

National Aeronautics and Space Administration
Langley Research Center
100 NASA Road
Hampton, VA 23681-2199



February 15, 2013

Reply to Attn of:

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TO: 12/Research and Development Contracting Branch, Office of Procurement

FROM: 190/Dawn Jegley, Structural Mechanics and Concepts Branch, Research Directorate

SUBJECT: Justification for Other than Full and Open Competition, for PRSEUS panels and Associated Components

I. Recommendation

NASA Langley Research Center (LaRC) intends to initiate a new firm-fixed priced (FFP) contract with Boeing Research & Technology (R&T) to deliver panels and associated hardware in support of the planned testing of a large-scale test article representing the center portion of a Hybrid Wing Body (HWB) vehicle.

As discussed below, this research began as a “collaborative effort” between Boeing and LaRC. Boeing, at its own expense, fabricated 11 Pultruded Rod Stitched Efficient Unitized Structure (PRSEUS) panels under Space Act Agreement (SAA) SAA1-1018, Annex 1 and LaRC, through a Structures, Materials, Aerodynamics, Aerothermodynamics, and Acoustics Research and Technology (SMAAART) task order, funded the assembly of those panels into the PRSEUS multi-bay configuration and tested the resulting configuration.

[REDACTED]

In order to continue the research effort, LaRC intends to purchase the already-completed panels under this FFP contract and to purchase the remaining panels required to complete the multi-bay configuration under a new SMAAART task order. All panels will be provided as Government Furnished Property (GFP) under task order NNL10AA05B/ NNL11AA68T for the assembly of the multi-bay box test article. SAA1-1018, Annex 1 will be modified to reflect this plan and the parties’ responsibilities. Boeing R&T will continue to support efforts not related to the fabrication and assembly of the multi-bay configuration.

Boeing R&T is the sole source capable of performing the required effort because it is the only contractor with experience in stitched structure and the only contractor capable of providing the design and manufacturing of the required PRSEUS Panels.

II. Background

Some years ago, LaRC and Boeing joined forces under the NASA Advanced Composites Technology (ACT) Program to make large composite airplane structures a reality. As such, the NASA ACT program was set up in 1989 to improve the efficiency of composite structures and to reduce their manufacturing costs. The ACT Program aimed to reduce air travel costs through the use of composite materials on commercial aircraft.

At the time the ACT Program was established, the potential of composites materials to save weight on aircraft primary structure (wing and fuselage) was well-known but the roadblocks to its use were its manufacturing complexity and cost, its brittle nature and sensitivity to damage, a lack of experience with the material systems, and inadequate analysis techniques to reliably predict the behavior of these complex structures.

The Environmentally Responsible Aviation (ERA) Project within the Integrated Systems Research Program (ISRP) of the NASA Aeronautics Research Mission Directorate (ARMD) has the responsibility to develop technologies which will allow future commercial aircraft to simultaneously burn less fuel, produce fewer pollutants, and reduce the amount of noise the community around the airport hears compared to aircraft today. One key component of this effort includes introducing new advanced aircraft configurations such as a hybrid wing body which provides less drag and more lift than the traditional tubular fuselage and wing configuration. Another key factor is lightweight primary structures. To meet these goals, a lightweight composite structure is being developed which will support the loadings associated with the non-tubular shape of the center section of the hybrid wing body and support a higher aspect ratio wing than typically used today.

The structural concept under development under ERA is PRSEUS which is an outgrowth of work begun under the NASA ACT Program in 1990-2000, continued through LaRC-supported trade studies with Boeing in 2004 through a contract awarded under an NRA supporting the Subsonic Fixed Wing Program which ran from 2007-2010.

A summary of the McDonnell Douglas/Boeing involvement through competitively and non-competitively awarded research efforts in resin infusion and stitching technology is shown in the following table and detailed in the narrative below:

