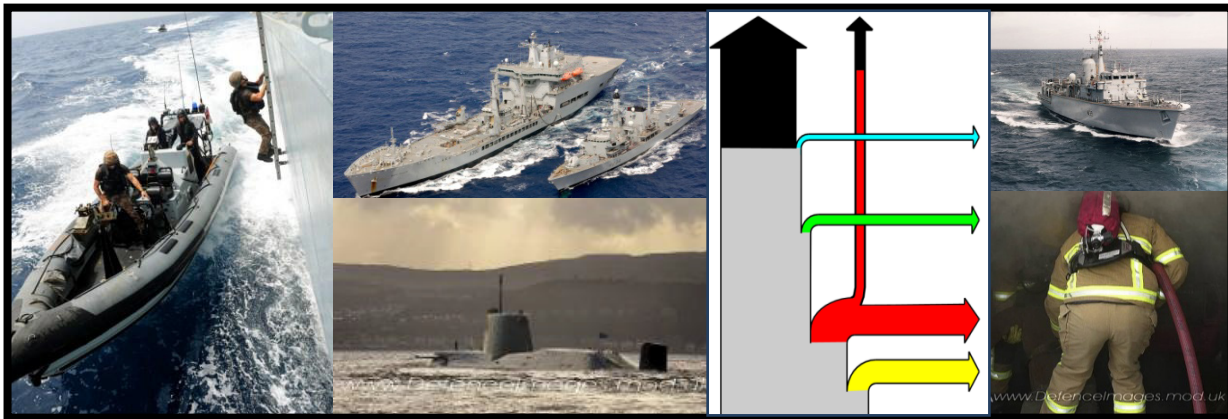




Maritime Platform Efficiency & Sustainability

Call Release Date: 26 January 2012

Call Closes: 13 March 2012 (at 1200 noon)



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Proposals for funding should be submitted by **1200 noon on 13th March 2012** using the Centre for Defence Enterprise Portal (www.science.mod.uk/enterprise). All proposals should be clearly marked "**MPSE Challenge #**" as a prefix in the title and include which challenge number, as described in this document, they are aimed at addressing.

- Queries on **technical aspects** of the call should be sent to dstlmaritimeinnovation@dstl.gov.uk.
- All questions relating to the **submission process** (including how to use the Portal) should be sent directly to the CDE at science-enterprise@mod.uk or by phone on 01235 438445.

www.science.mod.uk

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Maritime Platform Efficiency & Sustainability

This call for proposals is addressing the need for greater efficiency and sustainability to ensure continued global reach and freedom of operation of maritime platforms in the face of increasing platform requirements and energy consumption.

Introduction

As a maritime nation, the UK's economic prosperity depends on seaborne trade.

- 95% of UK trade by volume (580 million tonnes) is transported by sea.
- UK based shipping contributes £10 bn a year to GDP.
- 95% of global maritime trade passes through just nine chokepoints which are inevitably vulnerable to attack.

It is therefore essential that UK Armed Forces are capable of delivering a range of maritime effects worldwide at varying scale in support of joint operations and our strategic interests. In order to continue to deliver these effects with security and persistence, the efficiency of all sizes and classes of maritime platforms must be addressed to meet the challenges of increasing pressure on the environment and the long term availability of fossil fuels.

The UK has world-class ships and submarines that protect our national interests around the world despite ever smaller numbers of platforms. However, these vessels were never designed with the major emphasis on fuel or energy efficiency that is now needed; other performance requirements generally took precedence. Efficiency and sustainability may have limited priority in war fighting but future maritime platforms will be increasingly affected by the need for the UK Ministry of Defence to make a contribution to cross government energy targets set for 2020 & 2030 and ensure that the UK's Armed Forces are cost effective.

The Royal Navy is faced with the added challenge of delivering greater efficiency and sustainability when most of the fleet that will be in service in the near future is already built, or in the final stages of design and build, and cannot incorporate major changes that would compromise future naval capability. Much further ahead, the challenge for future ships and submarines is to deliver this capability with smaller and cheaper platforms which will demand ever smaller and more efficient systems throughout the platform.

This document provides an overview of the priorities for maritime platform efficiency and sustainability. It highlights the technical challenges and areas of interest as they relate to this call.

