Statement of Work
for the
Single-system Multi-mission Airborne Mine Detection (SMAMD)
Future Naval Capability (FNC) Support

July 2020

PREPARED BY:

AIRWorks,

Naval Air Systems Command
Patuxent River, MD 20670

Table of Contents

1.0 Introduction and Background

The Single-system Multi-mission Airborne Mine Detection (SMAMD) system ("SMAMD System") is in development as part of a Future Naval Capability (FNC) program managed by the Office of Naval Research (ONR). BAE Systems will perform the SMAMD system development and performance validation. This capability will reduce the mine countermeasure (MCM) timeline by utilizing single-pass and real-time mine classification for detection, classification, and localization of mines across all zones extending from the deep water thru the beach. The SMAMD system will discriminate targets from background, clutter, and biologics to achieve a high Probability of Detection (Pd) with a low False Alarm Rate (FAR). The SMAMD system utilizes a dual pod payload design that can be mounted onto a helo airframe. Specific sensors and software include Passive Electro-optical (EO) Sensors, 2D Light Detection and Ranging (LiDAR) sensor, and data fusion algorithms for real-time processing of contacts. Currently, during system development, the pods are being flown on a Bell 407 commercial helicopter prior to collect flight test data.

As part of the FNC program objectives, the SMAMD system will be demonstrated aboard the Unmanned Air System (UAS) Fire Scout MQ-8C which is managed by Multi-Mission Tactical Unmanned Aerial Systems (PMA-266).

The FNC demonstration will include data fusion hardware and software necessary to integrate outputs from the individual sensors into a coherent and accurate target list. The SMAMD system will be demonstrated for technical performance on a Bell 407 surrogate using the two (2) NAVAIR designed pods and populated with avionics from BAE Systems. The system performance will be reported as a function of target characteristics, local environmental conditions, and sensor parameters to generate a table of performance estimates, including probability of detection and classification (Pdc) and False Alarm Rate (FAR). The results will be compared to pre-test predictions and to the established exit criteria as appropriate.

The data collected will be comprised of demonstrated and modeled system performance, operating envelopes, and characteristics to include:

- Operational ranges of altitude and speed compatibility with Fire Scout MQ-8C platforms based on mechanical/vibration profiles
- Predicted performance in expected ranges of environments (Kd, Sea State, clutter densities)
- Operating and non-operating temperature ranges
- Operating and non-operating vibration/shock ranges
- Continuous and peak power consumption
- System and subsystem dimensions and weight

Appendix A provides a Fire Scout Pelican Pods Weight and Balance Report prepared by NAWCAD Aircraft Prototype Systems Division (APSD) on 15 July 2019 that delineates individual weights, center of gravity, and moments for both SMAMD pods. The high-speed mine contact data and command and control of the pods will be transmitted (bi-directional) via Common Data Link (CDL) using the higher data rate Bandwidth Efficient (BE) CDL modes. BAE Systems will provide a laptop which will control of the pods (both power and data). All

SMAMD data will be displayed locally on the system provided laptop. The wiring changes for the Power Distribution Modules (PDM), individual load control, and pod to pod wiring will be designed and installed by NAVAIR at Patuxent River, MD.

An illustration of the two (2) pods is shown below in Figure 1.

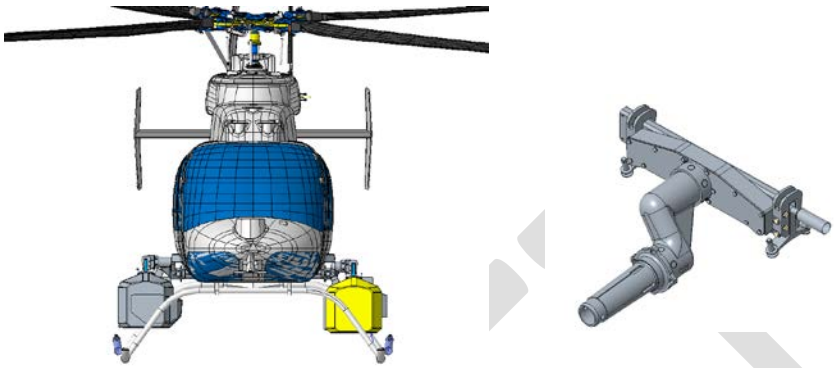

FIGURE 1: NAVAIR DESIGNED PODS WITH WEAPONS ARM

2.0 Demonstration Objective

Overall, the FNC program will develop the SMAMD podded system, validate the performance of the SMAMD capability on a Bell 407 surrogate, and then demonstrate the capability aboard a MQ-8C. The demonstration will assess:

1. Flying qualities of the MQ-8C with the mounted SMAMD pods
2. SMAMD system performance, as installed on MQ-8C
3. Mine detection data is transmitted real-time

AIRWorks, working closely with PMA-266, PMS-495, and other key stakeholders and organizations, will execute the hardware integration and demonstration aboard the MQ-8C. A notional schedule is provided below. The scope of the SMAMD demonstration is estimated to take approximately 27 months following project funding; completion is currently projected in 3QFY22, however, the goal is to expedite if possible.