Item	Contract / Task Order	Title	Value	Period of Performance	Type
1.	NAS1-18862	Innovative Composite Aircraft Primary Structures (ICAPS).	\$30,382,645	3/1989-11/1995	Competitive
2.	NAS1-20546	"Technology Verification of Composite Primary Wing Structures for Commercial Transport Aircraft".	\$77,787,903	9/1995-9/2001	Competitive
3.	NNL04AA36C	"NASA Maturation of Advanced Aerodynamic and Structures".	\$432,034	2/2004-8/2004	Competitive
4.	NNL07AA48C	"Damage Arresting Composites for Shaped Vehicles".	\$3,905,015	9/2007-10/2010	Competitive
5.	NNL04AA11B/ NNL10AA99T	"Design, Analysis and Fabrication of Curved PRSEUS Panel"	\$596,237	2/2010-12/2010	Non-Competitive
6.	NNL04AA11B/ NNL10AB00T	"HWB Multi-bay Test Article Design and Tooling"	\$4,997,767	2/2010-3/2011	Non-Competitive
7.	NNL10AA05B/ NNL11AA68T	"HWB Multi-bay Test Article Analysis and Assembly"	\$5,299,821	5/2011-9/2013	Non-Competitive
		TOTAL	\$123,401,422		

1. NAS1-18862:

In 1989, a NASA Research Announcement (NRA) was issued to solicit innovative ideas that could significantly contribute to development and demonstration of composite technologies to enable composite primary structure for transport aircraft. Out of the 48 proposals submitted, 15 contracts were awarded to industry and university partners. Douglas Aircraft Company's (now part of the Boeing Co.) proposal for the development of stitching technology that would improve damage tolerance, reduce part count, reduce hands-on labor and thereby make composite wing structures 25 percent lighter, and reduce fabrication costs by 20 percent compared to their own aluminum airplanes was 1 of the 15 contracts proposals selected for award. LaRC contract NAS1-18862 was awarded to Douglas to design composite wing structures and develop stitching and resin infusion technology. The technology development under this contract included numerous large stitched panels which were tested either at Douglas' facilities or at LaRC. The final phase of that contract was the design and fabrication of a 12-foot long composite box section which was successfully tested at LaRC in 1995.

2. NAS1-20546:

In order to further advance the state of the art in composite technology for primary aircraft structure, a new competition was conducted in 1995. That competition was aimed at organizations that had expertise in all the technology areas needed for composite applications to large aircraft structures including the ability to fabricate full-scale aircraft parts. The only proposals LaRC received were from Boeing and McDonnell Douglas. Awards were made from that solicitation to both Boeing and McDonnell Douglas. The Boeing contract (NAS1-20553) was to study the application of composites to fuselage structure and the McDonnell Douglas contract (NAS1-20546) was to develop stitching and resin infusion technology and gain a better understanding of the behavior of composite wings under realistic loading conditions. Under the McDonnell Douglas contract, the contractor fabricated numerous articles, including a stitching and resin infusion 40-foot long wing box with complex curvature representative of the inboard section of the wing of a 220-passenger commercial aircraft. Contracts NAS1-18862 and NAS1-20546 were instrumental to the development of stitching technology and the understanding of resin flow through dry preforms, and the contractor Douglas Aircraft and McDonnell Douglas achieved their goal of 20% cost reduction and 25% weight reduction over metallic structure.

3. NNL04AA36C:

At the successful completion of the ACT program in 2001, the former McDonnell Douglas organization (now part of Boeing) continued to privately develop stitched technology and looking for additional applications of this process. In the 2003 to 2004 timeframe, an NRA under the Twenty-first Century Aircraft Technology (TCAT) project competitively sought proposals for structures technology development and Boeing was awarded a contract for trade studies to apply stitched, resin infused technology to a hybrid wing body aircraft and an advanced theater transport under LaRC contract NNL04AA36C entitled "NASA Maturation of Advanced Aerodynamic and Structures." Since the TCAT program was cancelled, the

research only included trade studies and did not involve the follow-on task of hardware fabrication.

Boeing's efforts to apply stitched structures on flying aircraft resulted in a contract with the Department of Defense (DOD) to provide stitched resin infused fairings in 2003 and stitched gear doors in 2006 on the C-17. These stitched structures are currently flying on C-17 aircraft. Boeing also worked with the Air Force Research Laboratory (AFRL) to develop aerospace quality parts from out-of-autoclave processing and a more structural efficient stiffener. The concept developed while working with AFRL is PRSEUS. This work was completed in 2006 and is described in the AFRL document "Multi-role Bomber Structural Analysis."

