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Systems Center
San Diego

LOW COST UUV'S FOR MILITARY APPLICATIONS: IS THE TECHNOLOGY READY?



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KEY US NAVY UUVs

NAVSEA

- NMRS - STANDBY
- LMRS - UNDER DEVELOPMENT
- RMS - UNDERGOING TESTING
- MRUUV - LONG RANGE PLAN
- MANTA TEST BED (MTV) (NUWC)

NAVOCEANO

- LAZARUS - OPERATIONAL
- SEAHORSE - INITIAL TESTING

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- AUSS - COMMERCIAL USE AGREEMENT

COMMONALITY OF EXISTING NAVY UUVs

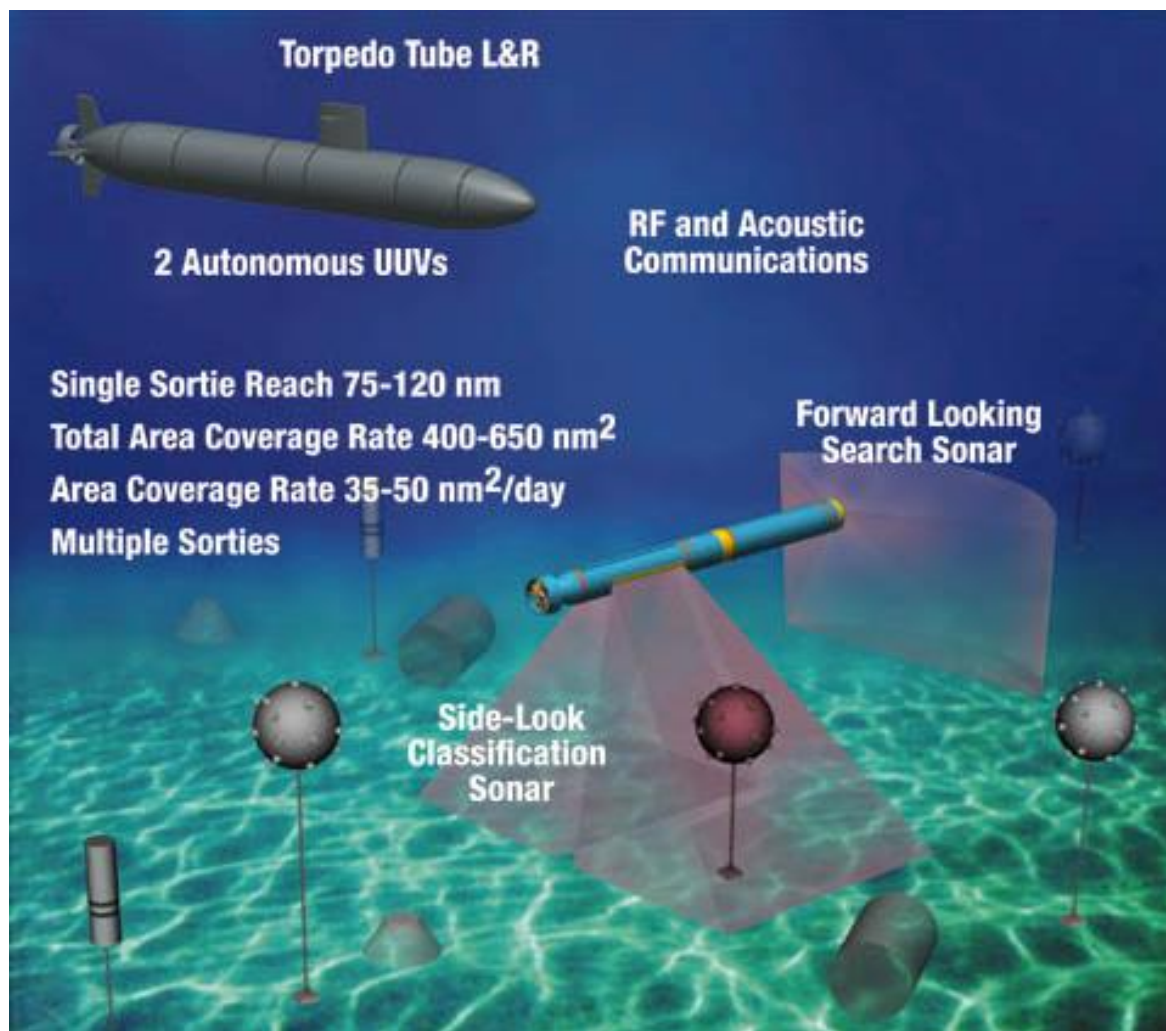
EXISTING UUVs ARE:

