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

September 13, 2013

Reply to Attn of: 12

TO: 12/Research and Development Contracting Branch, Office of Procurement
Attn: Drena J. McIntosh

FROM: 170/Anthony Washburn, Flow Physics and Control Branch, Research Directorate

SUBJECT: Justification for Exception to the Fair Opportunity Process (JEFOP) for The Boeing Company, Estimated Value $12M – NNL10AA05B

In accordance with FAR 16.505, the following information is provided to support this justification:

I. Recommendation

NASA Langley Research Center (LaRC) intends to award a task order directly to Boeing under the existing Structures, Materials, Aerodynamics, Aerothermodynamics, and Acoustics Research and Technology (SMAAART) contract, NNL10AA05B. The purpose of this proposed task order is to conduct research flight tests on a large commercial test bed platform. Specifically, NASA requires access to the Boeing 757 ecoDemonstrator test bed aircraft to conduct a series of flight demonstrations to test the readiness levels of two areas of technology: (1) investigating the suitability of Active Flow Control (AFC) as an enhancement to vertical tail aerodynamic performance, and (2) investigating insect accumulation and mitigation (IAM) strategies on a wing of the aircraft to ascertain the practicality of laminar flow on large commercial aircraft.

The ecoDemonstrator program is a multiyear flight test program intended to significantly reduce traditional technology development cycle timelines of promising technologies. The program consists of a series of demonstrators, or test beds, where a different commercial aircraft is fitted each year for aeronautic innovations beneficial to reduce the environmental impact of aviation to be tested. Boeing operates the test bed aircraft, which integrates an array of technologies ready for demonstration. The demonstrations are conducted through partnerships with entities including airlines, suppliers, engine manufacturers, and US government agencies such as the FAA and NASA. The program has ongoing annual flight-test campaigns scheduled into FY15 and beyond on aircraft, including a 737-800 in 2012, a 787-8 in 2013, and a 757-200 in 2014 and 2015.

The technology development undertaken by the NASA Environmentally Responsible Aviation (ERA) Project is expected to advance the Technology Readiness Level (TRL) of ERA sponsored technologies to a 5 or 6 (by NASA TRL definition), where a component or concept is validated in a relevant environment (TRL 5) or where a prototype of a system concept is demonstrated in a relevant environment (TRL 6).

A planning Purchase Request (PR) 4200484954 has been generated for this proposed task order and includes a Total Estimated Value of $12M and a Total Committed Amount of $10K in incremental funding. LaRC plans to utilize the SMAAART contract, which is a multiple award, indefinite delivery/indefinite quantity (IDIQ), cost plus fixed fee (CPFF) contract.

II. Background

The ERA Project within the Integrated Systems Research Program (ISRP) of the NASA Aeronautics Research Mission Directorate (ARMD) is responsible for developing 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. The ERA Project is a 6-year, two-phase project with several Integrated Technology Demonstration (ITD) work packages that are currently defined for Phase II (FY 13-FY 15). One of the ERA Project objectives is to mature promising technologies from initial TRL of 3 to 4 up to TRL of 5 to 6 so they can be available for fleet insertion by 2025. For the technology development covered by this task order, flight-testing is necessary to continue advancing the TRL from its current status. The AFC Enhanced Vertical Tail testing must be done on a large twin airliner with nacelle under wing engines having thrust rating to create a sufficient, yet controllable thrust asymmetry to demonstrate the prototype system to TRL 6. The flight testing done with the IAM technologies will be conducted at the scale and conditions relevant for integration into a laminar flow designed system. The information gathered through the flight tests, combined with other data, is expected to raise the overall TRL of a natural laminar flow wing sub-system to at least 5. The Boeing 2014 ecoDemonstrator program provides the platform to do the experiments, meet the criteria, and is available in the necessary timeframe for the flight tests.

The demonstrations that will be performed under this new requirement builds on an extensive history of previous AFC and laminar flow testing jointly conducted by NASA and Boeing through other contractual mechanisms, which are summarized below:

1. NAS1-18574, "High Reynolds Number Hybrid Laminar Flow Control (HLFC) Flight Experiment", completed in 1991: This contract was a cooperative research effort between The Boeing Company, NASA, and USAF. Under this contract, Boeing flew a modified 757 to demonstrate suction-based Hybrid Laminar Flow Control (HLFC) on a mid-span section of the left wing. The assessment of this body of flight experiments was that the aerodynamics of HLFC were at a TRL of 6 or greater, but integration challenges such as manufacturing and aircraft trim still remained. In addition, the effects of the operational environment—including the impact of insects on laminar flow surfaces—were still not sufficiently understood. This outcome helped set the stage for the current proposed IAM flight tests.

