



# *Breaking the Tether: The Future of Mine Warfare*

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# *Familiar with this Scene*

- Amphibious ships are at sea ready for an assault loaded with Marines
- Mines are discovered in the water
- The assault force sits idly at sea
- The MCM force arrives (often a week or more later)
- The divers get to work
- Helicopters are brought in for sweeping
- Mines are found and disabled or blown up
- The MCM force requires force protection while conducting its mission
- Eventually, safe routes are established to assault the beach
- The campaign may or may not have been postponed, given the time required to complete MCM activities

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# Wonsan 1950 – Timing is Everything

Avoiding future “Administrative Landings” – that’s what the amphibious assault was changed to at Wonsan after the two-week delay to clear mines. The city had already been taken by ROK troops and Bob Hope had already arrived with the USO tour. Hope rubbed salt in the Marine wound by saying he “and his dancing girls had beat the famed Leathernecks ashore.”

– *“On Desperate Ground: The Marines at The Reservoir, the Korean War’s Greatest Battle,” Hampton Sides*



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# MCM Theory

- Initial Search Theory Developed during WWII



Dr. B.O. Koopman

- Search Theory established as a new branch of operations research in 1942 to support ASW
- Seminal document for search theory is “Search and Screening” by Dr. B.O. Koopman

- Mine Countermeasures (MCM) Tactical Theory Developed in the 1950s



Dr. R.K. Reber

- Dr. R.K. Reber developed the underlying MCM tactical theory and generated numerous technical reports/memoranda
- Serves as the basic theory to Estimating MCM effectiveness in current naval doctrine (NWP 3-15)



# Application of Technology

Technological advancements are being applied to a static concept of operations.



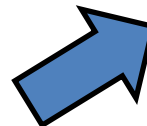
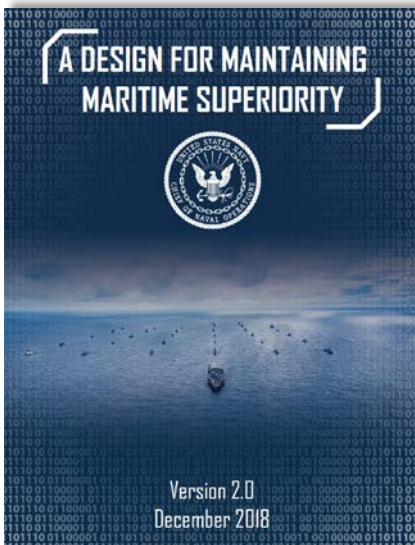
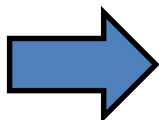
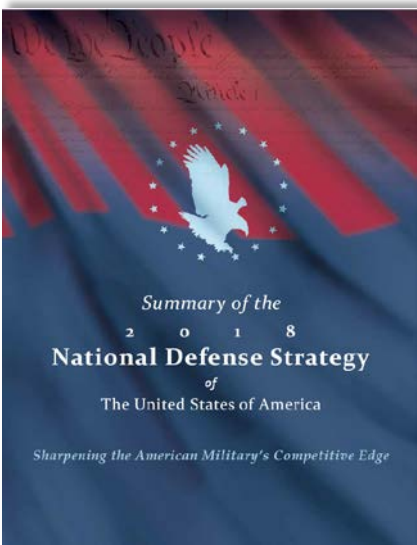
This is not a criticism of any program/system/platform.  
It **IS** a call to action.



# Current Need

“We cannot expect success fighting tomorrow's conflicts with yesterday's weapons or equipment.”

- 2018 National Defense Strategy



MCM Master Plan

Mining Master Plan

In this era of great power competition, there is an opportunity, some might even say a need, to embrace bold ideas.

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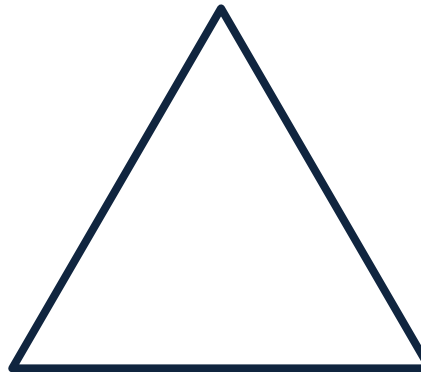
# The Dedicated MCM Triad - Present

