ten (10) work day review prior to providing it for release for fabrication to any specialty Subcontractor (such as a bellows manufacturer).

### **3.0 Data Management**

All data deliverables shall be delivered electronically in common computer formats such as Word, Excel, Acrobat, etc. unless otherwise specified. All engineering records - drawings, reports, calculations, etc shall be provided to the government in root file format as well as an image file such as Adobe PDF (portable document format) and two clean hard copies. All Contractor detail proprietary documents such as shop practices/procedures shall be appropriately marked per individual sheet.

All documents provided to the Contractor that contain an Export Control Determination, or similar information sensitivity marking, shall have that marking maintained with that document & information at all times. Contractor created drawings created based on such drawings must carry-over that information sensitivity marking as that determination belongs to the information and not the document.

### **4.0 Monthly Status and Final Reports**

The Contractor shall provide a monthly status report. Contractor format is acceptable. The first report shall be delivered thirty (30) days after contractor Notice to Proceed. The contractor shall prepare an agenda and send to the government three (3) work days prior to the meeting. The following reports should be delivered on the second Friday of each month following the first report through to the end of the contract. Monthly project status reports shall be delivered every ten (10) work days following the end of each month. These reports shall provide data for the assessment of monthly cost, technical and schedule progress. The monthly status report shall include:

- A. Agenda, project schedule and changes
- B. Work accomplished for current reporting period, including a report of overall cost, technical and schedule performance including photos / videos, standard cell phone / digital camera quality, of major item progress.
- C. Work planned for next reporting period.
- D. Current problems which impede performance or impact program schedule or cost, and proposed corrective action.
- E. Other information that assists NASA in evaluating the Contractor's cost, technical and schedule performance.

- F. A thirty (30) minute review shall be held after report is submitted for follow-up NASA questions and/or clarification.

## **5.0 Project Schedule**

The Contractor shall develop, maintain, and track a project schedule. The program schedule shall illustrate the schedule that the Contractor intends to follow over the period of performance and shall be delivered to the NASA Contracting Officer ten (10) days after Contract award.

## **6.0 Meetings**

The Contractor shall provide manpower, facilities, and data to support the meetings and reviews defined in this SOW, and will document and provide NASA the meeting minutes for review, within two (2) working days after the meeting. Meetings defined below shall include as a minimum:

- A. Technical Kickoff Review
- B. Monthly Teleconference (as defined in Section 4.0)
- C. Prefabrication Start Design Review
- D. Acceptance Review

### **6.1 Technical Kickoff Review**

The Contractor shall conduct a Technical Kickoff Review not later than ten (10) work days after contract award at the NASA Kennedy Space Center with at least one technical lead representative from the vendor present (other support parties may be tied in via telecom / WEBEX, if desired). At a minimum this review should cover proposed basic high level concepts, and initial schedule for design and acceptance testing. This meeting will also serve as first technical exchange of Contractor engineering and NASA engineering for clarification of any specification technical items.

### **6.2 Design Reviews**

#### **6.2.1 Contractor Responsibilities**

##### **6.2.1.1 Agenda**

The agenda shall specify the time and place for the scheduled review at contractor or nearby fabrication plant facilities, specific review items, supporting documentation, and key participants and shall submit the agenda for review three (3) days prior to the meeting. Submit approved copies at the review.

### **6.2.1.2 Review materials**

All design drawings, analysis, inspect / test plans, etc must be saved in a common viewable electronic format (along with root file format) to NASA Contracting Officer ten (10) work days prior to start of review period.

### **6.2.1.3 Minutes**

The minutes shall contain a description of the review with sufficient detail to enable the review decisions and comment disposition to be made a matter of record. The minutes shall include any presentation charts, a listing of disposition to comments, action items with actionee and suspense (closure) date. Minutes shall be provided to each attendee within two (2) work days after review meeting and an electronic copy shall be available.

### **6.2.1.4 Design Comment (DC) Disposition**

The Contractor shall perform all work necessary to prepare recommended technical options, solutions and dispositions to close each DC that is within scope of the contract. Initial disposition shall be within five (5) work days after closure of comment period. No review milestone shall be considered completed until all DC's deemed critical by the NASA Contracting Officer are closed.

## **6.2.2 NASA Responsibilities**

### **6.2.2.1 Meeting Support**

NASA will co-chair the formal reviews required within this scope of work.

### **6.2.2.2 Design Comments (DC) Tracking**

NASA Contracting Officer Technical Representative shall track final closure of Design Comments (DC) associated with the design reviews.

