

With two minds: thinking at machine speed

A CASE STUDY OF SCIENCE AT THE FRONTIER OF HUMAN-MACHINE TEAMING

The Intelligent Ship AI Network (ISAIN) is an innovation programme within Dstl for the Royal Navy. It focuses on using Artificial Intelligence (AI) and data science to build a “Ship’s Mind”, that can out-think and out-pace our adversaries.

In November 2020, Dstl awarded SeeByte a contract to demonstrate GALILEO as a core component of the ISAIN platform.

GALILEO is a proof-of-concept AI decision aid to enhance the command team’s cognitive ability to understand a rapidly changing operational environment and decide the appropriate Course of Action (CoA).

GALILEO offers this capability at increased “machine” speed, following the chosen CoA through to completion, until it is no longer viable, or an alternative CoA becomes available.



Thinking at machine speed is about changing paradigm.

Incremental improvements must give way to a quantum leap of human-machine teaming.

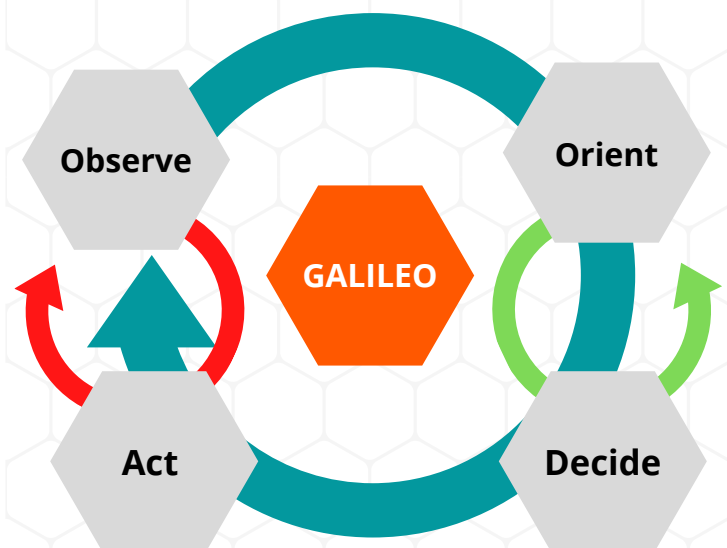


Figure 1 GALILEO supports the Command Team decision making process - illustrated by the OODA loop

POTENTIAL OF AI

In addition to superior training and preparedness, AI may provide alternative outcomes that a human would be unable to consider in isolation.

Autonomous Systems can make decisions that are difficult to anticipate by our adversaries, and an AI system, such as GALILEO, can have a positive impact on the command team, and its decision making.

This new interaction will be more powerful than the sum of a human and a computer system. It will capitalise on the synergistic effect of human-machine symbiosis, making it possible to achieve an increase in the overall system IQ.

It offers the potential to enhance operational capability currently beyond reach. It will enable a human operator to explore a greater number of CoA's, and monitor and control more assets, entities and processes in high pace scenarios.

