MCM ITP

Materials & Components for Missiles Innovation & Technology Partnership

MCM ITP TENTH ANNIVERSARY

11 & 12 OCTOBER 2017

LILLE, FRANCE

[dstl]

The UK MOD and French DGA MCM ITP programme brings together the best in British-French Missile Research & Development.

DGA

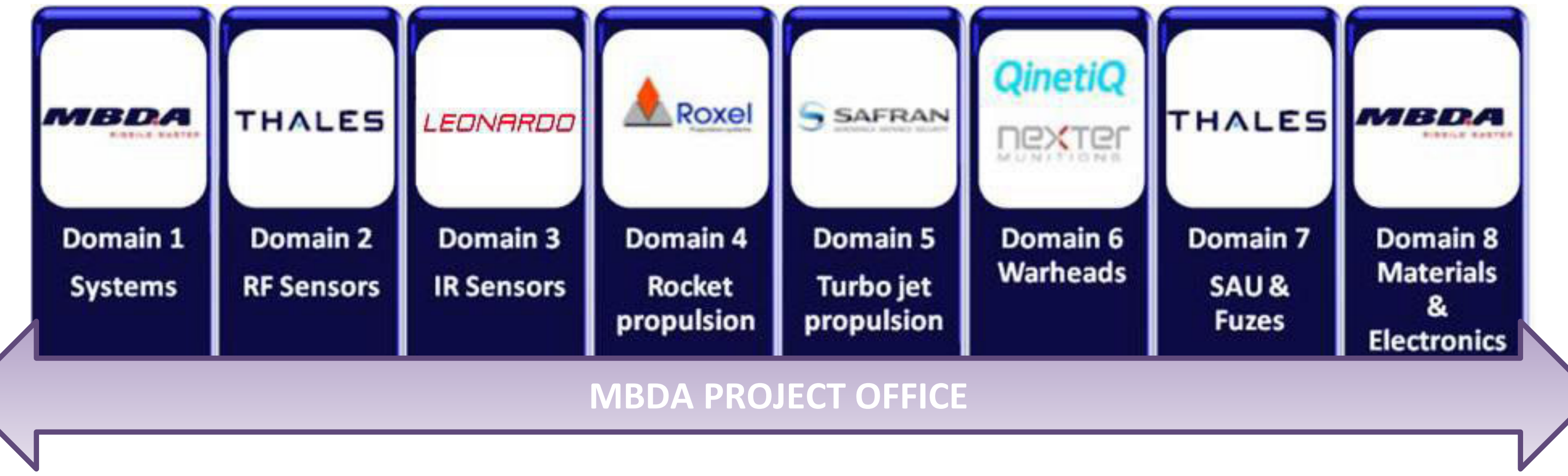
The programme, today…

The Materials and Components for Missiles Innovation and Technology Partnership, MCM ITP, is a dstl and DGA sponsored research fund open to all UK or French companies and academic institutions.

Launched in 2008, the MCM ITP develops novel, exploitable technologies for generation-after-next missile systems.

The MCM ITP aims to consolidate the UK-French Complex Weapons capability, strengthen the technological base and allow better understanding of common future needs. The programme manages a portfolio of over **100 cutting-edge technologies** which hold the promise of major advances, but are still at the laboratory stage today.

The MCM ITP is aligned into **eight technical domains**, each of which is led by one of the MCM ITP industrial consortium partners[1].



[1] *The MCM ITP Industrial Consortium partners are: MBDA; THALES; Roxel; Leonardo; Safran Power Units; QinetiQ; Nexter.*

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And tomorrow...

The MCM ITP programme is laying the foundation for one of the key global challenges, how to deliver advanced and world class military capability at lower cost. Examples of MCM ITP technologies are already finding applications in future product roadmaps.

Ministry of Defence [dstl]	DGA	MBDA MISSILE SYSTEMS
Richard Crabtree Amanda Tucker	Maxime Caillie Thierry Lacoste	Nick Gooch Patrice Raipin (tbc)

Since its inception, the **MCM ITP has conducted over 200 research projects** and, in October 2017, a further 19 projects are being progressed, which will extend the programme to 2019.

There is now an opportunity for new organisations to propose new projects for the programme to start in September 2018, and to present their research at the **next ITP conference which will be in the UK in October 2019.**

The Funding of MCM ITP...

The programme is funded equally by the governments and the industrial partners and is composed of research projects on innovative and exploratory technologies and techniques for future missiles. There is strong participation from SMEs and academia with over **80 participating in the programme** to date, and over **150 organisations involved** in the overall programme.