Mine countermeasures assets that make up the Navy's dedicated mine warfare force



**AMCM**  
Speed, Area Coverage,  
Over-the-Horizon

**EOD**  
Flexibility, Intel



**SMCM**  
Endurance, Deep Capability



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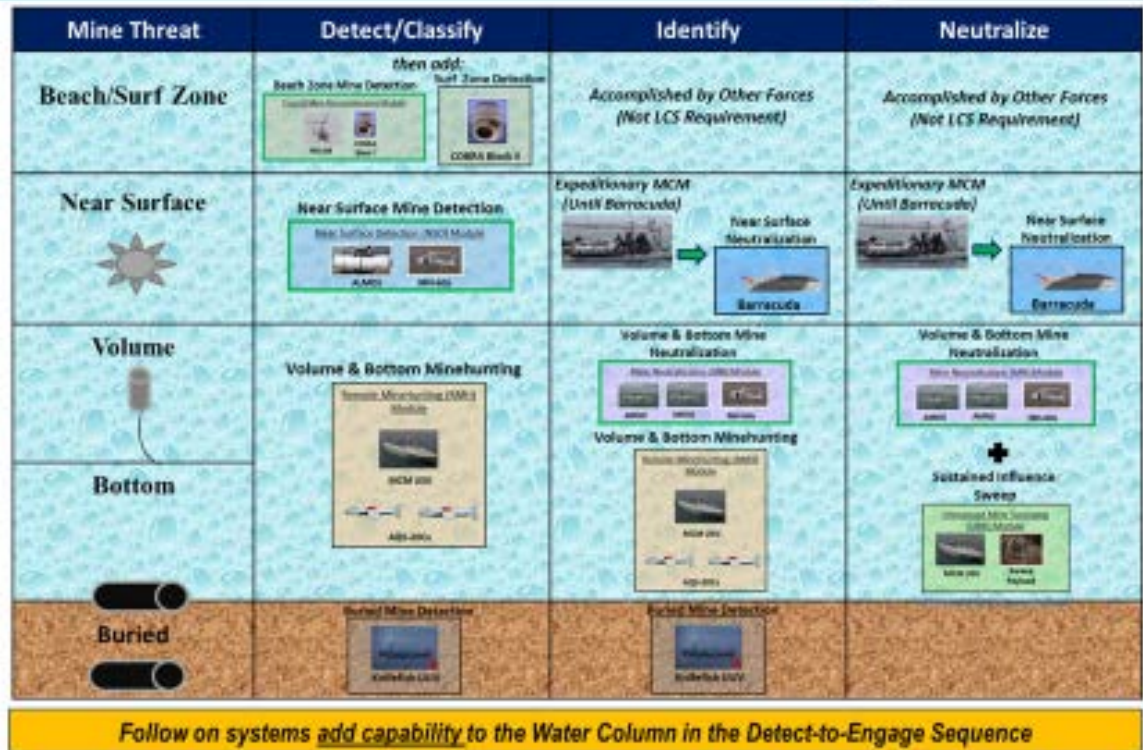


# Modular MCM Force

- Modularity
- Flexibility
- Agility
- Adaptability
- Unmanned



## MCM Capabilities



ACCELERATE | INNOVATE | DELIVER

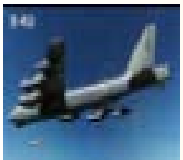
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ACCELERATE | INNOVATE | DELIVER



# Evolution of Mine Warfare - 2025

Aviation



Various Aircraft/JABS

**Today**

AQS-24B/C or SeaFox AMNS

MH-53E Influence Sweep Systems

MH-60S

ALMDS

MH-60S

AMNS

**Tomorrow**

MQ-8B

COBRA Block I

MQ-8C

COBRA Block II

**Future**

MQ-8C

Future optical sensor

Surface

SeaFox AMNS

SeaFox AMNS

SLQ-38 Influence Sweep System

MCM 1

MCM 1

LCS 2 Variant

LCS 2 Variant

LCS 1 Variant

LCS 1 Variant

ESB

ESB

MCM USV/sonar

MCM USV/sonar

MCM USV with Barracuda

MCM USV with Barracuda

MHU 1-4 with AN/AQS-24

MHU 1-4 with AN/AQS-24

USV with sweep payload

USV with sweep payload

USV with hunt payload

USV with hunt payload

Medium USV (Hull form(s) TBD)

Medium USV (Hull form(s) TBD)

Undersea

Marine Mammals

Marine Mammals

EOD

EOD

Mk18 Mod 2 (Kingfish)

Mk18 Mod 2 (Kingfish)

Knifefish

Knifefish

SEABOTIX ROV

SEABOTIX ROV

Mk18 Mod 1 (Swordfish)

Mk18 Mod 1 (Swordfish)

