

Installation of Reduced Vertical Separation Minima (RVSM) Equipment on the NASA Langley Research Center's Dassault HU-25A Aircraft

Statement of Work

Background

NASA N5XXNA, formerly a U.S. Coast Guard Dassault HU-25A Guardian (based on the Dassault Fanjet Falcon Series G (FA-20G) aircraft (serial number (S/N) 411)), is a NASA Langley Research Center (LaRC) public-use aircraft. The aircraft is used for research missions needing to fly at altitudes above 28,000 ft. Flights above this altitude require Federal Aviation Administration (FAA)-equivalent compliance with Reduced Vertical Separation Minima (RVSM) equipment and world-wide operational approvals. NASA LaRC requires implementation using an FAA-approved Supplemental Type Certificate (STC) for RVSM group approval of Dassault FA-20 aircraft, including the FA-20G model. Alternatively, the Contractor shall provide an STC-approved RVSM equipment solution followed by aircraft flight tests to develop a custom Static Source Error Correction (SSEC). This aircraft will be used for both domestic and foreign research deployments. Recent upgrades in equipment requirements to operate in international airspace require an upgrade in the ship's Traffic Collision Avoidance System (TCAS) software and the addition of a capability for Automatic Dependent Surveillance-Broadcast (ADS-B) Out. The ADS-B Out solution must meet requirements for operations in Europe, Canada and Australia.

Project Scope

The Contractor shall design, fabricate, install and flight test RVSM-required equipment, provide copies of appropriate documentation, secure approval of the specific modifications to this aircraft from a FAA Designated Engineering Representative (DER), and demonstrate successful functional operability of the modifications. The Contractor shall also provide Flight and Maintenance Manual supplements. This Statement of Work (SOW) consists of four contract tasks as listed below. The overall period of performance for all four tasks is contract award through September 30, 2015. Upon award, Contractor will make arrangements to complete the tasks as prescribed in this Statement of Work at the NASA Langley Research Center in Hampton, Virginia

The Contractor shall perform, in parallel, the following four tasks:

- a) Provide RVSM capability suitable for certification by NASA
- b) Upgrade the existing TCAS processor to TCAS II Change 7.1
- c) Upgrade the ship's avionics suite to provide ADS-B Out utilizing a 1090-MHz Mode S Extended Squitter (1090ES), such that the suite meets requirements for operations in Europe, Canada and Australia in accordance with FAA Advisory Circular AC-20-165A and Technical Standard Order TSO-C166B

- d) Implement Collins Service Bulletin 5 that provides an altitude alert deviation to +/- 200 ft

The Contractor shall pass a NASA Flight Safety Review for Commercial Aircraft Services, as described in NASA Procedural Requirements NPR 7900.3, prior to commencing modifications on the NASA aircraft.

The Contractor shall provide access to Contractor project management, and on-site aircraft access to NASA designated personnel, to include aircrew, engineering, maintenance, and quality assurance, while the aircraft is in-work at NASA Langley. The Contractor shall coordinate all travel to NASA Langley. In accordance with LaRC Management System Technical Directive LMS-TD-0940 and FAR 52.246-11, NASA Quality Assurance (QA) personnel shall conduct the final inspection and approval of all modifications done to the NASA Dassault HU-25A aircraft.

Upon completion of the contract tasks, the Contractor shall participate in a NASA Flight Readiness Review (FRR), typically one hour in duration led by NASA LaRC via teleconference or in person. NASA will provide the Contractor with the requirements for the FRR. Following the FRR, NASA may conduct a functional check flight to verify airworthiness.

The Contractor shall ensure that the aircraft is airworthy during system activation and aircraft preparation for the functional check flight and flight test.

Contract Tasks

1. RVSM (Estimated Period of Performance: Award plus 7 weeks, working in conjunction with a NASA Maintenance Crew as the aircraft undergoes a C-Check Inspection NTE 4 weeks)

The Contractor shall design, fabricate, install and flight test all RVSM required equipment, in accordance with FAA Advisory Circular 91-85 on the NASA LaRC HU-25A aircraft (Dassault Fanjet Falcon S/N 411). A list of existing avionics is provided in the Attachment, "Existing Avionics/Equipment Listing for the NASA LaRC Dassault HU-25A, S/N 411". Some components may already meet RVSM criteria and are available for reuse in the solution. The modifications shall be documented on FAA Form 8110-3 and/or company equivalent; however, formal approval by the FAA is not required. If FAA approval does not already exist, NASA airworthiness authorities will perform a design review. The Contractor shall not make any aircraft modifications prior to NASA review and approval of draft engineering design drawings. NASA review and approval shall be provided within two calendar weeks of receipt of draft engineering drawings. The preferred method of modification is by an approved FAA STC for Dassault Fanjet Falcon FA-20 aircraft, including the FA-20G model. If no STC is used or available, then approval by an appropriate FAA DER using FAA Form 8110-3 at conclusion of the effort is desired. If STC or DER design approval is not available, then NASA will conduct internal engineering airworthiness reviews. The Contractor shall restore the aircraft to the as-delivered condition with the exception of the modifications