Scope

Platform efficiency and sustainability is one of the most difficult problems that the maritime Science & Technology programme has been charged with delivering.

Proposals are invited that offer new solutions to substantially improve the efficiency and sustainability of maritime platforms; such solutions need to be both effective and affordable and balance their cost against their benefits. Technologies for system efficiency (and sustainability) are widespread outside the defence maritime industry; solutions are welcomed from all sectors but there is an expectation that expertly exploited technology from other industries could be applied to these problems.

It is expected that solutions can be found among innovative technologies that will

- reduce the demands and wasted energy of maritime platforms;
- reduce through life operating costs;
- reduce impact on the environment, support regulatory compliance or meet government obligations.

The scope of this call for proposals covers warships and submarines, which must operate over all of the world's oceans, frigates and other maritime craft; this includes unmanned maritime systems.

This call is supported by presentations given at the launch seminar on 26 January 2012 and which are available to download at http://www.science.mod.uk/events/event_detail.aspx?eventid=156.

Overview of Technical Challenges

This call is for proposals from all sectors that can demonstrate the technology and new solutions needed to increase the efficiency and sustainability of all maritime platforms. Proposals must address the priorities and constraints that have been defined for maritime platforms such as **system efficiency through life** and packaging of concepts. Solutions must be affordable and proposals should anticipate how the proposed changes can be readily adopted by the platform without major redesign which would otherwise negate any cost benefits.

For the purposes of this call, three parts, covering six technical challenges, are highlighted below. Some parts are more or less relevant to individual platforms, such as warships or small surface craft, but the call covers all maritime platforms including unmanned systems. Proposals do not have to address all challenges and can address just one.

Part 1 – Heat Management

Current platforms present two significant challenges in the way they manage the heat that is generated during operations: how the heat is used and how the heat is dissipated. Currently, there is far too much waste heat generated on ships and submarines. The goal is to ensure both humans and equipment systems operate at normal working room temperatures and that energy is used efficiently without adversely affecting system efficiency.

Challenge 1 – Recover (and re-use) waste heat that is generated

A large percentage of the energy derived from fuel is lost to waste heat in the engines of maritime platforms; classic Carnot cycle engines lost between 60% and 65% of energy as heat. Complex cycle gas turbines have been tried with limited success; most platforms will continue to use diesels and normal gas turbines. The challenge is to recover as much waste heat energy as possible and convert it into useful electrical energy; this could be in the form of energy that is stored or recycled.

Some earlier attempts to recover waste heat considered steam generators but these proved unsuitable, fragile, complex, and added to demands on crew workload. Future platforms, in particular, are demanding that technologies are simplified to reduce the demands and specialism of tasks that need to be performed and allow manning levels to be reduced.

Technology and new solutions are needed to recover and re-use waste heat but should consider the constraints:

- Ships and submarines operate over a very variable speed regime and cannot guarantee to provide a steady thermal or energy state
- The additional system must not introduce hazards to the platform through mechanisms such as shock
- There is limited space in funnels and exhausts of warships
- Mass and volume savings need to be made on submarines

Priority will be given to solutions which are compatible with platform operation and installation without compromising the fighting characteristics or the maintenance workload of the crew; solutions should be easy to fit and low maintenance.

Challenge 2 – Cool (and treat) waste heat that is generated but not re-used

Far too much energy is spent on the air conditioning and cooling of ships and submarines. The challenge is to deliver air treatment energy efficiency or thermal management systems for warships and frigates which are based on the best “green building” practices, to reduce the “hotel” load and improve the true energy efficiency of the whole platform. The challenge for submarines is to develop smaller (lower volume) systems with appropriate signature (acoustic, thermal, electro-magnetic) management.

Technology and new solutions are needed to cool the waste heat that is generated but should consider the constraints:

- Warships work from the hottest parts of the Gulf to some of the coldest waters in the Arctic and Antarctic; effective systems must work in all these conditions
- It is necessary to be able to operate warships atmospherically closed down with only minimal refreshment of air through chemical and biologically filtered intakes
- Under battle damaged conditions the materials used in systems must not present fire or toxicity hazards
- Platform signatures should, ideally, be improved, or at least not affected adversely, by any new systems or changes to the platform; submarines must stay quiet

Priority will be given to new technologies and systems that offer new and retro fit opportunity and increase the total energy efficiency of the platform.

