FREQUENTLY ASKED QUESTIONS ON THE EXPRESSION OF INTEREST (EOI) TO DESIGN AND DEVELOP ELECTRIC HARBOUR CRAFT IN SINGAPORE

Timeline

Question 1 **What does it mean for the Project to be operational by 2025 or earlier?**

Answer New electric harbour craft (e-HC) designs must be approved by MPA from 2027 according to reference designs and safety standards, to cater enough time for design reviews and construction.

To support this, the e-HC from this EOI should be ready for commercial adoption before 2027 – this means that its design and relevant supporting mechanisms (i.e. operating model, financing and insurance solutions) should be ready by 2025 to cater for sufficient time for construction, testing, commissioning and design validation.

Question 2 **What is MPA's plans for larger harbour craft like tankers and tugboats?**

Answer For a start, this EOI focuses primarily on designing e-HC that will replace a large proportion of smaller, conventional harbour craft that are assessed to be most suitable for full-electrification and share common parameters suitable for aggregation.

Participants may also suggest alternative types of harbour craft (e.g. tanker, tugboats, and other larger harbour craft) to enable the Project, with due consideration of the requirements in Section 3 – *Overview of requirements*.

Based on the outcome of the EOI, MPA may consider adopting similar strategies to meet the needs of other harbour craft types.

Requirements of the EOI

Question 3 **Are fuel cell technologies or other net zero fuels part of the scope of the EOI?**

Answer The scope of this EOI covers proven energy storage systems/ technologies (i.e. batteries), as the main energy source, and/or working in concert with other energy systems (e.g. supercapacitors).

As the sole use of other fuels and hydrogen-carriers require separate considerations with respect to supply, storage and handling, they will not be considered for this EOI specifically as the requirements have not been fully specified.

Proposals for hybrid systems involving energy storage systems and carbon-intensive fuel (e.g. LNG, marine gas oil) would not be considered further.

Question 4 **What is the envisaged role of Classification Societies authorised by MPA as Recognised Organisations?**

Answer The design of the e-HC shall be approved by the eight Classification Societies authorised by MPA as Recognised Organisations (RO).

Question 5 **Must the e-HC be a new design, or can the proposed design be a retrofit?**

Answer The design of the e-HC will be assessed based on its efficiency, weight optimisation, and future-readiness, with an emphasis on optimisation taking a total-systems approach.

Question 6 **Can MPA share the technical data or operational profiles of the existing fleet of harbour craft?**

Answer There are about 400 smaller harbour craft (about 25% of the population) that share common parameters suitable for aggregation as specified in clause 3.3.

Interested Participants are encouraged to work together with end-users (e.g. harbour craft operators) to ensure that the proposed e-HC is able to meet or exceed the technical and operational requirements of the end-user.

Question 7 **Is there a critical requirement for the e-HC to meet the operational profiles specified in clause 3.4?**

Answer The e-HC should meet the operational profiles, or equivalent performance, specified in clause 3.4. This would allow harbour craft operators meet current operational requirements without disrupting routine operations.

Alternatives to battery charging (e.g. battery replacement, battery swapping) may also be considered to minimise disruption to the routine operations of the harbour craft.

Question 8 **What is the expectation for Proposals to be able to meet all the requirements as specified in Section 3 – *Overview of Requirements* of the EOI?**

An EOI is intended as a sourcing method to solicit e-HC designs, with a possibility to further work with selected interested parties to refine e-HC designs. As such, at this stage, proposals are intended to be non-binding where Participants share their design capabilities with MPA.

Participants are invited to submit Proposals best suited to the needs of the harbour craft sector. The submission should be as detailed as possible to better enable MPA to evaluate the Proposals fairly on the basis of the merits of each Proposal.

Question 9 **What is the key focus for the design of the e-HC?**

The EOI seeks to solicit best-in-class e-HC design(s), optimised using total-systems approach, that is suited for operations in the Port of Singapore. The electrification of vessels will require some fundamental design changes to incorporate energy storage system, electrical propulsion and hull design.

