

DRAFT
Statement of Work (SOW) for
USCG Heavy Polar Icebreaker Industry Studies

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GENERAL

1.0 Introduction.

The Heavy Polar Icebreaker Program requires design studies and analysis be conducted. The overall objective of this early industry involvement effort is to enable the Government to analyze input from industry and further refine the system specification. The contract for the Industry Studies outlined in this SOW will be awarded to contractors able to build and design, or who have a plan for achieving production capability to build, Heavy Polar Icebreakers (i.e. shipyards with in-house design capability, or a designer as a team member). It is envisioned that this effort will require input from a shipyard capable of constructing the Polar Icebreaker, since only shipyards with adequate production facilities (i.e. vessel length of approximately 400-500 feet) have the ability to fully assess the producibility and affordability of the Polar Icebreaker. The contract for the construction of the Heavy Polar Icebreaker will be awarded to a US shipyard, in accordance with 14 USC 665. This SOW specifies the required Industry Studies.

2.0 References.

1. Draft Heavy Polar Icebreaker System Specification
2. Heavy Polar Icebreaker Indicative Design to include drawings and principle characteristics
3. Operating Profile to Support Fuel Endurance Calculations (will be provided at contract award)
4. Heavy Polar Icebreaker Operational Requirements Document (will be provided at contract award)

5. Navy Cost Estimating Classifications- Web site:
http://www.navsea.navy.mil/Portals/103/Documents/SUPSHIP/SOM/Ch6-CostEstimating_18Aug15.pdf

3.0 Statement of Work.

3.1. Objective:

Design studies and analyses will be performed to identify solutions for the Heavy Polar Icebreaker that minimizes cost, schedule, production, and technology risk. The overall objective of this early industry involvement effort is to enable the Government to analyze input from industry and further refine the system specification and ensure that an affordable solution can be produced on an accelerated schedule. Industry input will be used to support the following Heavy Polar Icebreaker Industry Study objectives:

- Affordability – Identify possible affordability initiatives for reducing acquisition costs as well as overall life cycle cost.
- Producibility Risk – Consider producibility attributes early in the design and acquisition cycle, considering icebreaker-unique design attributes.
- Technology Risk – Make use of existing state of the market technology/components with proven performance, considering icebreaking and harsh environment operations.
- Sustainability – Maximize reliability, maintainability, and supportability over the service life.

The Government is interested in proposed systems approaches and alternatives that offer advantages in meeting the Heavy Polar Icebreaker Industry Study objectives of reduced production and technical risks along with reduced acquisition and sustainment costs. The contractor shall perform design studies and analyses addressing the topics outlined in Section 3.2 of this SOW focused on affordability. Using the Draft Heavy Polar Icebreaker System Specification and the other listed references, the contractor shall establish a Heavy Polar Icebreaker Baseline Design that represents a ship meeting the requirements of the Draft Heavy Polar Icebreaker System Specification. The contractor shall make every effort to identify areas within design, production, documentation and testing to reduce the acquisition cost and schedule for the vessel.

Through these industry studies, the contractor shall conduct specific cost, schedule, production and technical studies to support validation and refinement of the Draft Heavy Polar Icebreaker Specification and to enable the contractor to mature their designs. It is envisioned that this effort will require input from a shipyard capable of constructing the Polar Icebreaker, since only shipyards with adequate production facilities (i.e. vessel length of approximately 400-500 feet) have the ability to fully assess the producibility and affordability of the Polar Icebreaker.

The Industry Studies are divided into two parts: the Initial Studies and the Follow On Studies. Each of these parts will have separate deliverables. This approach is to ensure that the Heavy Polar Icebreaker Program receives study output early in the process that impacts verification that the Government can affordably acquire a vessel with the required size and powering.

