

SSC Project Recommendation for FY 2022

Recommendations for the use of Thermoplastics as Hull Materials on Small Passenger Vessels

1.0 OBJECTIVE.

- 1.1 The objective of this project is to develop recommendations for updates to the Coast Guard's regulations, policies, and guidance regarding hull materials allowed in the construction of small passenger vessels, specifically, research into the viability of various thermoplastics being included as an acceptable material for hull structure in the construction of small passenger vessels.

2.0 BACKGROUND.

- 2.1 The Coast Guard has noted an increasing trend in the use of thermoplastics for the construction of small craft. Thermoplastics are in use across the world in commercial vessels including workboats, response vessels, and recreational vessels. Recently, several companies have attempted to utilize these materials within the jurisdiction of the U.S. Coast Guard for both personal and commercial use, to include vessels which are certificated under the small passenger vessel requirements found in 46 CFR Subchapter T.
- 2.2 The Coast Guard recognizes the potential use of thermoplastic materials within the inspected U.S. fleet but does not have an appropriate understanding of properties and limitations of these materials as they pertain to the structures of vessels.
- 2.3 Though there exist standards from various internationally recognized organizations, the Coast Guard seeks to complete further material analysis on multiple types of thermoplastics to include high density poly ethylene, medium density poly ethylene, low density poly ethylene, and acrylonitrile butadiene styrene. This analysis will consider these thermoplastics to help determine if they provide a suitable level of safety to be considered as a material to be used in small passenger vessel (46 CFR Subchapter T) construction.
- 2.4 This project addresses the focus area of Novel Materials and Manufacturing.

3.0 REQUIREMENTS.

- 3.1 Scope.
 - 3.1.1 The Contractor shall conduct the work required by this project in three phases:
 - 3.1.1.1 Literature review;
 - 3.1.1.2 Use, inspection and repair recommendations; and
 - 3.1.1.3 Analysis and reporting.
 - 3.1.2 In Phase 1, the Contractor shall identify the state of the art understanding of the use of thermoplastic hull manufacturing including the various types of thermoplastics that can be involved and their limitations.
 - 3.1.3 In Phase 2, the Contractor shall develop a methodology for the application of thermoplastics for small passenger vessel hull construction, inspection, and repair.
 - 3.1.4 The Contractor shall prepare a final report regarding their findings. If the findings show that thermoplastic hulls are an acceptable material for small passenger vessel hulls and

structures, the Contractor shall detail all analysis and recommendations for review by the SSC Project Technical Committee.

3.2 Tasks.

- 3.2.1 The Contractor shall undertake a comprehensive literature review of relevant technical documents. The contractor shall provide a summary of the history and use of thermoplastics in recreational and small passenger vessels.
- 3.2.2 The Contractor shall compile relevant industry and classification society standards for the testing of thermoplastics and the design of marine vessels using thermoplastics as the primary hull structure material.
- 3.2.3 The Contractor shall make quantitative recommendations for the allowable tolerances/limits for all relevant material properties, including their environmental limitations within the marine environment.
- 3.2.4 The Contractor shall make recommendations for best practices for inspection of thermoplastic hulls and structures. 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.
- 3.2.5 The contractor shall make recommendations for the use of Thermoplastics in the marine environment and potential exposures that would lead to material property degradation over time.
- 3.2.6 The Contractor shall produce a report containing the technical recommendations developed in tasks 3.2.2 through 3.2.5. The Contractor shall recommend which, if any, thermoplastics are suitable for small passenger vessel construction, any operational limitations, and inspection and repair guidelines or standards to be utilized by the Coast Guard Marine Safety program.

3.3 Project Timeline.

Table 1. Proposed project timeline

Task	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Task 1: Literature Review	■	■	■									
Task 2: Compiling of Standards		■	■	■	■	■						
Task 3: Quantitative Recommendations			■	■	■	■						
Task 4: Inspection Recommendations					■	■	■	■				
Task 5: Marine Environment Recommendations							■	■	■	■		
Task 6: Analysis and report preparations										■	■	■

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 46 Code of Federal Regulations, Chapter 1, Subchapter T

8.2 Marine Safety Center, Plan Review Guide H1-12, September 2021

8.3 DNV-GL, DNVGL-ST-0342, Craft, Edition July 2016

8.4 Turk Loydu, Tentative rules for polyethylene Crafts, 2014

8.5 Indian Register of Shipping, Guidelines on Hull Structures of Thermoplastic Vessels (Provisional), July 2021