Maritime Expeditionary MCM UUV System

Maritime Expeditionary MCM UUV System

Knifefish P31

Knifefish P31

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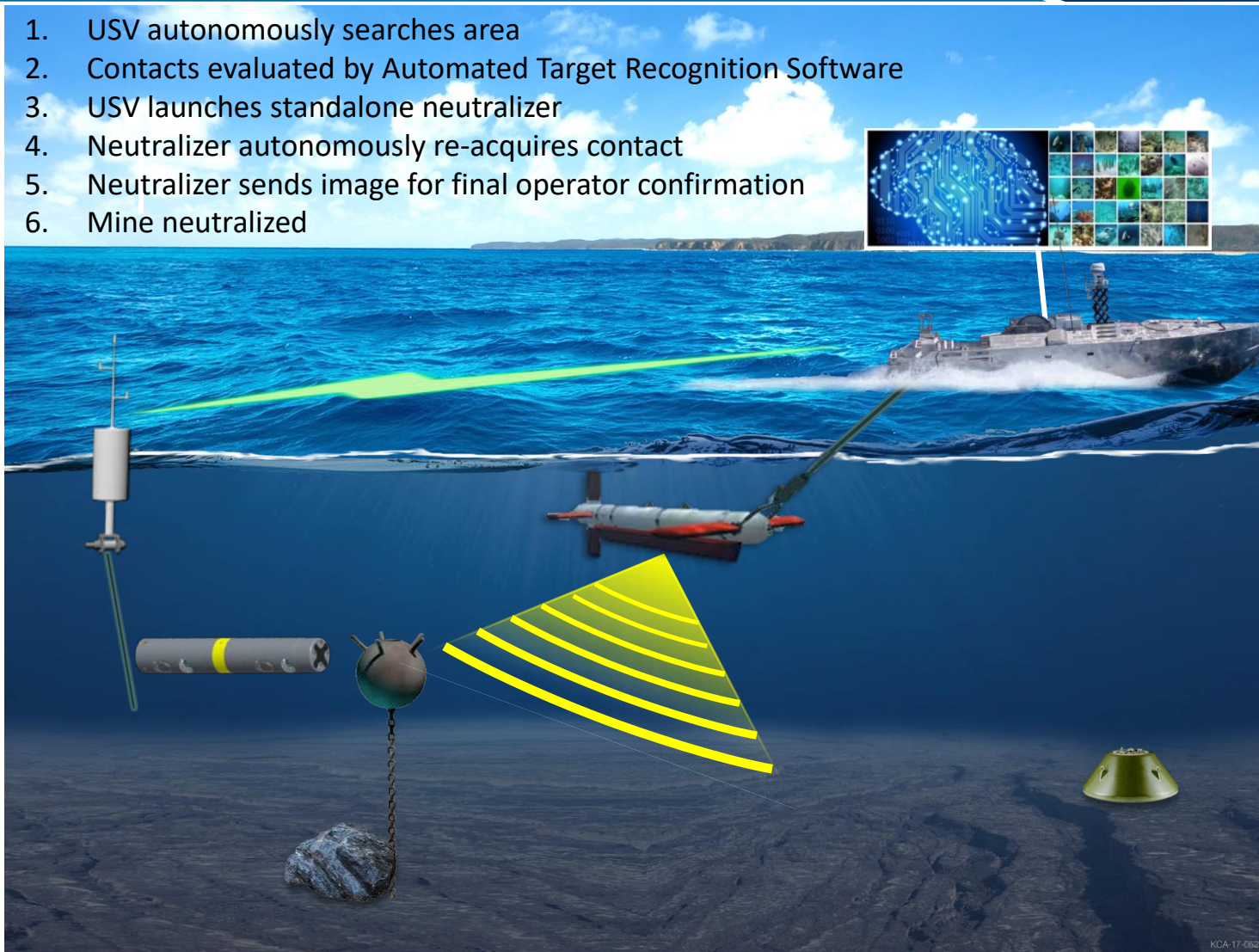
# Single Sortie Detect-to-Engage Demonstration Project Overview

- Purpose:
  - Demonstrate the feasibility of an automated detect-to-engagement sequence for mine hunting.
  - Developing critical technologies are mature enough to fully enable this capability
  - Accelerate selected needed improvements to current POR MCM USV systems
  - Accelerate Artificial Intelligence (AI) use to address the MCM challenge
  - Demonstration Date: Summer 2019
- Participants:
  - Johns Hopkins University – Applied Physics Lab
  - University of Texas – Applied Research Lab
  - Northrop Grumman Annapolis
  - Raytheon IDS
  - Sparton Corp
  - General Dynamics: Applied Physical Sciences



# Operational View

1. USV autonomously searches area
2. Contacts evaluated by Automated Target Recognition Software
3. USV launches standalone neutralizer
4. Neutralizer autonomously re-acquires contact
5. Neutralizer sends image for final operator confirmation
6. Mine neutralized