With an annual budget of up to **13M€** and 30% of the budget targeted towards SMEs and Academia, the MCM has become the cornerstone of future collaborative research and technology demonstration programmes for UK-French missile systems.

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The Conference...

On 11 and 12 October 2017, DGA, dstl, MBDA and its partners will review the last two years of the MCM ITP programme, and present the technical advances that have been made possible thanks to this cooperative programme.

During the two days **in Lille, France, the 270 delegates attending** the conference will have the ability to:

- Understand the future technology requirements in the Complex Weapons sector.
- Find out how to apply for future funding and take part in the MCM ITP programme.
- View the novel, innovative technologies that have been researched within the programme.
- Network with Academia, small and large businesses and meet the decision makers from UK/French Government and industry.

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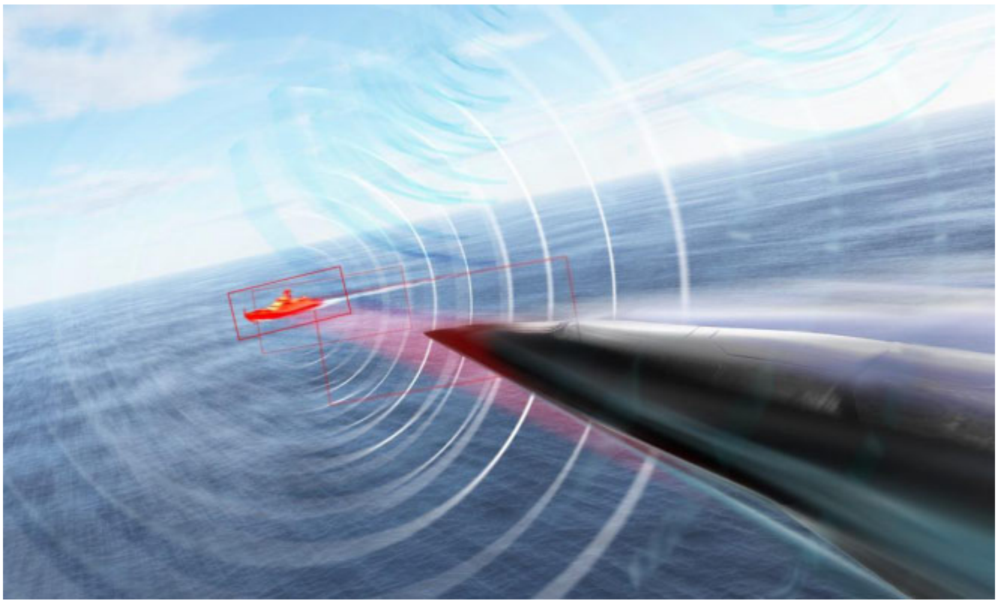
PAMIR II - (PAssive Missile-borne Radar)

The purpose of the PAMIR II study **is to demonstrate the feasibility of using signals of opportunity** in order for a missile to detect and track a naval target.

Here, a bi-static[2] missile receiver compares a direct signal from a transmitter of opportunity and an indirect signal (reflection) from the target in order to localize and track the target. Since the PAMIR II sensor on board the missile is passive in operation, as the missile itself is not required to transmit, it has advantages **associated with both radio-frequency discretion and low cost.**

The approach adopted in PAMIR II makes use of satellite as illuminators, potentially providing near worldwide coverage, and aligns with the significant increase in space based illuminators in recent years.

Bi-static sensor for future anti-ship missiles. It compares emissions from known sources such as satellites with their reflections on surface targets, in order to locate them without the missile revealing its presence by its own emissions. This passive guidance mode allows extremely stealthy strikes with a total surprise effect.



The technical challenges and achievements associated with PAMIR II are related to developing a bi-static radar system concept which works with platform size and volume constraints, platform motion and the bi-static nature of potential engagement geometries.

PAMIR II experiments have proved the feasibility of passive bi-static naval target detection from a moving platform. The next step is to validate functional performance from an airborne platform.