EOI Participants would need to consider the operation profile of the craft, the power requirements and needs of the energy storage and management systems, and manage the trade-offs between battery weight and craft endurance. Thus, it would be important to consider how aspects of weight reduction, hull efficiency, energy density, and maintainability can be enhanced through innovative technologies (e.g. additive manufacturing) and design thinking. This differs from the design for conventional /non-full-electric harbour craft.

Charging infrastructure

Question 10 **What are the requirements of the e-HC for standardised and interoperable charging systems?**

Answer MPA is currently working with the industry, academia, and relevant government organisations to develop a Technical Reference (TR) for e-harbour craft charging systems, which aims to standardise the charging systems to ensure safe operation and interoperability.

The charging requirements of the e-HC should be developed flexibly to respond to the upcoming TR.

Question 11 **What are MPA's plans to develop the necessary charging system infrastructure to support the e-HC?**

Complementing the transition to e-HC, MPA is also developing a charging infrastructure masterplan. MPA is currently working with research institutes, such as the Singapore Maritime Institute and A*STAR, to assess the suitability of charging sites, demand drivers and power requirements to support e-HC operations in the Port of Singapore.

MPA will also be launching a Call for Proposal in the second half of 2023 to pilot charging stations for e-HC at public landing facilities, such as Marina South Pier. Feedback from harbour craft users and lessons learnt will contribute towards the development of the masterplan for implementation in tandem with e-HC adoption.

Evaluation of the EOI

Question 12 Does the consortium leader need to be a Singapore-registered company? Does the consortium need to comprise only Singapore-registered companies?

Answer Project teams will be assessed based on their proven track record, having proven ability to build up local capabilities to commercialise e-HC will be most preferred.

Question 13 What are MPA's plans after receiving the Proposals?

Answer MPA will assess the feasibility of (1) designing and developing best-in-class e-HC according to reference designs, engineered according to common design principles; and (2) scalable viable business models based on an aggregated harbour craft fleet with financing and insuring solutions.

MPA also plans to release a separate EOI to call for information or proposals from financial institutions and marine insurers to support the outcomes of the Project.

Depending on the quality of submitted proposals when the EOI closes on 15 Sep 2023, MPA may either (i) launch a Request for Proposal (RFP); or (ii) approach EOI participant(s) directly, to refine the e-HC design for implementation.

After the EOI, subsequent e-HC design submissions, can be reviewed according to the framework established through this EOI.

Question 14 How does MPA plan to handle commercially sensitive information?

Answer

MPA will only share information submitted by Participants in the EOI with the evaluation panel, for the purpose of assessing the Participant's Proposal. The evaluation panel will be chaired by MPA and consist of members from the academic and industry association with the necessary expertise. Members of the evaluation panel outside of MPA may be required to sign a non-disclosure agreement (NDA) to safeguard the protection of information.

Where any part of the submission is marked as confidential, MPA will seek the consensus of the Participant (consortia) to share the material with the evaluation committee or other intended recipients of the information.

Question 15 **What role does MPA envisage for industry projects on electrification of harbour craft to play with regards to this EOI?**

The EOI will add to e-HC engineering knowledge and local capabilities developed by the joint industry-research consortiums, for example Seatrium Consortium and 'Goal Zero' Consortium, supported by MPA and the Singapore Maritime Institute (SMI), and other industry-led ones, for example, the Coastal Sustainability Alliance (CSA) and Shell's electric ferries which are designed, built, owned, and operated by Penguin.

Today, the development of e-HC in Singapore has gained more traction within the industry. Thus, the EOI serves a different aim, to assess and validate proposals for best-in-class e-HC designs with proven and commercially available technologies.

The designs obtained through this EOI will also allow MPA to gain the necessary technical experiences and knowledge to develop a set of e-HC design guidelines, to support the mandatory design submission for MPA's review in 2027. These would include design requirements for vessel structure that is optimised for efficiency, integrated battery management and energy storage systems, and essential safety systems, which include emergency back-up, cybersecurity, and firefighting capabilities.

