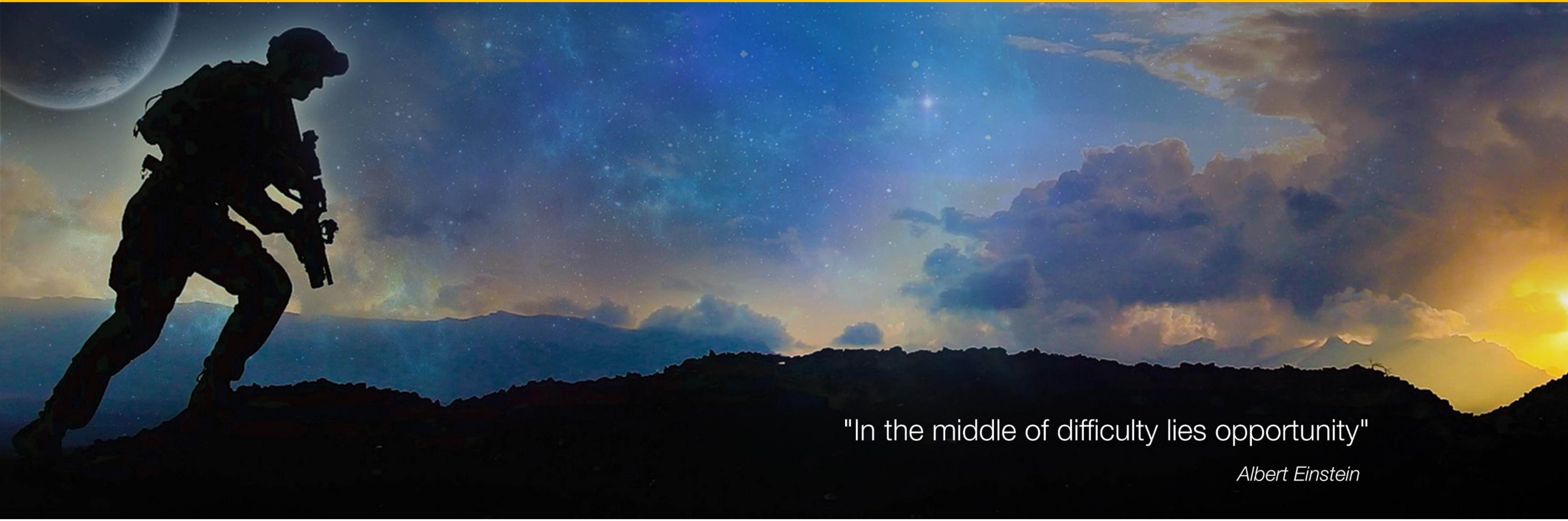


SPECIAL OPERATIONS FORCES ACQUISITION, TECHNOLOGY, & LOGISTICS

Win • Transform • People

Brian Sisco *Futures Chief, Science & Technology*

Innovation Foundry 6

ABOUT THE FOUNDRY

Special Operations Command (SOCOM) hosted their 6th Innovation Foundry (IF6) online in a virtual workshop event, designed and facilitated by Voltage Control.

Over a three-day period, IF6 brought together Special Operations Warfighters and non-traditional technologists to explore future Special Operations scenarios. The diverse set of participants were assembled into seven teams of 6-10 people. The teams used design thinking exercises to ideate, explore, refine, and rank potential concepts. On the final day, each team selected one concept to pitch to SOCOM leadership and other military VIPs.

SOCOM will build on the outcomes of this workshop in future rapid prototyping events.

LIGHTNING TALKS

Douglas Ferguson, President of Voltage Control, kicked off the first day with a brief introduction to the Design Thinking process. Mr. Brian Sisco, Science and Technology (ST) Futures Chief, gave an introduction to USSOCOM, and the acquisitions process. Dr. Bruce Morris presented the goal of exploring solutions for maritime special operations in the year 2030.

SCENARIO BRIEFS

UNDERSTAND THE MISSION

Together, the participants watched an overview video for the context of the scenario, then Operation "Fisherman's Shelter" was presented as the mission. This provided context on the operational environment, and detailed critical constraints such as denied, degraded satellite communication (SATCOM) and global positioning system (GPS), large areas of geography with no landmarks, and limited capacity of maritime mobility assets.

Each team of participants were to envision how advancements in autonomy, machine learning (ML), manned-unmanned teaming, emergent technologies, and unmanned systems might be employed by Special Operations Forces (SOF) to enhance the warfighting functions of maritime maneuver, intelligence, effects and mission command in the form of concepts designed to support potential future missions.

OPERATIONAL SCENARIO

Mission, code name “Fisherman’s Shelter, is to gather intelligence across the ever expanding Marin claim. This area spans the mainland to the Atlantis outpost. You must confirm or deny the presence of defense infrastructure, characterize the current status of suspected reclamation projects, all while generating maps, in real time, of the sub-surface terrain. You will have 72 hours to complete.