4. NNL07AA48C:

In 2007, the NASA Fundamental Aeronautics Program, Subsonic Fixed Wing Project, initiated a competitive NRA to develop technologies related to hybrid wing body vehicles. Fifty two (52) proposals were received. Six (6) of these proposals were in the area of Materials and Structures. Eleven (11) contracts were awarded overall, two in the area of Materials and Structures. The Langley contract (i.e., NNL07AA48C) entitled "Damage Arresting Composites for Shaped Vehicles" was awarded to the Boeing Company. Contract NNL07AA48C consisted of a 1-year phase I effort for trade studies and fabrication of two 80" x 42" PRSEUS panels and a 2-year phase II effort to continue analysis work, improve stitching and resin infusion methodologies, and to fabricate three larger PRSEUS panels and test one and deliver the other two to LaRC for testing. This contract was completed in October 2010 by bringing the Technology Readiness Level of PRSEUS structure for fuselage applications to four.

5. NNL10AA99T:

The application of PRSEUS to traditionally shaped tubular fuselage sections was explored using American Recovery and Reinvestment Act (ARRA) funding under a task which was directed to Boeing under contract in 2010 (i.e., NNL04AA11B/NNL10AA99T). ARRA funding allowed LaRC to support a partnership with the FAA (IA1-1019) wherein LaRC paid for a test article, the FAA paid for conducting a test and Boeing provided test support with its funds. Boeing also used its own tooling which it previously fabricated without government support. Since this activity was not in line with the stated goal of developing HWB structure in ERA, it was kept separate from the HWB development activities. Under this LaRC contract task order NNL10AA99T, Boeing designed and fabricated a 90-inch radius, 10-foot long curved panel to demonstrate the applicability of PRSEUS to traditionally-shaped aircraft fuselage sections. This panel was subsequently tested at the FAA Full-Scale Aircraft Structural Test Evaluation and Research (FASTER) facility, where it met or exceeded all design requirements. This design and fabrication activity proved that high-quality PRSEUS curved panels could be manufactured to meet FAA requirements.

6. NNL10AB00T and SAA1-1018:

In 2010 ARRA funding allowed LaRC to move forward with a long term plan for development of PRSEUS structure. A Space Act Agreement (SAA) between Boeing and LaRC (SAA1-1018, Annex 1) was initiated under which Boeing has fabricated and continues to fabricate test articles related to PRSEUS joints, repairs and other PRSEUS features. Some of these test articles have been tested at LaRC. Many of these features support the development of a 30-foot Multi-bay box test article. This SAA has not yet expired.

A non-competitive contract task was initiated with Boeing as part of a collaboration which included the SAA. Under contract with LaRC (i.e., NNL04AA11B/NNL10AB00T) Boeing designed the Multi-bay box test article containing 30-foot long PRSEUS panels. The Multi-bay box test article was designed to fit into the LaRC Combined Loads Test System (COLTS) facility.

7. NNL11AA68T:

The tool fabrication and Multi-bay box test article assembly task order was awarded in 2011 as a non-competitive SMAAART task order with LaRC (i.e., NNL10AA05B/NNL11AA68T) to operate in conjunction with SAA1-1018, Annex 1. Under the contract Boeing R&T completed design of a 30-foot-long composite test article and completed the fabrication of the tooling needed to fabricate the PRSEUS panels for the Multi-bay box. This tooling is being used to fabricate the PRSEUS panels to build the Multi-bay box. Boeing R&T will assemble the PRSEUS panels and other associated hardware into the Multi-bay box test article assembly under contract/task NNL10AA05B/NNL11AA68T. Boeing R&T will continue to support efforts related to the fabrication and assembly of the multi-bay configuration with a new task order that will be awarded using the SMAAART contract.

Over the last six years, several research announcements from NASA and the Air Force Research Laboratory have sought advanced aircraft structure designs that save weight, are cost effective, and damage tolerant. The most promising approach identified involves the use of resin infused stitched composites. Through numerous site visits to many commercial and military aircraft original equipment manufacturers (OEMs) and their aerospace supplier companies (small and large), over the last 6 years, we have found that the Boeing R&T group in Huntington Beach, CA) is the only company pursuing this technology at this time. The stitching machine and layup and infusion techniques are unique to Boeing R&T, and enable the realization of a low cost, light weight, and damage tolerant aircraft structure that has the potential to revolutionize the aircraft and spacecraft industry. It is this approach by Boeing R&T that is most consistent with the ERA Project goal of identifying the most promising and realistic technologies, and transitioning these to the aircraft industry over the next three years.