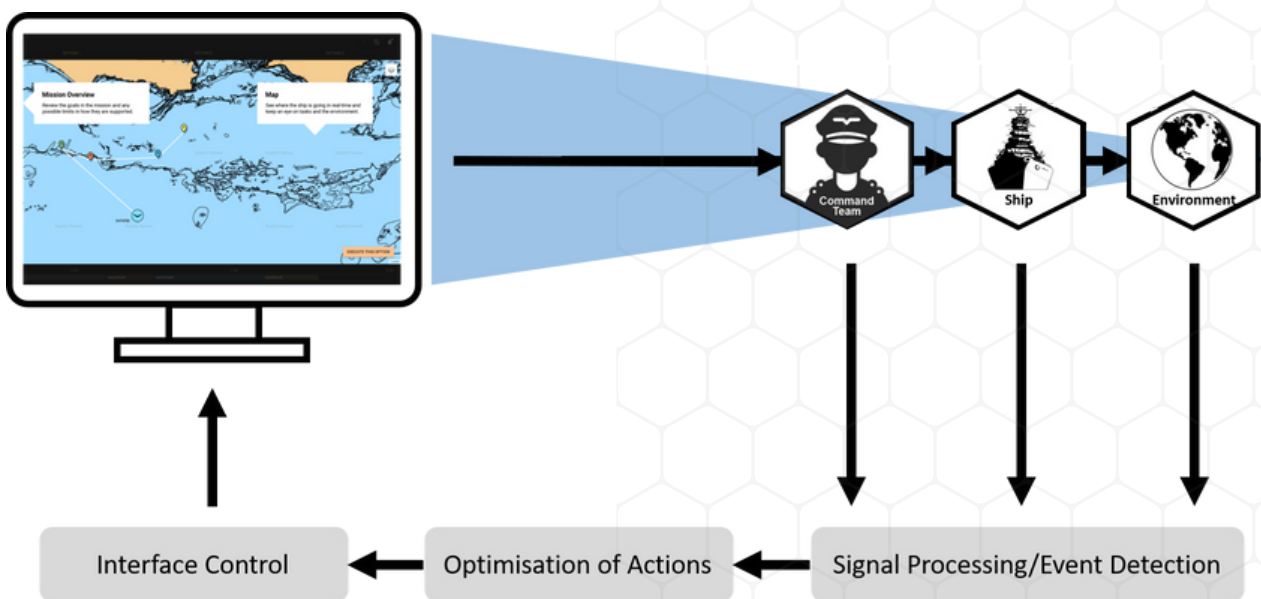


Figure 2 GALILEO Human-Machine Interaction

HUMAN-MACHINE TEAMING FROM THE OUTSET

Human-Machine teaming must be a design consideration from the outset, it is simply not good enough to “bolt-on” human-machine interaction as an after-thought.

The closer the two minds of the human and machine are in their understanding of the mission and of the world, the closer the interaction and robustness of decision making.

GALILEO's aim is to enhance the command team's ability to anticipate potential threats, respond to changes in the recognised environment and decide the most appropriate course of action at faster speeds.

By considering the arc of the possible solutions, GALILEO may help the command team to choose courses of action that are difficult to predict by our adversaries that might not have otherwise been considered. GALILEO interacts with the command team in the following ways:

Command team interacts with GALILEO at Commander's Intent level.

The Commanders Intent succinctly defines a successful mission, whilst allowing for initiative and improvisation when things don't go to plan.

It is critical to helping a plan maintain relevancy and applicability in a chaotic, dynamic, and resource-constrained environment. The mission command team interact with the orders to add new elements or adjust the existing ones to incorporate local intelligence and personal judgment.

Taking only moments, working in the background, GALILEO continuously analyses the task orders to determine the alternative courses of action that can achieve the mission outcome.

GALILEO monitors mission execution and proposes alternative courses of action.

When the mission is underway GALILEO continuously interacts with the other AI Agents to track the state of the platform, resource consumption, the navigation path plan, and possible or real presence of threats.

In doing so GALILEO becomes aware of the internal and external factors affecting the mission, can verify that the mission outcome remains viable, and analyses what alternative courses of action are available.

The command team interacts with GALILEO at mission level to anticipate emergent scenarios, and assess the impact of the current versus alternate CoA.

FRONTIER OF SCIENCE AND TECHNOLOGY

The fundamental research and development into the advanced AI concepts behind GALILEO are helping SeeByte and Dstl to challenge the human-machine design paradigm where humans must learn the system.

GALILEO moves to a partnership where humans and machine cooperatively solve the command order problem.

Together they arrive at collaborative optimal decisions, providing rational solutions to problems faced in the challenging, complex, and contested environments of modern operations.

GALILEO and the Intelligent Ship programme are as much about building an AI understanding of ourselves as they are understanding our adversaries.

We wish to extend our thanks to the Dstl and Royal Navy team for this opportunity and for their support and commitment throughout this project. We are proud to continue supporting the Royal Navy and Dstl.