PERFORMANCE WORK STATEMENT (PWS)
FOR
ENGINEERING TECHNICAL SUPPORT SERVICES TO SUPPORT PARAMETRIC SHIP HULL MODELING IN RHINO

1.0 GENERAL

1.1 BACKGROUND

The Salvage Engineering Response Team (SERT) provides emergent naval architecture support to U.S. Coast Guard (USCG) field units responding to marine casualties. Naval architects at SERT use approved software to build computerized hull models to evaluate ship stability and strength using existing and available ship plans and information.

SERT requires contractor assistance to build a parametric hull model creation tool using Rhinoceros software. Rhinoceros is a 3D computer aided design software application developed by McNeel & Associates and approved for use by the USCG. Rhinoceros has a built in Python script editor as well as the graphical algorithm editor "Grasshopper" which have the functionality to create accurate ship models using a rapid hull design and fairing methodology.

During marine casualties on commercial ships, information is limited to basic drawings (general arrangements, capacity plan) and principal dimensions (length, breadth, depth, maximum draft, full load displacement). In most cases, some additional information regarding hull form is available including block coefficient and a deadweight scale. Salvage naval architects use this limited information and knowledge of other ship hull forms to generate computerized hull models. Models are tested for accuracy and used to evaluate the ship's structure and stability during casualty events.

A model creation tool capable of parametrically generating models for common types of commercial ships will improve SERT response time and abilities. Using limited information that is available, parametric hull models can be modified in Rhinoceros with minimal user intervention to increase accuracy.

1.2 SCOPE

The purpose of this Task Order is to obtain Technical and Engineering Support Services to develop, test, and document a ship hull model creation tool. Software will be limited to Rhinoceros and modules included within the stock distribution of the software (no third-party plug-ins). Commercial ship types, plans, drawings and information for creating ship models will be provided by SERT for development and testing. The modeling tool will not contain protected or proprietary information or drawings.

The contractor shall perform the effort required by this TO on a Time and Materials (T&M) basis for all labor.

1.3 OBJECTIVE

The objective of this Task Order is to obtain contractor support to develop a Rhinoceros model creation tool that can generate a commercial ship hull model with accurate hydrostatic properties using only limited information available to salvage naval architects during marine casualties.

1.4 APPLICABLE DOCUMENTS

The following reference documents may be helpful to the Contractor in performing the work described in this document:

- *International Maritime Organization (IMO): MSC.1/Circ/ 1229 of 11 Jan 2007, "Guidelines for the Approval of Stability Instruments."*
- *U.S. Navy Salvage Engineer's Handbook, Revision 1*

2.0 SPECIFIC REQUIREMENTS/TASKS

The Contractor must support the SERT in developing naval architecture tools within Rhino for utilization by the USCG. The development process is divided into three stages/tasks, as described below; specific responsibilities are defined in PWS Sections 2.1 through 2.3.:

- Task One – Develop modeling tool for common commercial ship types.
- Task Two – Generate ship models with developed modeling tool and validate against actual ship hydrostatic properties.
- Task Three – Draft technical paper documenting methodology, use, assumptions, and limitations of the modeling tool

2.1 TASK ONE. *Develop modeling tool for common commercial ship types*

The contractor will use a simplified ship hull modeling methodology to create sample ship hulls and validate their hydrostatic characteristics. The simplified hull modeling technique will be automated within Rhinoceros.

2.1.1 Contractor personnel assigned to this task must complete Hull Design and Fairing Training Level 1 and 2. This course is offered online by Rhino Centre and completion of the course will help the contractor personnel better understand hull design and fairing within Rhinoceros and introduce an existing methodology for parametric creation of hull models using Rhinoceros' Grasshopper module.

2.1.2 The contractor will develop a written methodology that uses only a commercial ship's Capacity Plan with a zero trim deadweight scale as input. The methodology will then outline the steps needed to generate a 3D model including iterative solving to attain a model that meets the accuracy of IMO's "Guidelines for the Approval of Stability Instruments."

2.1.3 The contractor will implement the rapid modeling methodology in Rhinoceros in a repeatable manner that is mostly automated using Python or Grasshopper. This may only use modules contained within the standard distribution of Rhinoceros software (such as Grasshopper or the built in Python script editor). Third party plug-ins and packages for Rhinoceros should be avoided.