Part 2 – Platform Propulsion

Most of the ships and submarines in service for the next 20 years are already built or in the final stages of design and build, but efficiency has not been one of the key criteria originally considered in the design of platform propulsion. With fuel consumption becoming increasingly significant, together with the lack of opportunities to change hulls or prime movers, the demands for efficiency savings must be met from other areas.

Challenge 3 – Increase the efficiency of propulsion systems

In the absence of major changes to maritime platforms, some of the greatest opportunities lie in a few percent gain in propulsive efficiency. The commercial world is increasingly turning to efficiency derived from retro fit options such as propeller bosses, propeller intake flow modifications, and twisted rudders. The challenge is to develop solutions delivering propulsive efficiency gains that can be maintained across a wide speed and power range.

Technology is needed to maximise propulsive efficiency but should consider the constraints:

- Ships and submarines operate over a range of speeds and need to be efficient at all speeds
- Changes should not compromise the performance of noise quietened propellers
- Dry docking periods are expensive and consume valuable ship availability, installation modifications should limit the extent of the modifications to avoid costs
- The operating authority will be very risk averse due to the critical nature of warship availability; ships are not going to be used as experimental test beds for radical ideas with a significant risk of failure
- Submarines need propulsion systems that have greater power density

Priority will be given to technologies and approaches which can convincingly demonstrate their effectiveness and reliability prior to installation on maritime platforms.

Challenge 4 – Increase the power and efficiency of outdrive systems

Small fast boats play an increasingly important role in Maritime Interdiction Operations where potential threat vessels require boarding. These craft are required to possess outright speed as well as acceleration and manoeuvrability alongside target ships; petrol powered outboard motors are currently the propulsors of choice. The Royal Navy is seeking to move away from dependence on petrol burning outboards as part of increasing safety onboard host platforms, and a fuel standardisation (on diesel) policy. This means future fast craft need to obtain a similar performance from diesel engine boats to current petrol engine craft. In addition future fast craft are growing in size to accommodate whole body shock and vibration mitigation measures.

Commercial diesel engines are developing rapidly in their power outputs. However, for powers in excess of 450 kW, or torques above 1200 N-m, there are not yet suitable drives to put the power into

the water. The challenge is to develop such outdrive systems that can deliver the output of the available high performance engine into the water.

Technology is needed to increase the power and efficiency of outdrive systems but should consider the constraints:

- Standard commercial solutions of waterjets or surface piercing drives are not acceptable due to their poor performance in the disturbed wake of the target craft
- Solutions must fit into twin installation in lightweight RIBs or rigid hull interceptors in the 11 m to 12 m regime

Priority will be given to technologies and approaches which deliver working units compatible with installations in craft that are growing in size and power and efficiency demands.

Part 3 – Novel Platform Efficiency & Sustainability

The principle for greater platform efficiency in Parts 1 & 2 has been to target specific areas where it is known that there are potential solutions that could be adapted to military needs. The next step is to look for novel solutions and approaches to support improvement elsewhere in the platform.

One of the goals is to develop technologies that can enable smaller (and cheaper) platforms which, in turn, demands an understanding of system efficiency, and efficiency through life, so that appropriate systems can be designed in to tomorrow's ships and submarines.

Challenge 5 – Novel solutions to increase the efficiency of maritime platforms

The requirements described above, for heat management and platform propulsion, may also be addressed through the introduction of novel solutions, and other measures that can address the target to increase efficiency. This should include all platform needs for reducing the heat load, managing heat, and increasing platform propulsion but extends to items such as low friction coatings and low wear coatings that can increase component life.

In very cash constrained times it must be accepted that solutions which require major new ship procurement programmes such as replacing part of the fleet are unlikely to be helpful or successful.

Solutions that do not address compatibility with military operations are unlikely to be successful.

Challenge 6 – Novel solutions to maximise system efficiency through life

The in-service efficiency of maritime platforms may also be addressed through the introduction of novel approaches (or methodologies) that can maximise system efficiency through life or modularity that can enable platform capability to be maintained. This should include all platforms and consideration of how systems, addressing targets for heat recovery, feedback, and variable speed drives, should be designed for maximum efficiency.