performed per this SOW. The contractor shall return all components (line replaceable units) removed during this process. The Contractor shall ensure that the aircraft is airworthy for non-RVSM flight operations while the custom SSEC is being developed (N/A if existing STC SSEC is used and immediately available).

- 1.1 The Contractor shall provide a list of new, overhauled or modified system components and a block diagram of pitot-static and electrical changes required to implement FAA Advisory Circular 91-85 on the NASA HU-25A aircraft prior to beginning any work.
- 1.2 The Contractor shall provide a flight test plan, for review by NASA LaRC aviation safety personnel, prior to implementation of RVSM calibration and certification. The flight test plan shall contain the following items:
 - a) Plans for coordinating for any FAA waivers or special-use airspace required to execute the test plan
 - b) Data recording requirements
 - c) Safety-of-Flight parameters
 - d) Safety-of-Test parameters
 - e) Flight test cards
 - f) Risks to include probability/severity along with mitigations
- 1.3 The Contractor shall provide the engineering test personnel, including the test conductor, for required RVSM flight tests. NASA will provide the pilot and copilot for required RVSM flight tests. NASA may designate a qualified Contractor pilot as a NASA pilot for these flight tests to fly with a NASA provided pilot. All Contractor personnel flying on board the aircraft for flight test must meet NASA medical and flight clearance requirements. The NASA medical and flight clearance requirements form will be provided by NASA at award. The NASA medical and flight clearance requirements form shall be submitted no less than 5 days before the scheduled test flight.
- 1.4 The Contractor shall provide and install the required RVSM equipment and SSEC for the NASA HU-25A aircraft, either from a FAA-approved STC for Dassault FA-20 RVSM group approval, including the FA-20G model, or from an STC-approved RVSM equipment solution followed by aircraft flight tests.
- 1.5 The Contractor shall provide the temporary modifications and recording equipment to complete RVSM flight testing, and remove temporary modifications and equipment prior to delivery back to NASA.
- 1.6 The Contractor shall provide operations and maintenance training for no more than seven (7) NASA or NASA-designated personnel, to ensure initial operational approvals, continued airworthiness and RVSM certification. The training shall be held at the NASA Langley Research Center:

- Operations training for three (3) pilots – Pilot training to be conducted prior to Functional Check Flight, but not later than the period of performance.
- Maintenance training for four (4) aircraft maintenance personnel – Maintenance training to be conducted no later than September 15, 2015.

1.7 The Contractor shall provide all documentation to support a NASA engineering review of the design and installation approach to the NASA Technical Point of Contact, Mr. Dale Bowser, for those Contractors not approved by FAA STC or by the appropriate FAA DERs using FAA Form 8110-3. The review shall occur prior to modifying the aircraft with these items.

1.8 The contractor shall return all line replaceable units removed during this process.

2. TCAS software update (Period of Performance: “as required” as long as it remains concurrent with and does not exceed the aircraft down time from Task 1)

2.1 The Contractor shall update the existing TCAS processor to CAS 100B TCAS with Change 7.1. Demonstration of operability will be determined by instrument self test and conformance with TCAS documentation.

2.2 The Contractor shall provide a TCAS software upgrade compatible with the modifications described in Contract Tasks 1 and 3 of this Statement of Work.

3. ADS-B Out Avionics (Period of Performance: “as required” as long as it remains concurrent with and does not exceed the aircraft down time from Task 1)

The Contractor shall design, acquire, and install all required equipment necessary to provide an ADS-B Out capability which meets requirements for operations in Europe, Canada and Australia in accordance with FAA Advisory Circular AC-20-165A and Technical Standard Order TSO-C166b on the NASA LaRC HU-25A aircraft (Dassault Fanjet Falcon S/N 411). A list of existing avionics is provided in the Attachment, “Existing Avionics/Equipment Listing for the NASA LaRC Dassault HU-25A, S/N 411”. Some components may already meet systems criteria and are available for reuse in the solution. The modifications shall be documented on FAA Form 8110-3 and/or company equivalent; however, formal approval by the FAA is not required. If FAA approval does not already exist, NASA airworthiness authorities will perform a design review. The Contractor shall not make any aircraft modifications prior to NASA review and approval of draft engineering design drawings. NASA review and approval shall be provided within two calendar weeks of receipt of draft engineering drawings. The contractor shall return all components (line replaceable units) removed during this process.