2. NAS1-20267, "Integrated Wing Technology", completed in 1999: Under this contract, Boeing was tasked to conduct a preliminary assessment of the potential benefits of applying AFC to transport aircraft. The final report of the study identified the wing trailing edge high-lift system as the most promising application due to impact and feasibility. The assessment, based only on paper studies, was that the vertical tail could potentially be reduced by 20% to 30% in size and it was noted that strategies had been implemented on the 777 to reduce the tail size through more conventional approaches.

3. SAA1-588, Annex 3 "Adaptive Integrated Technologies (ADVINT) Phase IIA Joint Research Program", executed in 2004: Under this annex, a team consisting of Boeing, DARPA, NASA, and AFRL worked on a large-scale project, in which AFC was applied to the hinge line of a tilt wing aircraft to demonstrate the effectiveness of synthetic jet actuation in the NASA LaRC 14 x 22 low speed wind tunnel. Boeing was responsible for the design of the wing airfoil and simple flap. The outcome was particularly relevant for the ERA program because several environmental factors were studied and the simple flap on a swept wing was aerodynamically very similar to a vertical tail with a rudder.

4. NNL04AA29C "Boeing Lightweight Actuator and Control System for Aerodynamic Performance Enhancements of Transports", awarded in 2004: In 2004, Boeing participated in the NASA Research Announcement (NRA) 03-LaRC-02 competition entitled, "Maturation of Advanced Aerodynamics and Structures Technologies for Subsonic Transport Air Vehicles" and was awarded Contract NNL04AA29C to develop Lightweight Actuator and Control Systems for Aerodynamic Performance Enhancements of Transports. This work pursued electroactive-based actuator design and also identified the vertical stabilizer as a prime target of opportunity for the application of AFC. The Phase 1 conclusions from the contract were: 1) There is a clear technical and business case to pursue AFC on transport aircraft, and 2) Boeing believed it had the technology, the people, and the plan to continue on to technology development. Although the critical technologies were assessed to be at TRL of 4, follow-on technology development did not occur at that time because of a change in NASA's aeronautics program.

5. SAA1-588, Annex 26 "Cooperative Investigation of a Cruise Efficient STOL Concept at the LaRC 14 x 22 Subsonic Tunnel", executed in 2008: Through this annex, Boeing and NASA applied sweeping jet actuators in lieu of steady blowing to a powered high lift advance military transport model in the LaRC 14 x 22. Boeing provided the transport model and NASA contributed the wind tunnel test and the sweeping jet actuators. The sweeping jet actuators demonstrated a 40% efficiency improvement after the high lift system was modified to be a simple flap rather than a Fowler flap system.

6. SAA1-1018, Annex 2 "Active Flow Control Rudder Technology Development", executed in 2010: As part of ERA Phase I, Boeing and NASA conducted cooperative research through SAA1-1018, Annex 2 to explore the two approaches to actuator design considered in the SMAAART Task Order NNL10AD24T. During the course of the cooperative research, a down selection was made to use the NASA developed actuator approach in a flight test on a full-scale vertical tail. This decision was supported by a Boeing response

to the ERA Request for Information (RFI) for Phase 2 planning outlining a desire to jointly pursue the use of AFC applied to a vertical tail in flight. No other company returned an RFI response indicating a desire to pursue AFC in an airframe application.

7. NNL10AD24T, "AFC-Enabled Vertical Tail System Integration Study", competed and awarded under SMAAART Contract #NNL10AA05B in 2010: Currently, under this task order, Boeing is performing an integration analysis of the AFC technology for vertical tail application. The task takes into consideration the aerodynamic performance, structural integration, weight, complexity, energy requirements, cost, and operational concerns of each AFC system studied. The task also considers the approaches for operating the AFC-based vertical tails in a flight environment.