2.2 TASK TWO. *Generate and validate ship models*

The contractor will use the tool and methodology in Task One to generate parametric ship hull models. These models will be created by with limited information (e.g. without a vessel lines drawing). Existing hull models or hydrostatic data for each model created by the rapid modeling tool will be used to validate the results. The contractor will then modify the modeling tool and user interface within Rhinoceros to attain the best accuracy possible using the IMO's "Guidelines for the Approval of Stability Instruments."

2.3 TASK THREE. *Draft Technical Paper*

The contractor must document the creation and tested uses of the model creation tool. A draft technical paper format will be used for documentation. The technical paper should include methodology, technical assumptions, and validation comparing the output of the modeling tool to actual ships.

3.0 CONTRACTOR PERSONNEL

It is the responsibility of the contractor to propose qualified contractor personnel to perform all requirements specified in the PWS.

3.1 Qualified Personnel

The Contractor must provide qualified personnel to perform all requirements specified in this PWS. All Contractor personnel must be citizens of the United States of America.

3.1.1 Contractor Personnel must be proficient in Rhinoceros modeling of marine vessels. Contractor personnel must understand hydrostatics and naval architecture fundamentals. Contractor Personnel meeting these requirements are considered Key Personnel for this contract. Resume and Sample of Contractor Key Personnel rhino modeling shall be submitted with bid.

3.1.2 Contractor personnel assigned to this task must complete Hull Design and Fairing Training Level 1 and 2 within 20 business days from the period of performance start date.

3.1.3 Contractor personnel must have a naval architecture degree or two years of marine design experience.

3.1.4 Contractor personnel must have at least one year of experience with Python programming.

3.1.5 Ship drawings and information must be safeguarded as outlined in the Protection of Information Section of this task order.

3.2 Key Personnel

Before replacing any individual designated as *Key* by the Government, the Contractor must notify the Contracting Officer no less than 15 business days in advance, submit written justification for replacement, and provide the name and qualifications of any proposed substitute(s). All proposed substitutes must possess qualifications equal to or superior to those of the *Key* person being replaced, unless otherwise approved by the Contracting Officer. The Contractor must not replace *Key* Contractor personnel without approval from the Contracting Officer. The following Contractor personnel are designated as *Key* for this requirement. Note: The Government may designate additional Contractor personnel as *Key* at the time of award.

The positions designated as *Key* for this requirement are:

Project Engineer

3.3 Employee Identification

The following paragraphs apply to when contractor employees visit government facilities or work on-site at government facilities.

3.3.1 Contractor employees visiting Government facilities must wear an identification badge that, at a minimum, displays the Contractor name, the employee's photo, name, clearance-level and badge expiration date. Visiting Contractor employees must comply with all Government escort rules and requirements. All Contractor employees must identify themselves as Contractors when their status is not readily apparent and always display all identification and visitor badges in plain view above the waist.

3.3.2 Contractor employees working on-site at Government facilities must wear a Government issued identification badge. All Contractor employees must identify themselves as Contractors when their status is not readily apparent (in meetings, when answering Government telephones, in e-mail messages, etc.) and display the Government issued badge in plain view above the waist at all times.

3.4 Employee Conduct

Contractor's employees must comply with all applicable Government regulations, policies and procedures (e.g., fire, safety, sanitation, environmental protection, security, "off limits" areas, wearing of parts of DHS uniforms, and possession of weapons) when visiting or working at Government facilities. The Contractor must ensure Contractor employees present a professional appearance at all times and that their conduct must not reflect discredit on the United States or the Department of Homeland Security. The Project Manager must ensure Contractor employees understand and abide by Department of Homeland Security established rules, regulations and policies concerning safety and security.

3.5 Removing Employees for Misconduct or Security Reasons

The Government may, at its sole discretion (via the Contracting Officer), direct the Contractor to remove any Contractor employee from DHS facilities for misconduct or security reasons. Removal does not relieve the Contractor of the responsibility to continue providing the services required under the contract. The Contracting Officer will provide the Contractor with a written explanation to support any request to remove an employee.

4.0 OTHER APPLICABLE CONDITIONS

This area addresses additional requirements the Contractor will need to accomplish in the performance of the PWS.

4.1 SECURITY

Contractor access to unclassified, but Security Sensitive Information may be required under this PWS. Contractor employees must safeguard this information against unauthorized disclosure or dissemination.

4.2 PERIOD OF PERFORMANCE

The period of performance for this contract is a one (1) year base period with an additional one (1) year option period.

