

CMIS Briefing

UW16 Challenge - Problem State



RN MarCap Challenge:

“Using the outcome of Unmanned Warrior 2016, develop some credible options for what the maritime domain could look like in 2035 with increased use of autonomous systems to inform Balance of Investment Decisions in 2017/18”

Captain Sharon Malkin Royal Navy

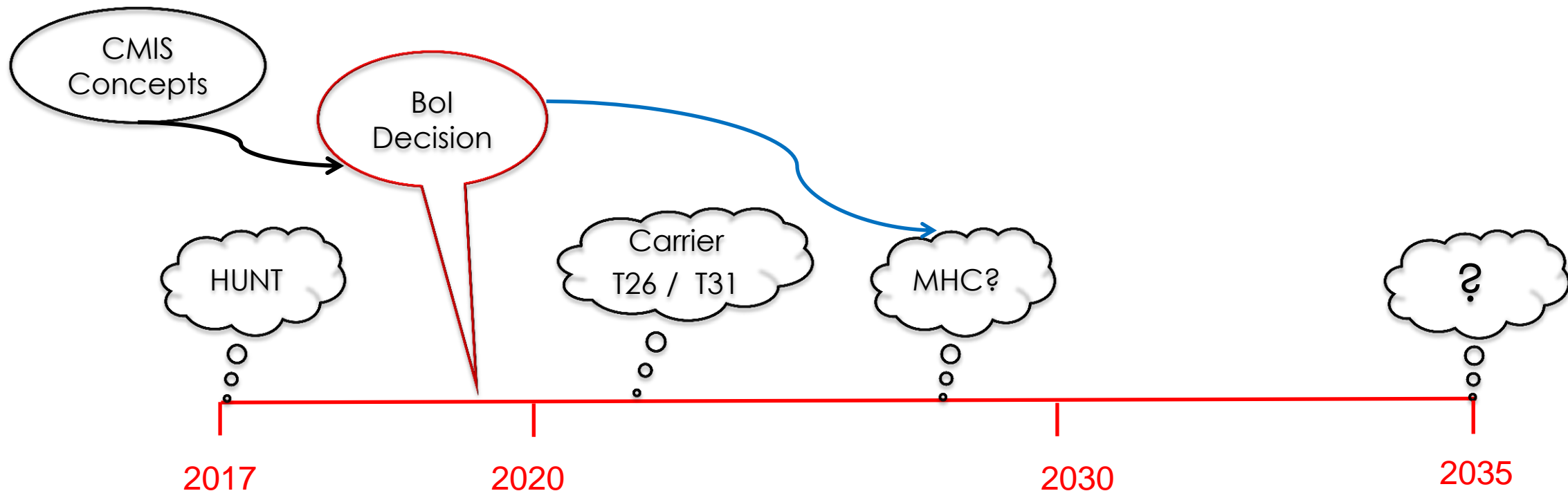
Pilot Experiment: “Can I deliver freedom of manoeuvre with a portable and organic system capability that is not dedicated?”