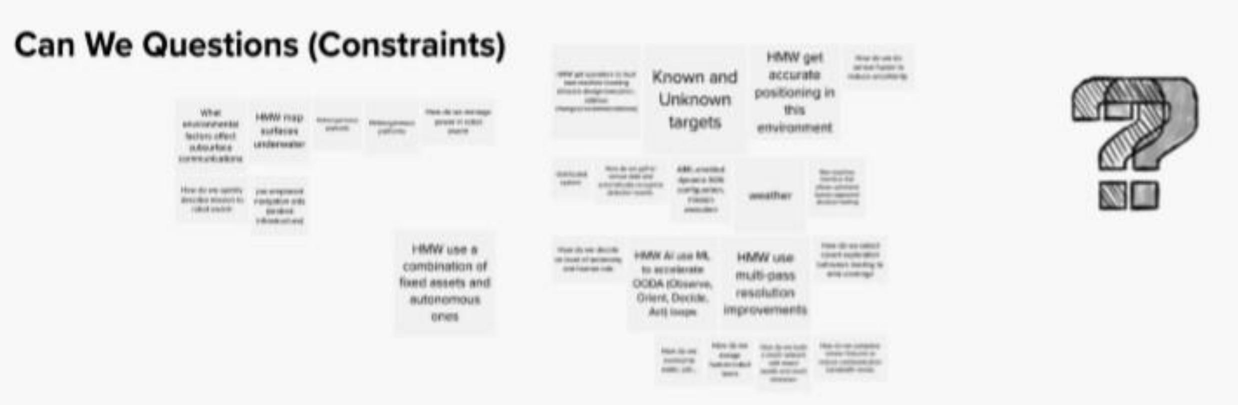
Specified tasks included ascertain terrain characterization of new islands, developing subsurface mapping of potential future islands, and possible or likely supply routes, and to remain undetected.

LIMITATIONS

1. Denied, degraded SATCOM
2. Denied, degraded PNT, for example, GPS
3. Transiting large areas of maritime geography with no SATCOM or GPS
4. Limited capacity of manned Special Operations Forces (SOF) maritime mobility platforms
5. As this is an unclassified, fictional setting the event will not focus on existing SOF maritime surface platform mobility capabilities
6. Complex Environment = a function of Weather, Natural and Manmade terrain without Defense Urban Clutter
7. Contested Environment = a function of Cyberspace Electromagnetic Activities (CEMA), Threat Action, Stand Off and Adversary Speed
8. Do not focus on existing SOF maritime surface platform mobility capabilities

ESTABLISH GOAL

Participants, without conversation, each described the goal in their own words. After sharing with the group, each table voted to align on the task at hand.



IDENTIFY CHALLENGES

Participants were assigned to one of seven teams that included both technology experts and special warfighters. Each team began by discussing the objective and then identified key challenges and risks in the form of Critical Questions.

ASK THE EXPERTS

Technologists interviewed the warfighters while taking "How might we" (HMW) notes to learn from the warfighters' perspective.

TWILIGHT CRITICAL QUESTIONS

How are the assets going to arrive?
Can we develop a surface target signature using multiple ISR assets?
Can we guarantee that they can communicate?
Can we drop any subsurface assets from flying assets?
Is it practical to find "normal"/"abnormal" comms patterns to detect cyber posture?
Can our UW ISR assets have high-bandwidth comms?
Can we 'hitch a ride' on unsuspecting surface vessels to get to OpArea?
Can we guide the mesh so that work isn't duplicated?
Can we power/low-power the devices, esp. network comms. are expensive..
Can we cover the area within the time limit?
Can they have self-defense capability built in in case they are pursued?
How might we minimize chance of detection?
What aspects of the AOI do we care about most?
What is current commercial air and sea traffic in the area (that we could take advantage of via humin and placing sensors on those assets)?
How might we aggregate and process the data gathered?
How do we power and exfiltrate the data from sensors?
Can accurate position fixes be inferred to precisely map the key features?
What autonomous platform can cover the area of operation?
How do we select covert exploration behaviors leading to area coverage?
How do we build a mesh network with mixed assets and avoid detection?

Is it possible to adequately map ~1.8M Sq miles in 72hours?
If we are assessing and mapping Marin assets without knowing what sensors they employ, how will we ensure undetection?
How do we power/recharge on the go with unmanned assets?
Can you use sonar for subsurface mapping without being detected?
Can we categorize and prioritize and execute on targets faster than the enemy can respond to the threat in the area of SR?
Can we resolve geospatial location without GPS or landmarks at high enough fidelity?
Can we fuse multiple (underwater?) sensors together to achieve needed ISR and navigation fidelity?
Can we appropriately prioritize the areas we need to analyze? (create just-in-time maps of the most likely places of military emplacements)
Can we create autonomous systems that are stealthy at operational depths?
Are the mechanisms used for terrain mapping detectable?
How to navigate in a featureless terrain?
How do we do sensor fusion to reduce uncertainty?
What environmental factors affect subsurface communications?
How do we manage power in robot swarm?
How do we gather sensor data and automatically recognize detection events?
How do we quickly describe mission to robot swarm?
HMW use a combination of fixed assets and autonomous ones?