The contractor shall place emphasis on the use of commercially available, state of the market, and proven technologies. Component commonality with other U.S. Coast Guard Cutters is desirable. The Government intends to use the deliverables to refine the Draft Heavy Polar Icebreaker System Specification, which may include recommended innovative methods and alternative standards.

3.2. Tasks:

The contractor shall perform studies to evaluate proposed approaches against the goal of the Heavy Polar Icebreaker Program as specified herein. The Government is interested in proposed systems and approaches that meet the mission requirements as described in reference (4) and offer advantages in meeting the Heavy Polar Icebreaker Industry Study objectives. The contractor shall address the relevant Draft Heavy Polar Icebreaker System Specification requirements, and may identify opportunities for alternate requirements for meeting the mission requirements while being affordable and producible.

Task	Description
1-1	Initial Cost As an Independent Variable (CAIV) Assessment
1-2	Establish Industry Baseline Heavy Polar Icebreaker Design (Rev. 0)
1-3	Cost and Schedule Estimate for Baseline Design (Rev. 0)
1-4	Initial Studies
	1-4.1 Propulsion Plant / Power Train Study
	1-4.2 Electric Plant Configuration / Topology Study
	1-4.3 Hull Form and Structures Study
	1-4.4 Proposed Areas for Further Study
1-5	Define Industry Baseline Heavy Polar Icebreaker Design (Rev. 1)
1-6	Cost and Schedule Estimates for Baseline Design (Rev. 1)
1-7	Follow On Studies
	1-7.1 Cold Weather and Remote Operations
	1-7.2 Selected Space Arrangements
	1-7.3 Icebreaking Enhancements
	1-7.4 Other Studies
1-8	Integration Study
1-9	Updated CAIV Assessment
1-10	Define Industry Baseline Heavy Polar Icebreaker Design (Rev.2)
1-11	Cost and Schedule Estimates for Baseline Design (Rev. 2)

1-1 Initial Cost As an Independent Variable (CAIV) Assessment

The contractor shall perform a cost assessment for the Heavy Polar Icebreaker Program requirements as described in Heavy Polar Icebreaker Operational Requirements Document (Reference 4) and the Draft Heavy Polar Icebreaker System Specification (Reference 1). The goal of this assessment is to define the costs associated with each of the Heavy Polar Icebreaker missions and capabilities. As part of the CAIV analysis, the contractor shall identify which capabilities and/or requirements are the major cost drivers. Further, the Contractor shall identify

the impact to the cost of an accelerated schedule. This Initial CAIV Assessment will be used as the basis for the Updated CAIV Assessment as described in Section 1-9 of this SOW.

1-2 Establish Industry Baseline Heavy Polar Icebreaker Design (Rev. 0)

The contractor shall establish a baseline design that represents a ship meeting the requirements of the Draft Heavy Polar Icebreaker System Specification and using reference (2) as needed. The contractor shall prepare a Baseline Design Description Report that includes the contractor's assessment of the degree of design maturity (i.e., Concept, Preliminary, Contract, or Detail Design). If an existing design is used as the baseline, the contractor shall discuss design refinements and system modifications needed to meet the Heavy Polar Icebreaker requirements. The contractor shall provide information on the design tools to be used and the method or approach used to modify the existing design and validate the naval architectural and marine engineering design features. The contractor's baseline design shall be used as the basis of the design studies conducted under this effort. The contractor shall also prepare Study Drawings that show the following information on the contractor's baseline Heavy Polar Icebreaker design:

- General Arrangements, Inboard and Outboard Profile
- Watertight Subdivision and Initial Intact Stability
- Area and Volume
- Hull Lines (Hull Form Table and Offsets)
- Seakeeping Analysis
- Primary Hull Structural Arrangements (including the design's structural configuration in the Bow, Mid-body, Stern and Icebelt, including material selection, initial spacing, type and orientation of framing)
- Weight and Center of Gravity Estimate, including approach addressing design margins and level of maturity
- Machinery Space Arrangements (Propulsion and Ship Service Plants Including Uptake Space) demonstrating adequate separation and survivability
- Major Machinery Equipment List (MMEL) identifying candidate equipment and/or key characteristics
- Electric Plant Load Analysis (EPLA)
- Electrical One-Line Block Diagram
- Speed-power Estimates
- Shaft Horse Power Estimates for Icebreaking (describing approach to the estimate and level of validation)
- Range, Endurance and Fuel Burn Curve