Besides the technical development of e-HC, ongoingdevelopment in green financing for the maritime sector, in particularly for harbour craft, can be further catalysed through this EOI. The EOI could also spur an industry-wide review in the business model of harbour craft operations, which could potentially transform the harbour craft sector.

These existing consortiums are welcomed to participate in the EOI, subject to their compliance with its requirements.

Question 16 How does MPA aim to ensure that an environment of innovation and competition can continue to be stimulated through this EOI?

MPA seeks to work with multiple partners to ensure that the market remains innovative and competitive. Monopolies and anti-competition mechanisms would not be considered, as MPA seeks to ensure an open and fair market.

The EOI allows MPA to collaborate with the industry to design and develop e-HCs suitable for operations in the Port of Singapore, with the aim to develop a set of design guidelines for e-HCs. These guidelines will seek to achieve some levels of standardisation, following common design principles, to facilitate interoperability, without limiting or precluding innovative and novel designs. The guidelines seek to ensure a baseline design, whilst the industry are free to further “add-on” to the design to suit their concept of operations. This also ensures that the design of the e-HC is futureproofed to adopt future technology upgrades and avoid asset stranding.

MPA will also consider future onboarding of designs based on the design framework established through this EOI

Annex A

Industry Briefing on EOI to Design & Develop Electric Harbour Craft (e-HC)

31 Jul 2023

Objectives of the EOI

- From 2030, all new harbour craft operating in our port waters can choose one or more of these pathways – be fully electric, be capable of using B100 biofuels, or be compatible with net-zero fuels such as hydrogen
  - Craft designs must be approved by MPA from 2027 according to reference designs and safety standards
  - The EOI allows MPA to work closely with industry to develop and refine such policies and regulations for future electric harbour craft (e-HC)

- MPA will partner the research community (Maritime Centre of Excellences) and industry associations to work with identified partners
  - (i) industry (i.e. harbour craft owners/ operators, manufacturers, etc.) to enhance the design of the harbour craft
  - (ii) financial institutions to identify ways to lower the cost of adoption and mobilise support, such as financing/ insurance solutions

- The Project grants access to Participants to collaborate with key domain experts, including Classification Societies, and MPA Port and Flag States

Key desired outcomes of the EOI

- Design and develop a reference point for a national design-approved e-HC design, standards, and guidelines
    - Adopts key design principles and parameters, taking into consideration efficient and optimised design specifications, robust operational performance, safety of operation, and affordability
    - Fit for purpose for an aggregated fleet of harbour craft
- Share the outcomes of the Project at various national and international platforms (e.g. IMO and/or the International Electrotechnical Commission (IEC)) with a view to internationalise the national reference e-HC designs

Overview of requirements – targeted demographic

- The EOI primarily focuses on designing e-HC that will replace a large proportion of conventional harbour craft that are frontrunners for full-electrification and share common parameters suitable for aggregation

Combined shaft power
200 – 400kW

Overall length
10 – 20m

Gross tonnage
20 – 40 GT

- The Participant may propose the following types of e-HC within the targeted demographics (elaborated above), meeting current operational requirements without disruption* to routine operations:

Targeted Demographic

Type I Craft

Maximum of 12 passengers at 15 knots for 6 hours, or equivalent performance

Type II Craft

Fully-laden dry/ packaged cargo and/or other purposes (e.g. survey, salvage, garbage collection) at 12 knots for 8 hours, or equivalent performance