TOP VOTED TWILIGHT HOW MIGHT WE NOTES

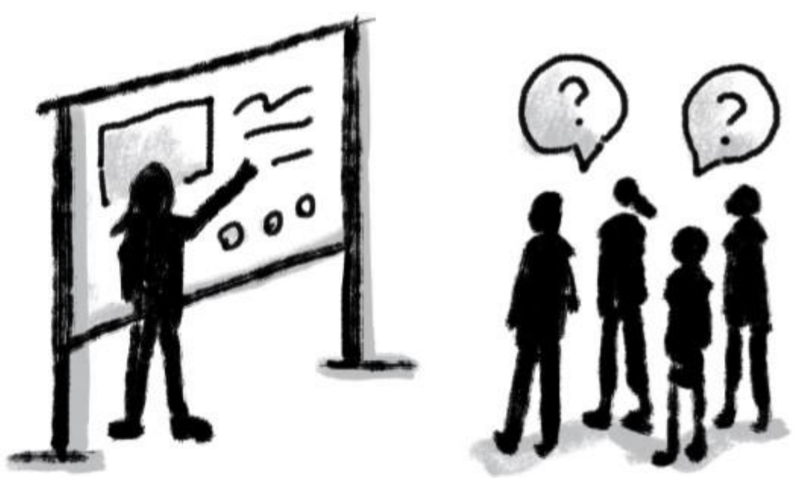
How might we..Plan routes of mobile ISR sensing assets to optimize classification accuracy
How might we..EXFIL data without SATCOM without detection/intercept
How might we..profile the environment based on sensor readings (using AI?)
How might we..Establish a mesh network of passive sensors
HMW Focus on the hardest target
HMW detect if we've been detected
HMW utilize multiple comms channels to achieve resilience and undetectability?
HMW Launch and recover unmanned systems from land or sea(need the where to do the time, speed, distance problem)
HMW make our system non-attributable to the US?
HMW ensure explainable decisions / classifications and provide a simple, trustworthy AI platform
HMW create the most useful map for the mission including all spectrum and terrain features.
HMW Leverage simulation, ML, and game theory to drive recon priorities? To enhance overall platform?
HMW process sensor data, provide key information, & stream to operators
HMW quickly identify areas of interest and deploy undersea assets covertly to map / investigate those areas
HMW Design of human-machine team utilizing AIML for mission execution and TC-PED

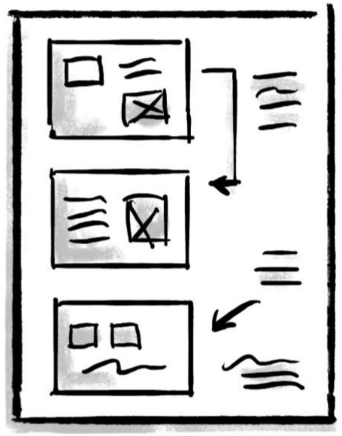
HMW... leverage AI to minimize the cognitive load when interacting with UAVs or drones?
HMW - use magnetic flux navigation surface and subsurface
HMW...extend our underwater perception at night and at depth
HMW...Create Lightwave alternative to enable a mapping collection sensor?
HMW...switch between current low swap weight signal to create synthetic undiscoverable manor .... do signals have a window of non-discoverability
HMW...integrate multiple RF modes in a single piece of equipment
use computer vision and imagery (EO, SAR, LIDAR, other) to annotate military objects in the water?
HMW Enable extended energy for an AUV?
HMW maintain accurate position, navigation and timing (PNT)?
HMW leverage enemy navigation (stolen) non-degraded to understand your own position based on their positional data
How might we determine how much GPS accuracy we need to achieve?
HMW Establish temporary subsea infrastructure in an AO?
HMW use a 'probability map' of places important to our adversary to prioritize our search space?
HMW Temporary data capture "remote hub" for incoming data and burst outgoing
HMW gain persistent access to exploit adversary networks
HMW recognize objects of interest and their variations?.
How do we automatically select the right autonomy level for machines?

REMIX ANYTHING

BRAINWRITING

CONCEPT SKETCH



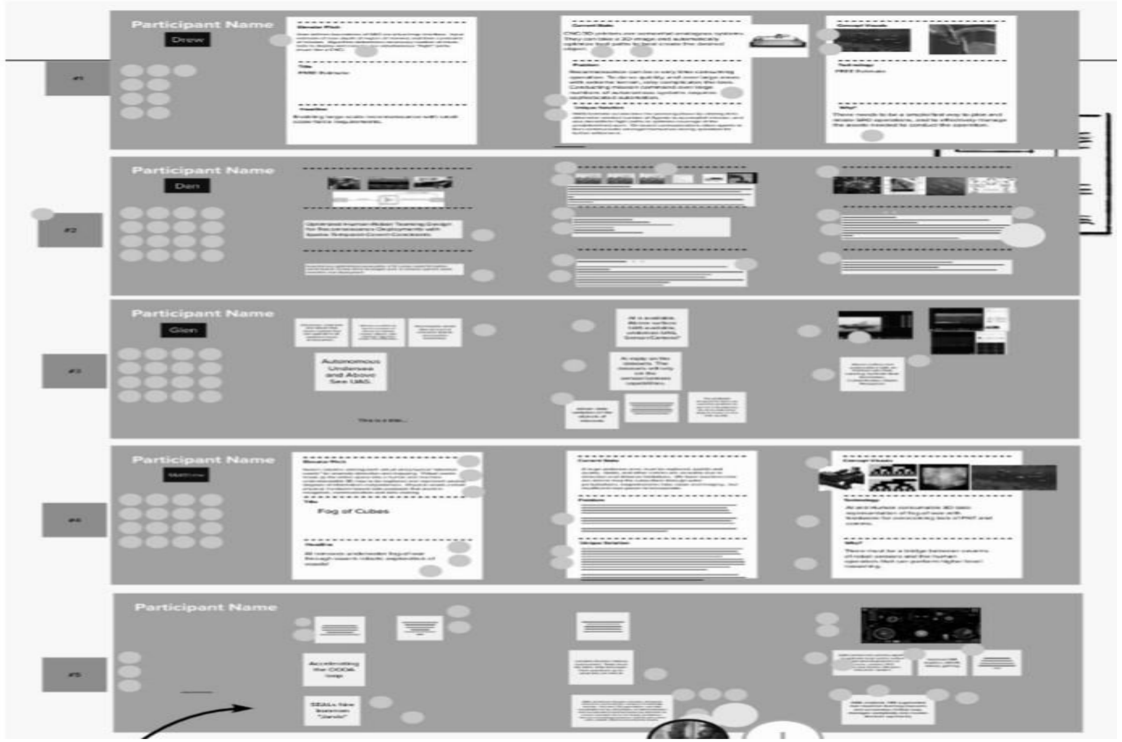


ANALOGOUS INSPIRATION
Everyone brought ideas of disruptive technology solutions that could help accomplish the missions. They presented these ideas to their table to consider incorporating in the solutions.

