



MASS Technology Update

MASRWG Conference 2020

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...a sound decision

Overview

- Brief Introduction to AEUK
- History of Maritime Autonomy
- Research to the Front Line: A Case Study
- Autonomy is More Than Just Unmanned
- Where Next for Maritime Autonomy?



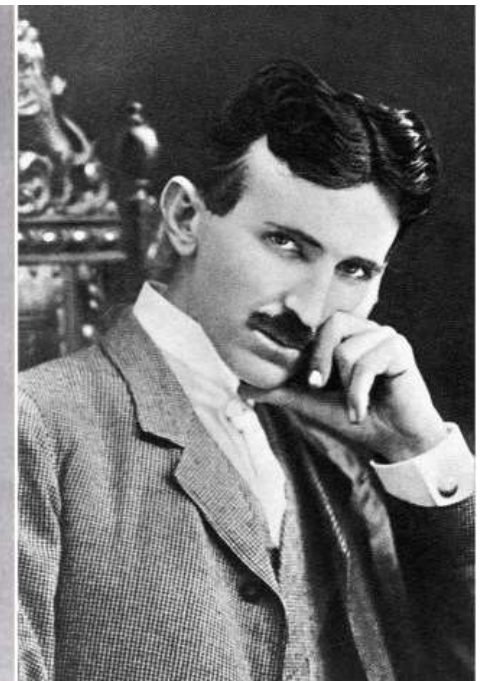
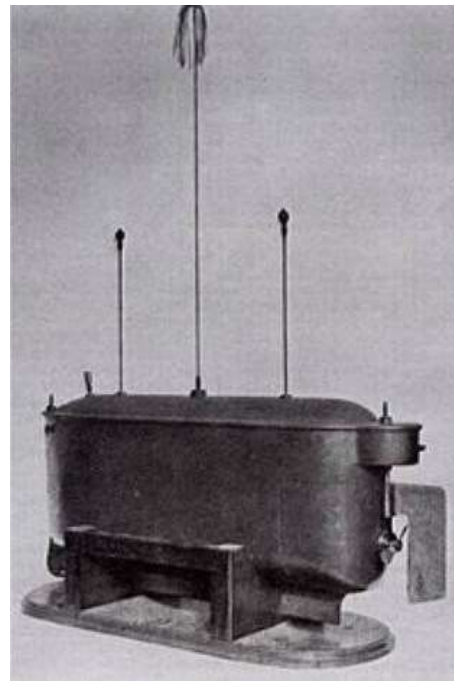
AEUK Overview

- ATLAS ELEKTRONIK UK Ltd – over 60 years of maritime research heritage
- Currently one of the leading suppliers of science & technology to Dstl
- Autonomous systems since 2003
- Delivered first autonomous minesweeping capability – RNMB HUSSAR – to the Royal Navy in 2018, RNMB HARRIER in 2019
- Not just platforms but sensors and system integration
- Wide range of autonomy behaviours to cover multiple warfare mission types



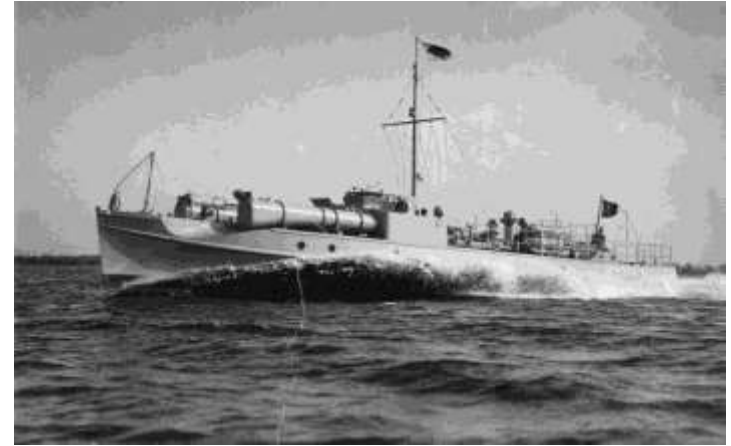
History of Maritime Autonomy

- Maritime autonomous vehicles not new
- 1850 – first design of a torpedo by Robert Whitehead for the Austrian Navy
- 1898 – “Teleautomata” USV developed and tested by Nikola Tesla in New York