CMIS Briefing

Pilot an innovation process in RN 2035 context

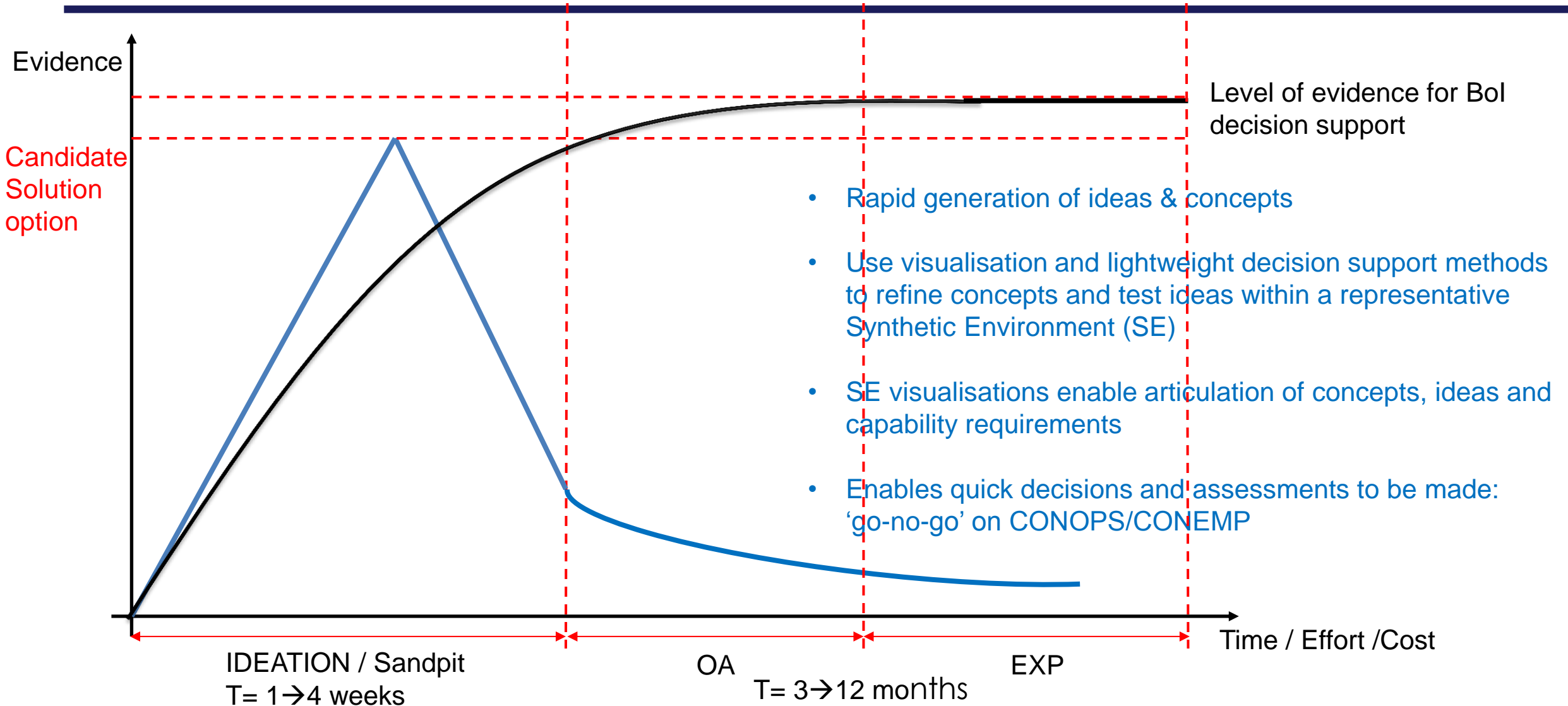
Rationale:

- To establish how CMIS and modelling can support the Innovation agenda and inform Balance of Investment Decisions



CMIS Briefing

“Ideation”