In addition to the information provided as part of the Baseline Design Description Report, the contractor shall prepare a Regulatory Design Impacts Report. The severe and environmentally sensitive areas of operation for the Heavy Polar Icebreaker bring unique regulations into consideration. The contractor shall conduct a gap analysis on the Draft Heavy Polar Icebreaker Specification identifying areas where there is a difference between the Draft Heavy Polar Icebreaker System Specification and existing or emerging regulations such as IMO Polar Code, SOLAS, MARPOL, ASPPR, POLARIS, etc.

1-3 Cost and Schedule Estimate for Baseline Design (Rev. 0)

The contractor shall identify the expected cost and schedule to construct the Heavy Polar Icebreaker baseline identified in Section 1-2 of this SOW. These estimates shall be based on the Draft Heavy Polar Icebreaker System Specification and the identified Heavy Polar Icebreaker Baseline Design (Rev. 0). In order to analyze the producibility and affordability of the Heavy Polar Icebreaker, the Government expects the contractor to be able to design and build a vessel capable of meeting the technical requirements of the Draft Heavy Polar Icebreaker Systems Specification. To ensure producibility and affordability, the Heavy Polar Icebreaker cost estimates should be based on, and compared to, cost data for vessels of similar size (i.e. vessels of similar full load displacement, length overall, extreme breadth and draft).

1-3.1 Cost Estimate

The contractor shall provide a Heavy Polar Icebreaker Baseline Design (Rev. 0) cost estimate (in Fiscal Year 2017 dollars) broken down as follows:

1. Design Development through detailed design, to include non-recurring engineering costs
2. Cutter construction (through cutter delivery)

The contractor shall develop the cost estimate to at least a Navy cost estimate classification Class F level as described in reference (5). The contractor shall identify all cost assumptions made in the development of the estimates as well as the basis for those cost assumptions. Assumptions based on recent relevant construction experience of comparably-sized ocean going vessels shall be noted. To the extent possible, the contractor shall arrange the costs by Ship Work Breakdown System (SWBS) number.

1-3.2 Schedule Estimate

The contractor shall develop a schedule (in months) broken down as follows:

1. Design Development through detailed design, to include non-recurring engineering
2. Cutter construction (through cutter delivery)

Identify all assumptions made in the development of the schedule. Assumptions based on recent relevant construction experience of comparably-sized ocean going vessels shall be noted.

1-4 Initial Studies

The contractor shall perform individual studies to address the items listed in Sections 1-4.1 through 1-4.3. Within each study, the contractor shall identify alternative approaches to meeting the requirements of the Draft Heavy Polar Icebreaker System Specification. Each study shall evaluate how these alternative approaches are addressed in the identified Heavy Polar Icebreaker

Baseline Design to achieve the Heavy Polar Icebreaker Industry Studies objectives. Specifically, the cost and schedule impacts should be clearly discussed. Further, for each identified solution the contractor must identify the associated technical and production risks. The focus on these initial studies is on finding an affordable, low risk solution that can be produced on an accelerated schedule.

The contractor shall develop a Study Report for each study that describes the baseline and each alternative analyzed. The contractor shall describe the study methodology and assumptions. The Study Reports shall describe and justify the assessment of how each alternative ranks against the identified Heavy Polar Icebreaker Baseline Design while addressing the Heavy Polar Icebreaker Industry Study objectives as identified in Section 3.1 of this SOW.