UPDATE SCHEDULE

3.0 Scope and Tasking

The “Contractor” shall provide the following to support for the SMAMD FNC Demonstration:

3.1 The Contractor shall review the Government provided design of the power distribution and pod-to-pod data interconnect cable and provide recommended changes (CDRL A001). Notional design provided in Appendix B.

3.2 The Contractor shall perform modeling and simulation for shore-based flight testing of SMAMD pods on the MQ-8C to operate from surface to 5000 ft AGL and maximum airspeed not to exceed 85 Knots ground speed.

3.3 The Contractor shall update the MQ-8C aircraft software to enable the SMAMD pods to operate from surface to 5000 ft. AGL. Note: Minimal integration planned; no new flight patterns anticipated; Maximum airspeed will not exceed 85 Knots ground speed.

3.4 The Contractor shall update the aircraft software for the SMAMD payload including data, power control, and payload control to/from the laptop in accordance with SMAMD Interface Control Document (ICD).

3.5 The Contractor shall conduct lab regression testing to include power distribution modules.

3.6 The Contractor shall provide reach-back engineering support for flight clearance and ground test.

3.7 The Contractor shall conduct analysis of flying quality flight test data.

3.8 The Contractor shall provide reach-back engineering support for the FNC demonstration flight.

3.9 The Contractor shall perform Functional Qualification Testing (FQT)/System Integration Test (SIT) using hardware-in-the-loop to test system level operation that includes simulated flight test, payload power control, and mission payload data exchange with the SMAMD system.

3.10 The Contractor shall demonstrate through laboratory simulation that the system and software operation is safe to use in flight in accordance with the Contractor's program Test and Safety Plans.

3.11 The Contractor shall support Government participation and witnessing of SITs.

3.12 The Contractor shall deliver software/system/test artifacts in support of a Flight Clearance in accordance with the SETR instructions:

- **a.** Software Requirements Specification (CDRL A002)
- **b.** Interface Design Description (CDRL A003)
- **c.** Software Test Plan (FQT/SITS) includes Test Cases (CDRL A004)
- **d.** Software Test Description (FQT/SIT) includes Test Cases (CDRL A005)
- **e.** Software Test Report (FQT/SIT) (CDRL A006)
- **f.** Software Safety Memo (CDRL A007)
- **g.** Software Version Description (CDRL A008)
- **h.** Hardware Software Configuration Matrix (CDRL A009)
- **i.** Software Product Specification (including the MPEDD Hard Drive) (CDRL A010)

3.13 The Contractor shall provide required artifacts associated with the Engineering/Data Requirements Agreement Plan (EDRAP) to the Government for coordination with the flight clearance authority. (CDRL A011)

3.14 The Contractor shall support a two (2) Technical Interchange Meetings, a System Requirements Review (SRR), and a combined Preliminary Design Review (PDR) / Critical Design Review (CDR) for the software builds. (CDRL A012)

3.15 The Contract shall support weekly meetings as part of engineering consulting activities with NAVAIR and the BAE systems.

3.16 The Contractor shall prepare, maintain, and status a schedule for the tasking outlined within Section 3 of this SOW and send it to Government in advance of team meeting.

3.17 The Contractor shall provide technical status reports on a quarterly basis. These reports will update the program office on progress towards achieving the tasking outlined above. The report will include progression of the design and reports task status / completion relative to a master schedule. (CDRL A013)

4.0 Optional Tasking

4.1 The Contractor shall perform modeling and simulation for “ship-based” flight testing of SMAMD pods on the MQ-8C to operate from surface to 5000 ft AGL and maximum airspeed not to exceed 85 Knots ground speed (CDRL A014).

4.2 The Contractor shall update the MQ-8C aircraft Guidance, Navigation, and Control (GNC) software to enable the SMAMD pods to operate from surface to 5000 ft MSL in order to support Dynamic Interface testing on the ship.

4.3 The Contractor shall provide support for Cybersecurity Interim Authority to Test (IATT).

5.0 Government Furnished Information/Equipment

5.1 SMAMD power switching relay design will be provided for lab validation testing

5.2 SMAMD pods with avionics will be provided for lab validation testing

5.3 SMAMD laptop, including the software, to operate the pods for lab validation testing

5.4 MCS network configurations will be provided for lab validation testing

5.5 SMAMD pod-to-pod data interconnect cables will be provided for lab validation testing

5.6 SMAMD Interface Control Document (ICD)

6.0 Deliverables

6.1 The Contractor shall provide documentation in accordance with the CDRLs defined in the attached DD1423 forms.

CDRL No.	Title
A001	Power distribution and pod-to-pod data interconnect cable design
A002	Software Requirements Specification
A003	Interface Design Description
A004	Software Test Plan (FQT/SITS) includes Test Cases
A005	Software Test Description (FQT/SIT) includes Test Cases
A006	Software Test Report (FQT/SIT)
A007	Software Safety Memo
A008	Software Version Description
A009	Hardware Software Configuration Matrix
A010	Software Product Specification (including the MPEDD Hard Drive)
A011	Artifacts for EDRAP
A012	Information for TIMs/SETR Events
A013	Technical Status Reports

A014	Modeling and Simulation Data

Appendix A

Technical Report Developed by Aircraft Prototype Systems Division (APSD)
Fire Scout Pelican Pods Weight and Balance Report

15 July 2019

Appendix B

Notional Power Distribution Design