CMIS Briefing

Community of Interest Contributors



THALES

BAE SYSTEMS
INSPIRED WORK

GENERAL DYNAMICS

 **LEONARDO**

LOCKHEED MARTIN 

QinetiQ

UNIVERSITY OF
Southampton

Cranfield
UNIVERSITY

 **ATLAS ELEKTRONIK UK**
A company of the ATLAS ELEKTRONIK Group

Roke

Part of the
Chemring Group

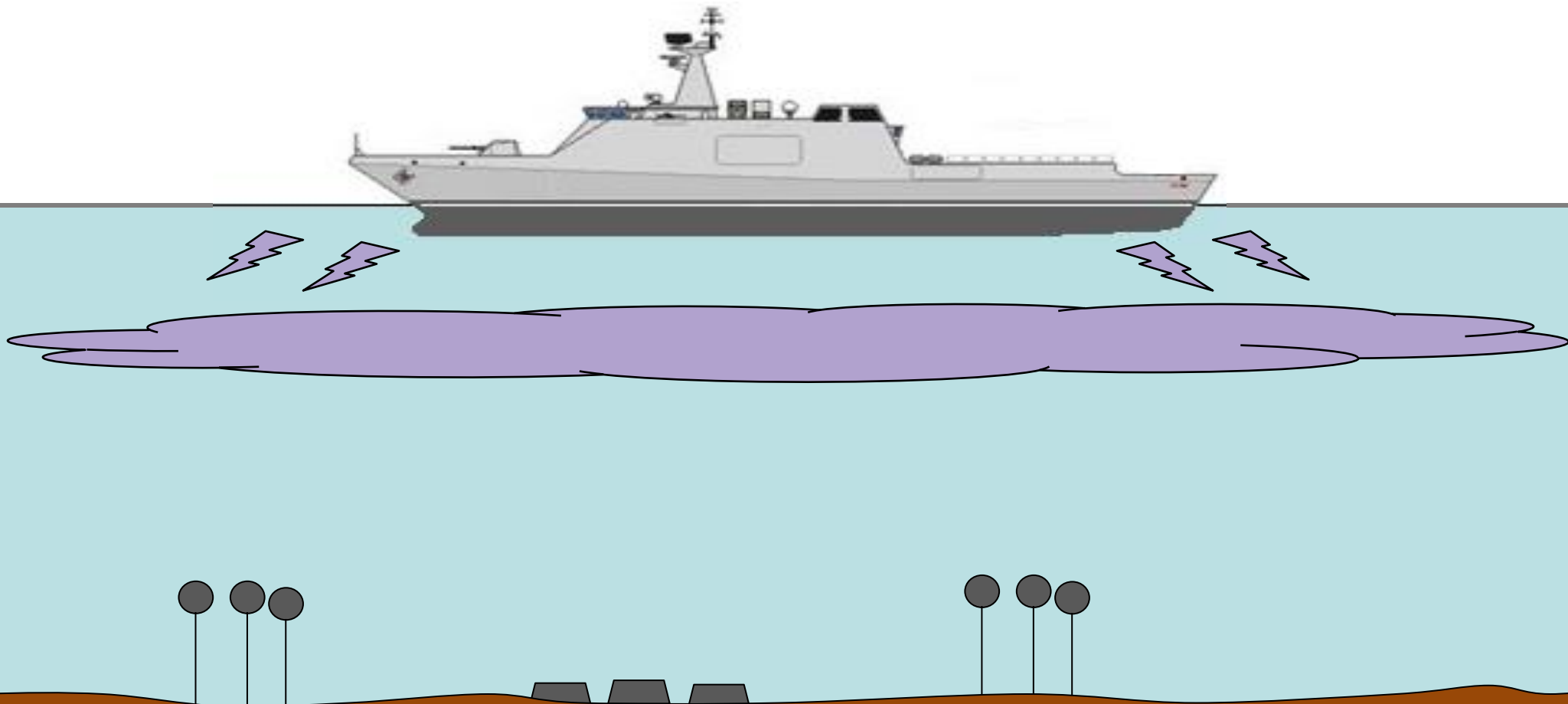
Ultra
ELECTRONICS

 **Sonardyne**
SOUND IN DEPTH

CMIS Briefing

Concept – Make Vessel Invisible To Mines

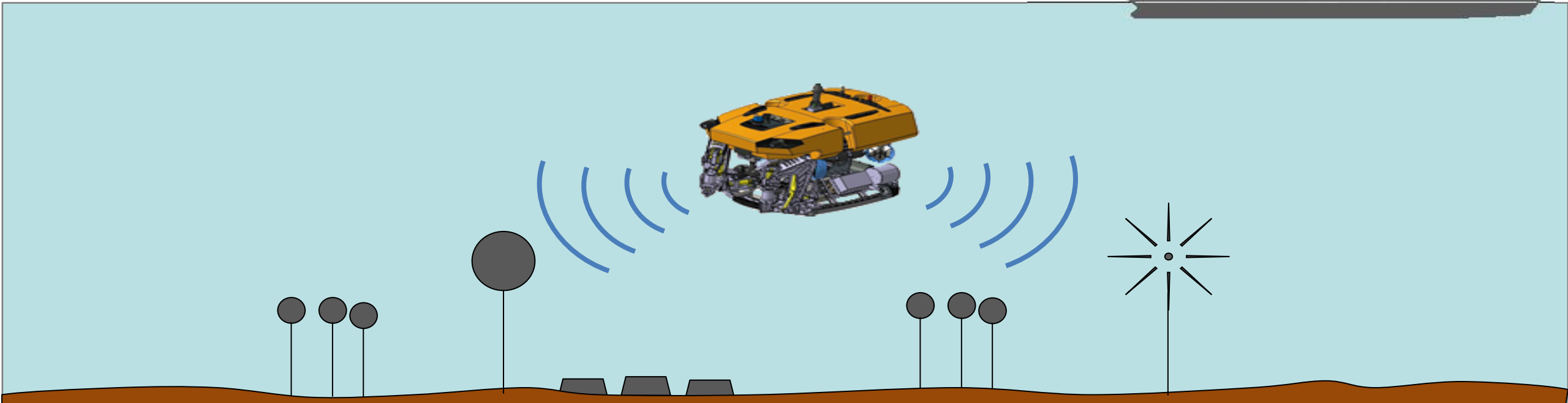
- ‘Cloaking device’ - vessel immune to all types of mines
- A layer / barrier to prevent or transpose magnetic, acoustic and pressure signatures