1-4.1 – Propulsion Plant / Power Train Study

The propulsion plant of a ship is responsible for generating the power required to propel the ship through the water, conduct icebreaking, support general operations in Arctic and Antarctic polar regions and in between, and support the Heavy Polar Icebreaker endurance requirements. In this respect, the propulsion plant/power train has a significant impact on meeting the vessel's mission. The contractor shall perform a propulsion plant/power train study to evaluate the potential options for providing vessel propulsion for the operating profile, as defined in reference (3), which meets the requirements of the Draft Heavy Polar Icebreaker System Specifications. The contractor shall identify a range of alternatives to be investigated. For each alternative investigated, the contractor shall develop the design sufficiently to assess any hull form impacts for optimization and determine the resultant speed-power estimate, icebreaking power estimate, and range and endurance impacts. For each of the solutions, the Contractor shall identify the cost, schedule and production impacts. The main machinery space arrangements shall identify any impacts to the general arrangements, shall ensure a survivable plant configuration, and demonstrate that adequate space has been allocated for maintenance access and equipment removals. The contractor shall use this data to support the preparation of the various calculations below. The contractor shall prepare the following for the Baseline Design and each alternative:

- Machinery Space Arrangements (Including Uptake Space)
- Major Machinery Equipment List (MMEL)
- Speed-power Estimates
- Shaft Horse Power Estimates for Icebreaking
- Range, Endurance and Fuel Burn Curve

1-4.2 – Electric Plant Configuration / Topology Study

The electric plant of a ship is responsible for generating the power required to support the full range of mission operations, conduct icebreaking and general operations in Arctic and Antarctic polar regions and in between. In this respect, the electric plant has a significant impact on meeting the cutter's missions. The contractor shall perform an electric plant configuration/topology study to evaluate the potential options for providing ship service power and potential propulsion using the operating profile as defined in the Draft Heavy

Polar Icebreaker System Specifications. The contractor shall identify a range of alternatives to be investigated. The electric plant space arrangements shall identify any impacts to the general arrangements and to ensure that adequate space has been allocated for maintenance access and equipment removals. The contractor shall prepare an electric plant load analysis for each alternative to assess the ship's electrical power requirements across the operating profile. The contractor shall also conduct a Heating, Ventilation and Air Conditioning (HVAC) Impact Assessment to identify the technical, operational, and cost impacts of various HVAC approaches. The contractor shall include an assessment of electric and thermal fluids, and discuss the efficiencies and related sustainment of the various systems. For each of the solutions, the contractor shall identify the cost, schedule, and production impacts. The contractor shall use this data to support the preparation of the various calculations below. The contractor shall prepare the following data for the contractor's Baseline Design and each alternative:

- Electric Plant Arrangements
- Major Electric Plant Equipment List
- Electric Plant Load Analysis (EPLA)
- Electrical One-Line Block Diagram
- Main Machinery Arrangements
- Speed-power Estimates
- Shaft Horse Power Estimates for Icebreaking
- Endurance and Annual Fuel Consumption Calculations

1-4.3 – Hull Form and Structures Study

The primary missions of the Heavy Polar Icebreaker are to break ice in the Arctic, to provide year-round assured access to Polar Regions for national security purposes, to resupply McMurdo outpost in the Antarctic, and support US Coast Guard missions. The Heavy Polar Icebreaker hull form must be capable of supporting both open water transit and icebreaking operations as defined in the Draft Heavy Polar Icebreaker System Specification, considering producibility of the hull form and structure. The contractor shall perform a hull form and structures trade study to evaluate potential alternatives that balance icebreaking power, open water speed, endurance, maneuverability in open water and ice, stability, seakeeping, strength and producibility. The contractor shall conduct comparison and alternative studies to include tradeoffs on hull form and structural performance while providing a producible design. The contractor shall investigate the impact of material selection on the Heavy Polar Icebreaker design. Specifically, the contractor should examine the use of high tensile strength steel, high strength steel, mild steel and other materials for the ice belt and primary hull structure. For each of the solutions, the contractor shall identify the cost, schedule, and production impacts.