History of Maritime Autonomy

- USVs developed in WW2 include:
 - COMOX – a Canadian smoke screen laying boat
 - Bob Sled/Woofus 120 – US Landing craft based surf zone MCMVs
 - German remote control S-Boat
- German Navy deployed their Seehund Troika MCM system early 1990s
- MIT started work in 1990s on various USVs (AutoCat)



MASS Technology Development at AEUK

2003

- UOR for Shallow Water Influence Minesweeper (SWIMS) into Umm Qasr (11 systems delivered in 4 months)



MASS Technology Development at AEUK

2006

- MOD Succession Planning for Combined Influence Sweep (CIS)

2007-2011

- Flexible Agile Sweeping Technology (FAST) Technology Demonstrator Programme (TDP)



MASS Technology Development at AEUK

2012-2016

- AEUK develop ARCIMS with export sales to overseas customers

2015-2018

- ARCIMS forms basis of UK Sweep Capability Project



ARCIMS Advanced Unmanned Minesweeping System

- USV with Sense and Avoid Autonomy with COLREGS behaviours
- High Power Generation Module
 - Greater magnetic swept width
- Acoustic Sweep Payload
 - Programmable and non programmable sources
- Magnetic/Electric Sweep Payload
 - Basic and Advanced minesweeping options available
- Sweep Monitoring System
 - Remote Operator feedback
- Programmable Sweep waveforms



ARCIMS Today

- Boats 1 & 2: In service, Middle East Navy
- Boat 3: In service as RNMB HAZARD (“for but not with” Autonomy)
- Boat 4: In service with WTD71 Eckernfoerde, Germany
- Boat 5: In service as RNMB HUSSAR
- Boat 6: Going into service as RNMB HARRIER
- Boats 7 & 8: awaiting Autonomous capability fit
- Boats 9 & 10: Complete, going into service with Middle East Navy
- Boats 11 & 12: In production