CMIS Briefing

Concept – ‘Super-Bot’

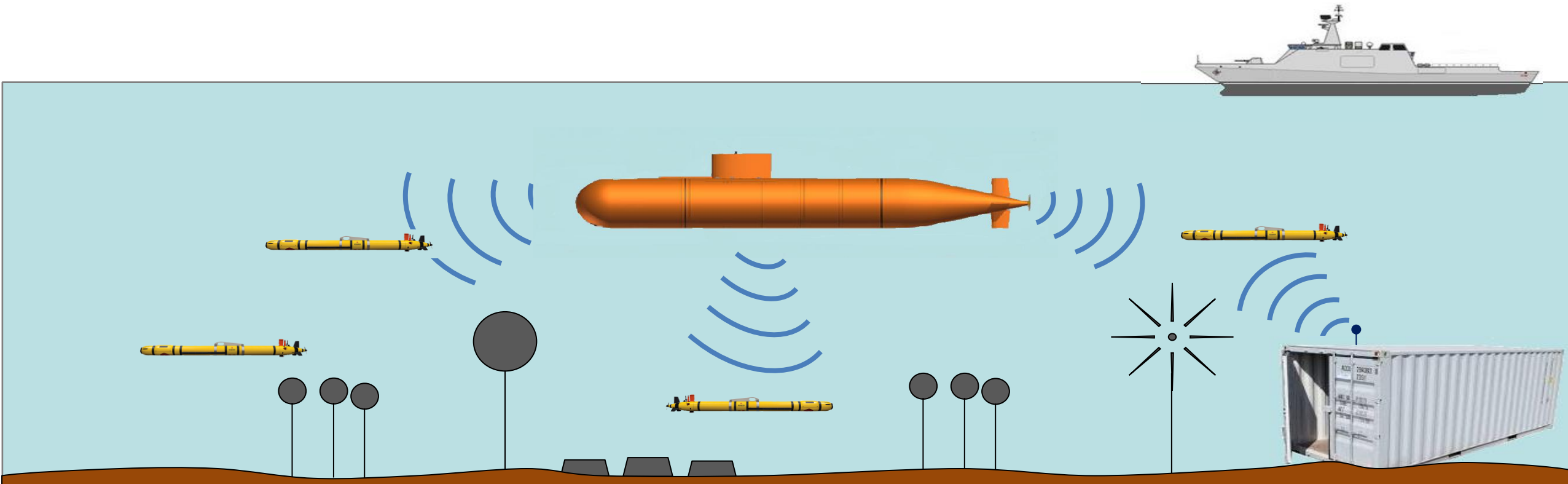
- Re-usable sophisticated super-bot: expensive – requires protection / recover
- Capable of deployment into area and autonomously detect, validate and neutralise (hard or soft) all mines
- Organic (tethered), but equally autonomous and delivered by non-organic options



CMIS Briefing

Concept – ‘Mother-Bot’ and ‘Mini-Bots’

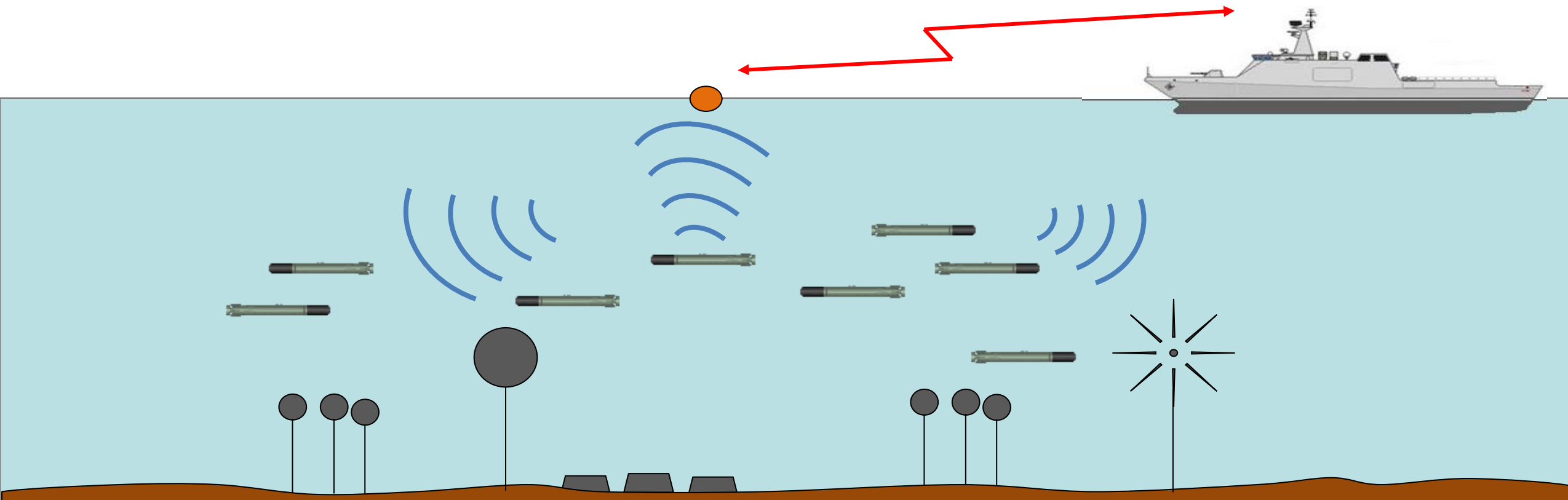
- Sophisticated ‘mother-bot’ - organising / coordinating / re-charge / protect ‘mini-bots’
- Mother-bot could be host ship / separate deployed system / in-situ garage
- Mother-bot is recoverable and re-useable.
- Mini-bots detect / validate / tag / neutralise mines autonomously