For each alternative hull form investigated, the contractor shall prepare the following items:

- Lines plan
- Seakeeping Assessment
- Stability Calculations

- Structural Assessment - weight and strength
- Material Specifications

1-4.4 – Proposed Areas of Further Study

The contractor shall identify a list of additional studies recommended to further meet the program objectives stated in paragraph 3.1. The contractor shall provide a description for each additional proposed area of study within the Proposed Areas of Further Study report.

1-5 Define Industry Baseline Heavy Polar Icebreaker Design (Rev. 1)

The contractor shall update the Heavy Polar Icebreaker Baseline design utilizing the information obtained from Section 1-4 of this SOW. The Updated Heavy Polar Icebreaker Baseline design (Rev. 1) shall be used as the basis of the Follow-On design studies conducted under Task 1-7 of this SOW. The contractor shall prepare an Updated Baseline Design Description Report that shall describe how the Rev. 1 design improves on the Heavy Polar Icebreaker Baseline design (Rev. 0) and design level, while at the same time decreases technical and production risk while remaining affordable and sustainable. The contractor shall prepare the following items for the selected baseline design:

- General Arrangements, Inboard and Outboard Profile
- Watertight Subdivision and Initial Intact Stability
- Area and Volume
- Hull Lines (Hull Form Table and Offsets)
- Seakeeping Analysis
- Primary Hull Structural Arrangements (including the design's structural configuration in the Bow, Mid-body, Stern and Icebelt including material selection, initial spacing, type and orientation of framing)
- Weight and Center of Gravity Estimate including approach, addressing design margins and level of maturity
- Machinery Space Arrangements (Propulsion and Ship Service Plants, including Uptake Space) demonstrating adequate separation and survivability
- Major Machinery Equipment List (MMEL) identifying candidate equipment and/or key characteristics
- Electric Plant Load Analysis (EPLA)
- Electrical One-Line Block Diagram
- Speed-power Estimates
- Shaft Horse Power Estimates for Icebreaking (describing approach to the estimate and level of validation)
- Range, Endurance and Fuel Burn Curve

1-6 Cost and Schedule Estimates for Baseline Design (Rev. 1)

The contractor shall identify the expected cost and schedule to construct the Heavy Polar Icebreaker Baseline Design (Rev.1) identified in Section 1-5 of this SOW. In order to analyze

the producibility and affordability of the Polar Icebreaker, the Government expects the contractor to be able to design and build a vessel capable of meeting the technical requirements of the Draft Heavy Polar Icebreaker Systems Specification. To ensure producibility and affordability, the Heavy Polar Icebreaker cost estimates should be based on, and compared to, cost data for vessels of similar size (i.e. vessels of similar full load displacement, length overall, extreme breadth and draft).

1-6.1 Cost Estimate

The contractor shall provide a Heavy Polar Icebreaker Baseline Design (Rev. 1) cost estimate (in Fiscal Year 2017 dollars) broken down as follows:

1. Design Development through detailed design, to include non-recurring engineering costs
2. Cutter construction (through cutter delivery)

The contractor shall develop a cost estimate that shall be developed to at least a Navy cost estimate classification Class F level. The contractor shall identify all cost assumptions made in the development of the estimates as well as the basis for those cost assumptions. Assumptions based on recent relevant construction experience of comparably-sized ocean going vessels shall be noted. To the extent possible, the contractor shall arrange the costs by SWBS number.

1-6.2 Schedule Estimate

The contractor shall develop a schedule for Heavy Polar Icebreaker Baseline Design (Rev. 1) (in months) broken down as follows:

1. Design Development through detailed design, to include non-recurring engineering efforts
2. Cutter construction (through cutter delivery)

The contractor shall identify all assumptions made in the development of the schedule. Assumptions based on recent relevant construction experience of comparably-sized ocean going vessels shall be noted.