Solutions that do not address key issues that impact on through life efficiency are unlikely to be successful. The payback period on capital investments necessary to accomplish these changes needs to be fairly short. When comparing to commercial practice it must be accepted that the loss of availability of any platform during refit periods is very significant and the substitution of another craft could prove extortionately expensive.

What we want

We want proposals that will demonstrate or de-risk the exploitation of existing/emerging technologies and/or provide new solutions to increase the efficiency, and reduce the waste and demands of maritime platforms. The call is not limited to emerging technology and should consider optimising combinations of innovative, but existing, technology.

Technology for heat management and system efficiency are widespread outside the defence maritime industry and it is expected that solutions developed for other industry and other sectors could be transferred to this set of technical challenges. Proposals are welcomed from all sectors but in particular from outside traditional defence suppliers.

We want solutions that address packaging in maritime platforms. In particular, proposals are welcomed which will address the de-risking of installations with minimal demands on the time and availability of much utilised equipment and assets.

Solutions should address the priorities and constraints that have been defined in this document. Global constraints that need to be considered include the survivability and signature requirements of the platform together with the mass and volume of the system.

What we don't want

We do not want maritime or land based solutions that do not address the problems of installation in a platform e.g. shock, power density, hazard, signature.

We do not expect to be offered ordinary solutions, or technology that is known to have already been considered and found to have limited capability; we expect the very best solutions in industry and academia that offer high performance and efficiency.

We do not want solutions that are not affordable (e.g. expensive redesign or entirely new platforms) or not compatible with low maintenance and low volume.

A short summary (1 or 2 paragraphs at most) of intended proposals can be sent to the technical query email as a check on previously conducted work or whether the proposal falls within an area of interest. **Please note that submitting such a query will generate a short factual response (essentially yes / no) and will not provide narrative or detailed comment on the proposal.**

Invitation for CDE Proposals

Proposals are invited from industry and academia for research that can demonstrate (in approximately 100 days) a proof-of-concept to meet one or more of the challenges for “Maritime Platform Efficiency & Sustainability”.

There is no cap on the value of proposals but it is more likely that at this stage a larger number of lower value proposals (e.g. £30k—£90k) will be funded than a small number of higher value proposals.

No funding is offered as part of this call for activity beyond the proof-of-concept stage. Promising concepts **may** be taken forward for assessment, developed to Technology Readiness Level (TRL) 5/6¹, and demonstrated in 2013/2014 but Dstl does not commit to fund any follow-on work as a result of any contract placed via CDE.

Proposals must include:

- A clear description of what is novel in the solution
- A clear statement of the programme of work that would be carried out and the outputs (deliverable) from the work
- A clear statement of the expected outcome(s) and how this will be proven or demonstrated.
- A clear description of the value of the solution to operational capability including the likely saving to though life costs
- A clear statement of what type of platform the solution is aimed towards
- A statement on the anticipated practicability of adopting the proposed technique in a maritime platform

Proposals that do not include the required information are unlikely to be successful.

Proposals should focus on a short, sharp proof of concept phase of approximately 100 days. Proposals may scope a longer programme matched to the potential assessment and demonstration phase mentioned above, but these will not be funded as part of an initial contract. The proposals in response to this call should be primarily concerned with this call and have a clear, distinct and costed proof-of-concept stage that addresses the focus of this call. Further development of successful proposals will only be considered after the successful end of the proof-of-concept phase. In

¹ Technology Readiness Levels (TRL) are defined at http://esto.nasa.gov/files/TRL_definitions.pdf.

particular, remember that this initial proof of concept stage should be used to work up a detailed understanding of the solution and the outputs needed to provide sufficient information and evidence to support the advantage to maritime platform efficiency. Dstl does not commit to fund any follow on work as a result of any contracts placed via this CDE call.

Proposals will be assessed by subject matter experts from MOD and Dstl using the MOD [Performance Assessment Framework \(PAF\)](#) (available from the CDE website). Deliverables from contracts will be made available to technical advisors and subject to review by UK MOD.

Dstl will be available to provide advice and/or guidance throughout the project and provide the interface with the MOD and wider government stakeholder community.