CMIS Briefing

Concept – Swarm of ‘Mini-Bots’

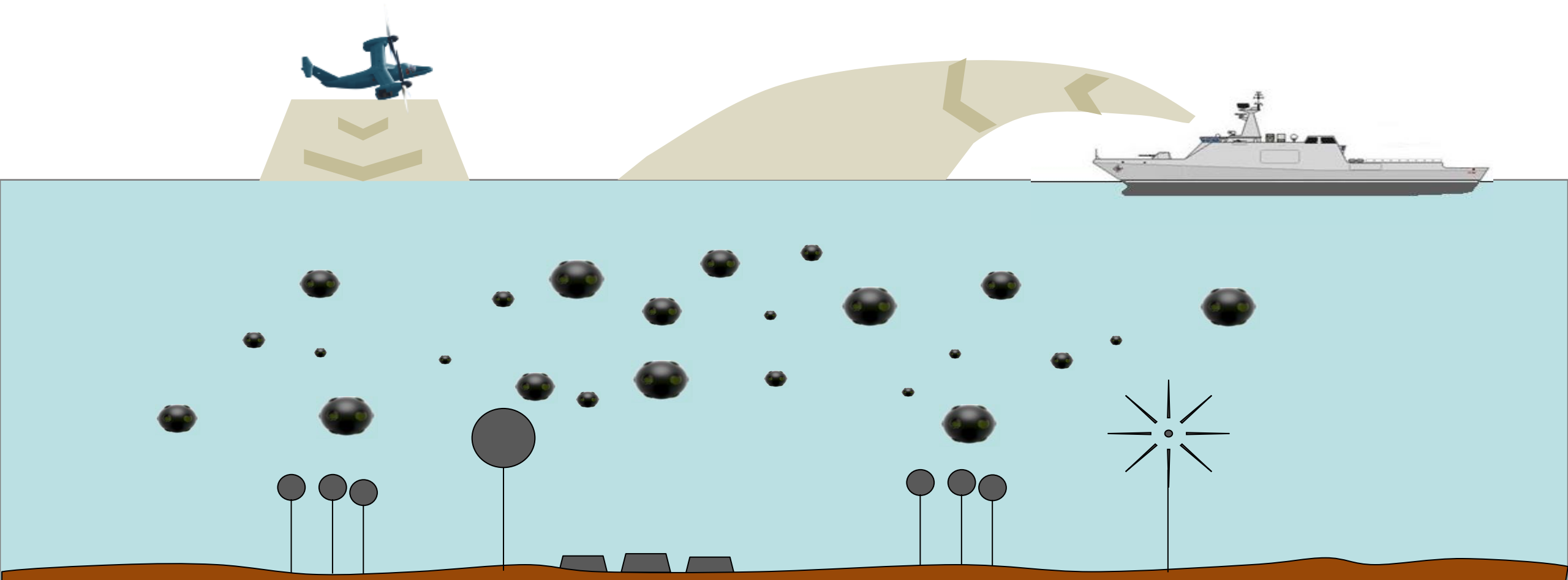
- Autonomous swarm of collaborating mini-bots deployed into area to detect, validate and neutralise mines.
- Optional C2 to third party – initial operator overwatch
- Ideally inexpensive bots – part ‘left behind’ to deal with each mine
- Intelligent portion recovered for re-use if expensive