- 3.1 The Contractor shall design an upgrade to the ship's avionics suite to provide Automatic Dependent Surveillance-Broadcast (ADS-B) Out utilizing a 1090 ES unit in accordance with FAA Advisory Circular AC-20-165A and Technical Standard Order TSO-C166b.
 - 3.2 The Contractor shall provide a list of new, overhauled or modified system components and a block diagram of electrical changes required to implement FAA Advisory Circular AC-20-165A and Technical Standard Order TSO-C166b on the NASA HU-25A aircraft prior to beginning any work.
 - 3.3 The Contractor shall provide an ADS-B Out avionics capability which is compatible with the modifications described in Contract Tasks 1-3 of this Statement of Work.
 - 3.4 The Contractor shall provide and install the required ADS-B Out avionics in the NASA HU-25A aircraft.
 - 3.5 The Contractor shall provide all documentation to support a NASA engineering review of the design and installation approach to the NASA Technical Point of Contact, Mr. Dale Bowser, for a solution not approved by FAA STC or by the appropriate FAA DERs using FAA Form 8110-3. The review shall occur prior to modifying the aircraft with these items.
 - 3.6 The Contractor shall demonstrate operability by instrument self test and conformance with ADS-B Out documentation.
 - 3.7 The Contractor shall provide all associated Operations and Maintenance Manuals for this modification.
 - 3.8 The contractor shall return all components (line replaceable units) removed during this process.
4. Collins Service Bulletin 5 (Period of Performance: "as required" as long as it remains concurrent with and does not exceed the aircraft down time from Task 1)

The Contractor shall design, acquire, and install all required equipment necessary to implement Collins Service Bulletin 5 on the NASA HU-25A aircraft (Dassault Fanjet Falcon S/N 411) to change the PRE-80M Altitude Alerter to a 200-ft altitude alert versus the current 300-ft alert. A list of existing avionics is provided in the Attachment, "Existing Avionics/Equipment Listing for the NASA LaRC Dassault HU-25A, S/N 411". Some components may already meet systems criteria and are available for reuse in the solution. The modifications shall be documented on FAA Form 8110-3 and/or company equivalent; however, formal approval by the FAA is not required. If FAA approval does not already exist, NASA airworthiness authorities will perform a design review. The Contractor shall not make any aircraft modifications prior to NASA review and approval

of draft engineering design drawings. NASA review and approval shall be provided within two calendar weeks of receipt of draft engineering drawings.

- 4.1 The Contractor shall design an upgrade to the ship's avionics suite to implement Collins Service Bulletin 5.
- 4.2 The Contractor shall provide a list of new, overhauled or modified system components and a block diagram of electrical changes required to implement Collins Service Bulletin 5 on the NASA HU-25A aircraft prior to beginning any work.
- 4.3 The Contractor shall implement Collins Service Bulletin 5 in a manner which is compatible with the modifications described in Contract Tasks 1-3 of this Statement of Work.
- 4.4 The Contractor shall provide and install the required avionics in the NASA HU-25A aircraft required for this task.
- 4.5 The Contractor shall provide all documentation to support a NASA engineering review of the design and installation approach to the NASA Technical Point of Contact, Mr. Dale Bowser, for a solution not approved by FAA STC or by the appropriate FAA DERs using FAA Form 8110-3. The review shall occur prior to modifying the aircraft with these items.
- 4.6 The Contractor shall demonstrate operability by instrument self test and conformance with the documentation associated with this task.
- 4.7 The Contractor shall provide all associated Operations and Maintenance Manuals for this modification.
- 4.8 The contractor shall return all components (line replaceable units) removed during this process.

Meetings and Deliverables

1. FAA Form 8110-3 (Task 1, 3 and 4): The Contractor shall submit FAA STC reviewed and approved FAA Form 8110-3 for structural and electrical designs of the aircraft modifications, or all documentation to support a NASA engineering review. Due at least 24 hours prior to FRR, date and time to be coordinated with the Contractor.
2. Engineering Review (Tasks 1-4): The Contractor shall prepare and present an engineering review of the design and installation approach by conference call/Lync to NASA technical POCs prior to modification of the aircraft. The presentation material shall include an overview of the analysis previously conducted, assembly drawings of the installation, a summary of previous modeling or test results, flight operational or performance changes expected from the installation on the aircraft, airframe lifetime changes, additional maintenance requirements, the location of the items on the aircraft,

and requirements for interfaces. The Contractor shall deliver the presentation documentation in electronic format two business days prior to the presentation to the NASA technical POC.