4.3 PLACE OF PERFORMANCE

The primary place of performance will be designated by the contractor. Subject to space availability and the COR's approval, place of performance may be at the Department of Homeland Security at the U.S. Coast Guard Headquarters, 2703 Martin Luther King Jr. Ave SE, Washington, D.C. 20593-7430.

4.4 HOURS OF OPERATION
Contractor employees must generally perform all work between the hours of 0800 and 1700 EST, Monday through Friday (except Federal holidays).

4.5 TRAVEL
Contractor travel is not needed for this requirement.

4.6 POST AWARD CONFERENCE
The Contractor must attend a Post Award Conference with the Contracting Officer and the COR. See table in PWS Section 8.0. The purpose of the Post Award Conference, which will be chaired by the Contracting Officer, is to discuss technical and contracting objectives of this contract. The Post Award Conference will be held at the Government's facility, located at the U.S. Coast Guard Headquarters, 2703 Martin Luther King Jr. Ave SE, Washington, D.C. 20593-7430 or via teleconference.

4.7 PROGRESS MEETINGS
The Project Engineer must provide a weekly progress meeting to the COR, or designated personnel, via MS Teams. The information included in the meeting may be adjusted by the Contracting Officer or COR at any point during the period if they determine that other metrics are necessary to best capture the performance of the contract.

The Project Engineer must be available (via Microsoft Teams) to meet with the COR upon request to present deliverables, discuss progress, exchange information and resolve emergent technical problems and issues.

4.8 TECHNICAL PAPER
The Project Engineer must provide a draft technical paper to the COR, or designated personnel via MS Word. The paper must include a description of the methodology, technical assumptions, and validation comparing the output of the modeling tool to actual ships.

4.9 GENERAL REPORT REQUIREMENTS
The Contractor must provide all written reports in electronic format with read/write capability using applications that are compatible with DHS workstations (Microsoft Office Applications).

4.10 PROTECTION OF INFORMATION
Contractor access to proprietary information is required under this PWS. Contractor employees must safeguard this information against unauthorized disclosure or dissemination in accordance with DHS MD 11042.1, Safeguarding Sensitive But Unclassified (For Official Use Only) Information. The Contractor must ensure that all Contractor personnel having access to business or procurement sensitive information sign a non-disclosure agreement (DHS Form 11000-6).

5.0 GOVERNMENT FURNISHED RESOURCES
The Government will not provide equipment for Contractor use in performing work under this task order.

6.0 CONTRACTOR FURNISHED PROPERTY
The Contractor must furnish all facilities, materials, equipment and services necessary to fulfill the requirements of this contract.

7.0 GOVERNMENT ACCEPTANCE PERIOD

The COR will review deliverables prior to acceptance and provide the contractor with an e-mail that provides documented reasons for non-acceptance. If the deliverable is acceptable, the COR will send an e-mail to the Contractor notifying it that the deliverable has been accepted.

7.1 The COR will have the right to reject or require correction of any deficiencies found in the deliverables that are contrary to the information contained in the Contractor's accepted proposal. In the event of a rejected deliverable, the Contractor will be notified in writing by the COR of the specific reasons for rejection. The Contractor may have an opportunity to correct the rejected deliverable and return it per delivery instructions.

7.2 The COR will have 15 business days to review deliverables and make comments. The Contractor must have 15 business days to make corrections and redeliver.

7.3 All other review times and schedules for deliverables must be agreed upon by the parties. The Contractor must be responsible for timely delivery to Government personnel in the agreed upon review chain, at each stage of the review. The Contractor must work with personnel reviewing the deliverables to assure that the established schedule is maintained.

8.0 DELIVERABLES

The Contractor must consider items in **BOLD** as having mandatory due dates.

ITEM	PWS REFERENCE	DELIVERABLE / EVENT	DUE BY	DISTRIBUTION
1	4.6	**Post Award Conference**	Within 5 days of Period of Performance Start date	N/A
2	4.8	**Progress Meetings**	Weekly	COR
3	2.1.1	**Complete Hull Design and Fairing Level 1 and Level 2 Course**	Within 20 days of Period of Performance Start date	COR, Contracting Officer
4	2.1.2	**Develop written methodology outlining proposed development steps**	3 months after contract award	COR
5	2.1.3	**Implement first draft of rapid modeling methodology within Rhinoceros**	6 months after contract award	COR
6	2.2	**Generate and perform validation on three ship models with the modeling tool**	9 months after contract award	COR
7	2.3 4.9 4.10	**Draft Technical Paper**	11 months after contract award	COR, Contracting Officer