### **6.2.2.3 Design Comment Closure**

Formal DC closure requires NASA Contracting Officer Technical Representative concurrence.

## **6.3 Pre-Fabrication Start Design Review**

The Contractor shall conduct a pre-fabrication start Design meeting with NASA. The meeting shall be held at or nearby contractor fabrication / assembly facilities. The pre-fabrication Start Design is chaired by the NASA Contracting Officer (or designated representative). The pre-fabrication start Design maturity shall mean the design/analysis is complete and that drawings /

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test procedures are ready to issue for use for fabrication start as deemed by the manufacturer ready for NASA review / concurrence.

The pre-fabrication start Design shall include review of the following items, at a minimum and shall be provided to the Contracting Officer ten (10) work days prior to the design review:

- A. Component description – A written narrative description of the accumulator functional capabilities
- B. Final Specification Tree and Drawing Tree of component subassemblies
- C. Design / Shop fabrication drawings including but not limited to such items as dimensional details, weld symbols, materials / parts list, thicknesses, and key interface details.
- D. Procurement specifications for any procured major specialty subcontract items
- E. Acceptance Test Procedures for each deliverable EDU
- F. Verification plan– Identify verification approach to tech specification requirements and auditable methods of analysis, test, demo, or inspection
- G. Handling requirements/design
- H. Any design analysis performed
- I. Materials Identification and Usage List
- J. Development and Production Plan with Long Lead time parts/components identified
- K. Operations and Maintenance Manual/Instructions and trouble-shooting of bellows positioning sensor (if applicable)
- L. Final Shop production process procedures for such items but not limited to weld procedures records, NDE processes / individual certifications, cleaning processes / procedures, etc.
- M. Packaging, protection, and transportation plans to KSC of EDU's.
- N. A detailed fabrication and test schedule.
- O. After successful completion of this review and disposition of comments incorporated to final fabrication test drawings and specifications work may proceed to start fabrication of test articles.

## **6.4 Acceptance Review (AR)**

The Contractor shall conduct an Acceptance Review via telecom / WEBEX based on the contents of the Acceptance Data package (ADP) send to NASA. This final review data shall be issued for review no later than ten (10) work days post final successful acceptance testing completion. A certification of compliance to the SOW and procurement specification shall be submitted. The AR will be co-chaired by the NASA Contracting Officer (or designated representative) and with the Contractor supplying all documentation needed to establish acceptability of hardware for its intended use. This review is conducted after as-built design drawings are complete and acceptance and certification testing and associated reports are complete. All data may be submitted in Contractor format.

The Acceptance Data Package for each accumulator unit shall include data described in the SOW Paragraph 9.2 (Acceptance Data Package)

## **7.0 Document Control**

The Contractor shall implement a Document Control as defined by their process meeting ANSI/ISO/ASQ 9001 requirements.

All documents and records - Drawings, reports, calculations, etc shall be provided to the government in an electronic format, root file format as well as an image file such as PDF and two clean hard copies. All Contractor detail Proprietary documents shall be appropriately marked per individual sheet

### **7.1 Request for Information (RFI)**

After contract award, the successful Contractor shall, when contract information or clarification is required by the Contractor, prepare and submit KSC Form 8-268, "Request for Information (RFI)/Clarification." The form shall be submitted to the Contracting Officer and will be processed by the Government. The RFI will be returned to the contractor with the appropriate information/response within no greater than five (5) work days. The Contractor shall indicate on the RFI if when the concern /question have an effect on schedule or cost. The form will be provided to the successful contractor at the post award pre-work meeting.

### **7.2 Request for Change or Deviation/Waiver**

All Contractor requests to deviate from the technical requirements in Specification K0000113580-SPC or this SOW, shall present rationale for requested deviation and the impact of the deviation with respect to achieving the component's specification performance (along with cost adjustment -either additional or reduced price).

No changes to the accumulator design, material composition, or processes are authorized without the written direction from the NASA CO or NASA COTR.

### **7.3 Change Management**

The Contractor change process shall ensure that all design changes that affect development, fabrication, assembly, inspection, or testing shall go through a controlled process to ensure that the quality of the component and associated documents are not compromised. Any changes that impact approved documents from pre-fabrication review will require NASA approval.

### **7.4 Engineering Release**

The Contractor shall establish an engineering release system in accordance with internal company procedures, to issue configuration documentation to functional activities and to authorize the use of configuration documentation associated with an approved configuration.