INDIVIDUAL BRAINSTORM
Attendees wrote down ideas about how to approach their scenario and then passed their solutions to the next person, who added to those ideas. They built on and integrated each others ideas for five rounds.

SOLUTIONS
Each individual committed to a concept in detail. This template was structured for the attendees to develop a pitch of their idea.

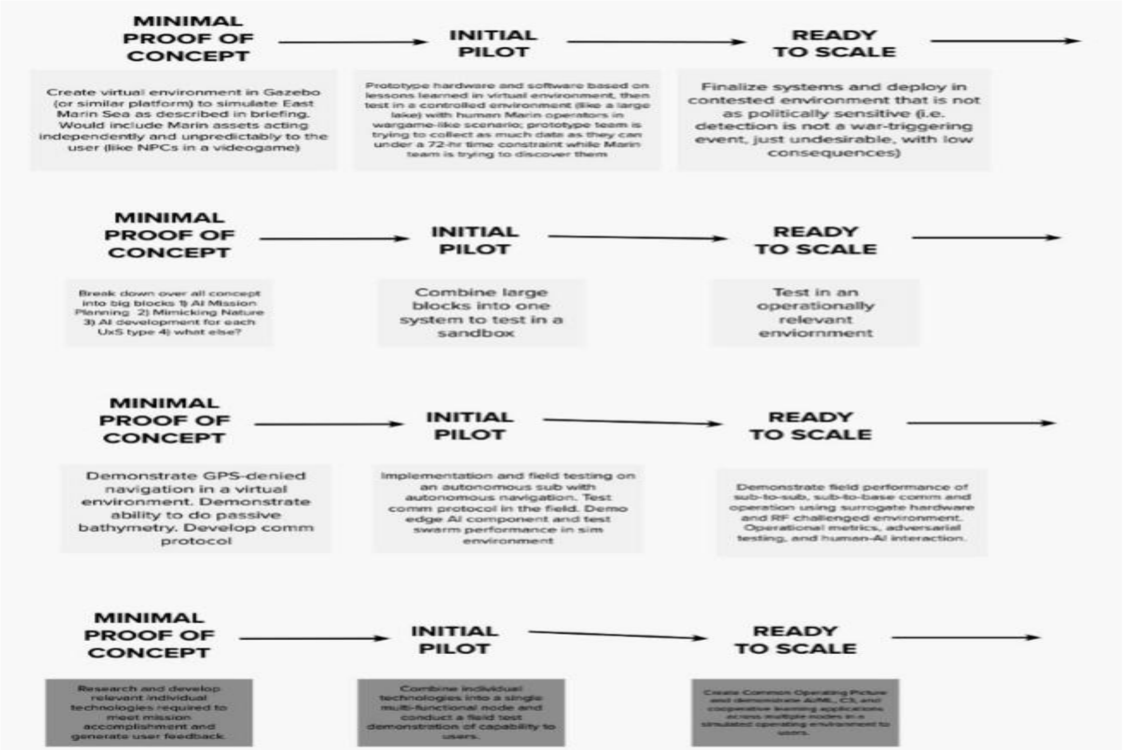
SELECT CONCEPTS



GROUP VOTING

Through a process of "dot voting" each team ranked, debated, and selected the top concepts for the operations. The following sketches are the top voted ideas as well as the other concepts that were presented at each group.