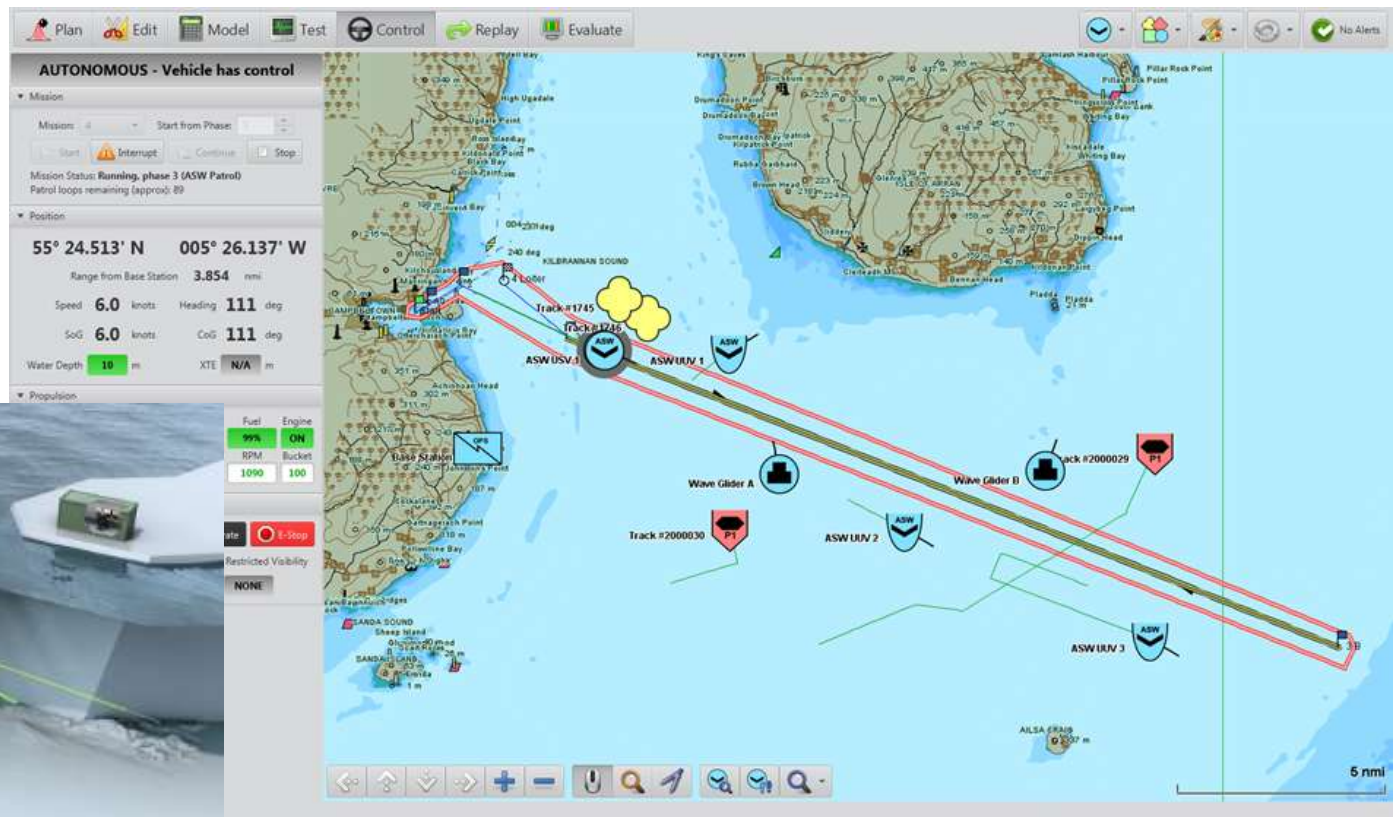
Multi-Role Autonomy

- ARCIMS originally developed to “remove the man from the minefield” through sweeping
- Yet platform flexibility leads to multiple roles – minehunting, ASW, HM, FP, Logistics support
- Collaborative – Cooperative



Anti-Submarine Warfare

- USV Autonomous patrol with towed array
- Management & control of heterogenous assets via tactical display



Autonomy: More Than Just Unmanned

- To gain the full benefit of MASS, the mission systems must also be capable of delivering the autonomous capability.
- Example: Minehunting

Task	Traditional	MASS
Mission planning	Operational Cdr	Operational Cdr
Task planning	MCM Cdr/MCMV Ops	MASS Op/MASS Autonomy Software
Transit to OpArea	MCMV CO/OOW	MASS Autonomy Software
Minehunting search	MCM Ops/MW Op	MASS Autonomy Software
Detection	MW Op	MASS ATR Software
Classification	MW Op	MASS ATR Software/MW Op?
Localisation	MW Op	MASS ATR Software
Identification	MCM Ops/MW Op	MASS ATR Software/MCM Ops
Disposal	MCD Diver/Remote disposal device	Remote disposal device (SeaFox?)

