Defence-related Research Action - DEFRA

ACRONYM: METAJAM

Title: **M**etasurface-**E**nabled conformal **T**echnology for wideband **A**nd **JA**mming with **M**ultifrequency antennas

Duration of the project: 01/12/2024 - 01/03/2029

Key words: Antennas for tactical Vehicles, Conformal Metasurface technology, RF Front-ends, Multi-beam, Jamming

Budget: 886.915 **€**

of which RHID contribution: 713.386 **€**

PROJECT DESCRIPTION

Context

While in mission, tactical vehicles and their crews must be protected from explosive devices, which can take the form of remote-controlled improvised explosive devices (RCIEDs) or drones. These vehicles are normally equipped with a jammer to neutralise such attacks. Ground and sky protections are provided by high-intensity electromagnetic (EM) fields generated by a jammer and transmitted by multiple antennas for different frequency bands. In the current scenario, there are many visible and significant challenges related to the antenna system considering operational and cost criteria. With this in mind, we, the research consortium, would like to propose an innovative idea that represents a paradigm shift in the way tactical vehicle antennas can be deployed.

General objectives

To simultaneously protect vehicles against RCIEDs, drones, and hostile jamming systems, with an expected 360° view of the surroundings, we propose to develop low-profile and robust metasurface antenna systems. This project offers the prospect of compact and conformal broadband-jamming antennas shaped around tactical vehicles by using the latest advancement in EM research and development.

Methodology

Our methodology consists of several phases: thorough requirements analysis; design, including EM modelling and physical prototyping; and testing and validation. In each phase, various aspects such as performance, cost, size and robustness are assessed and optimised to create a highly-specialised design. The knowledge gained will contribute to the continuous development and improvement of antenna designs and jamming techniques for current and future defence applications in areas where the military wants to disrupt or deny the enemy's ability to communicate.

Potential impact of the research on Defence

Technologically, METAJAM will improve jamming, range, and coverage compared to the state of the art, while offering more possibilities for integration, interfacing, and interoperability. Technology aside, the solution will reduce current limitations, leading to new possibilities on the battlefield and requiring a reformulation of training and doctrine. The reduced size, weight and power requirements will increase efficiency and simplify logistics. A successful METAJAM can help to propose optimisations in the established Defence R&T processes and applications. The technologies and solutions resulting from METAJAM can also be used in other types of vehicles.

Expected final research results and valorisation perspectives at short and medium term

The dedicated computer-aided design methodology developed in this project will enable **efficient numerical modelling and synthesis** of large-area metasurface antennas that can combine multiple (and possibly conflicting) requirements. In addition, the **most promising fabrication technologies** for conformal metasurface antennas will be identified to develop selected prototypes. During the design and development activities, the proposed metasurface antenna technology will be validated up to **TRL4**. After refinement through these validation results, we will develop an **accurate and efficient design methodology** for large-scale conformal metasurface antenna systems that considers technological constraints and can evaluate the robustness of a design via tolerance analysis.

Both an upgrade path for existing jammers and a fully integrated system for new vehicles are expected to achieve a short- and longer-term impact. Following the development of the required **application-specific manufacturing technology**, prototypes will be created and characterised under real-life conditions to validate the metasurface antenna technology up to **TRL5**. Finally, the knowledge and insights gathered during the project will be **disseminated** through various channels, including publications, conferences, workshops, and collaborations. This will ensure that the new knowledge is widely available and accessible to all relevant stakeholders, which is essential for the successful integration of the new technology.

CONTACT INFORMATION

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LINK(S)

In the course of project execution, stay tuned to our future publications in this area, a possible project website, and perhaps a LinkedIn page.