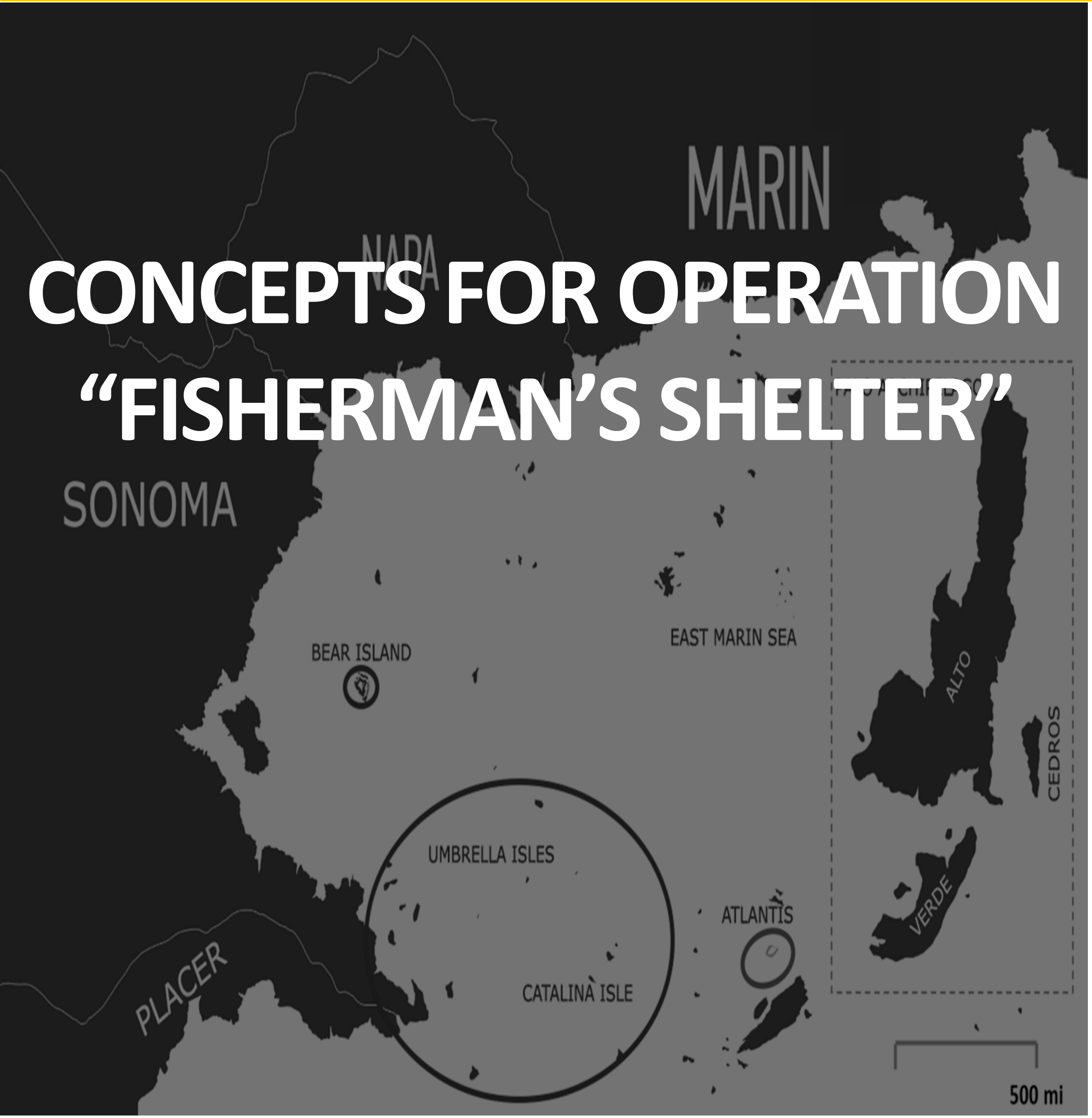
BASECAMPING

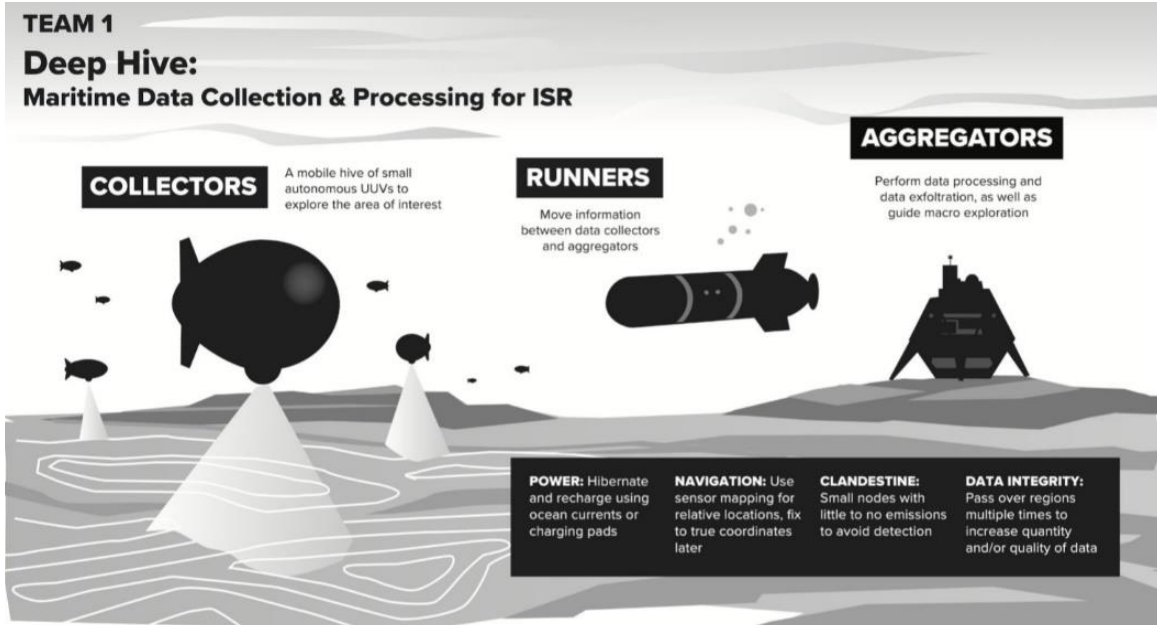


STRONG STRATEGIES

After selecting their top idea, the team thought about a basecamp strategy about how they would segment out the building of the concept from a prototype phase all the way until it is production ready.