[2] *bi-static is a wording which means that signal transmission and signal reception are not performed at the same place.*

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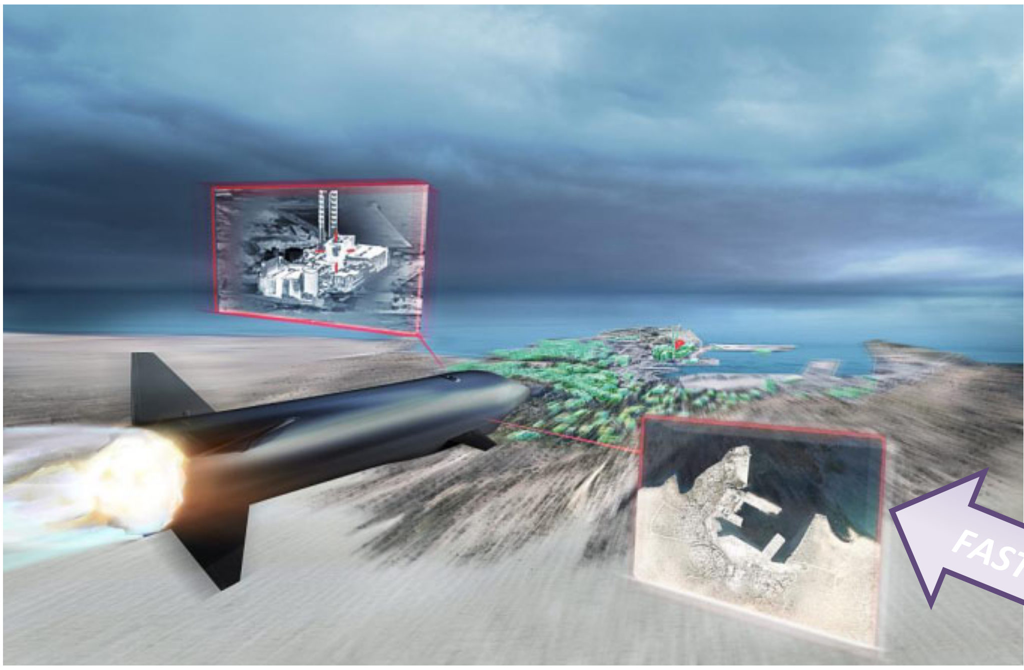

Novel target matching technique - allows designation images (such as those from visible-band satellites) to be correlated with on-board seeker images (such as IR) despite differences in viewpoint and frequency band. This enables a significant reduction in the engagement timeline and allows more flexibility and robustness to changing conditions.

Today, existing long range missiles are guided through target recognition algorithms which need preparation during the Mission Planning phase: Input target models need to be created manually by experienced operators, which is a time and resource intensive task. **Significant potential benefits to the overall mission timeline are possible** should this step be reduced in time and complexity.

The purpose of **FAST TARGETING is to develop a capability to perform the same recognition function** on infrastructure or other fixed targets, without any input model (manual or automatic). The consequence **is a possible drastic simplification or complete removal of the target modelling task.**

To reach this goal **we must have a robust solution to automatically match images** used to designate a target (e.g. from satellites) to on-board images coming from the terminal guidance sensor (seeker).
In a complex engagement scene, this comparison is a difficult task due to geometric and contrast differences between the satellite image and the on-board seeker image.

Existing techniques are reaching limitations in terms of their ability to cope with these challenges.
The FAST TARGETING project addresses this problem through machine learning techniques

The potential benefits of this technique include a signification reduction in the overall engagement timeline, less burden on training and operator skill level required, reduced time and cost of the target modelling process and flexibility of designation sources.

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CONFORMAL DOMES

Conformal designs for infrared optical windows will improve aerodynamic flight characteristics for a missile while maintaining the high image quality required for tracking performance and terminal accuracy, leading to increased missile system performance.

The Conformal Domes project investigates the use of more aerodynamically shaped optical apertures in infra-red missile seekers.

As missile velocities increase, a **more aerodynamic shape and reduced drag offer** corresponding increases in range and velocity, as well as reduced time to target.

Traditional optical apertures, or domes, tend to be hemispherical in shape **to minimize optical distortion** in the seeker. Moving away from a hemispherical shape to one that is closer to a tangent ogive, i.e. more conformal to the aerodynamic shape of the missile, presents a challenge for the optical designer as they need to identify corrective techniques to manage the optical distortion that is introduced.

The Conformal Domes project considers the **aerodynamic benefits of a number of conformal shapes**, from an extreme tangent ogive back to almost a hemisphere. In parallel, the distortions these shapes introduce to the optical design are being quantified and corrective techniques are being investigated.

The studies will inform an assessment of the likely operational benefit, when applied to a theoretical missile system. This will indicate whether, in conjunction with an alternative dome manufacturing technique[3], a conformal dome offers a **competitive advantage for future missile systems.**

A third strand of the project is utilizing the aerodynamic data produced to assess the vulnerability of the dome shapes to raindrop impact, often a limiting requirement on candidate dome materials, to see if conventional understanding of the dome environment is correct. **This will help inform any future dome material studies.**

[3] An enabling technology previously investigated under the MCM ITP Domain 3.