## **8.0 Quality Assurance**

### **8.1 Quality System**

The contractor's quality system shall be compliant to ANSI/ISO/ASQ 9001. The contractor can satisfy this requirement by current registration by a recognized registrar. If NASA has accepted Contractor's ANSI/ISO/ASQ 9001 registration and Contractor subsequently changes registrars, loses its registration status, or is put on notice of losing its registration status, it shall notify the NASA's CO within three (3) work days of receiving such notice from its registrar.

### **8.2 Pre or Post-Award Survey**

Prior to starting work on this order and at the discretion of NASA Quality Assurance Representative, a pre or post award survey of the supplier may be conducted by customer representatives consisting of representatives from Engineering, Procurement, and Quality Assurance. This survey will be conducted at a time mutually agreeable to by all parties on a non-interference basis.

### **8.3 Inspection Control Point Outline**

Special inspections, called mandatory inspection points (MIP), will be designated by the Government during the performance of this contract. Prior to the start of work, the Contractor shall provide the NASA KSC Quality Assurance Representative (QAR) a schedule and Inspection Control Point Outline (ICPO) which shows the work sequence(s) to be employed during the performance of this Purchase Order. The contractor's schedule/ICPO must indicate what types of contractor inspections will be performed and where in the contract's sequence of events they will be accomplished. The contractor shall notify The NASA KSC QAR at least five (5) work days prior to the occurrence of a scheduled, designated MIPS. Designation of MIPS does not relieve the contractor of the obligation to perform all contractually required inspections. In addition, NASA Engineering inspection shall be included.

Reference the attached Mandatory Inspection Points table in Appendix B.

#### **8.4 Contamination Control**

The Contractor shall develop and implement a Cleaning Procedure that meets the requirements in Specification K0000113580-SPC. The Procedure shall be provided to the NASA Contracting Officer or Contracting Officer Technical Representative ten (10) work days prior to the Pre-fabrication Design Review start. The procedure shall address as a minimum the following:

- A. **Materials Selection** - Materials shall be selected to preclude generating contaminants during operation and launch environments.
- B. **Cleaning and Surface Cleanliness** - All materials shall be cleaned and verified clean to meet specification K0000113580-SPC requirements for the end item use. The Cleaning methods shall include required solvents and method and shall also be forwarded to the NASA Contracting Officer or Contracting Officer Technical Representative for review and approval.

#### **8.5 Calibration System**

The Contractor shall have a documented calibration system that meets the requirements of ANSI/ISO/ASQ Q10012 Measurement Management Systems - Requirements for Measurement Processes and Measuring Equipment - First Edition, or equivalent standards.

## **9.0 SUBMITTAL DOCUMENTS**

The Contractor shall provide all of the data listed in Appendix A of this Statement of Work entitled "Contract Data Requirements List (CDRL)". All Contract data requirements shall be submitted to NASA CO as identified in the purchase contract unless otherwise specified. All CDRL's shall be subject to the unilateral approval of the NASA CO. In the event of disapproval, the Contractor shall initiate immediate corrective action and shall resubmit to the NASA CO for approval within five (5) work days.

The Contractor shall submit all data deliverables electronically along with a signed hardcopy. All documents shall be submitted in an electronic format that is searchable (e.g., PDF). For documents that were scanned, the Contractor shall run "paper capture" or optical character recognition to convert the file to a searchable format before submittal.

### **9.1 Certificates of Compliance**

Certificates of Compliance (COC) shall be provided in the acceptance data package (ADP) when all ADP requirements are met.

### **9.2 Acceptance Data Package (ADP)**

The Contractor shall develop, maintain and deliver, for each component end item assembly, an Acceptance Data Package. Delivery of data package to NASA Contracting Officer must be ten (10) work days prior to Acceptance review and ten (10) work days before shipment of units via electronic scanned / PDF file. Two (2) signed hard copies shall be delivered to NASA, one to Contracting Officer, and one to Contracting Officer Technical Representative, before or with shipment of unit to KSC. Any units shipped without ADP will not be considered acceptable for receipt at customer site. The Acceptance Package shall include the following as a minimum:

- A. Test history log, including post manufacturing checkout and final verification tests of the component, with the following data (may refer to the Component Data Log for details):
  1. Actual measurements identified to specified tests.  
References made to applicable test reports are satisfactory provided that copies of the reports are provided.
  2. Brief test summary.
  3. List of actual and recommended retest.
  4. Special test instructions, investigations, warnings, and problems encountered during test.
  5. Failure and corrective actions data for all failures during all testing.
  