III. Description of Required Supplies/Services

The Environmentally Responsible Aviation (ERA) Program includes the development of lightweight aircraft structures to reduce fuel burn and emissions. The structural concept under development in ERA is PRSEUS. The Contactor is required to deliver five PRSEUS panels

using the same materials, design methodology, and out-of-autoclave manufacturing approach used in contract NNL07AA48C. [REDACTED]

[REDACTED] Boeing has completed stitching and resin infusion of the five PRSEUS panels, which is the subject of this JOFOC that will be delivered under this FFP contract and later provided as GFP under SMAAART task order NNL10AA05B/NNL11AA68T to be used for the assembly of the Multi-bay box test article. LaRC will support the fabrication of the five lower section PRSEUS panels and one upper forward bulkhead panel under a SMAAART task order under development.

The total estimated Cost is anticipated to be approximately \$3.0M with an estimated Period of Performance of three months.

IV. Statutory Authority Permitting Other than Full and Open Competition

10 U.S.C. 2304 (c)(1), as implemented by FAR 6.302-1, Only One Responsible Source and no other source or services can satisfy agency requirements.

V. Demonstration of the Contractor's Unique Qualifications or Nature of the Acquisition to Provide the Required Supply/Service

As shown in the table above, this project represents 20 years of experience and a total of over \$123 million invested by LaRC in this technology. The level of quality required cannot be obtained from the other offerors because this work requires use of tooling owned by Boeing R&T and manufacturing methodologies used by and developed under numerous LaRC Contracts. This proposed contract builds upon work initiated under the contracts listed above and under SAA1-1018, Annex 1. The stitching machine and layup and infusion techniques are unique to Boeing R&T, and enable the realization of low cost, light weight, and damage tolerant aircraft structure that has the potential to revolutionize the aircraft and spacecraft industry. It is this approach by Boeing R&T that is most consistent with the ERA Project goal of identifying the most promising and realistic technologies, and transitioning these to the aircraft industry over the next three years.

This proposed work, which builds upon the work that Boeing has already accomplished, is in the best interest of the Government because LaRC has invested a substantial amount of money, time, and effort in the above-mentioned PRSEUS development efforts with Boeing R&T; it is not economically feasible to award this contract to a new/different contractor who would not have the facilities, methods, experience, or data available to fabricate these PRSEUS panels. Thirty (30) patents related to various aspects of stitching, resin infusion and PRSEUS have been awarded to Boeing and McDonnell Douglas. As such, it is in the best interest of the Government to complete the award to deliver the panels and associated hardware.

VI. Description of Efforts Made to Ensure that Offers are Solicited from as Many Potential Sources as is Practicable

The ERA program engaged in a series of market research activities to develop its Phase 2 activities, where it seeks to mature technologies from a TRL of 4 to 5 or 6, with an emphasis on those technologies that can be matured to a higher technology maturation level and those that have demonstrated commercial viability in the 2020 to 2025 timeframe. These efforts included publishing a Request for Information (RFI) in FEDBIZOPPS and the NASA Acquisition Internet Site on February 24, 2012 which solicited extensive information including (1) recommendations of technologies associated with the technology focus areas ready for Integrated Technology Demonstrations, and associated test campaigns and test assets to be completed by the end of FY 2015, raising TRL to 5 or 6 and thereby advancing integration readiness level and (2) product focused transition plans associated with the identified technologies. The ERA program also conducted a Meeting of Experts (MOE) on March 29, 2012 to gather additional information to set its Phase 2 Strategy. After the RFI responses and information obtained at the MOE, the ERA Program made the decision to move forward on several Integrated Technology Demonstration (ITD) research efforts. PRSEUS was one of those selected. Only Boeing R&T proposed continuing development of stitched structures or demonstrated, through responses to the RFI, that it has the capability to pursue development of stitched structures.

As mentioned above and below, this proposed contract action builds upon the work already completed and/or in progress under an existing task order under SMAAART. Several research announcements from NASA and the Air Force Research Laboratory have sought advanced aircraft structure designs that save weight, are cost effective, and damage tolerant. The most promising approach identified involves the use of resin infused stitched composites. Through numerous site visits to many commercial and military aircraft original equipment manufacturers (OEMs) and their aerospace supplier companies (small and large), over the last 6 years, Boeing Research & Technology (R&T) group in Huntington Beach, CA is the only company pursuing this technology at this time.