[OPTIONAL] Alternative types of Harbour Craft

Tanker

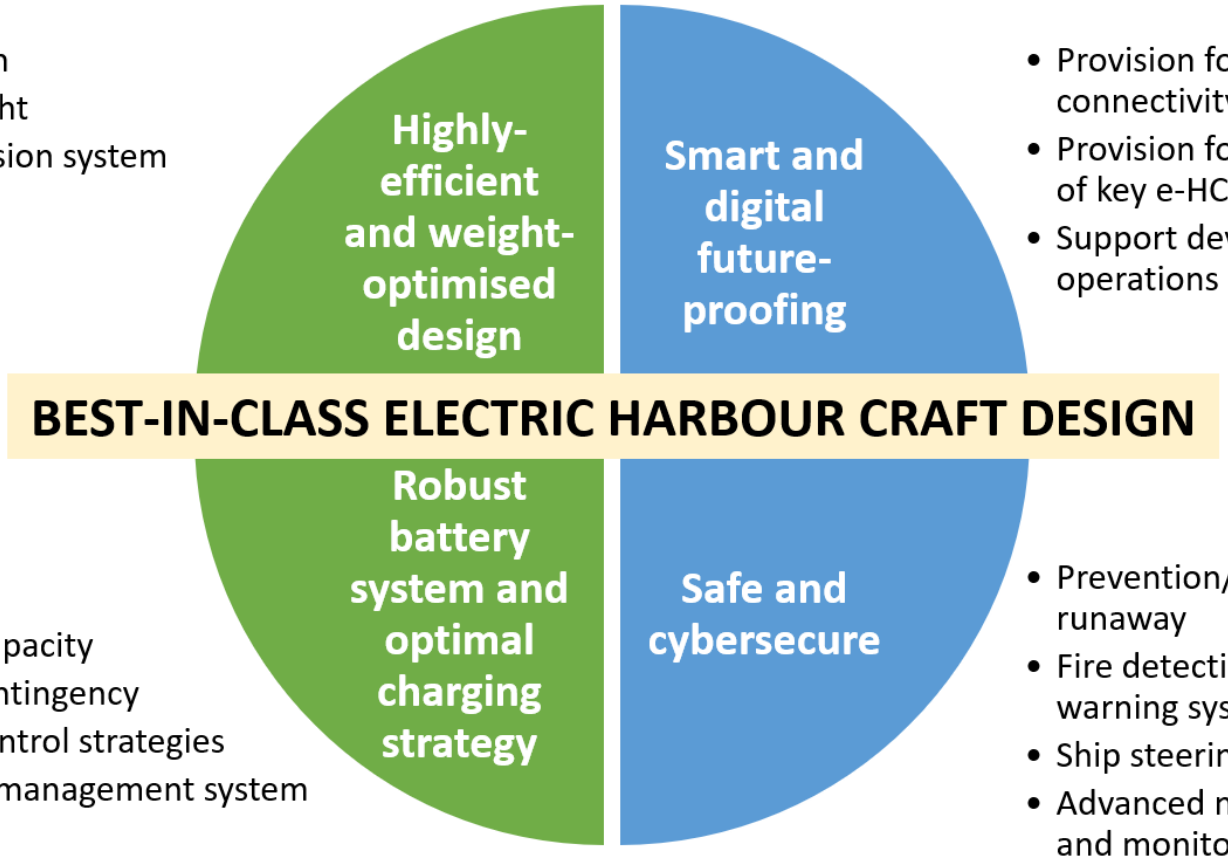
Tugboat

Larger Harbour Craft

*may consider alternatives to battery charging (e.g. battery replacement, battery swapping) which would minimise disruption to the routine operations of the harbour craft

Overview of requirements – design

- Hull form design
- Optimised weight
- Efficient propulsion system
- Lower manning



- Provision for communications and connectivity capabilities
- Provision for data storage and transmission of key e-HC systems
- Support development of autonomous operations

- Sufficient energy capacity
- "Back-to-shore" contingency
- Battery charging control strategies
- Regulated e-waste management system

- Prevention/ management of thermal runaway
- Fire detection and monitoring, early warning systems and firefighting systems
- Ship steering and manoeuvrability
- Advanced navigational equipment and monitoring
- Cybersecurity

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Overview of requirements – economic viability

Total cost of ownership (TCO)

Calculated over its estimated lifecycle, assuming 20, 25, and 30 years of operations

Capital costs for the design, build, testing, and delivery of one fully-equipped and outfitted unit(s) of e-HC