- B. Each component will have a data log which shall include the following:
  1. Weld Related Data:

- a. Inspection records for all NDE inspections, such as radiograph and dye penetrant, including weld traceable maps of welder and procedure number at each joint.
- b. Welder and Weld inspector certifications.
- c. Weld procedures
2. Records for all metallic materials and shall include:
  - a. Material Listing – (Vendor certificate acceptable)
  - b. Testing certificates – (Vendor certificate acceptable)
3. Records for non-metallic materials:
  - a. Material certifications – (Vendor certificate acceptable)
  - b. Test data – (Vendor certificate acceptable)
4. Acceptance Test Data:
  - a. Final Test Plan & Procedure
  - b. Test Reports
5. Contamination:
  - a. Finalized cleaning procedure
  - b. Results
6. Dimensional check that includes measurements of the outside interface dimensions to check conformity with drawings.
7. Records showing any identified defects during inspection / testing with correction data. – Applicable to all the above tests and inspections.
8. Analysis of acceptance test data
9. Photographs and video of acceptance testing shall be provided to NASA (digital quality).
- C. All analysis performed per specification K0000113580-SPC to include stress and flow analysis.
- D. Complete copies of drawings reflecting AS-BUILT configuration to the level required to permit repair, maintenance and operation of the component.

## **10.0 Design and Development**

The Contractor shall design and develop the component such that it meets all requirements detailed in the component specification K0000113580-SPC and this SOW. Acceptance testing shall be performed as part of the design/development phase to assure compliance with the above specification. Data deliverables and analyses to be performed include the following:

### **10.1 Component Specifications**

A detail technical specification for any subcontract piece part of the component fabrication is required for NASA review at Pre-fabrication design review. All associated data deliverables are due ten (10) work days prior to the Pre-fabrication design review and with final acceptance data package following acceptance testing of EDU units.

## **10.2 Drawings and Associated Lists**

The Contractor shall provide four (4) hard copies of the as-built assembly cross section drawing of each component / assembly in a part breakdown format, part information, part breakdown list with part numbers and shall be provided ten (10) work days prior to Pre-fabrication design review. Two (2) each electronic version of each of these documents shall be provided on a disc or other transferable electronic media: one (1) in PDF and one (1) in native format with native source program specified.

## **11.0 Acceptance Test Planning, Procedures, and Reporting**

The Acceptance Test data shall be documented by the Contractor in separate documents for each EDU and shall be provided ten (10) work days prior to prefabrication design review and per the following:

### **11.1 Test planning information shall include the following as a minimum:**

- A. Complete description of article under evaluation, including the description of the interface requirements between the article and the test facility (or apparatus) and differences between the article under evaluation and the fully configured flight article.
- B. The overall philosophy, approach, and objective for each item, including any special tailoring or interpretation of design and testing requirements.
- C. Detail descriptions of all test activities (i.e., tests, analyses, inspections) to be performed based on the identified requirements. Identify any prerequisites, constraints, and objectives for all the test activities.
- D. Description and planned usage of the support equipment, software, facilities, and tooling necessary to execute the test activities, and required tools, test beds, etc.
- E. The contractor shall notify the NASA Contracting Officer and Contracting Officer Technical Representative at least ten (10) work days prior to the occurrence of a scheduled test, which is listed as a Mandatory Inspection Point (MIP).

### **11.2 Test procedures shall contain the following as a minimum:**

- A. Identification of item/article being subjected to test, inspection, or demonstration.
- B. Identification of objectives established for the particular test, inspection, or demonstration.
- C. Description of steps and operations, in sequence, to be taken.
- D. Identification of measuring and recording equipment to be used, specifying range, accuracy, and type and any special instructions for operating such equipment.
- E. Layouts, schematics, or diagrams showing identification, location, and interconnection of item/article, support equipment, and measuring equipment.

- F. Environmental and/or other conditions to be maintained with tolerances.
- G. Constraints on test, inspection, or demonstration.
- H. Pass-fail criteria for evaluating results.
- I. Instructions for handling non-conformances and anomalous occurrences during activity.
- J. Confirmation that required support equipment has been calibrated and certification of the calibration is still valid.
- K. Identify requirements verification points (NASA, Contractor)

### **11.3 Test Reports shall include the following as a minimum:**

- A. Conclusions and recommendations relative to success of the test activity.
- B. Description of deviations from nominal results, failures, approved corrective actions and procedures, and retest.
- C. Traceability back to the requirement.
- D. Copy of as-run procedure (as appropriate).
- E. Identification of test configuration.
- F. Specific results of each procedure including automated test segments and associated analyses.
- G. The contractor shall provide test report data no later than five (5) work days upon completion of testing.