CONCEPTS FOR OPERATION "FISHERMAN'S SHELTER"



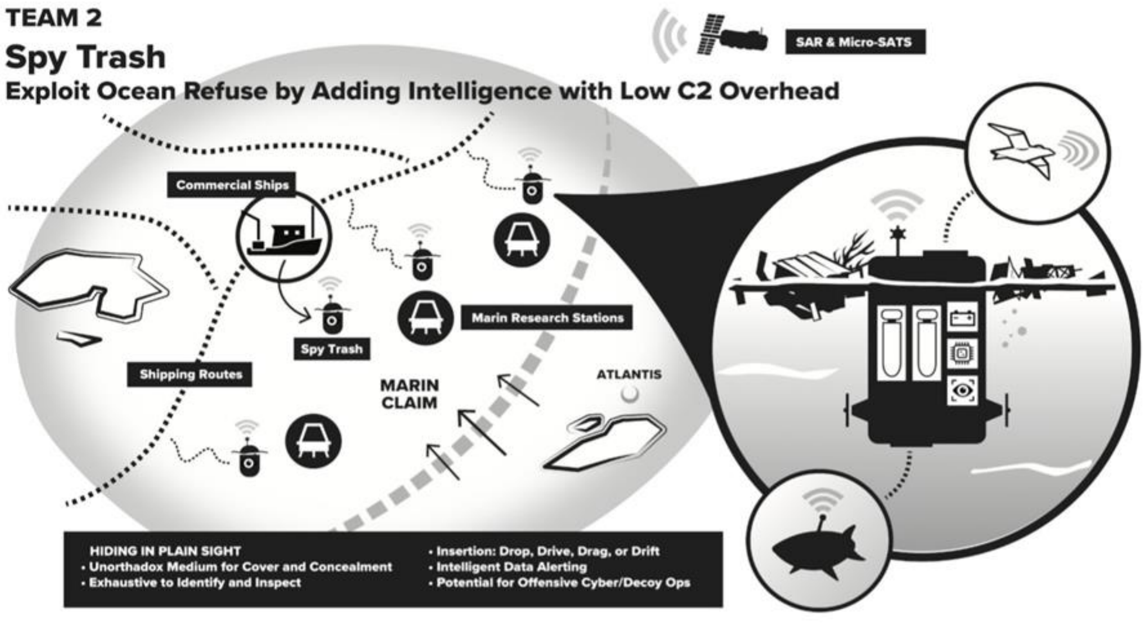


A mobile hive of small autonomous unmanned underwater vehicles (UUV) to explore the area of interest

Key elements

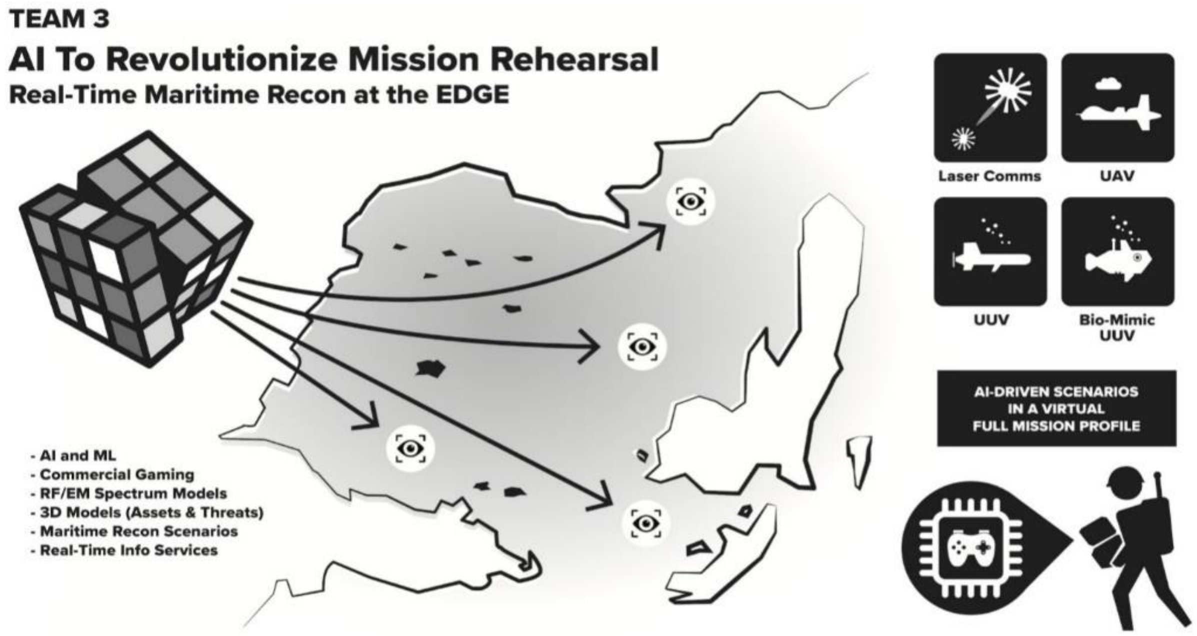
- Data collectors use unique bio-mimicked pathing
- Data runners move information
- Data aggregators perform data processing and data exfiltration.

