Statement of Work

Autonomous Underwater Vehicle (AUV)

Phase I – Development & Demonstration



**HISTORY CHANGE LOG**

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| REV | DATE | ORIGINATOR | USED ON | SUMMARY DESCRIPTION OF CHANGES |
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# Introduction

## Scope

This Statement of Work (SOW) defines the scope of work necessary to develop, build, test and demonstrate a prototype for an autonomous underwater vehicle (AUV) with the following capabilities.

* Surveillance and reconnaissance, e.g. identification of underwater mines and other subsurface weapons.
* Recovery of reusable underwater targets, test torpedoes, etc.
* Manipulative abilities sufficient to attach recovery lines to objects.

## Background

The tasks associated with the AUV to be developed are being performed by dolphins trained by the Department of the Navy. The use of dolphins is to be phased out over the next three years, resulting in a gap in capabilities, to be filled by the AUV. The CONTRACTOR shall develop and demonstrate a prototype AUV to meet the requirements specified in the associated Space and Naval Warfare Systems Command (SPAWAR) contract 645\_667-M16-A1A.

## Period of Performance

The period of performance (PoP) will be a maximum18 months after receipt of order (ARO), with an objective PoP of 12 months.

# Applicable Documents

The following documents form a part of this SOW to the extent specified herein. In the event of a conflict between the documents specified below and the content of the SOW, the SOW shall take precedence. In all cases, SPAWAR shall be notified of any conflicts. Nothing in this document, however, supersedes applicable law and regulations unless a specific exemption has been obtained and incorporated as part of the contract. The following documents of the most recent released issue at the time of the award form a part of this SOW to the extent specified herein.

## Contract Documents

Table 2-1 Contract Documents

|  |  |
| --- | --- |
| **Document Number** | **Title** |
| 645\_667-M16-A1A | Autonomous Underwater Vehicle (AUV) Prototype |

# Program Tasks

The CONTRACTOR shall provide all necessary labor, materials, and facilities required to perform the work described by this SOW and to meet all delivery requirements and the terms of the related contract.

## Program Management and Control

### Monthly Status Review

The CONTRACTOR and SPAWAR shall conduct a monthly review. The dates for the monthly reviews will be agreed upon by both the CONTRACTOR and SPAWAR a minimum of 14 days prior to the review. These reviews may take place at the CONTRACTOR’s facility or virtually at SPAWAR’s discretion.

### Monthly Status Report

The CONTRACTOR shall submit Monthly Status Reports (MSR) (CDRL-001) by close of business on the fifth working day after the CONTRACTOR’s accounting month end during the period of performance. The monthly status report shall be electronically sent to SPAWAR’s Contract Manager (CM) and Technical Lead. Content of the MSR will include the following items at a minimum:

1. Contract Status Summary
   1. Programmatic accomplishments
   2. Technical status and accomplishments
2. Issues & Concerns
3. Action Item Review/Status
4. Schedule Update
5. Identification of Long Lead Materials necessary to meet prototype demonstration date

### Program Management Reviews

The CONTRACTOR shall hold a Program Management Review (PMR) meeting with SPAWAR’s representatives, coinciding with the reviews defined below, to review the progress of the program and discuss technical, status, management status, and discuss the current monthly status report (MSR). The meetings shall be held at the CONTRACTOR’s facility or virtually, at SPAWAR’s discretion. Program action items shall be agreed upon at the meeting, and the agreements included as part of the monthly program review minutes.

### Integrated Master Schedule

The CONTRACTOR shall submit an integrated master schedule (IMS) (CDRL-002) for the duration of the contract phase, as well as a notional schedule for completion of engineering and manufacturing development (EMD) and low-rate initial production (LRIP). The schedule shall show how the CONTRACTOR will meet deliverables, program milestones and risk mitigation milestones.

The schedule status shall be provided to SPAWAR’s technical representative and CM in conjunction with the monthly status report.

### Quality Management

The CONTRACTOR shall plan, implement, and maintain a quality management system. The quality management program (CDRL-006) shall be described as part of the first MSR.

### Configuration & Data Management

The CONTRACTOR shall maintain a configuration management system for all items required by this SOW that assures the configuration identification, control, status accounting, reporting, and auditing of all deliverable items. The CONTRACTOR shall maintain a configuration management system that adheres to established CONTRACTOR CM Policies and Procedures provided to SPAWAR (CDRL-005), and that is subject to SPAWAR’s review and approval. Authorization to proceed with changes to the baseline configuration shall be provided to the CONTRACTOR by means of appropriate contractual direction prior to change implementation.