3. Draft Engineering Drawings (Tasks 1-4): The Contractor shall submit all draft engineering drawings two calendar weeks prior to aircraft installation, for NASA review and approval.

4. Flight Test Plan (Task 1): The Contractor shall provide a flight test plan, for approval by NASA LaRC aviation safety personnel prior to implementation of RVSM calibration and certification, two weeks prior to FRR.

6. Training (Task 1): The Contractor shall provide all training manuals and training briefing materials, such as Power Point presentations, for the training provided in Paragraph 1.6. The training manuals and all briefing materials shall be provided in electronic format. The Contractor shall provide data rights, for reproduction and future training of NASA or NASA designated pilot or aircraft maintenance personnel, for the training manuals and briefing materials if third party provided. Due one week prior to FRR.

7. Documentation Requirements (Tasks 1-4, as applicable): The Contractor shall provide copies of all documentation generated as a consequence of this contractual effort, including all installation and removal documentation, drawings, approvals of task modifications, all substantiation analyses, and all quality-assurance approvals, in electronic PDF format for documents, and electronic AutoCAD-compatible format, .dwg or .dxf, for drawings. All due 24 hours prior to the FRR with the exception of the RVSM flight test results, as noted below. Specific documentation includes, but is not limited to:

- Updated Weight and Balance for the aircraft
- Approval documentation from an FAA DER for the Contractor designed RVSM solution
- Approval documentation from an FAA DER for the installation of the associated equipment
- Engineering rationale for FA-20, including the FA-20G model, RVSM group compliance, or flight test results of non-group performance
- Flight test results of non-group performance (if RVSM flight test is required) due prior to NASA commencing certification efforts after the modifications described in Tasks 1-3 are complete
- RVSM Flight Manual supplement
- RVSM Maintenance Manual supplement
- List of new, overhauled or modified system components required to implement FAA Advisory Circular 91-85
- Block diagram of new, overhauled, or modified system components required to implement FAA Advisory Circular 91-85
- TCAS, Change 7.1 documentation
- ADS-B Out documentation

- Collins Service Bulletin 5 documentation

8. Technical and Program Interface (Tasks 1-4): The Contractor shall participate in weekly technical and program interface. The technical and program interface shall be by teleconference and periodic face-to-face meetings, at NASA Langley.

9. Flight Readiness Review (following completion of Tasks 1-4): The Contractor shall participate in a NASA Flight Readiness Review (FRR) conducted by NASA LaRC, typically one hour in duration, via teleconference and in person. Due prior to first flight.

10. Weekly Schedule (Tasks 1-4): Following contract award, the Contractors shall provide an updated schedule weekly to the NASA Technical Point of Contact, Mr. Dale R. Bowser.

NASA Furnished:

1. FRR requirements within two weeks after award of the contract.
2. HU-25A aircraft for installation from contract award through the period of performance. The exact dates for aircraft availability will be agreed upon by NASA and Contractor upon contract award. Avionics facilities are available for equipment modification and harness buildup. The Aircraft shall be returned to flight status no later than the period of performance upon completion of all four tasks.
3. NASA Medical and Flight Clearance Requirements Form.
4. HU-25A aircraft repair manuals (upon request).
5. NPR 7900.3 (upon request).

Attachment: Existing Avionics/Equipment Listing for NASA LaRC Dassault HU-25A,
S/N 411

Component	Manufacturer Model	Part Number
#1 Air Data Computer	Collins ADC-80M	622-2704-1016
#2 Air Data Computer	None installed	N/A
#1 Altimeter		622-8339-001
#2 Altimeter	Pneumatic only	570-23931-012
#1 Mach/Airspeed Indicator		622-2702-001
#2 Mach/Airspeed Indicator	Pneumatic only	575-25850-272
Left Pitot-Static Probe	Rosemount 0856HK1	NSN 6610-01-083-1527
Right Pitot-Static Probe	Rosemount 0856HK2	NSN 6610-01-083-1528
#1 Transponder	MST-67A Mode S	066-01143-0601
#2 Transponder	None installed	N/A
TCAS	TPA-81A/CAS-81A TCAS II	066-50000-0108
Altitude Alerter System		622-2703-001
Autopilot System	Collins APS-80M	N/A
Autopilot Amplifier	Collins APA-80M	622-3900-006
Autopilot Computer	Collins APC-80M	622-3899-006
Autopilot Panel/Controller	Collins APP-80M	622-3901-001
Speed Control Computer	Collins SCC-80	622-4120-001