CONCEPT PITCHES



Exploit ocean refuse by adding intelligence with low command and control (C2) overhead

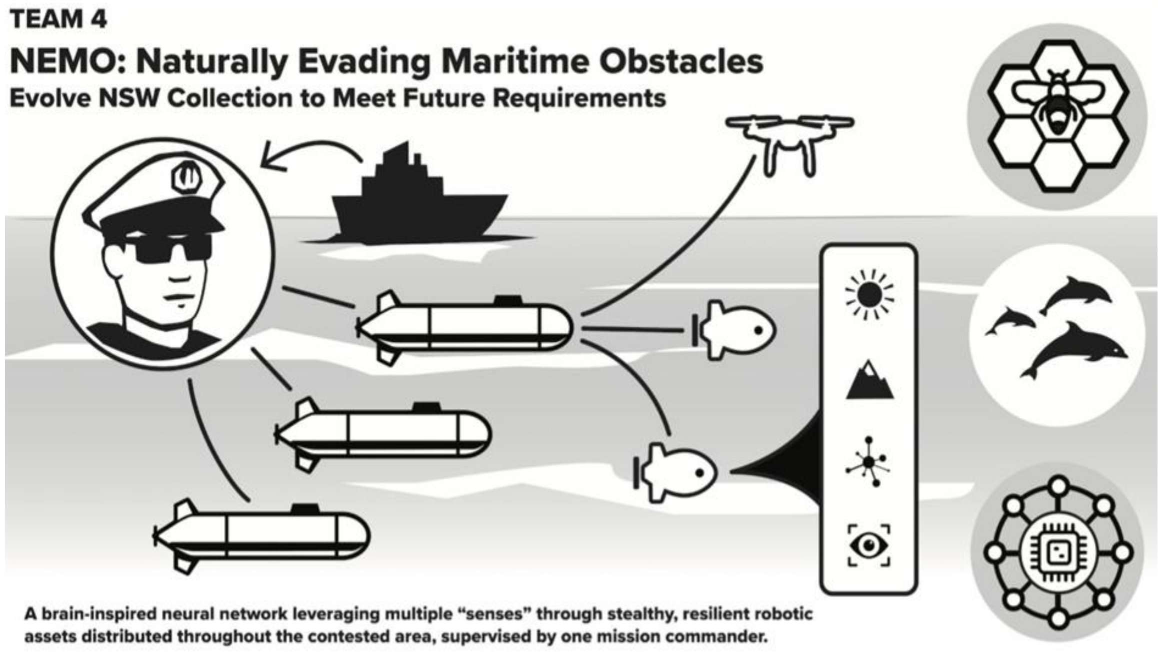
Key elements
• High resolution Electro-Optical/Infra-Red (EO/IR)
• Acoustic transducers
• Smart navigation
• Machine learning (ML) to learn environment



Provide mission rehearsal (simulation) capabilities for human-machine integration that can drive research, development, test and evaluation (RDT&E) and mission planning

Key elements
• Artificial intelligence, machine learning (AI/ML)
• Computation
• Open-source tools

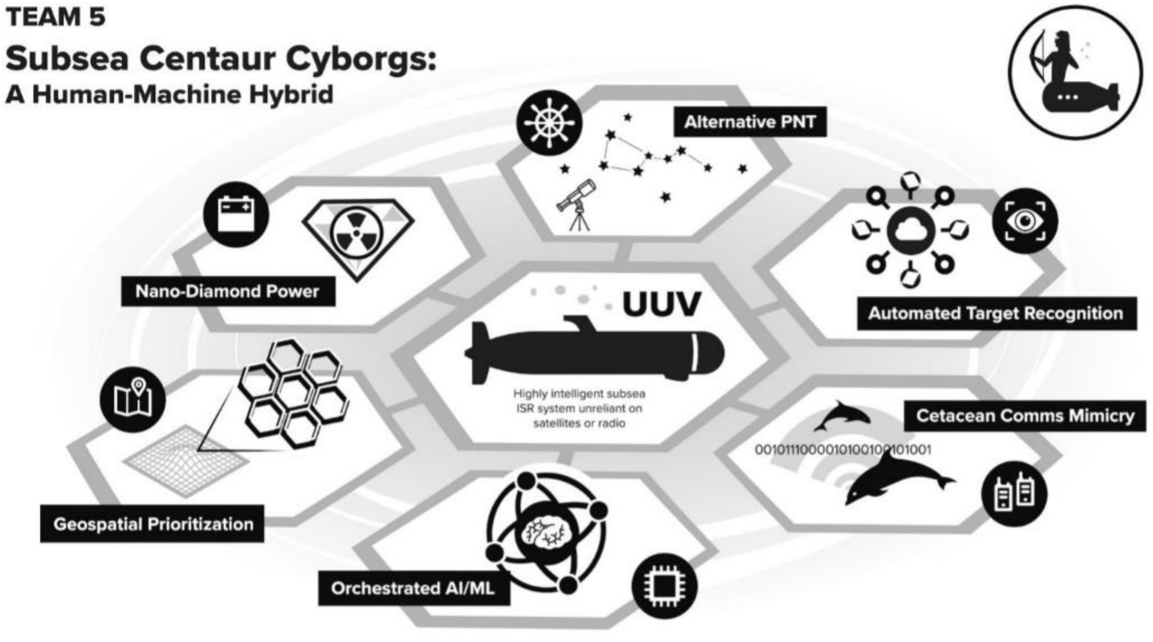
CONCEPT PITCHES



Develop bio-inspired, platform-agnostic artificial intelligence (AI) to create a school of smart, autonomous robots using both existing and new assets

Key elements

- A brain-inspired neural network leveraging multiple "senses" through stealthy, resilient robotic assets distributed throughout the contested area, supervised by one mission commander