9.0 GOVERNMENT TERMS & DEFINITIONS

- *COR* – Contracting Officer's Representative
- *DHS* – Department of Homeland Security
- *IMO* – International Maritime Organization
- *KO* – Contracting Officer
- *MSC* – Marine Safety Center
- *PRS* – Performance Requirements Summary
- *PWS* – Performance Work Statement
- *SERT* – Salvage Engineering Response Team
- *USCG* – U.S. Coast Guard

10.0 PERFORMANCE REQUIREMENTS SUMMARY (PRS).

The PRS establishes key elements of Contractor performance that represent “mission essential” service requirements, which are identified in the table below in the “Service Output” column. The “Performance Objective” column represents the standard against which Contractor performance will be measured in relation to accomplishment of the corresponding service output. The performance objective or “standard” describes the minimum acceptable level of service by the Contractor for satisfactory performance.

Service Output	***Performance Objective***	***Positive Incentive***	***Negative Incentive***
1. Complete Required Training (PWS 2.1.1)	Contractor personnel must complete Hull Design and Fairing Training (Level 1 & 2) within 20 business days of the performance start date.	Completion of training within the timeframe will result in a “Very Good” rating in CPARS. If the project engineer is replaced, the replacement will have completed the training prior to receive a “Very Good” rating in CPARS	Late completion of training or replacement of the project engineer with a person that has not completed training will result in a “Unsatisfactory” rating in CPARS.
2. Develop Written Methodology (PWS 2.1.2, 4.7)	The contractor shall deliver a written methodology that outlines the steps to generate a 3D model from a ship's Capacity Plan and deadweight scale. The Project Engineer must attend and lead weekly progress meetings with the COR to discuss progress, deliverables, and resolve issues.	Exceptional rating: 100% attendance; consistent, near independent progress made toward completed methodology with complete documentation. Very Good rating: Exceeds 95% attendance; mostly independent progress toward completion of methodology Satisfactory rating: 95% attendance; some independence with significant government project direction toward completion of methodology	Unsatisfactory rating: Falls below 95% attendance; frequently unprepared; needs near constant government direction or fails to make progress in methodology development.

Service Output	***Performance Objective***	***Positive Incentive***	***Negative Incentive***
3. Implement Modeling Tool (PWS 2.1.3, 4.7)	The contractor shall deliver a functional, repeatable, and mostly automated modeling tool within Rhinoceros using standard software modules. The Project Engineer must attend and lead weekly progress meetings with the COR to discuss progress, deliverables, and resolve issues.	Exceptional rating: 100% attendance; consistent, near independent progress made toward implementation with complete documentation. Very Good rating: Exceeds 95% attendance; mostly independent progress toward implementation Satisfactory rating: 95% attendance; some independence with significant government project direction toward implementation	Unsatisfactory rating: Falls below 95% attendance; frequently unprepared; needs near constant government direction or fails to make progress in implementation.
4. Generate and Validate Ship Models (PWS 2.2, 4.7)	The contractor shall generate three ship models using the developed tool and validate them against actual ship data to the accuracy specified by IMO guidelines. The Project Engineer must attend and lead weekly progress meetings with the COR to discuss progress, deliverables, and resolve issues.	Exceptional rating: 100% attendance; consistent, nearly independent progress made in developing hull models and validating (positively or negatively) models with full documentation. Very Good rating: Exceeds 95% attendance; mostly independent progress made in developing hull models and validating them with documentation Satisfactory rating: 95% attendance; some independence with significant government project direction toward generation of hull models and validation.	Unsatisfactory rating: Falls below 95% attendance; frequently unprepared; needs near constant government direction or fails to make progress in hull model generation or validation.

Service Output	***Performance Objective***	***Positive Incentive***	***Negative Incentive***
5. Draft Technical Paper (PWS 2.3, 4.7, 4.8)	The contractor must deliver a draft technical paper documenting the tool's methodology, assumptions, and validation results. The Project Engineer must attend and lead weekly progress meetings with the COR to discuss progress, deliverables, and resolve issues.	Exceptional rating: 100% attendance; consistent, nearly independent progress made in writing technical paper. Written work is polished without need for significant editing. Very Good rating: Exceeds 95% attendance; mostly independent progress made in writing technical paper. Written work needs only minor editing. Satisfactory rating: 95% attendance; some independence with significant government project direction in writing technical paper. Written work needs significant editing.	Unsatisfactory rating: Falls below 95% attendance; frequently unprepared; needs near constant government direction in writing technical paper. Work needs to be rewritten.