- Due consideration for value-engineering
- Similar financial breakdown and projections for multiple units of e-HC with aggregated demand (e.g. 20, 50, 100 units) clearly indicating capacity and cost projections at different stages of the scale-up

Financial breakdown and projections related to operational costs

- Covers the lifecycle of the e-HC (i.e. hull, propulsion system, battery management system, and electrical equipment, etc.)
- Insurance, consumables (e.g. cost of electricity), maintenance*, repair, overhaul, disposal costs, residual value (including battery recycling, etc.
- Lifespan of the battery taken into consideration, assuming 5, 10, and 15 years of operations

*Specify the scope of preventive and scheduled maintenance requirements and frequency for the harbour craft outboard, propulsion system, energy storage system and battery management system, and electrical components, etc

Overview of requirements – summary of key requirements

- Participants are required to design an e-HC optimised using a total systems approach

- Participants are required to provide MPA with technical and operational information to validate their Proposals by demonstrating that the proposed e-HC design is able to meet these requirements
  - This includes engineering, technical, design/ schematics/ drawings, calculations, and modelling, where applicable

- Participants are required to propose requirements for crew training including, not limited to:
  - Required enhancements to existing Certificate of Competency (COC) courses
  - Battery management and safety
  - Fire safety and training
  - Maintenance regime

- Proposals received after 15 Sep 2023 will not be considered

Overview of requirements – optional requirements for proposing viable business model and financing/ insurance solutions to lower cost of adoption

- To further encourage the wider-scale adoption of e-HC by the sector, Participants may include preliminary considerations of the following components to better ascertain cost parameters and corresponding financial structures
    - Demonstrate or propose a scalable and viable business model (e.g. via orderbook, commitments from prospective buyers, bulk pricing, or otherwise) that would be able to meet various operation profiles, thus consolidating demand for services
        - Maximise cargo/ passenger deliveries that can be performed per unit vessel and/or time
    - Illustrate concepts of potential ownership models and financing/ insurance solutions to encourage industry adoption of e-HC on a commercially viable basis
        - Competitive financing solutions to lower financial barriers for the adoption of e-HCs
        - Insurance solutions to manage financial risks of operating e-HCs
- MPA plans to release a separate EOI to call for information or proposals from financial institutions and marine insurers to support the outcomes of the Project

Overview of assessment

MAIN component

Section 1 – Electric harbour craft design

Highly efficient & weight optimised

Low hull resistance

Lightweight construction

Optimal ship dimensions

High structural strength

Efficient propulsion

Renewable energy source

Optimal battery system & charging strategy

Optimised capacity

Smart battery management systems – intelligent decision-making capabilities

"back-to-shore" capability

Smart, digital future-proofing & cybersecurity

Support development of autonomous operations,

Provision for data exchanges and data storage and transmission

Training and manpower development

Requirements for crew training:

Enhancements to COC; battery management and fire safety; maintenance regime

Safety

Fire fighting and containment system – thermal runway protection, early warning, detection systems, response

Ship safety and design (access and escape)

Ship manoeuvrability, navigational safety features

Section 2 – Overall feasibility of Project

TCO (20/25/30 operational years)

Capital costs for design, build, testing, and delivery for multiple units of e-HC with aggregated demand (e.g. 1, 20, 50, 100 units); operational costs (insurance, consumables, maintenance, repair, overhaul, disposal costs, residual value, etc.)

Received support from end-users (local operators) (e.g. LOIs/ MOUs)

Local value creation and capture

Value-adding activities in Singapore (e.g. manufacturing of key components), local capability development (e.g. hiring, local partnerships), deployment plan

Capability and track record

Track record of company(s) and project team

OPTIONAL component

Section 3 – Lowering cost of adoption

Business/ operating model

Consolidates demand for services, maximise cargo/ passenger deliveries performed per unit vessel and/or time,

Higher utilisation of fleet, smaller fleet size

Financing/ insurance solutions

Competitive financing solutions to lower financial barriers for the adoption of e-HCs

Insurance solutions to manage financial risks of operating e-HCs

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Questions and answers