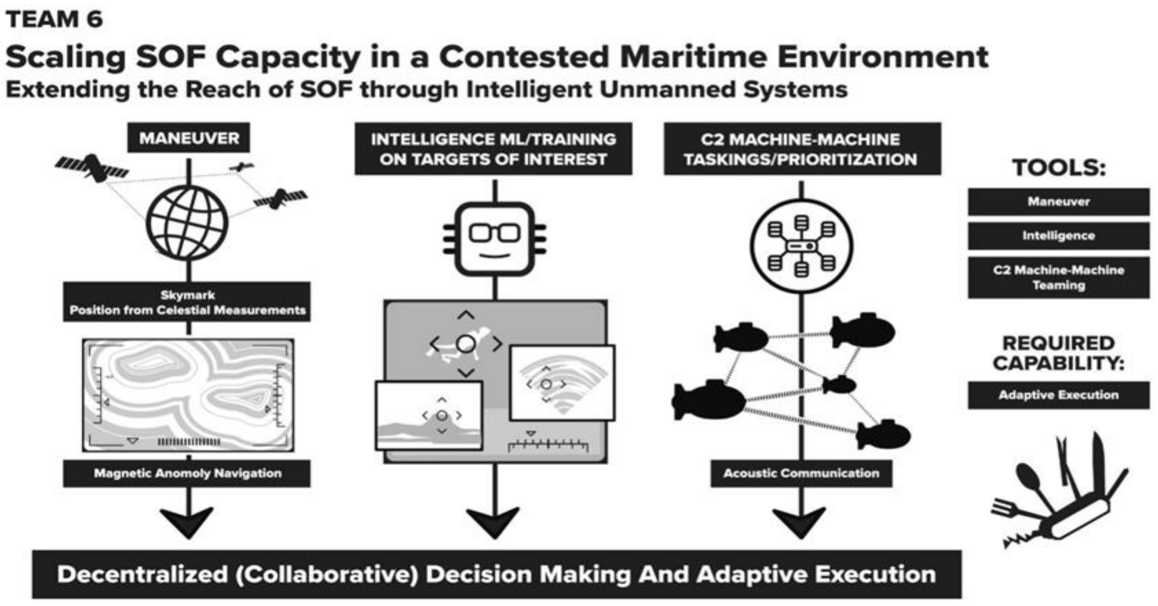


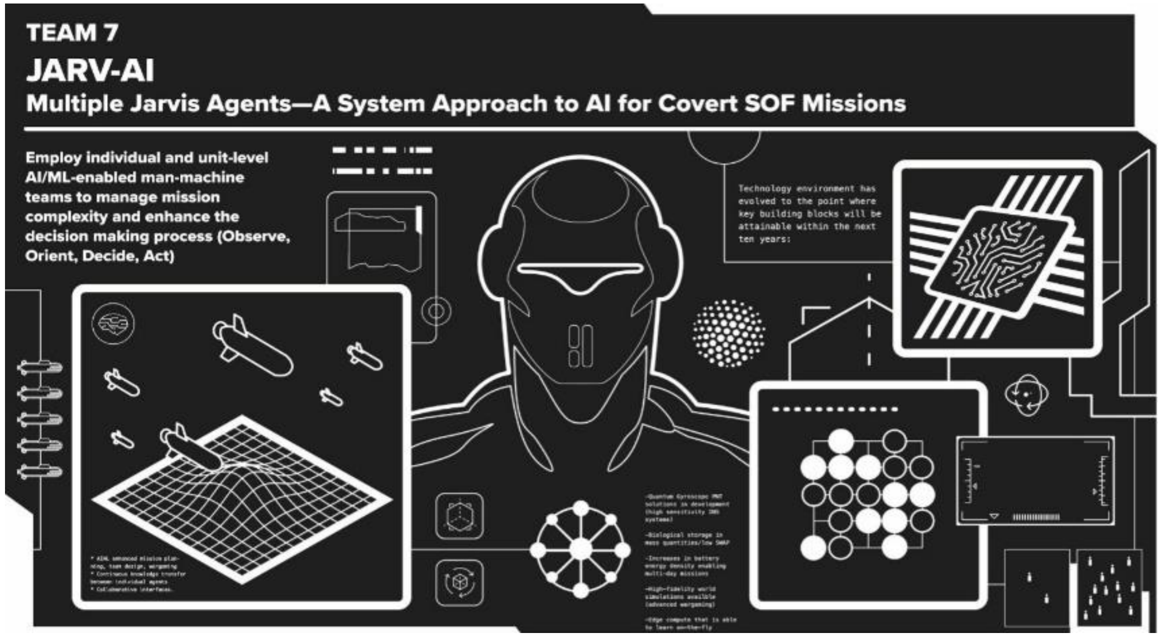
A highly intelligent subsea intelligence, surveillance, reconnaissance (ISR) system un-reliant on satellites or radio

Key elements

- Multimodal, uses proven tech from other industries
- Clandestine, communicates through "whale songs"
- Advanced mission and payload autonomy
- Magnetic velocity navigation
- Celestial-based geolocation
- Graceful failure modes for position, navigation and timing (PNT), machine learning (ML), and data processing

CONCEPT PITCHES





AI equipped robotic autonomous systems

- Maneuver
- Intelligence
- C2 (machine-machine teaming, human out of the loop)
- Swarming – make current inventory smart (force multiplier)
- AI portability – free up exquisite assets

Employ individual and unit-level AI/ML-enabled man-machine teams to manage mission complexity and enhance decision making

Key elements
- Quantum gyroscope PNT solutions
- Biological storage for low size, weight and power (SWaP)
- Increases in battery energy density
- High-fidelity world simulations
- Edge computing
- Passive communication via laser-induced retro-reflection
- Advanced wearables

QUESTIONS?