1-7 Follow On Studies

The contractor shall perform additional individual studies to address the items listed in Sections 1-7.1 through 1-7.3. Within each study, the contractor shall identify alternative approaches to meeting the requirements of the Draft Heavy Polar Icebreaker System Specification. Each study shall evaluate how these alternative approaches are addressed in the identified Heavy Polar Icebreaker Baseline Design so as to achieve the Heavy Polar Icebreaker Industry Studies objectives.

The contractor shall develop a Study Report for each study that describes the baseline and each alternative analyzed. The contractor shall describe the study methodology and assumptions. The Study Reports shall describe and justify the assessment of how each alternative ranks against the identified Heavy Polar Icebreaker Baseline Design while addressing the Heavy Polar Icebreaker Industry Study objectives as identified in Section 3.1 of this SOW. For each of the solutions, the contractor shall identify the cost, schedule, and production impacts.

1-7.1 Cold Weather and Remote Operations

The contractor shall identify the impact of Cold Weather and Remote Operations on the Polar Icebreaker. The contractor shall analyze the impact of operating in the Polar regions on the vessel's functional areas. Specifically, the Study Report shall include, but not be limited to, identifying the technical, operational, and cost impacts of cold weather and remote operations. The analysis should address the impact of the applicable criteria of recognized standards. The equipment and sensors exposed to or interfacing with the environment should be evaluated for the operational requirements of -40F and survival requirements of -50F, using -20F as the basis of comparison. For each of the solutions, the Contractor shall identify the cost, schedule, and production impacts.

1-7.2 Selected Space Arrangements

The contractor shall further define the following space arrangements to demonstrate compliance with the Heavy Polar Icebreaker System Specification:

- Multi-mission Spaces (maximize multi-use space arrangements)
- Aviation Facilities – Ability to land, hangar and service
- Topside Arrangements
- Bridge Operation and Visibility
- Galley and Messing Facilities

The contractor shall perform space trade-off studies analyzing the operational and technical impacts of each alternative arrangement. For each of the solutions, the contractor shall identify the cost, schedule, and production impacts. The overall impact on cost and producibility should also be examined in the Study Report.

1-7.3 Icebreaking Enhancements

The contractor shall identify a list of potential icebreaking enhancements. For each of the solutions, the contractor shall identify the cost, schedule, and production impacts. The contractor shall assess the design impact of various methods of improving icebreaking performance including, but not limited to:

- Hull coatings
- Bow wash system
- Bubbler system
- Heeling system

- Reamers

The contractor shall assess the impact of the icebreaking enhancements on producibility, affordability, and sustainment. The Study Report should identify any technical or operational impacts on the Polar Icebreaker. Where commercial products are identified, the product specification sheets shall be provided.

1-7.4 Other Studies

The contractor shall conduct additional studies as needed by the Government.

1-8 Integration Study

The contractor shall perform an integration study to assess the combined impacts and effects of the initial and follow on studies prepared under Sections 1-3 and 1-7. In order to perform the integration study, the following steps should be followed:

- Select systems, equipment and approaches from the initial and follow on studies performed under this SOW.
- Analyze how these selections integrate into a single concept. Separate integration concepts may be prepared to evaluate different combinations of selections.
- Evaluate the selections for any compatibility issues or compounding impacts.
- Identify one or more cutter concepts based on the integration studies.

The contractor shall prepare an Integration Study Report that documents all of the above mentioned steps and the results of the various evaluations. The Report shall include an assessment of how each integrated solution performs when compared to Heavy Polar Icebreaker Baseline design (Rev. 1) and the Heavy Polar Icebreaker Industry Study objectives outlined herein. The methodology and assumptions used to make the assessment shall be included in the Report. The report shall clearly identify how the following Heavy Polar Icebreaker Industry Study objectives are impacted:

- Affordability – Identify possible affordability initiatives for reducing acquisition costs as well as overall life cycle cost.
- Producibility Risk – Consider producibility attributes early in the design and acquisition cycle, considering icebreaker unique design attributes.
- Technology Risk – Make use of existing state of the market technology/components with proven performance considering icebreaking and harsh environment operations.
- Sustainability - Maximize reliability, maintainability and supportability over the service life.

