

# Autonomous Resilient Cyber Defence – Track 1: ARCD Concepts

## AI Decision Making

**Objective:** The AI Decision Making (AIDM) project within Track 1 aims to leverage cyber defence approaches and techniques that have been previously explored/researched but require additional funding to get them to a demonstrable stage (TRL5-6). The AIDM project will generate the mature cyber defence concepts for the ARCD concept demonstrator in 2025.

### Approach:

- Provide additional funding to **mature promising ARCD concepts**: typically, through larger and longer-term projects. To date we have committed almost £4m in AIDM alone, on projects ranging from 2 months to 3 years in duration.
- **Configure** and/or **extend** existing technologies to military applications.
- **Integrate** into **ARCD Track 2** representative training and demonstration environments, and frameworks for actuation and evaluation.

## Themes of Current Research

- Focus on longer term follow-on for most promising projects
- Demonstration in higher fidelity environments enabling more sophisticated attack and defence actions:
  - Maritime Integrated Platform Management System (IPMS) (e.g. Dstl Test Rig).
  - Leader-Follower vehicles using Generic Vehicle Architecture (GVA) and Distributed Data Service (DDS).
  - Land Environment Tactical Communications and Information Systems (LE TacCIS) and Defence Digital
- Multi Agent Reinforcement Learning (MARL).
- Co-evolution and adversarial learning
- Transfer learning between environments, levels of fidelity and cyber attacks
- Generalisation
- Integration with Track 2 environments (Yawning Titan, PrimAITE, Imaginary Yak).

## ARCD

A four-year programme (completing March-25), which aims to develop self-defending, self-recovering concepts for military operational platforms and technologies, with an aspiration to achieve 'Full Auto' cyber defence.

**Track 1** - being delivered by Frazer-Nash Consultancy, under Serapis Lot 6, will deliver the ARCD Concepts. Track 1 is split into 3 projects:

- High Risk & Disruptive Options.
- Informed Cyber Sensing.
- AI Decision Making.

**Track 2** - being delivered by QinetiQ, under Serapis Lots 3, 4 and 5 will provide the ARCD Experimentation & Evaluation.

### HOW TO ENGAGE

For Track 1, Frazer-Nash will issue problem books to the Serapis Lot 6 Supply Chain.

We are also interested in any ideas from the supply chain or academia which can contribute to the Track 1 concepts.

## Case Study – MARL for OT

A current AIDM project has combined several of these themes (see diagram), Phase 2 findings showed MARL out-performing single agent RL and MARL agents autonomously assigning cyber security roles to defend a representative Maritime IPMS. Phase 3 has been contracted out to March 2025 to develop a high fidelity simulation environment (TRL5) with a view to demonstrating on a 'real' system, possibly a Dstl Test Rig (TRL6), and to increase the reality of cyber attacks to train against.

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