CMIS Briefing

Concept – Blitz of ‘Nano-Bots’

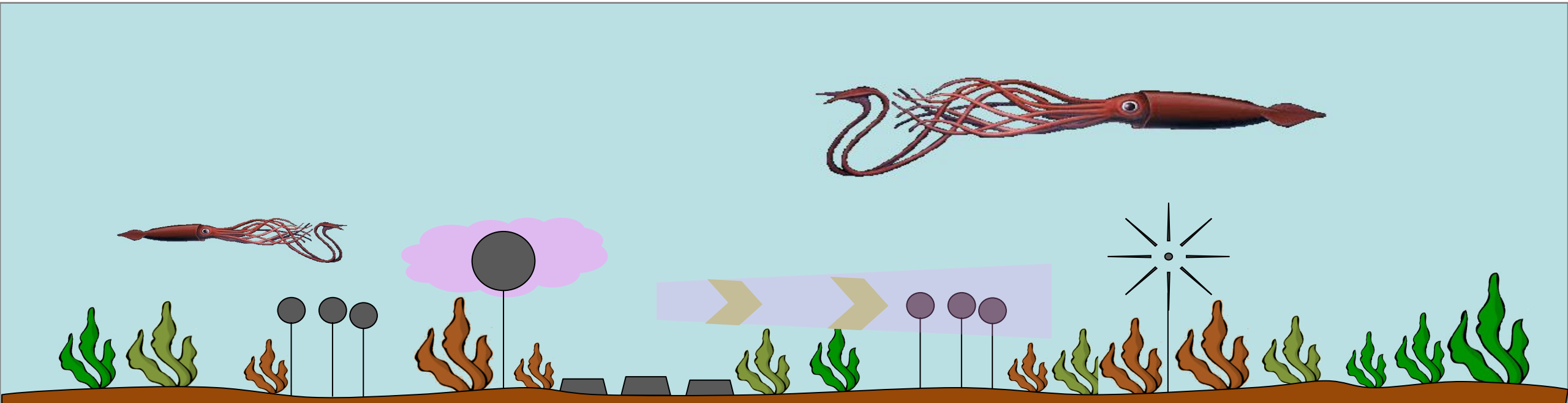
- Cheap, fire and forget bots to swamp area and ‘latch onto’ all mine-types
- Disable mines – etching / burrowing / chemical / degrading
- Sufficient deployed to ensure all mines covered – decompose / self destruct if not employed



CMIS Briefing

Concept – Exploitation of the Biosphere

- Exploit Biosphere to indicate mines (existing characteristics) - algae, seaweed, water disturbances, fish behaviour to indicate mines.
- Manipulate sea creatures to indicate, tag or dispose of mines - modifying behaviour to provide capability:
 - ❖ Exploit existing behaviour or breed new behaviours.
- Method of detecting mines / mark mines with a substance / cloak mines crustacean material / deliver a material to dispose or disable mine.