8. NNL13AC06T, "Design of an Active Flow Control Mass Flow Distribution System for Flight Demonstration on a 757 Vertical Tail", awarded sole source to Boeing under SMAAART Contract #NNL10AA05B on September 4, 2013: Under this task order, Boeing will design an AFC mass flow system for integration onto the vertical tail of a commercial aircraft.

III. Nature and/or Description of Required Supplies/Services

This proposed task order is for flight tests that will assess the practicalities of incorporating two technology suites into commercial aircraft systems, with the intent of reducing fuel burn and emissions. The two flight experiments to be demonstrated are performance of the aircraft's vertical tail when Active Flow Control technology is applied, and evaluation of Insect Accumulation and Mitigation when applied to the aircraft's wing. The task requires flight services and access to the Boeing 757 ecoDemonstrator to support these demonstrations. The task also requires fabrication and integration of the AFC mass flow distribution system that is currently being designed under SMAAART Contract NNL10AA05B, Task Order NNL13AC06T. The Contractor will provide all personnel (including qualified pilots), ground equipment, tools, and other equipment necessary to conduct the research flight demonstrations and meet NASA's technical requirements. AFC flight demonstrations on the ecoDemonstrator are expected to begin late in the fourth quarter FY2014. IAM flight demonstrations on the ecoDemonstrator are expected to coincide with insect season around the beginning of the third quarter 2015.

The total estimated cost is anticipated to be approximately $12M with an estimated period of performance of 18 months.

IV. Identification of the Exception to Fair Opportunity and Supporting Rationale

FAR 16.505(b)(1)(i) requires the Contracting Officer provide each awardee under a multiple award contract, a fair opportunity to be considered for each order exceeding $3,000 unless a statutory exception applies. Specifically, the exception that precludes the fair opportunity process for this acquisition is FAR 16.505(b)(2)(i)(B), which states that "Only one awardee is capable of providing the services or supplies at the level of quality required because the service or supplies ordered are unique or highly specialized."

Boeing is the only source with the required level of research experience in AFC and IAM technology, and scheduled flight-tests campaigns that utilizes a suitable test bed aircraft (ecoDemonstrator) that is both compatible with NASA's technology goals and available for flight tests during the ERA testing timeframe. Boeing is also the only known source with an existing plan to conduct low-speed natural laminar flow integration within ERA's testing timeframe for scheduled flight demonstrations.

In addition, there are proprietary considerations. The proposed task order that is the subject of this justification will utilize proprietary integration analysis research and design work that is still being conducted by Boeing under NNL10AD24T and NNL13AC06T, as well as the knowledge gained from SAA1-1018 Annex 2 and related Space Act agreement annexes (SAA-1155, Annexes 9 and 10) under development. Through these agreements, Boeing is expected to contribute proprietary resources and data that will not be accessible to other sources. As such, Boeing is uniquely qualified and considered a highly specialized source for this task order. Award to any source other than Boeing would require the development of a new source for a test bed platform and associated expertise needed to meet NASA's TRL goals and schedule requirements for AFC and IAM testing. This would result in substantial duplication of cost to the Government that is not expected to be recovered through competition, and would also require substantial time that would exceed the length of the ERA Project.

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

The CPFF amount for this acquisition will be determined fair and reasonable by the Contracting Officer prior to award of the task order. 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.

IX. Other Facts Supporting the Justification

None.

XI. Actions the Agency May Take to Remove or Overcome Any Barriers To Increasing Fair Opportunity Before Any Subsequent Acquisition For the Supplies or Services

NASA may have future requirements that can only be met by Boeing. However, the Contracting Officer will continue to scrutinize all Statements of Works received to ensure fair opportunity is appropriately given. NASA 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.

Anthony Washburn — Sept 12, 2013
Anthony Washburn — Date
ERA Integrated Technology Demonstration
on AFC Enhanced Vertical Tail and
Advanced Wing Technologies Lead

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.

Drena J. McIntosh — Sep. 13, 2013
Drena J. McIntosh — Date
Contracting Officer

Concurrence:

Susan E McClain — Sep 16, 2013
Susan E. McClain — Date
Head, Research and Development Contracting
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DBruns — 16 Sept 13
Dacia K. Bruns — Date
Office of Chief Counsel

[signature] — 9/17/2013
Virginia C. Wycoff — Date
Procurement Officer

Approval:

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Stephen G. Jurczyk — Date
Competition Advocate

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