

Additive Manufacturing (AM) for Singapore's Maritime Industry: Joint Industry Programme (JIP) Phase 3 – Call for Proposals 2024

1. **Background:** JIP Phase 1 (Launched in 2019) provided an examination of the market feasibility of using AM for marine parts. Building on the insights of Phase 1, Phase 2 (Launched in 2020) delved into AM fabrication, testing, inspection, and certification of maritime and / or marine parts. Phase 2 paved the way for a deeper understanding of AM's capabilities and challenges. Whilst it validated the technical aspects of AM for maritime applications, it also revealed some challenges of scaled adoption. This includes limited capabilities in data preparation and design, lack of industry-wide standards and lack of digital infrastructure optimised for 3D printing workflows.

As the maritime sector continues to explore the use of AM, companies are increasingly aware of the benefits of 3D printing, presenting a mindset shift asking 'how' to integrate the technology and scale up production rather than seeking 'why' should they use it.

AM JIP phase 3 aims to accelerate the adoption of AM marine parts and strengthen the resilience of our supply chain. The details of Phase 3 are outlined below.

2. **Objective:** AM JIP phase 3 aims to accelerate the adoption of AM marine parts and strengthen the resilience of our supply chain. We invite interested industry consortia to submit a proposal that will serve as successful case studies in Singapore.
3. **Challenge Statement:** To encourage and integrate AM within the maritime industry¹, three tracks have been identified.
 - a. **Track 1 – Strengthen resilience of Singapore's supply chain for marine parts:** OEMs, distributors and end users are welcome to digitalise their designs through development of digital library of parts and / or replacement parts enabled by AM.
 - b. **Track 2 – Rapid qualification and certification by Classification Societies:** Classification societies are welcome to develop and streamline rapid qualification and certification process, to reduce the costs and duration for parts certification.
 - c. **Track 3 – Design for AM (DfAM) for Electric Vessels²:** Develop, test, and install AM parts in Electric Vessels for the purpose of weight reduction (at least 10% of weight reduction potential) and potential cost savings, with the goal of making Electric vessels more economically viable for adoption. These may include the need for re-design of existing technologies / systems used in electric vessels. May reference the Call for Expression³ on Interest to design and promote adoption of electric harbour craft in Singapore.

4. **Project Scope and Expected Deliverables:**

4.1 Track 1 – Strengthen resilience of Singapore's supply chain for marine parts

¹ These may include vessels and port equipment (proposers may look at aspect of port equipment to carry out testing)

² Vessels refers to harbourcraft, tugs and bunker tankers

³ www.mpa.gov.sg/media-centre/details/call-for-expression-of-interest-to-design-and-promote-adoption-of-electric-harbour-craft-in-singapore

- 4.1.1 Determine a selection of parts from various OEMs, distributors and/or end users for inclusion in the digital inventory. Evaluation and justification of selected parts to be provided.
- 4.1.2 Showcase a digital repository inclusive of CAD files and manufacturing blueprints necessary for fabrication, qualification, and certification at external (3rd party) service providers or internal business units or departments, includes managing Digital Product Passports (DPP) that contains information relating to the product's entire lifecycle.
- 4.1.3 Validation of digital repository with a small subset of converted / digitised part.
 - 4.1.3.1 Demonstrate accuracy of digital files to achieve production repeatability by sending the same file for print production to a few service bureaus*. This may include the use of design and simulation and/or demonstration into print alongside simulation for comparison.
 - 4.1.3.2 Demonstrate distributed manufacturing. Eg. Remote sending of file through network directly into the printer for print operation. This means that the file already contains the necessary print parameters.
- 4.1.4 Validation of digital qualification and certification of identified finished parts – Demonstrate the use of digital files including but not limited to part quality simulations in comparison with physical qualification. Use of port equipment in testing and qualifying methods should be considered and validated.

**Service bureaus can determine the best print process parameters for the part which may differ across service bureaus*

Track 2 – Rapid Qualification and certification by classification societies

- 4.2 Develop an enhanced and scalable methodology with classification societies on an acceptance criterion for additive manufacturing parts for use in maritime.
 - 4.2.1 Identify, collect, and analyse relevant data (throughout the manufacturing processes including both input and output data) which can be used for qualification and certification process. Use of port equipment in testing and qualifying methods should be considered and validated.
 - 4.2.2 Demonstrate and validate the use of semi-empirical and / or physical models to enable faster AM part qualification and rapid production ramp.
 - 4.2.3 Develop a scalable digital qualification and certification methodology integrating various processes and technologies to streamline the qualification and certification process ensuring compliance with relevant standards.

4.3 Track 3 – Design for AM (DfAM) For Electric Vessels

- 4.3.1 Develop, test and install AM parts in Electric vessels for the purpose of weight reduction (at least 10% weight reduction potential) and potential cost savings, with the goal of making Electric vessels more economically viable. Participants would need to consider the operation profile of the vessel, the power requirements and needs of energy storage and management systems while managing trade-offs between battery weight and craft endurance. It would be important to consider how aspects of weight reduction, hull efficiency, energy density and maintainability can be enhanced through innovative technologies like additive manufacturing and design thinking.

5. **Eligibility and Proposal Requirements:**

a. **Composition:**

- i. Industry consortia for Track 1 and 3 should minimally comprise a supplier of parts (Eg. OEM, Parts owner, Distributor), solution provider, classification society. Track 3 should also comprise a harbour craft operator.
- ii. Industry consortia for Track 2 should comprise of few different class societies and minimally a supplier of parts (Eg. OEM, Parts owner, Distributor), solution provider.
- iii. Each company can participate in no more than two (2) industry consortia
- iv. The work should be conducted in Singapore. This includes the development, fabrication with AM, testing, inspection, and certification process.

b. **Main Applicant:**

- i. The main applicant could be any of the collaborators in the consortia with a legal entity and presence in Singapore.

c. **The proposal (to be submitted in MPA's MINT Fund application form) should contain:**

- i. Project description (proprietary or confidential information must be clearly indicated in the proposal) and objectives, deliverables
- ii. Project description and methodology (i.e rationale for selected parts)
- iii. Innovation content, how the proposed work compares against available solutions
- iv. Relevance to maritime industry
- v. Company profile and respective manpower participating in the industry consortia including details on the involvement and contributions
- vi. Project risk assessment and mitigation plan

d. **Duration:** The project duration shall not be more than 18 months

e. **Submission:** Interested applicants shall submit the completed proposals to <sharine_tan@mpa.gov.sg>

f. **Deadline:** The application deadline is **11 August 2024**.

6. **Funding support:**

- a. Selected projects will be eligible for co-funding support from MPA's MINT fund for qualifying items.
- b. More information on the MINT Fund can be found on our website.

7. **Proposal Evaluation and Award Process:**

- a. The proposals will be evaluated by a project evaluation panel set up by MPA and NAMIC. Project proposals with clear strategies for implementing and/or integrating AM into the company's business would be preferred.
- b. The panel may seek additional information to elaborate or clarify areas described in the proposal during the review process.
- c. Shortlisted applicants should be notified by September 2024 and awarded by October 2024.

8. **Project Monitoring and Review:**

- a. Each project will be assessed for progress every six (6) months to ensure the proposed milestones and deliverables are on-track. Successful applicants will be required to present the progress update and submit a progress report to the joint project review team comprising industry experts appointed by MPA and NAMIC.

9. Please direct further queries to:
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 - b. Stanley POH (NAMIC): <stanley_poh@namic.sg>