1.0 OBJECTIVES

1.1 While the ship structure committee has completed a number of research projects into fatigue, fracture and design of aluminum structures (see Annex A) and industry has designed various aluminum vessels, the dissemination and application of these results and information from other sources remains incomplete.

The two objectives of the proposed project would be to develop a design guide suitable for use by the marine industry, and prepare a training program for US marine industry on the design of high speed and conventional aluminum ship structures.

2.0 BACKGROUND

2.1 Although the use of aluminum as a construction material for marine applications has been widely accepted for a number of years, its use in large marine vessels is still not widespread. Recent applications and demonstrations of the advantages of aluminum in auto / passenger fast ferries and warship designs have increased the interest in the use of aluminum as a hull construction material.

2.2 The primary reasons for selecting aluminum as a construction material include its relatively light weight (which increases cargo capacity and/or reduces power requirements), its corrosion resistance, and its low maintenance costs. However, the advantages and cost savings offered through the use of aluminum construction might not be realized, if the differences between traditional steel structural design and fabrication processes and those required for aluminum are not fully understood and addressed. For example, compared to steel, aluminum is less stiff and more susceptible to fatigue cracking, requires different welding practice/technique and involves different health and safety concerns during fabrication.

3.0 REQUIREMENTS

3.1 Scope.
3.1.1 The Contractor shall collect and review background information related to the marine industry’s experience and best practice for large high speed aluminum craft design with specific attention paid to: materials & welding, detailing, marine loads on high speed craft and how these influence fatigue, fracture and ultimate strength of hull structures. Industry input into the guide development shall be a priority.

3.1.2 The Contractor shall identify and document best practice for the design of large high speed aluminum vessels with attention to referencing sources for data and analytic procedures.

3.1.3 The design guide shall consider operational loading with attention to localized pressure fluctuations, machinery to hull connection interface issues and shaft line / propeller loads of unique concern to high speed aluminum vessels.

3.1.4 The best practice procedures shall outline rules of thumb, closed form and numerical modeling techniques to complete key stages of the design process.

3.1.5 The design guide shall be in a format readily adaptable to adoption by a standards development organization. Adherence to the form and style standards from ASTM International’s “Blue Book” is suggested.

3.1.6 The Contractor shall prepare a training syllabus and a course offering to disseminate the results of the research program.

3.2 Tasks.
The project completion will include the following sequential tasks:
3.2.1 Task 1 – Project kick off meeting to review the project scope and objectives with the technical committee.

3.2.2 Task 2 – Collection of project technical data and industry best practice information. In this task the project team will collect and review open literature, class information, aluminum industry guidance and analytic tools to produce an understanding of the current state of knowledge and practice. Based upon this review an outline for the technical guide will be produced and circulated to the project technical committee for review and comment.

3.2.3 Task 3 – After having received and considering feedback from the project technical committee, a guidance manual will be prepared to support design of large high speed aluminum ships. The guide will provide information related to materials & welding, detailing, marine loads on high speed craft and how these influence fatigue, fracture and ultimate strength of hull structures. Care will be taken to describe the subject matter at three levels of detail (e.g. rules of thumb, closed form and numerical modeling).

3.2.4 Task 4 – Project technical progress review – The project technical committee will be provided an early draft of the guidance manual for review and comment. A project review meeting will be held to review the contents of report and comments from the technical committee.

3.2.5 Task 5 – Completion of the high speed aluminum ship design guide. Delivery of a draft and final version of the report.

3.2.6 Task 6 – Preparation of a training course syllabus presenting the information contained in the guidance document will be prepared.

3.2.7 Task 7 – A training course will be offered in the continental US (location to be defined). This course offering will target an attendance of 40 with twenty seats reserved at no cost to SSC client organizations. The remaining seats will be used to support the cost of the course offering.

3.2.8 Task 8 – A final project meeting will be used to debrief and review the performance and quality of the project and deliverables. Modifications to the design guide will be reviewed.

3.3 Project Timeline
It is expected that the proposed technical document, training course syllabus preparation and delivery could be completed in an 18 month time frame. The delivery of a course from the course materials prepared in this project would be completed after the completion of the first year of the contract (e.g. in months 14 to 18).

4.0 GOVERNMENT FURNISHED INFORMATION.

4.1 Standards for the Preparation and Publication of SSC Technical Reports.

5.0 DELIVERY REQUIREMENTS

5.1 The Contractor shall provide quarterly progress reports to the Project Technical Committee, the Ship Structure Committee Executive Director, and the Contract Specialist.

5.2 The Contractor shall prepare and host a project kick-off meeting, a progress meeting and a meeting at the end of the technical document preparation.

5.3 The project deliverables will include the offering of a training course in the United States with preference given to attendees from SSC client organizations.

5.4 The Contractor shall provide a print ready master final report and an electronic copy, including the above deliverables, formatted as per the SSC Report Style Manual.
6.0 **PERIOD OF PERFORMANCE.**

6.1 Project Initiation Date
It is expected that the project will be awarded on or before September 2010.

6.2 Project Completion Date: 12 months from the date of award.

7.0 **GOVERNMENT ESTIMATE.** These contractor direct costs are based on previous project participation expenses. It is estimated that the guidance manual will be completed for approximately $70k and course offering syllabus will be assembled for $30k.

7.1 Project Duration: 12 months.

7.2 Total Estimate: $100,000

8.0 **REFERENCES.**

8.1 See previous SSC reports outlined in Annex A.

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**ANNEX A – Previous SSC Aluminum Projects**

<table>
<thead>
<tr>
<th>Report #</th>
<th>Title</th>
<th>Author</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSC-218</td>
<td>Design Considerations for Aluminum Hull Structures Study of Aluminum Bulk Carrier</td>
<td>C.J. Altenburg, R.J. Scott</td>
<td>01/30/1971</td>
</tr>
<tr>
<td>SSC-410</td>
<td>Fatigue of Aluminum Structural Weldments</td>
<td>R.K. Kramer, B. Rampolla, A. Magnusson</td>
<td>05/31/2000</td>
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<tr>
<td>SSC-452</td>
<td>Aluminum Marine Structure Design and Fabrication Guide</td>
<td>R.A. Sielski</td>
<td>02/01/2008</td>
</tr>
<tr>
<td>SSC-452-II</td>
<td>Aluminum Marine Structure Design and Fabrication Guide-Appendix</td>
<td>Sielski R.A.,</td>
<td>02/01/2008</td>
</tr>
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