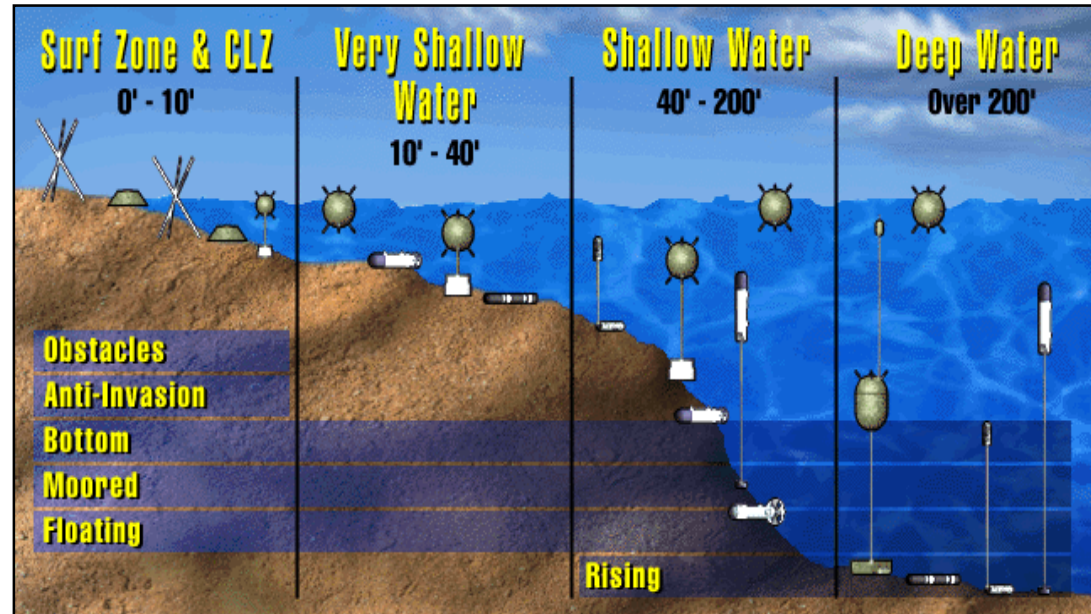
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# Future of Mine Warfare

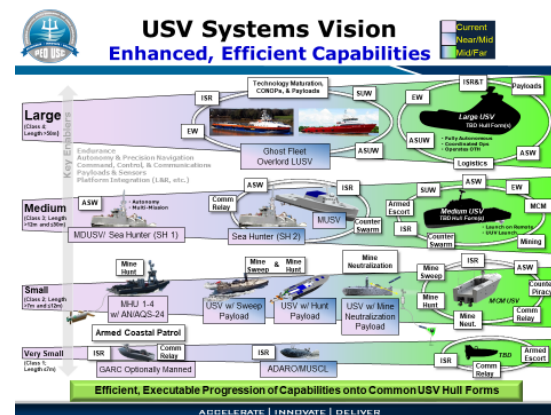
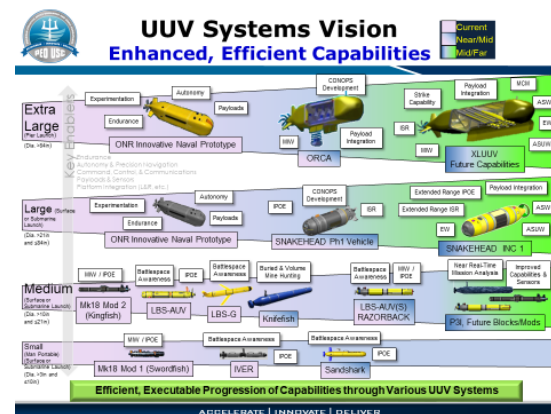
- Threats are changing and becoming more sophisticated
- Look at the problem differently
  - New CONOPS
  - New types of technologies
  - New employment approaches/tactics
- Willingness to disrupt the current MIW paradigm
- More cohesive alignment within MIW community





# Where do we start for MIW 2035 and beyond?

- Look to other areas within the Navy
- Use of other tools
- Novel teaming
- Experimentation
- Prototyping
- Do we need an MIW Grand Challenge?



Answers will not come from this room if we remain wedded to the status quo.



# A New Way Ahead

To make revolutionary leaps in MIW capability, we are going to have to think about the problem differently. We cannot expect vastly different results if we just replace current systems with new technology and operate the same way.

## Non-traditional Outreach

- Defense Innovation Unit
- National Security Technology Accelerator (NSTXL)
- Hacking 4 Defense (H4Di)
- SOFWERX
- Joint Artificial Intelligence Center

## Exploring New Ideas

- Intelligent search methodologies
- In-stride clearance technologies
- Adaptive algorithms
- Big-data concepts/analytics
- ?

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