

1.0 OBJECTIVE.

- 1.1. The goal of this project is to provide a basis for design of aluminum structures that will minimize the penalty on scantling selection.

2.0 BACKGROUND.

- 2.1. Unlike most steel alloys, aluminum alloys suffer a great reduction in strength, may be as much as 50 percent of the strength of the base material, in the heat affected zone (HAZ) of welds. The traditional approach to design has been using the minimum strength of the HAZ as the design strength. This approach may seriously underestimate the strength of welded structure.
- 2.2. Alternative approaches to design are possible. For example, as shown in Reference 7.1, Paik et al. (SNAME, 2005) proposed an equivalent yield strength based on the plate volume.
- 2.3. Although the concept of an equivalent yield strength has been used in research reports, the full implications for design standards have not been investigated. This study intends to provide a basis for modification to design standards.

3.0 REQUIREMENTS.

- 3.1. Scope. (Identify the phases of the project).
 - 3.1.1. The Contractor shall conduct literature review and identify the current design practices of welded aluminum structures.
 - 3.1.2. The Contractor shall address the subject of strength modeling through analysis backed by existing experimental data. (Who has the existing experimental data?)
 - 3.1.3. Write the report for PTC review, approval and SSC publication.
- 3.2. Tasks. (Identify the tasks to carry out the scope of the project).
 - 3.2.1. The Contractor shall review literatures to determine studies made on the effect of welding on the strength of welded aluminum structures.
 - 3.2.2. The Contractor shall review current design standards for welded aluminum structure and determine the methods by which accounting is made for the reduced properties in the weld metal and HAZ.
 - 3.2.3. Using a finite element analysis, such as NASTRAN, ABACUS or the like, that can model the strength properties of base metal, weld material, and HAZ in a fine-mesh model, the Contractor shall perform analyses of a typical structure for failure in tension, bending, and compression. The Contractor shall compare the results to those obtained when one models the structure with properties of base metal, HAZ, and a volumetric equivalent yield strength used for all structure in the finite element model Please see Reference 7.1 for volumetric equivalent data and results.
 - 3.2.4. The Contractor shall make recommendations for changes in design standards based on the above work.

- 3.3. Within four weeks after Contract award, the Contractor shall submit a project management plan for PTC approval. It shall include at least project timeline, manpower and fund expenditure projection. The manpower distribution should show who is going to spend how much time in doing what. If any portion of the work is to be subcontracted out, the subcontractor's training, qualification, previous work in the related area, his time and cost estimate shall also be included for PTC review and approval prior to the commencement of the work. The quarterly progress report shall also show work accomplished during each quarter and percentage of overall scope of work accomplished as of the reporting quarter.
- 3.4. Within four weeks after Contract award, the Contractor shall make an appointment with the PTC in order to hold a kick-off meeting in Washington, DC area. In addition, at about half way point, the Contractor shall make an appointment with the PTC in order to hold a mid-term review to ensure that the direction and progress are in good order.

4.0 GOVERNMENT FURNISHED INFORMATION.

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

5.0 DELIVERY REQUIREMENTS. (Identify the deliverables of the project).

- 5.1. The Contractor shall provide quarterly progress reports to the Project Technical Committee, the Ship Structure Committee Executive Director, and the Contract Specialist. See Item 3.3 above for progress report requirements.
- 5.2. 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: date of Contract award.
- 6.2. Project Completion Date: Not greater than 12 months from the date of Contract award.

7.0 REFERENCES.

- 7.1. Jeom Kee Paik, Owen F. Hughes, Paul E. Hess III, and Celine Renaud, Ultimate Limit State Design Technology for Aluminum Multi-Hull Ship Structures, SNAME Transactions, 2005.