MBDA Innovation Challenges

Introduction

MBDA is a defence company specialising in guided weapon systems. Some of the technology that goes into our products could have application in other sectors; however these sectors are increasingly developing technology that is now more advanced than that in defence. Hence MBDA would like to tap into these sectors and see if there is technology or know how that could address the following specific challenges.

The Challenges

1. Guidelines on issues associated with measurement of strains and stresses in components manufactured by Selective Laser Melting process. The process requires certification; this challenge is in several parts as stated below:
    a. How to complete the rapid certification of Additively Manufactured (AM) materials and components? Can Uncertainty Quantification Management (UQM) technique be a suitable approach in support of AM parts' certification?
    b. How to quantify measurement uncertainty and accuracy of residual stresses in AM parts?
    c. To what extent can we read-across the outputs from the above items for the Blown Powder AM process?

2. How to evaluate, including modelling such as shock physics, the mechanical properties of materials under high instantaneous shock loads of 1000's of G?

3. Which materials or intermediate materials are the most likely in isolation or in combination to survive, ultra-high "g" environments including understanding of their behaviours under the ultra-high "g"?

4. The use of emerging materials such as:
    a. Graphene/Carbon Nano-Tubes
        i. Graphene/Titanium Matrix composites for high performance structures. What percentage improvements are possible in their thermo-mechanical properties? What processes are under research?
        ii. Graphene/Aluminium Matrix composite. Similar questions as above
        iii. Graphene for EMC/EMI shielding/lightning protection
        iv. In general, where are we on Graphene uses for aerospace & defence?
    b. Nano-materials -How can we pull-in high maturity nanomaterials related developments into MBDA?
    c. Smart/Intelligent Materials including SMAs, piezo-electrics. What is the landscape on these materials in UK Plc?

5. Tin whisker growth has had a detrimental effect on electronic equipment for many years. How to understand and manage tin whisker growth and how to reduce the risk of tin whiskers in equipment that is stored for many years?

6. How to regulate standard industrial components when exposed to extreme ambient temperatures ranging from -55°C to over 100°C without external heaters or cooling equipment? An ideal solution should fit inside an internal layer of a multi-layer PCB.

7. Where "voltage wild" power systems distributed by a common bus are used. How to develop a small, standardised dc-dc converter module with a very wide input voltage range (e.g. 15-100 V DC), whilst providing a regulated output for an intermediate internal sub-system voltage (such as 12V) in the 100W range which is physically small and meets environmental and EMC considerations?

8. How to develop a tritium battery or similar that can last several decades without any US or other ITAR sourced technology?

9. Identify and develop a miniature hermetic interconnect methods between metal housing and mixed signal board, and between two mixed signal boards internal to housing. The performance requirements are:
    a. RF signal loss to be less than 0.5 dB for signal frequencies up to 20 GHz with interconnect area per signal to be less than 9mm^2.
    b. Digital signal performance up to 10 Gbits/s, with interconnect area per signal to be less than 2mm^2.
    c. High current handling up to 2 Amperes, with interconnect area per signal to be less than 1mm^2.

10. Signals such as DAB, ZigBee, Wi-Fi IEEE 802.11ad, Cellular networks, generally require different reception methods, what is the optimum way to receive multiple signals whilst minimising the number of antennas required?

11. Is it possible to design a small-sized antenna control unit (i.e. comparable to existing GPS-only products) that works for multiple navigation satellite systems which operate over several frequencies?

12. How to design and develop systems that incorporate both automation and human decision-making, using automation to perform essential tasks with greater precision and accuracy while retaining humans in the roles of moral agents and fail-safes.
    a. What is the optimal level of blended automation and human decision making and what are the interaction requirements and what technologies can be exploited to deliver this?
    b. How can trust between human and machine be developed without creating "unwarranted trust"/over reliance on automation and recognising the need to exercise judgement?

13. How can commercially available technologies such as immersive HMI technologies, augmented reality, portable / ubiquitous systems, more direct control methods (e.g. eye control, brain control) be exploited to enhance system operation and training for military purposes? What interaction metaphors can be adopted to increase system usability and decrease the training requirement?

14. How to robustly forecast the future evolution of highly uncertain and dynamic situations including (but not restricted to) multiple hypothesis and game-theoretic/defensive approaches?

15. How to have a robust, distributed, and decentralised system that is tolerant of failures and drop outs.

The Process

MBDA is working with the Knowledge Transfer Network (KTN) to promote these challenges. The intention is to fund projects from MBDA sources which involves completing an internal business case and going through an internal competition. In addition, where the idea has dual use, Innovators will be encouraged to leverage any MBDA support to apply for Innovate UK funding. All funding is competed.

For MBDA funding

Step 1: The challenges are only open to UK registered organisations. In the first instance proposers need to register on the MBDA Innovation Gateway https://www.mbdainnovationgateway.com/default.aspx

Step 2: Once you have received confirmation of your registration, you will be allowed to submit an outline of your idea against any of the challenges. You should provide enough information to allow MBDA to assess your idea without having to put a non-disclosure agreement in place.

Step 3: MBDA will invite a number of the respondents for a 20 minute session with our technical experts at an event in Sept 2016. The aim is to discuss your idea and determine the scope of a project. The technical expert will then develop an internal business case and make an application for funding

Both Innovate UK and MBDA Funding

Where solutions have civil applications it is possible to apply for Innovate UK funding and use any MBDA funding to provide the matched funding requirement of Innovate UK. https://www.gov.uk/government/collections/innovation-grants-for-business-apply-for-funding

Timescales

- Outline responses for MBDA funding must be received by 5th August 2016
- Meet the technical expert event Sept 2016
- See Innovate UK website for timescales