VII. Determination by the Contracting Officer That the Anticipated Cost to the Government Will Be Fair and Reasonable

The FFP amount for this acquisition will be determined fair and reasonable by the Contracting Officer prior to award of the contract. Actions anticipated to ensure reasonableness will be accomplished using the procedures and criteria contained in the Federal Acquisition Regulation (FAR), NASA FAR Supplement (NFS), and other regulatory documents as applicable. Detailed documentation and justification of reasonableness will be disclosed in the Price Negotiation Memorandum (PNM) which will be prepared using the evaluation of the Boeing R&T quoted pricing, compared to the independent Government estimate, and the pricing of previous similar efforts. Certified cost and pricing data will be obtained and used in determining a fair and reasonable cost.

VIII. Description of Market Research Conducted As a Result or a Statement of the Reason Market Research Was Not Conducted

As detailed in paragraph VI, the ERA program engaged in extensive market research and made significant efforts to achieve competition to award the contracts over many years. Based upon that knowledge, there is not a reasonable expectation that other potential offerors could satisfy the requirement because a contractor with similar capabilities would require many years of development either by NASA or other contractors to create a similar stitched structure at substantial duplication of cost, and the multi bay concept designed by Boeing that is not available on the market.

However, in an effort to identify potential sources, a synopsis will be posted at FEDBIZOPS in accordance with FAR 5.201 to determine whether the technology is available outside of the suggested vendor. The synopsis will request that interested sources submit a response to the technology.

IX. Other Facts Supporting the Use of Other than Full and Open Competition

ERA has an aggressive mission to execute based upon schedule and cost perspective. Any delays in obtaining the products required in this contract due to learning curves and lack of facilities by other sources will cause schedule delays resulting in budgetary impacts, increasing the potential for jeopardizing mission success. Boeing R&T is the only source with the specialized facility and expertise to satisfy the cost and schedule constraints. Inability to meet the ERA test schedule will risk the technology being used by NASA and ultimately the broader aircraft community.

X. A Listing of Sources That May Have Expressed Interest in the Acquisition

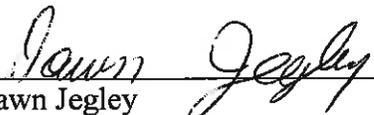
None.

XI. Actions the Agency May Take to Remove or Overcome Any Barriers to Competition before Any Subsequent Acquisition for the Supplies or Services

LaRC may have future requirements that can only be met by Boeing R&T. LaRC typically looks for proactive steps that can be taken to eliminate barriers to competition for future requirements and will do so should future requirements arise.

Technical Certification:

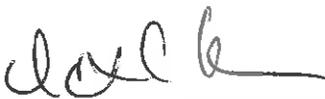
I certify that to the best of my knowledge and belief, the data furnished above is complete and accurate.


 Dawn Jegley
 ERA Integrated Technology Demonstration on
 Unitized Structures Lead

2/15/13
 Date

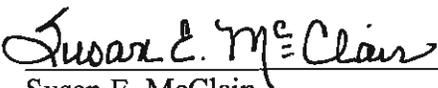
Contracting Officer Certification:

I hereby certify that the above justification is accurate and complete, to the best of my knowledge and belief, and the anticipated cost to the Government will be fair and reasonable.

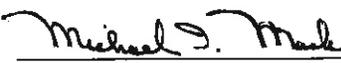

 Octavia L. Hicks
 Contracting Officer

2/15/2013
 Date

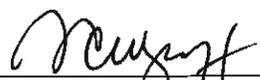
Concurrence:


 Susan E. McClain
 Head, Research and Development Contracting
 Branch, Office of Procurement

2/15/2013
 Date


 Michael I. Mark
 Office of Chief Counsel

15 FEB 13
 Date


 Virginia C. Wycoff
 Procurement Officer

2/20/2013
 Date

Approval:



Stephen G. Jurczyk
Competition Advocate

2/20/2013
Date

cc:

12/OP

30/OCC

12/O.L. Hicks

190/D. C. Jegley

12/OLHicks: 02/15/13 (48510)