CDE Proposal Submission Process

Key Dates

- 26 January 2012 Call launch event in Southampton
- 13 March 2012 Call closes at 1200hrs (noon)
- mid May 2012 Feedback provided, contract placement initiated.

Proposals must be submitted by **1200 noon on 13th March 2012**, via the Centre for Defence Enterprise Portal www.science.mod.uk/engagement/the_portal.aspx . The portal runs using an account system; if you do not yet have an account please ensure that open one as soon as practical.

All proposals should be clearly marked “**Maritime Platform Efficiency Challenge #**” as a prefix in the title and include which challenge number, as described in this document, they are aimed at addressing.

Further information, including presentations from the launch event, is available on the call webpage (www.science.mod.uk/events/event_detail.aspx?eventid=156).

Please plan the timeline for submitting your proposal carefully. If you have not used the CDE Portal before you will need to become familiar with the guidance, including how to open an account starting with the [Quick Start Guide](#) (available on the CDE website or click to open as a new pdf).

Other information and guides are available on the CDE website:

- General CDE Advice: www.science.mod.uk/engagement/cde/working_with_cde.aspx
- Contract & IPR Guidance: www.science.mod.uk/engagement/cde/funding_contracts.aspx
- On using the Portal: www.science.mod.uk/engagement/the_portal.aspx. The Portal is optimised for proposals based on physical sciences and engineering and we are aware that

proposers sometimes struggle to adapt to using it with social science based proposals. The key points (rather than the detailed questions) that are sought under the main headings still apply and further advice can be obtained from CDE.

Common errors in preparing and submitting a proposal include:

- **Character limit** – there is a limit of 1000 characters in the descriptive paragraphs of the proposal which when completed must be added to the document; additional paragraphs can be added if 1000 characters is insufficient.
- **It is a web based tool** – please save your work regularly to avoid ‘time-outs’ that lose work.
- **Attachments fail** – they must be Word 97-2003 format, portrait format, should have generous margins with no material overhanging the margin and a max size of 1 Mb. Please note that attachments should only be used for supplementary information, the main points of your proposal should be written into the online form. Care should also be taken to make sure that attachments are placed in the relevant section (e.g. technical information should not be attached to the commercial section).
- **Failing to properly submit** - **publish is not the same as submit**. You have **not** completed the submission process if your proposal is at the FINAL / PUBLISHED stage (in the status and published status columns respectively); CDE have no sight of the proposal at this stage. To complete submission you need to press ‘submit’ under the ‘Tasks’ column. This changes the status of your proposal to ‘SUBMITTED’; it will then change (normally after a few days, often sooner) to ‘RECEIVED’ indicating that the proposal has been accepted by CDE for assessment.

For a proposal to be accepted for assessment:

- The standard terms and conditions of the CDE must be unequivocally accepted.
- There must be at least one deliverable against which payment can be made.
- The commercial section of the proposal must be completed.

Please do not leave submission of your proposal until the last morning before the deadline. Past experience has shown that the Portal becomes heavily loaded near the call close resulting in slow operation (up to 1 hour to publish rather than a few minutes) and that with the pressure of the deadline, mistakes are made that mean proposals are not submitted or accepted. Proposals that are received after the deadline will not be included in the call but will be submitted into the CDE Open Call process automatically.

Queries and Help

As part of the proposal preparation process, queries and clarifications are welcomed.

- Queries on **technical aspects** of the call should be sent to dstlmaritimeinnovation@dstl.gov.uk.
- All questions relating to the **submission process** (including how to use the Portal) should be sent directly to the CDE at science-enterprise@mod.uk or by phone on 01235 438445.

An Invitation To Broader Engagement

You may submit a general expression of interest instead of (or as well as) a CDE proposal. You are also welcome to submit a proposal to the CDE open call on any topic that has been defined as a priority for the Maritime Research Agenda (*technical challenges that address some of the maritime research priorities were included in the launch presentations on 26 January 2012 and can be downloaded at http://www.science.mod.uk/events/event_detail.aspx?eventid=164*).

Expressions of interest, other than CDE proposals, can be sent directly to dstlmaritimeinnovation@dstl.gov.uk.

Note that an Expression of Interest is also a means by which you can register an interest in supporting the Maritime Research Agenda in the future even though you are not requesting funding under a call for proposals.