## **12.0 Fabrication and Assembly**

The Contractor shall be responsible for maintaining and conducting all fabrication and assembly activities (equipment, processes, and procedures) in a manner which is consistent with and supports the requirements of this SOW and specification K000013580-SPC. Hardware shall be fabricated and finished so appearance, fit and specific tolerances are observed. Any item failing the acceptance criteria shall be reworked or replaced and re-examined by the same acceptance criteria as required for the original item.

## **13.0 Interchangeability**

Hardware assemblies, components, and parts with the same part number shall be physically and functionally interchangeable.

## **14.0 Security**

The vendor shall be responsible for information and Information Technology (IT) security when information systems are used to store, generate, process or exchange information with NASA. At the completion of the contract, the Vendor shall return all NASA information provided to the vendor during the performance of the contract and certify that all ITAR information has been purged from vendor-owned systems used in the performance of this procurement.

## **15.0 Advance Shipping Notice**

An Advanced Shipping Notice is a courtesy letter or fax which provides advance shipping information to the NASA Contracting Officer/Contracting Officer Technical Representative (COTR) to coordinate the receipt of the shipped items with the NASA receiving, transportation, and management personnel. Complete shipping plan due ten (10) work days prior to each shipment. The Contractor shall furnish the following written information to the NASA COTR or his authorized designated representative five (5) work days prior to each shipment:

- Date of Shipment
- Method of Shipment
- Complete or Partial Shipment
- Number of Cartons
- Total Weight
- Dimensions

## **16.0 Transportation**

The Contractor is responsible for all fixtures, tie-downs and supports and any applicable permits required for shipping.

The Point of Acceptance will be Kennedy Space Center. Unless otherwise directed, the Contractor will ship all parts to:

Transportation Officer, NASA  
ISC Warehouse Building, M6-744  
Kennedy Space Center, FL 32899

## Appendix A – Submittals / Contract Data Requirement List (CDRL)

CDRL NO.	Section	Deliverables	Delivery Date
C1	1.2	Accumulator Bid	Proposal
C2	2.4	Component Qualification information from previous government qualification	Proposal, if applicable
C3	2.4	Subcontractor Technical Specifications / Requirements	Ten (10) work days prior to providing to Subcontractor & ADP
C4	4.0	Monthly Status Report	Ten (10) work days after the end of the Month & ADP
C5	5.0	Project Schedule	Ten (10) work days after Contract Award
C6	6.0	Meeting Minutes	Two (2) work days after the meeting & ADP
C7	6.1	Technical Kickoff Review	Ten (10) work days after Contract Award
C8	6.2	Monthly Teleconference	Monthly (at a mutually agreed time)
C9	6.3.1.1	Design Review Agenda	Three (3) work days prior to review
C10	6.3.1.2	Design Review Materials	Ten (10) work days prior to review & ADP
C11	6.3.1.3	Design Review Minutes	Two (2) work days after review
C12	6.3.1.4	Design Review Comment Disposition	Five (5) work days after closure of comment period & ADP
C13	6.4	Pre-fabrication Design Review	Per the approved Project Schedule
C14	6.4	Data for Pre-fabrication Design Review	Ten (10) work days prior to Pre-fabrication Design Review
C15	6.5	Acceptance Review	Ten (10) work days post final successful Acceptance Test
C16	7.1	Request for Information	As needed and full set with ADP
C17	7.2	Deviation & Waiver Request	As needed; Approved Deviation/Waivers with ADP
C18	8.3	Inspection Control Point Outline and Record	With Fabrication drawings and with ADP
C19	8.4	Cleaning Procedure	Ten (10) work days prior to Pre-fabrication Design Review

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<b>CDRL NO.</b>	<b>Section</b>	<b>Deliverables</b>	<b>Delivery Date</b>
<b>C20</b>	9.1	Certificate of Conformance	With ADP
<b>C21</b>	9.2	Acceptance Data Package	Ten (10) work days prior to Acceptance Review (AR), and fourteen (14) days before component is delivered.
<b>C22</b>	10.1	Component Specifications	Ten (10) work days prior to Pre-fabrication Design Review & ADP
<b>C23</b>	10.2	Drawings and Associated Lists	Ten (10) work days prior to Pre-fabrication Design Review & with ADP
<b>C25</b>	11.0	Acceptance Test Plans & Procedures	Ten (10) work days prior to Pre-fabrication Design Review & ADP
<b>C26</b>	11.1	Acceptance Test Notification	Ten (10) work days prior to test and with ADP
<b>C27</b>	11.3	Acceptance Test Reports	Five (5) work days upon test completion & ADP
<b>C28</b>	13.0	Advance Shipping Notice	Complete plan due five (5) days prior to each shipment

Note – Days are defined as Calendar days.