### Drawings

The CONTRACTOR shall provide one (1) legible reproducible set and a soft copy set of all CONTRACTOR drawings for any contractual deliverable units (prototypes, brassboards, etc.) in accordance with any established non-disclosure agreement in effect. Documents shall include all fabrication and assembly drawings and Bill of Materials (BOMs).

## Technical Tasks

### Engineering

The CONTRACTOR shall perform all necessary design, engineering, analyses, modeling, and documentation required to define and build the AUV in the prototype.

The CONTRACTOR shall maintain documentation to allow for a seamless transition to LRIP.

### Interface Definition

The CONTRACTOR shall support SPAWAR in refining required interface definitions from a support vessel to the AUV or support equipment to include physical dimensions, electrical interfaces, connectors, isolation, and network interfaces.

### Reliability Analysis

The SELLER shall provide a reliability estimate or prediction for the production voltage converters based on the SELLER’s other designs and planned component quality and stress levels. The SELLER shall use Telcordia SR322, Issue 4 for reliability calculations. The reliability estimate shall take into account the operational temperatures provided by the BUYER, and part stress levels de-rated in accordance with GEIA-SSTD-008 or equivalent. Any use of equivalent document shall be subject to BUYER review and approval. The reliability analysis shall include description of any approved derating exceptions, and analyses showing any limited life components exceed design and operational life requirements. The initial reliability analysis (CDRL-008) shall be submitted to the PM, SCM and SCA as part of the May MSR and updated monthly for each subsequent MSR submittal.

The SELLER shall update the reliability prediction as the design matures.

The SELLER shall mitigate any Single Point Failures in the \*\*\* design that would prevent the overall system from functioning, including input and output bus shorts.

The SELLER shall track and report all failures occurring during development, integration and test of the prototype units to support the BUYER’s failure trend analysis.

### Thermal Modeling

The SELLER shall perform and provide the results of thermal modeling that shows \*\*\*.

### Structural Modeling

The SELLER shall perform and provide the results of structural modeling that shows the critical stresses and margin to yield for the \*\*\* design. Structural analysis results (CDRL-011) are to be submitted in conjunction with Preliminary Design Review package (CDRL-004) to the PM, SCM and SCA and updated for Critical Design Review Package (CDRL-009).

### Milestone Reviews

The SELLER shall conduct milestone reviews with the BUYER identified below. Minutes of the actions and agreements at each review (CDRL-003) shall be submitted to the PM, SCM and SCA with the final review package.

Table 3-1 Milestone Reviews

|  |  |
| --- | --- |
| Review | Due Date |
| Preliminary Design Review |  |
| Critical Design Review |  |
| Demonstration Test Readiness Review | Prior to beginning of testing on deliverable production units |

#### Preliminary Design Review

The SELLER shall conduct a Preliminary Design Review no later than \*\*\* on a mutually agreed date that the BUYER will attend. A draft version of the Preliminary Design Review Package (PDR) (CDRL-004) will be electronically sent to the BUYERs PM, SCM and Technical Lead 10 working days prior to the review. Topics covered in the Preliminary Design Review will include the following as a minimum:

1. Detailed schematics and board layouts
2. Chassis and mechanical design drawings
3. Thermal modeling analysis
4. Structural analysis
5. Predicted performance estimates
6. Updated schedule
7. CM process
8. Action Item Status

The Preliminary Design Review shall serve as a control gate for agreement on modifications, performance characteristics and physical characteristics prior to committing to the initial fabrication of the brassboard voltage converter. The final presentation package and minutes taken at the Preliminary Design Review shall be prepared and submitted to the BUYER within 3 working days after the meeting. Program action items shall be agreed upon at the meeting, and the agreements included as part of the minutes.

#### Critical Design Review

The SELLER shall conduct a Critical Design Review no later than \*\*\* on a mutually agreed date that the BUYER will attend. A draft version of the Critical Design Review Package (CDR) (CDRL-009) will be electronically sent to the BUYERs PM, SCM and Technical Lead 10 working days prior to the review. Topics covered in the CDR will include the following as a minimum:

1. Brassboard unit schematics and board layouts
2. Brassboard unit chassis and mechanical design drawings
3. Updated schematics and board layouts for production units
4. Updated chassis and mechanical design drawings for production units
5. Updated thermal modeling analysis for production units
6. Updated performance estimates for production units
7. Updated schedule
8. Proposed test plan for deliverable units
9. Action Item Status

The Critical Design Review shall serve as a control gate for agreement on modifications, performance characteristics and physical characteristics prior to committing to the initial fabrication of the deliverable voltage converter. The final presentation package and minutes taken at the CDR shall be prepared and submitted to the BUYER within 3 working days after the meeting. Program action items shall be agreed upon at the meeting, and the agreements included as part of the minutes.

