SSC Project Recommendation for FY 2020

Risk- and Utility-Informed Optimum Decision Making for Naval Ship Structures

1.0 OBJECTIVE.

1.1 Develop a comprehensive framework for integrating inspections, structural health monitoring, time-varying system performance, and probabilistic consequences for risk-and utility-informed optimum decision making for ship structures.

2.0 BACKGROUND.

2.1 Professor Dan Frangopol of Lehigh University has studied maintenance management of ship and civil engineering structures for more thana decade, and with his students has written numerous papers on the subject, a sample of which are listed in the references.

2.2 The Ship Structure Committee has identified Structural Monitoring, Longevity, and Lifetime Extension as one of its principal focus areas.

3.0 REQUIREMENTS.

3.1 Scope. (Identify the phases of the project).

3.1.1 The Contractor shall conduct an assessment of current management practices for maintenance of ship structure.

3.1.2 The Contractor shall identify the ways that the latest research in structural longevity and lifetime extension can be applied for the management of the maintenance of ship structure.

3.1.3 The Contractor shall address the resources needed, changes in data gathering and recording, analysis tools required, and education necessary for application of the research.

3.2 Tasks. (Identify the tasks to carry out the scope of the project).

3.2.1 The Contractor shall conduct an assessment of current management practices for maintenance of ship structure. This will include interviews with managers of either commercial ships or naval and Coast Guard ships, and, as appropriate, classification societies. A summary of current practices in the various fields will be made, including deficiencies that could be addressed through application of the latest research.

3.2.2 The Contractor shall identify the ways that the latest research in longevity and lifetime extension can be applied for the management of the maintenance of ship structure. This could be through application to a hypothetical organization or if there is interest, to an actual organization

3.2.3 The Contractor shall address the resources needed, changes in data gathering and recording, analysis tools required, and education necessary for application of the research. An estimate of the cost of implementation shall be made. The level or training needed for a typical management staff shall be identified. Changes in ship instrumentation, data gathering, recording, and analysis shall be identified. An integrated framework will be developed.

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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. (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.

5.2 The Contractor shall provide to the Ship Structure Committee and member organizations the comprehensive framework for integrating inspections, structural health monitoring, time-varying system performance, and probabilistic consequences for risk- and utility-informed optimum decision making for ship structures

5.3 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: $100,000

7.3 The Independent Government Cost Estimate is attached as enclosure (*x*).

8.0 REFERENCES.

8.1 Yang, D.Y. & Frangopol, D.M., 2018. Probabilistic optimization framework for inspection/repair planning of fatigue-critical details using dynamic Bayesian networks. Computers & Structures, 198: 40–50.

8.2 Yang, D.Y. & Frangopol, D.M., 2019. Comparison of different risk-based inspection planning methods for life-cycle maintenance optimization. In ASCE-SEI Structures Congress 2019. Orlando, Florida

8.3 Gong, C. & Frangopol, D. M. (2020). Preferred Dry-docking Interval of Corroded Ship Hull Girders Based on Cumulative Prospect Theory. Ocean Engineering, (in press).

8.4 Gong, C., & Frangopol, D. M. (2019). Time-Variant Hull Girder Reliability Considering Spatial Dependence of Corrosion Growth, Geometric and Material Properties. Reliability Engineering & System Safety, 106612.

8.5 Han, X., Yang, D. Y., & Frangopol, D. M. (2019). Probabilistic Life-Cycle Management Framework for Ship Structures Subjected to Coupled Corrosion–Fatigue Deterioration Processes. Journal of Structural Engineering, 145(10), 04019116.

8.6 Han, X., Yang, D.Y. & Frangopol, D.M. 2019. Time-variant reliability analysis of steel plates in marine environments considering pit nucleation and propagation Probabilistic Engineering Mechanics, 57, 32-42.

8.7 Liu, Frangopol, and Cheng (2019). Risk-informed structural repair decision making for service life extension of aging naval ships. Marine Structures, 2019.

8.8 P. E. Hess, S. Aksu, N. Amila, M Rye Anderson, J.I.R. Blake, D Boote, P. Caridis, N. Chen, A. Egorov, G. Feng, P. Jurisic, B. Leira, L. Li, H. Murayama, M. Tammer, M. Vaz. Committee V.7. Structural Longevity, Proceedings of the 20th International Ship and Offshore Structures Congress (ISSC 2018) Volume III – ML. Kaminski and P. Rigo (Eds.), 2020, 261–276 doi:10.3233/PMST200016, 261-276.

9.0 SUGGESTED CONTRACTING STRATEGY.

9.1 Contracting strategy. Full and open competition will be employed to ensure that this work could be performed by a variety of organizations, including academia, research laboratories, classification societies, or naval architects. Because this subject is not included in the expertise sought for standing level-of-effort contracts, that contracting strategy is not appropriate for this work.