1-9 Updated CAIV Assessment

Using the information gleaned from Sections 1-4 through 1-8, the contractor shall update the CAIV Assessment to identify candidate capability reductions that may provide cost savings. The contractor shall also identify potential cost drivers associated with an accelerated schedule. The

contractor shall perform cost, schedule, and performance trade-offs and discuss the impacts to the Heavy Polar Icebreaker Program.

1-10 Define Industry Baseline Heavy Polar Icebreaker Design (Rev. 2)

The contractor shall update the Heavy Polar Icebreaker Baseline design utilizing the information gleaned from Sections 1-4 through 1-8 of this SOW. The Updated Polar Icebreaker Baseline design (Rev. 2) shall be used as the basis for the contractor's final cost and schedule estimates. A Study Report shall describe how the Rev. 2 design improves on the Heavy Polar Icebreaker Baseline design (Rev. 1), while at the same time decreases technical and production risk while remaining affordable and sustainable. The contractor shall prepare the following items for the selected baseline design:

- General Arrangements, Inboard and Outboard Profile
- Watertight Subdivision and Initial Intact Stability
- Area and Volume
- Hull Lines (Hull Form Table and Offsets)
- Seakeeping Analysis
- Primary Hull Structural Arrangements (including the design's structural configuration in the Bow, Mid-body, Stern and Icebelt including material selection, initial spacing, type and orientation of framing)
- Weight and Center of Gravity Estimate, including approach addressing design margins and level of maturity
- Machinery Space Arrangements (Propulsion and Ship Service Plants, including Uptake Space) demonstrating adequate separation and survivability
- Major Machinery Equipment List (MMEL) identifying candidate equipment and/or key characteristics
- Electric Plant Load Analysis (EPLA)
- Electrical One-Line Block Diagram
- Speed-power Estimates
- Shaft Horse Power Estimates for Icebreaking (describing approach to the estimate and level of validation)
- Range, Endurance and Fuel Burn Curve

1-11 Cost and Schedule Estimates for Baseline Design (Rev. 2)

The contractor shall identify the expected cost and schedule to construct the Heavy Polar Icebreaker Baseline design (Rev.2) identified in Section 1-10 of this SOW. In order to analyze the producibility and affordability of the Heavy Polar Icebreaker, the Government expects the contractor to be able to design and build a vessel capable of meeting the technical requirements of the Draft Heavy Polar Icebreaker Systems Specification. To ensure producibility and affordability, the Heavy Polar Icebreaker cost estimates should be based on, and compared to, cost data for vessels of similar size (i.e. vessels of similar full load displacement, length overall, extreme breadth and draft).

1-11.1 Cost Estimate

The contractor shall provide a Heavy Polar Icebreaker Baseline Design (Rev. 2) cost estimate (in Fiscal Year 2017 dollars) broken down as follows:

1. Design development through detailed design, to include non-recurring engineering costs
2. Cutter construction (through cutter delivery)

The contractor shall develop the cost estimate to at least a Navy cost estimate classification Class F level. The contractor shall identify all cost assumptions made in the development of the estimates as well as the basis for those cost assumptions. Assumptions based on recent relevant construction experience of comparably-sized ocean going vessels shall be noted. To the extent possible, the contractor shall arrange the costs by SWBS number.