CMIS Briefing

Concept Analysis – Quick & Dirty

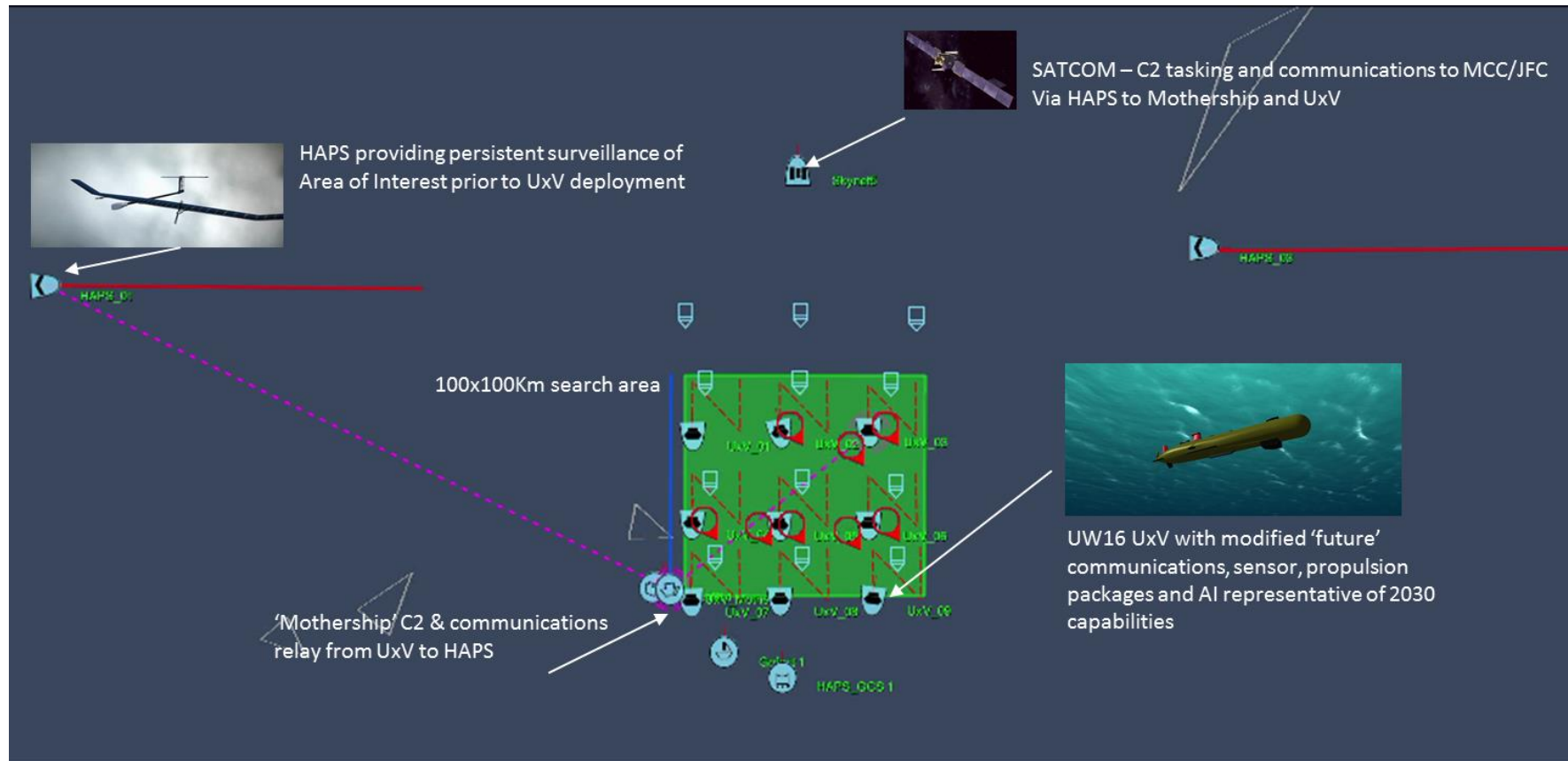
Concepts & Evaluation	Cloaking / Shield	Super-Bot	Mother-bot & clan	Mini-bot swarm	Nano-bot blitz	Bio-sphere
Future proof (not stuck in time)?	✓	✗	✗	✓	✓	✓
Is it novel?	✓	✗	✗	✓	✓	?
Manpower & cost benefit?	✓	✓?	✓	✓	✓	✓
Credibility (Is it P, O & D)?	✓?	✓?	✓	✓	✓?	?
Scientific Feasibility?	✓	✓	✓	✓	✓	?
Free from political, legal, ethical issues?	? ↑	✓ ↑	✓ ↑	✓? ↑	? ↑	✗
Operational practicality?	✓?	?	?	✓	?	?
Exploitation benefits?	✓	?	✓	✓	✓	?
'Black swan' Wow Factor	😊😊	😞😞	--	😊	😊	😊😊
Overall Potential	High	B' A' U	Near BAU	High	Evolved	Risky

'Black Swan' - 'outliner, outside the realm of regular expectation

- carries an extreme impact
- concocted explanations after event

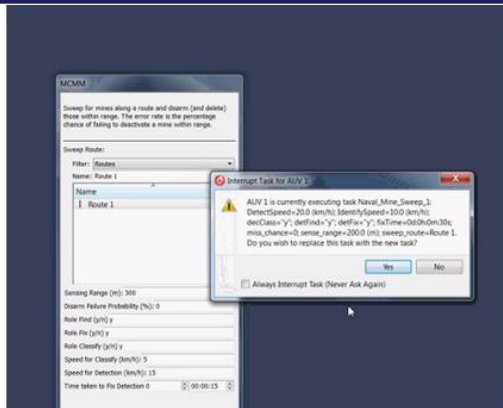
(Nassim Nicholas Taleb, 2010)

Visualisation 1 – mothership concept with increased UxV autonomous capabilities



Screenshot01: Concept – mothership with underwater communication to advanced AI UxVs (baseline UW16 UxV modified to have more capable sensors, propulsion systems and autonomy). Image depicts 9x UxVs surveying 100x100Km search area at 10→50m depth with comms between UxV's and comms to mothership. Mothership communicates via High Altitude Pseudo-Satellite (HAPS) constellation and SATCOM (Skynet5) back to Maritime Component and Joint Forces Command. Visualisation demonstrates significant benefit over current MMCM capabilities in DETECT, FIX, CLASSIFICATION and allows future Concepts of Operations to be studied.

