SSC Project Recommendation for FY 2021

Recommendations for Revisions to Guidelines for Inspection and Repair of Steel Hulls

1.0 OBJECTIVE.

1.1 The objective of this project is to develop recommendations for updates to the Coast Guard's repair guidelines for inspected steel-hulled vessels. The potential benefits of this project include improving the consistency and reliability of repairs, reduced uncertainty for required repairs by providing objective tolerances for structural degradation and repair specifications, and updating Coast Guard guidance to the current best practices.

2.0 BACKGROUND.

2.1 The Coast Guard published Navigation and Vessel Inspection Circular (NVIC) 7-68 as the official guidance for inspections of and repairs to steel-hulled inspected vessels. However, since the original publication of this NVIC in 1968, significant changes to best practices for the construction of steel-hulled vessels have been made, including but not limited to: increased use of high tensile steel, significant reduction in the use of riveting, greater optimization of structures through the use of software design tools, and a better understanding of fatigue damage and crack propagation. Based upon these and other factors, industry and classification societies have improved upon the steel repair methods contained in current Coast Guard policy.

2.2 The existing NVIC 7-68 provides significant qualitative discussion of inspection and repair guidance for steel hulled vessels, but it does not contain significant quantitative tolerances for allowable corrosion, deformation, crack length, etc. Also, it only contains limited sketches demonstrating acceptable repairs. These limitations make the acceptability of the deteriorated condition of a structure or the adequacy of a repair subject to the interpretation of the inspector. Providing specific objective tolerances and repair dimensions would make repairs less subjective. This would reduce uncertainty for the shipowner/operator, as well as provide inspectors and surveyors with specific guidelines by which to assess structural damage and appropriateness of proposed repairs.

3.0 REQUIREMENTS.

3.1 Scope.

3.1.1 The Contractor shall conduct a literature review of industry and classification society best practices for inspections of and repairs to steel-hulled vessels.

3.1.2 The Contractor shall identify the gaps between the inspection and repair methodologies in NVIC 7-68 and current industry best practices.

3.1.3 The Contractor shall develop draft recommendations for updates to NVIC 7-68 for USCG consideration in future revision of the NVIC.

3.2 Tasks.

3.2.1 The Contractor shall undertake a comprehensive literature review of relevant technical documents.

3.2.2 The Contractor shall make quantitative recommendations for the following allowable tolerances/limits:

3.2.2.1 Plating surface imperfections (e.g. pitting, wastage)
3.2.2.2 Plating cracks
3.2.2.3 Plating deformation
3.2.2.4 Frame/stiffener corrosion (e.g. pitting, wastage)
3.2.2.5 Frame/stiffener cracks
3.2.2.6 Frame/stiffener deformation
3.2.2.7 Stanchion deformation
3.2.2.8 Weld cracks

3.2.3 The Contractor shall compile repair procedures (including sketches) detailing recommended best practices for repair specifications for the following:

3.2.3.1 Rectangular insert plates
3.2.3.2 Circular insert plates
3.2.3.3 Doubler plates
3.2.3.4 Frame/stiffener renewals
3.2.3.5 Fatigue brackets
3.2.3.6 Welding of pitting corrosion
3.2.3.7 Welding repairs for cracks
3.2.3.8 Weld grinding
3.2.3.9 Weld hammer peening

3.2.4 The Contractor shall make recommendations for best practices for gauging.

3.2.5 The Contractor shall make recommendations for repair considerations specific to higher strength and low temperature steels (ABS Grades B, D, E, AH32, DH32, EH32, AH36, DH36, and EH36).

3.2.6 The Contractor shall provide guidance for determining residual stresses arising from a repair, in particular providing specific dimensional or other tolerances to reduce residual stresses.

3.2.7 The Contractor shall produce a report containing the technical recommendations developed in tasks 3.2.2 through 3.2.6.

3.2.8 The Contractor shall produce a draft update of NVIC 7-68 for Coast Guard review and consideration in revising the NVIC.

3.3 Project Timeline. See Enclosure (*x*).

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 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 award.

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.

7.1 Project Duration: 12 months.

7.2 Total Estimate: $150,000

8.0 SELECTED BIBLIOGRAPHY.

8.1 NVIC 7-68 “Notes on Inspection and Repair of Steel Hulls”
8.2 IACS Recommendation No. 47 “Shipbuilding and Repair Quality Standard”
8.3 IACS Recommendation No. 76 “Guidelines for Surveys, Assessment and Repair of Hull Structure – Bulk Carriers”
8.4 IACS Recommendation No. 96 “Guidelines for Surveys, Assessment and Repair of Hull Structures – Double Hull Oil Tankers”ABS Marine Vessel Rules, Part 7, Rules for Survey After Construction
8.5 Grubbs, Kim and Zanis, Charles. Underwater Repair Procedures for Ship Hulls (Fatigue and Ductility of Underwater Wet Welds). SSC-370
8.6 R.E. Heyburn, D.L. Riker. Effect of High Strength Steels on Strength Considerations of Design and Construction Details of Ships. SSC-374
8.7 K.A. Stambaugh, F. Lawrence, S. Dimitriakis. Improved Ship Hull Structural Details Relative to Fatigue. SSC-379
8.8 Dr. J.C. Daidola, J. Parente. Residual Strength Assessment of Pitted Plate Panels. SSC-394
8.9 K.J. Kirkhope, R. Bell, L.Caron, and R.I. Basu. Weld Detail Fatigue Life Improvement Techniques. SSC-400
8.10 Robert J. Dexter, and Paul J. Pilarski. Effect of Welded Stiffeners on Fatigue Crack Growth Rate. SSC-413
8.11 Robert A. Sielski, J. R. Wilkins Jr., J.A. Hults. Supplemental Commercial Design Guidance for Fatigue. SSC-419
8.12 R.J. Dexter, R. J. FitzPatrick, D. L. St. Peter. Fatigue Strength and Adequacy of Weld Repairs. SSC-425
8.13 S. Tiku. In-Service Non-Destructive Evaluation of Fatigue and Fracture Properties for Ship Structures. SSC-428
8.14 A. Kendrick, B. Ayyub, I. Assakkaf. The Effect of Fabrication Tolerances on Fatigue Life of Welded Joints. SSC-436
8.15 Sensharma, P.K., Dinovitzer, A., Traynham, Y. Design Guidelines for Doubler Plate Repairs of Ship Structures. SSC-443
8.16 Shield, C.K., Swanson, K.M., Dexter R. J. In-Service Non-Destructive Estimation of the Remaining Fatigue Life of Welded Joints. SSC-444
8.17 Wang, G., Khoo, E., et.al. Review of Current Practices of Fracture Repair Procedures for Ship Structures. SSC-462