1-11.2 Schedule Estimate

The contractor shall develop a schedule for Heavy Polar Icebreaker Baseline Design (Rev. 2) (in months) broken down as follows:

1. Design development through detailed design, to include non-recurring engineering
2. Cutter construction (through cutter delivery)

The contractor shall identify all assumptions made in the development of the schedule. Assumptions on recent relevant construction experience of comparably-sized ocean going vessels shall be noted.

4.0 Period of Performance.

The period of performance is approximately seven months from the date of award.

5.0 Deliverables.

The contractor shall provide the deliverables for each exercised Task in electronic format listed in Section 6.0 below.

6.0 Schedule.

The following is a representational sample of a schedule of deliverables for a contract that involves industry studies.

ITEM	TASK	DESCRIPTION	QTY	DUE DATE
1	1-1	Initial Cost As an Independent Variable (CAIV) Assessment	1	60 days after contract award
2	1-2	Industry Heavy Polar Icebreaker Baseline Design Report (Rev. 0)	1	30 days after contract award

ITEM	TASK	DESCRIPTION	QTY	DUE DATE
3	1-2	Regulatory Design Impact Report	1	90 days after contract award
4	1-2	Baseline Design (Rev. 0) Drawings, Calculations, Analysis	14	30 days after contract award
5	1-3	Cost and Schedule Estimates for Design and Construction for Baseline Design (Rev. 0)	1	60 days after contract award
6	1-4	Heavy Polar Icebreaker Initial Study Plan	3	30 days after contract award
7	1-4.1	Propulsion Plant / Power Train Study Report	1	120 days after contract award
8	1-4.1	Propulsion Plant / Power Train Study Drawings, Calculations, Analysis	5	120 days after contract award
9	1-4.2	Electric Plant Configuration / Topology Study Report	1	120 days after contract award
10	1-4.2	Electric Plant Configuration / Topology Drawings, Calculations, Analysis	8	120 days after contract award
11	1-4.2	Heating, Ventilation and Air Conditioning (HVAC) Impact Assessment	1	120 days after contract award
12	1-4.3	Hull Form Study Report	1	120 days after contract award
13	1-4.3	Hull Form Study Drawings, Calculations, Analysis	5	120 days after contract award
14	1-4.4	Proposed Areas of Further Study Report	1	120 days after contract award
15	1-5	Industry Heavy Polar Icebreaker Baseline Design Report (Rev. 1)	1	120 days after contract award
16	1-5	Baseline Design (Rev. 1) Drawings, Calculations, Analysis	14	120 days after contract award
17	1-6	Cost and Schedule Estimates for Design and Construction for Baseline Design (Rev. 1)	1	150 days after contract award
18	1-7	Follow On Studies Plan	3	120 days after contract award
19	1-7.1	Cold Weather and Remote Operations Report	1	150 days after contract award
20	1-7.2	Selected Space Arrangements Report	1	150 days after contract award
21	1-7.3	Icebreaking Enhancements Report	1	150 days after contract award
22	1-7.4	Other Studies Report	1	150 days after contract award
23	1-8	Integration Study Report	1	210 days after contract award
24	1-9	Updated CAIV Assessment	1	210 days after contract award
25	1-10	Industry Heavy Polar Icebreaker Baseline Design Report (Rev. 2)	1	210 days after contract award
26	1-10	Baseline Design (Rev. 2) Drawings, Calculations, Analysis	14	210 days after contract award
27	1-11	Cost and Schedule Estimates for Design and Construction for Baseline Design	1	210 days after contract award

ITEM	TASK	DESCRIPTION	QTY	DUE DATE
		(Rev. 2)		

7.0 Government Furnished Property.

None

8.0 Quality Assurance.

The contractor shall apply their internal quality control procedures.

9.0 Security Clearance.

Security clearances are not required for this project.

10.0 Contracting Officers Representative.

10.1. The U.S. Coast Guard Contracting Officer's Representative (COR) will be TBD.

10.2. The U.S. Coast Guard Alternate Contracting Officer's Representative (COR) will be TBD.

11.0 Notes.

None

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