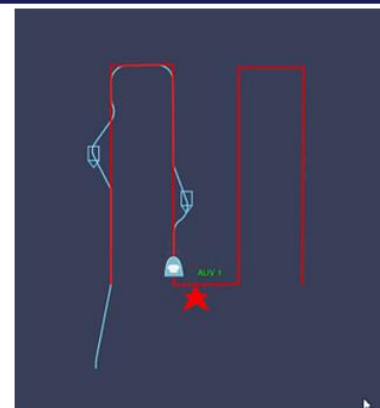
Visualisation 2 – Modify AI to allow timings for discrete tasks to be varied – FIND, FIX, CLASSIFY



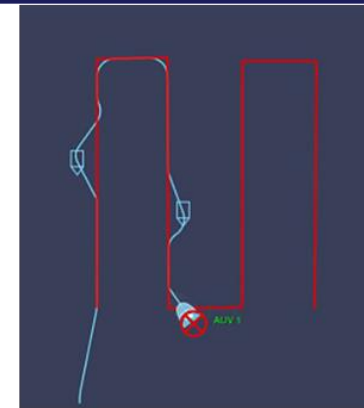
1 - New AI generated to enable the Mine hunting task to be decomposed into discrete elements (RN defined) which can have a variable time associated with each task. Operational roles for UxV (FIND, FIX, CLASSIFY) can also be defined.



2 – The ‘ground truth’ of the simulation depicting 2x ‘live’ mines and 4x ‘clutter’ within the UxV search pattern (red line)



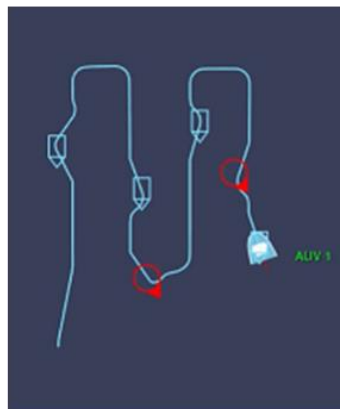
3 - UxV executing task based on AI parameters. Blue line indicates travel of UxV. Blue waypoints depict clutter after UxV has classified object. Red star denotes FIND position.



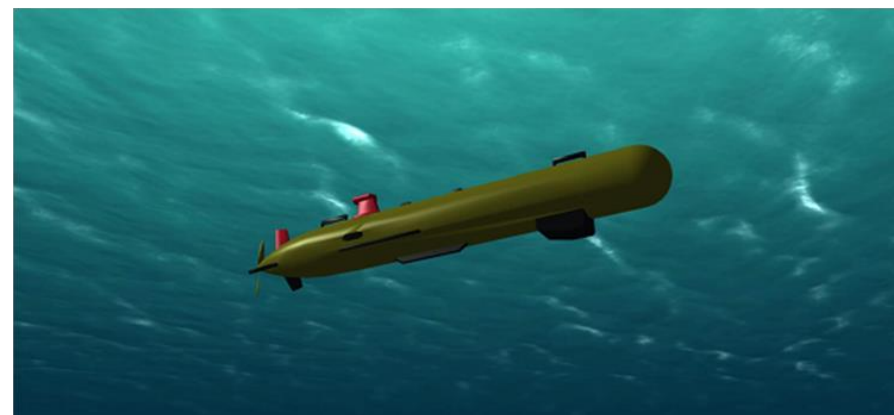
4 - UxV FIX (locating object to a high degree of accuracy). Red cross denotes FIX position.



4 - UxV moving onto next object – previous object FIXED and marked as a hostile mine, FIND (detection) made of next object.



5 – UxV completing search pattern, moving onto next object – previous object FIXED and marked as a hostile mine.



3D representation of UxV with modified AI to allow role/task decomposition and timings to be adjusted to potential new system capabilities.

CMIS Briefing

Process steps completed