#### Test Readiness Reviews

The SELLER shall conduct a Test Readiness Review in conjunction with the completed build of the first qualification unit on a mutually agreed date that the BUYER will attend. A draft version of the Test Readiness Review Package (TRR) (CDRL-010) will be electronically sent to the BUYERs PM, SCM and Technical Lead 10 working days prior to the review. Topics covered in the TRR will include the following as a minimum:

1. Verification Matrix showing traceability of all requirements to test plans
2. Completed test plans
3. Completed test procedures
4. Identification and description of test setup and test personnel

The Test Readiness Review shall serve as a control gate for beginning of design verification testing on a deliverable qualification unit. The final presentation package and minutes taken at the Test Readiness Review shall be prepared and submitted to the BUYER within 3 working days after the meeting. Program action items shall be agreed upon at the meeting, and the agreements included as part of the minutes.

### Engineering Consultation and Support

The SELLER shall provide engineering support to the BUYER in support of the BUYER’s development and demonstration of the higher level power subsystem. Engineering support shall include, as necessary, assistance and inputs for the BUYER’s design reviews with the end customer, assistance in setting up the units for an end customer demonstration at the contractor’s facility. The SELLER shall bid engineering support as follows:

Table 3-2 Engineering Support to Buyer.

|  |  |
| --- | --- |
| Support Task | Engineering Hours |
| Support Interface definition to include connectors, pin outs, command and control protocols, etc. | 24 Hours |
| Support BUYERs Critical Design Review with Block Diagrams, Charts, and Responses to Questions | 80 Hours |
| Support Technical Exchange Meetings as requested by the BUYER | 40 Hours |

# HARDWARE DELIVERABLES

## Delivery Quantities and Schedule

The SELLER shall adhere to the delivery schedule shown below in Table 4-1. The quantity listed in Table 4-1 represent the quantity required to be delivered to the BUYER.

Table 4-1. Hardware Deliverable List \*\*\*

|  |  |  |
| --- | --- | --- |
| QTY | Description | Due Date |
| 4 | Prototype Boards |  |
| 10 | Brassboard Units |  |
| 8 | Qualification Units |  |
| 8 | Production Run #1 |  |
| 8 | Production Run #2 |  |
| 4 | Spares |  |

## Delivery Instructions

The SELLER shall deliver all units in Table 4-1, unless notified otherwise, to the BUYER’s facility in Sacramento, California, as listed in the contract documents. When preparing units for shipment or delivery the SELLER shall package the \*\*\* to protect them from electrostatic discharge and from physical damage due to vibration, shock, or temperature.

# contract data requirements list (CDRL) \*\*\*

The Contract Data Requirements List (CDRL) is shown in Table 5-1.

Table 5-1. Subcontract Data Requirements List

|  |  |  |
| --- | --- | --- |
| CDRL# | Description | Due Date |
| 001 | Monthly Status Report | 5 working days after accounting month end |
| 002 | Master Schedule | Updates with the MSR packages 5 working days after month end |
| 003 | Milestone Review Meeting Minutes | 3 working days after design change review meeting |
| 004 | Preliminary Design Review Package | Draft 10 working days prior to review  Final 3 working days after review with minutes |
| 005 | SELLER’s Configuration Management Plan | Delivered as part of Preliminary Design Review Package |
| 006 | Quality Assurance Program Plan | Delivered as part of Preliminary Design Review Package  Update at Critical Design Review |
| 007 | Thermal Analysis Results | Delivered as part of Preliminary Design Review Package  Update at Critical Design Review |
| 008 | Reliability Analysis | Initial at May MSR  Updates as part of subsequent MSRs |
| 009 | Critical Design Review Package | Draft 10 working days prior to review  Final 3 working days after review with minutes |
| 010 | Test Readiness Review Package | Draft 10 working days prior to review  Final 3 working days after review with minutes |
| 011 | Structural Analysis Results | Delivered as part of Preliminary Design Review Package  Update at Critical Design Review |
| 012 | Qualification Data Package | Delivered 3 working days after completion of qualification testing program |
| 013 | Hardware Acceptance Data Package | Delivered with each hardware deliverable unit, starting with brassboard units |

# acronyms and abbreviations

Below is the list of acronyms and abbreviations

Table 6-1 Acronyms and Definitions

| Abbreviation | Definition |
| --- | --- |
| ARO | After Receipt of Order |
| DRP | Design Concept Review Package |
| ICD | Interface Control Document |
| MSR | Monthly Status Report |
| PSR | Program Status Review |
| RRP | Requirements Review Package |
| SCA | Subcontract Administrator |
| SDP | Software Development Platform |
| SCM | Subcontract Manager |
| SOW | Statement of Work |
| CDRL | Subcontract Data Requirements List |
| SPM | Subcontract Program Manager |
|  |  |