Minehunting Detect to Engage Demo June 2017

- Single sortie Detect to Engage
- Integrated MCM Toolbox deployment
 - ARCIMS USV
 - AQS24B SAS & SeaCat UUV SAS for Minehunting
 - Remote SeaFox for mine disposal



Collaborative – Cooperative

Project Wilton

- 15m SEA Class platform pulled into project
 - RNMB HEBE
- Modified to embark survey and MCM payloads and for autonomous ops
- Delivered to Wilton summer 2020
- Project Wilton also using additional 11m ARCIMS USV
 - RNMB HARRIER



Collaborative – Cooperative

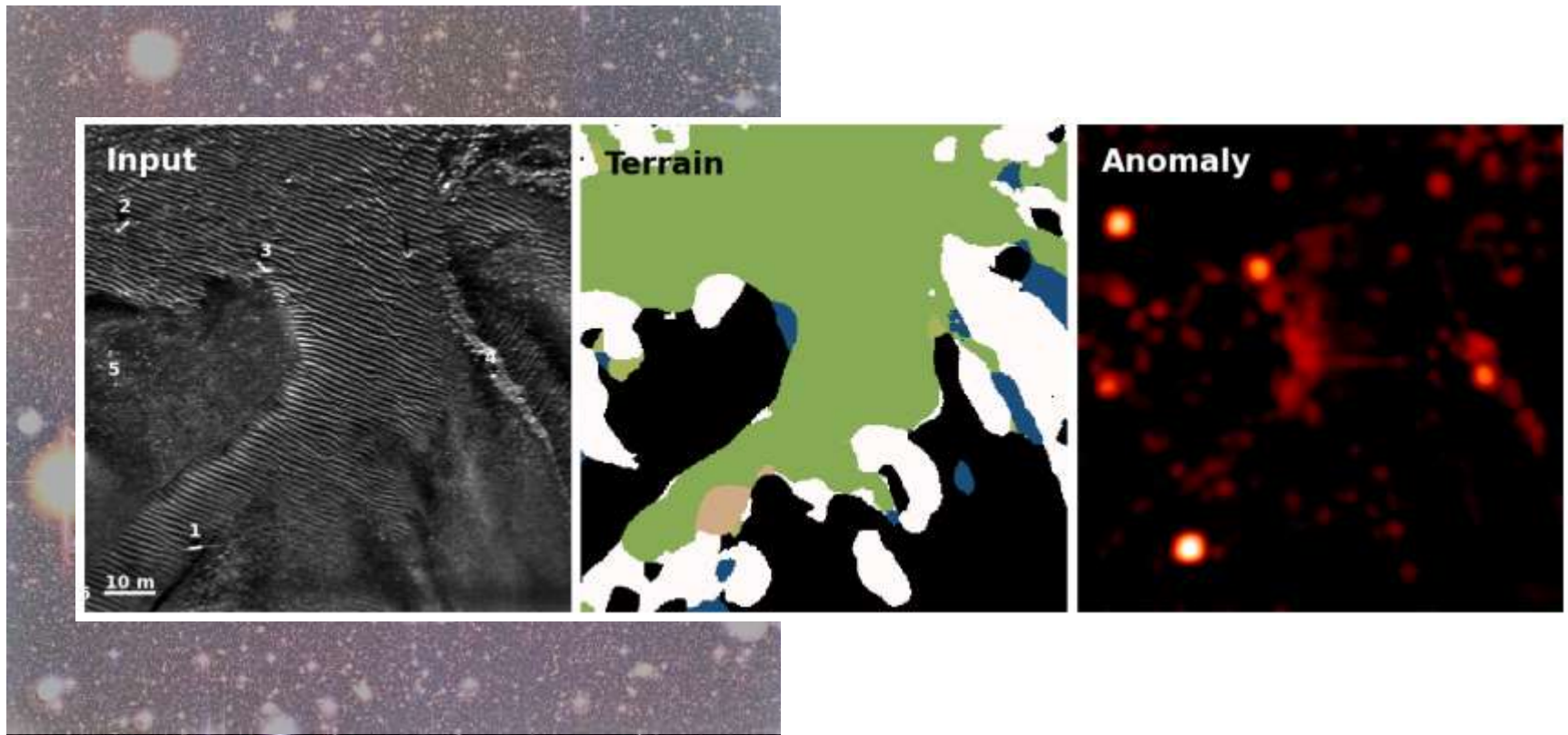
Project Wilton

- Further operational concepts to be developed and demonstrated
 - Hand off between 15m and 11m platforms
 - Control of 11m from 15m platform
 - Different combinations of survey, control, analysis and disposal roles across the two platforms



