

# Market exploration: air platform energy management technologies

## **Background**

This market exploration is intended to gather information in order that Team Tempest can understand the market capability to provide power and thermal management technical capability for advanced air platforms. This is intended to inform the scope of a potential future competition or procurement activity. However, we cannot commit to a DASA competition or procurement at this stage and therefore we are not asking for costed proposals. This market exploration is unique to previous calls in that it also offers the option to engage with Team Tempest industry partners in addition to UK Government.

## **Introduction to Team Tempest and the Future Combat Air System Technology Initiative**

Team Tempest is a UK Ministry of Defence (MOD) and UK industry co-funded technology initiative to develop a sixth-generation fighter aircraft through a partnership approach. Launched by the RAF Rapid Capabilities Office, as part of the MOD Future Combat Air System Technology Initiative (FCAS TI), it aims to deliver the UK vision to have a globally competitive combat air enterprise.

Team Tempest is delivering parts of FCAS TI and comprises a portfolio of activities which will keep the UK at the forefront of global combat air technology development. The technology initiative will help to ensure that UK industry maintains the technological competence necessary to retain military freedom of action and be able to play a lead role in future combat air system development.

It brings together the UK's world leading industry and sovereign capabilities across future combat air's four key technology areas: advanced combat air systems and integration (BAE Systems); advanced power and propulsion systems (Rolls-Royce); advanced sensors, electronics and avionics (Leonardo); and advanced weapon systems (MBDA).

## **The Challenge**

There are technical challenges to producing more advanced air platform power and thermal management systems (PTMS). Drivers for this include:

- Increasing on-board electrical power requirements (due to the introduction of more capable sensors, weapons and increased aircraft electrification) and hence increasing thermal requirements
- The need to operate for extended periods in extreme environmental conditions (particularly challenging scenarios include ground operations

on a hot day and extended duration, and high altitude operations on a cold day)

- Platform integration constraints imposed by signature requirements, such as the need to limit/reduce external inlets and exhausts

As well as developing PTMS that are more capable and efficient, future research should also aim to reduce the mass, volume and whole life cost of these systems, whilst improving reliability.

The scope of this market exploration is not restricted to the design of advanced PTMS. The platform requirements described above may also be addressed through other means, for example, development of air vehicle systems such as actuation systems that place a demand on PTMS.

## What We Want

This market exploration aims to address the challenges presented by the design of PTMS for advanced air platforms by inviting industry and academia to propose emerging/innovative technology research that may be included in future platform-level assessments. PTMS technology themes of interest including:

- Efficient vehicle utility systems: Replacing certain conventional vehicle systems/components with more advanced technologies may yield a power, thermal or mass benefit at a platform level. An example of this would be to replace conventional mechanically driven systems with electrically driven systems.
- Technologies that reduce the amount of heat generated: Reducing the amount of heat generated on-board an aircraft means that less heat needs to be rejected by the thermal management system, which would ultimately result in a smaller, lighter and potentially simpler system. Examples of these technologies include air and magnetic bearings, which have been shown to reduce the amount of heat transferred into the oil system by the engine.
- Energy storage technologies: On-board energy storage devices may be required for short duration, high electrical and thermal power demands. Examples of these devices include structural batteries, super-capacitors, fuel cells and phase-change devices, which will need to be lightweight and suitably sized for any air application.
- Technologies that directly convert energy into other forms: On-board waste heat can potentially be converted into useful electrical power by using thermo-electric devices. Conversely, these devices can also provide cooling capacity by passing an electrical current through them (e.g. Peltier coolers).
- Novel power distribution technologies: These technologies may be able to offer reduced electrical power loss and reduced platform mass compared to conventional electrical cables. Examples of these include fibre optics (photonic power) and super-conducting materials.
- Novel heat transfer technologies: Examples of these technologies include advanced lightweight and compact heat exchanger designs, heat pipes, cold plates and novel heat transfer materials/fluids aimed at achieving

a mass saving at platform level. Also of value is technology that prevents heat transfer, i.e. low volume, lightweight insulation.

- Technologies that increase on-board heat sink capacity: Additional cooling capacity can be achieved (for particularly demanding scenarios) by increasing the amount of heat that is rejected into the fuel system. This can be provided by fuel de-oxygenation technologies for example, where oxygen is removed from the fuel, enabling significantly higher fuel temperatures before fuel instability and coking occur.
- Systems Integration: This theme aims to bring together existing or advanced technologies within novel architectures with the overall goal of improving air platform level energy efficiency and capacity.

Note that this list is not exhaustive but gives a flavour of the types of technologies that are of interest.

The scope of this market exploration is not limited to emerging technologies – innovative solutions incorporating existing technologies are also of interest. Since PTMS are prevalent outside of the Defence aerospace industry, it is anticipated that technologies and solutions developed for other industries/sectors (e.g. automotive, marine and space) may be applicable to this problem space. Submissions are therefore welcomed from all sectors, at any level of maturity, including from outside of Defence industry.