## Appendix B – Inspection Control Point Outline / Mandatory Inspection Points

<b>Inspection Control Point Outline (ICPO)</b>					
1. Contractor Name:		TBD			
2. Contractor Address:		TBD		3. City/State:	
				TBD	
4. Point of Contact:		TBD		5. POC Phone:	
				TBD	
6. POC Email:		TBD			
7. Description of Procurement (including Contract number and Delivery Order number):					
Reference Specification K0000113580-SPC Table 1 - Acceptance Test Matrix					
<b>8. INSPECTIONS</b>					
Line	Description of Inspection [Reference to Specification]	Planned Date of Performance	Performance Date	Contractor Stamp and Date	NASA Stamp and Date
1.	Quality and Contracting Officer's Technical Representative (COTR) shall be notified when all welding is complete (both EDUs)				
2.	Quality and COTR shall be notified prior to proof/leak test , Section 4.1.5 (both EDUs)				
3.	Quality and COTR shall be notified prior to Volumetric /flow rate and instrumentation verification test, section, Section 4.1.4 (both EDUs)				
4.	Quality and COTR shall be notified and witness the Bellows cycle test (Vendor EDU), Section 4.1.7				
5.	Quality and COTR shall be notified prior to the burst test, Section 4.1.9				
6.	Quality and COTR shall be notified when assembly is ready for Final Inspection (both EDUs)				

**Appendix C – Specification Revisions**

Specification #	Revision	Title
NASA NPR 6000.1	H	Requirements for Packaging, Handling and Transportation for Aero-nautical and Space Systems, Equipment, and Associated Components
NASA-STD-8739.4	2011	Crimping, Interconnecting Cables, Harnesses and Wiring
MIL-PRF-26536	F	Propellant Pressurization Agent, Hydrazine
MIL-PRF-26539	F	Propellant Pressurization Agent, Nitrogen Tetroxide
MIL-PRF-27404	C	Propellant Pressurization Agent, Monomethylhydrazine
MIL-PRF-27407	C	Helium (Type I Grade A)
MIL-P-27401	F	Nitrogen (Type I/II Grade B)
MIL-STD-461	F	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
AWS G2.4/G2.4M	2007	Guide for the Fusion Welding of Titanium and Titanium Alloy
AWS D17.1/D17.1M	2010	Specification for Fusion Welding for Aerospace Application
AWS B1.10M/B1.10	2009	Guide for the Nondestructive Examination of Welds
ASME BPVC Section V Appendix IV	2011	Nondestructive Evaluation
ASNT-TC-1A	2011	Recommended Practice for Personal Qualification and Certification in Non-destructive Testing
ASTM B265-11	2011	Standard Specification for Titanium and Titanium Alloy Strip, Sheet and Plate
ASTM E1742/E1742M	2011	Standard Practice for Radiographic Examination
ASTM E1417/E1417M	2011	Standard Practice for Liquid Penetrant Examination
ASTM D1193	2011	De-mineralized Reagent Water, Type H
SAE AMS 4928	S	Standard Specification for Titanium Bar
SAE AS4350	2007	Plug, Straight Thread
SAE AS5202	A	Port Fitting End, Straight Thread
SAE AS9956	A	Packing, Preformed (PTFE)
SAE AS9132	A	Data Matrix Quality Requirements for Parts Marking
ISO 14952-1	2003	Surface Cleanliness of Fluid Systems (Vocabulary)
ISO 14952-4	2004	Surface Cleanliness of Fluid Systems (Rough Cleaning Processes)
NFPA 70	2012	National Electric Code
ANSI/ISO/ASQ 9001	2000	Quality Management Systems
ANSI/ISO/ASQ Q10012	2003	Measuring Management Systems – Requirements for Measurement Processes and Measuring Equipment
K0000113580-SPC	BASIC	Procurement Specification – Accumulator EDU – Nitrogen Tetroxide, Hydrazine and Monomethylhydrazine