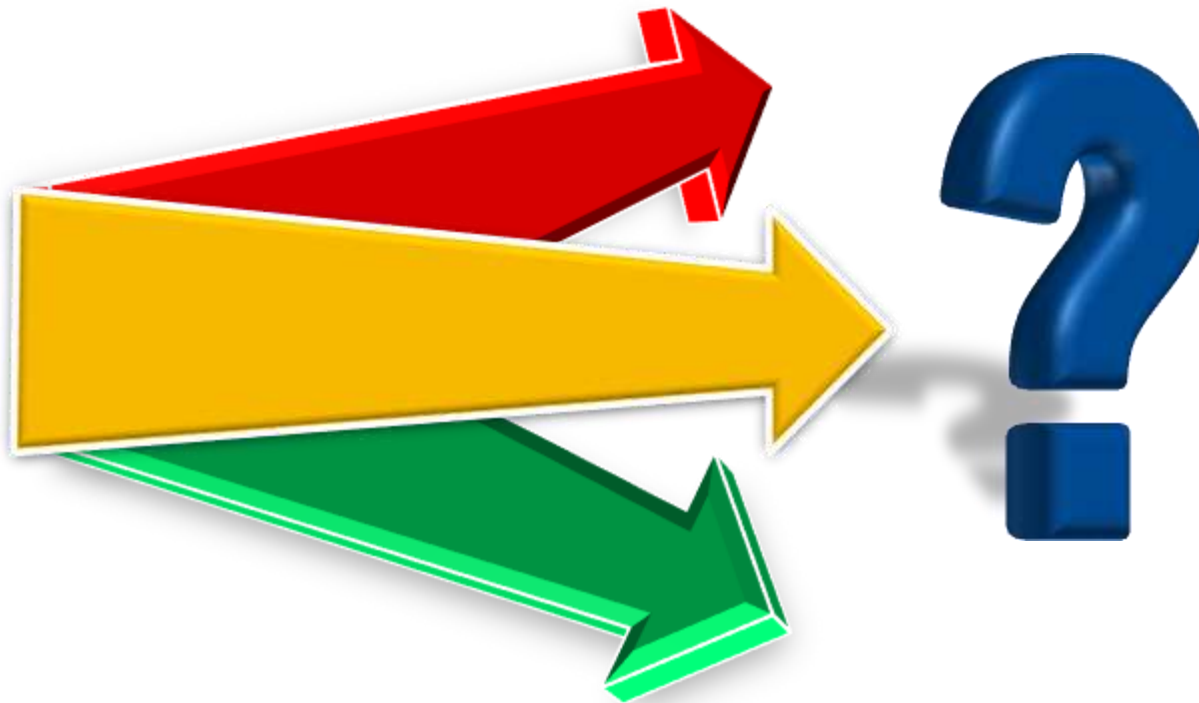
System Automation

- Need to make tactical decisions without operator intervention
- Project Galaxy Quest



Where Next for Maritime Autonomy?

- Where should our industry be heading?



Where Next for Maritime Autonomy?

- What can we learn from adjacent markets?
 - Driverless cars?
 - Aerospace?



- DAL/SIL?
 - Do we/should we apply DO178C standards?
 - Do we need to be at SIL 4 i.a.w. IEC 61508?
 - Or will SIL 2 suffice?

Where Next for Maritime Autonomy?

- Higher level of autonomy
 - We've taken the man out of the minefield, now lets take him out of the RCC
 - But SOLAS 5?
- Need to build trust and confidence
 - Collectively, the UK Autonomous Industry has completed many thousands of incident free operation days
- Cultural change



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