## **What We Don't Want**

Supplied concepts should be targeted with the intent to achieve development to at least [Technology Readiness Level 6](#) in line with planned future air system acquisitions; submissions that detail only basic research without considering their future development potential are unlikely to be of interest.

## **A focus on potential for exploitation and commercialisation**

It is normal for DASA market explorations to have a focus on examining the potential to exploit technology for military capability. This market exploration does that but uniquely also provides the opportunity for those with innovative technology applicable to advanced air platform PTMS that may have value to Tempest and other future air platforms to voluntarily choose to not only enter into a dialogue with MOD but also with the industry members of the team.

As UK competitiveness is a key focus for Team Tempest, we are keen to consider the potential for commercial application of the technologies at an early stage and to examine with industry partners how component innovation could be integrated into future and current systems and, ultimately, into Tempest and other platforms. Through the MOD Team Tempest partnership with industry, this market exploration provides the opportunity for organisations to choose to engage with the Team Tempest industry partners to discuss potential routes for commercialisation of their technologies.

The choice of whether to engage solely with the MOD element of Team Tempest or also with the industry partners is entirely the decision of the organisations responding to this call.

A dashboard of organisational business readiness levels As part of this market exploration DASA will use the data provided by you and publicly sourced data to put together a dashboard of the business readiness level of your organisation to display a simple profile comprising four elements. The profile will not be a ranking or grading of the organisations that respond to this market exploration. The four elements on the dashboard will be: two showing historical performance and two which demonstrate recent trends. We will use the [Beauhurst platform](#) that gathers data from public sources on the UK's fastest growing companies for the historical data. Recent trends will be derived from the data submitted when applying for this call. No raw data, will be displayed on the dashboard.

## **How to submit**

Responses to this market exploration must be submitted via the DASA submission service, for which you will need to register.

You will be asked for a title and short summary of your innovation, followed by questions related to your capability. We are seeking to understand what and how much further development is required for a complete solution to all requirements, or whether a combination of separate solutions is required. The information you provide may assist in developing a statement of requirements for potential future activities.

You have the choice to provide information to the Tempest Industry partners to support the potential for commercialisation of the technologies. Alternatively you can choose to limit your engagement to UK government only. Restricting access of the information you provide to solely MOD will limit the consideration of the commercial potential of your technology.

If you would like to enter into a dialogue with the Team Tempest industry partners, then you have the opportunity to provide an anonymised paragraph that can be released to them.

To enter into a dialogue with the Team Tempest industry partners, the submitting organisation must explicitly indicate their preference in Part 4 of the capability submission form and provide an introductory paragraph describing an organisation's technology. The submission form also provides the opportunity for organisations to select which of the Team Tempest industry partners they wish to have their introductory paragraph shared with. Only an anonymised version of the paragraph you provide and an anonymised business readiness level Dashboard will be provided to the industry partners.

If your technology is of interest to one or more industry partners then this information will be passed on to you along with partner contact details so that you can initiate contact to arrange a discussion exercising good business practices, such as use of non-disclosure agreements. MOD / DASA will not be party to these NDAs and commercial discussions.

Submissions must be submitted by midday on Friday 7 August 2020.

Please only provide details of one product/capability per submission. If you have a number of potential solutions, then please make multiple submissions.

If you have any questions then please email [accelerator@dstl.gov.uk](mailto:accelerator@dstl.gov.uk) with “air platform energy management technologies” in the subject line.

## **How we will use your information**

Information you provide to us, that is not already available to us from other sources, will be handled in-confidence. By submitting, you are giving us permission to keep and use the information internally within DASA, and to provide the information onwards, in-confidence, within UK Government. The Defence and Security Accelerator will not use or disclose the information for any other purpose, without first requesting permission to do so.

Where an organisation gives their consent for engagement with the Team Tempest industry partners, DASA will provide in-confidence to the nominated industry partners an anonymised version of the introductory paragraph at Part 4 of the relevant capability submission form, alongside an anonymised business readiness assessment Dashboard in order that they can identify those organisations that most closely match their engagement profiles.

If an industry partner or partners express an interest in your technical capability DASA will provide you with the requisite contact details in order that you can arrange a discussion. It is advised that any discussions follow good business practice by taking place under a non-disclosure agreement (NDA). MOD will not be party to the NDAs or the commercial discussions.

Organisations that do choose to engage in dialogue with the Team Tempest industry partners should prepare their introductory paragraph with care so as not to inadvertently release valuable intellectual property.

Following initial exposure of information to the Team Tempest industry partners, if an industry partner indicates a desire to engage with the anonymised organisation then that request will be passed by DASA to the relevant organisation to respond. Note that MOD / DASA will not participate in or manage these organisation/Industry engagements beyond the initial introductions.

The Defence and Security Accelerator will not use or disclose the information for any other purpose than that stated above, without first requesting permission to do so.