- LARGE
- EXPEN\$IVE
- MULTI-YEAR DEVELOPMENTS
- LIMITED IN NUMBER



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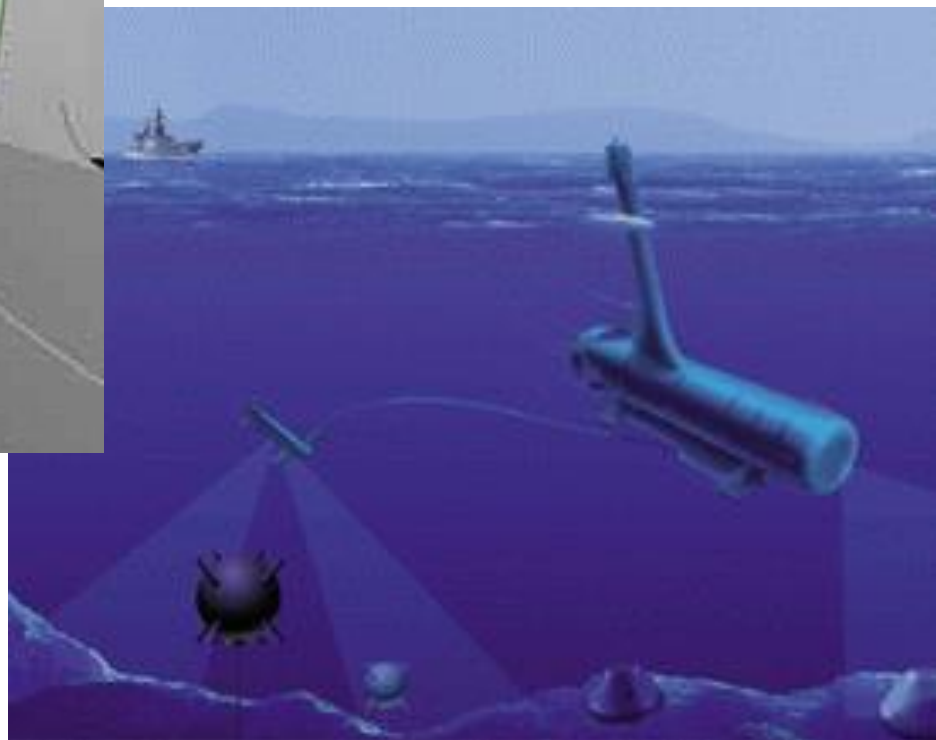
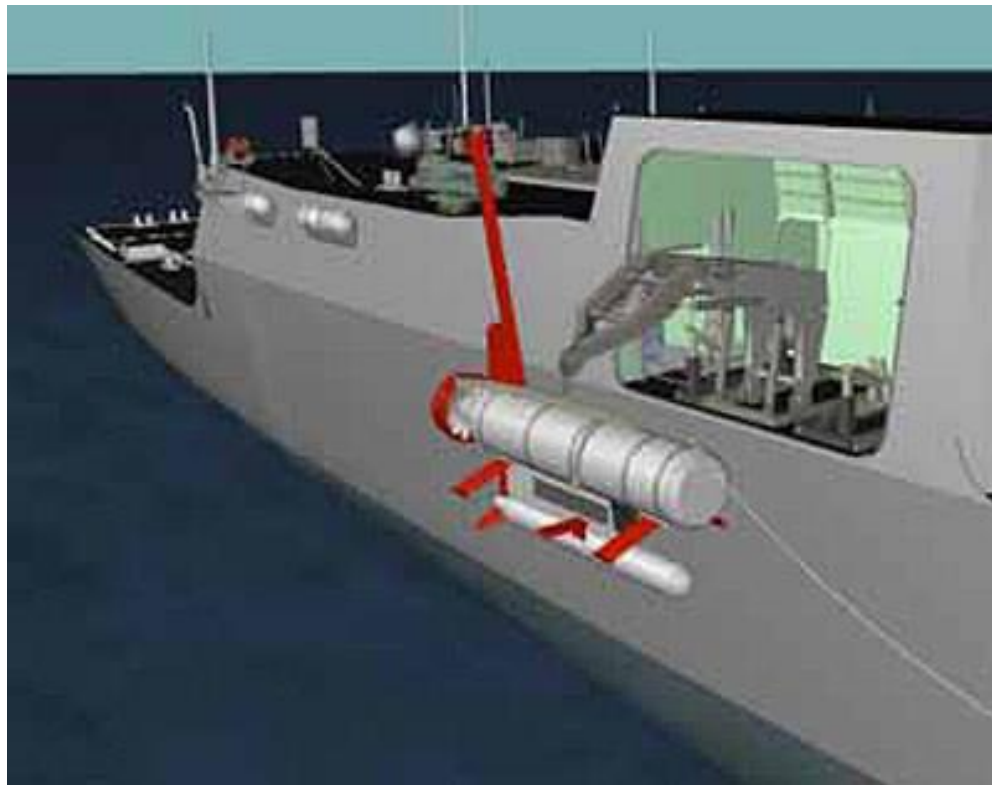
LONG TERM MINE RECONNAISSANCE SYSTEM (LMRS)





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REMOTE MINEHUNTING VEHICLE (RMV)



10 July 2001

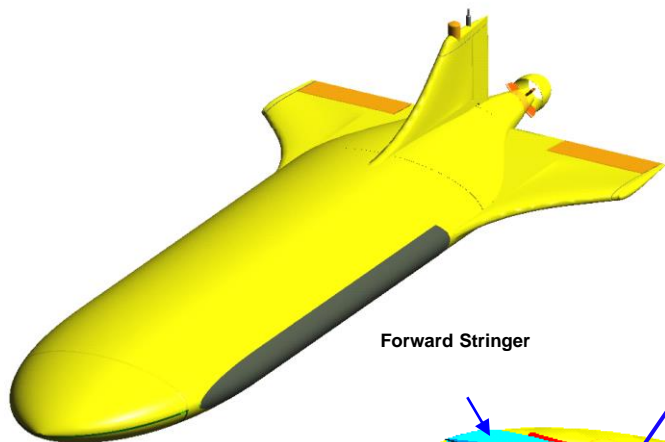
PACON 2001

5



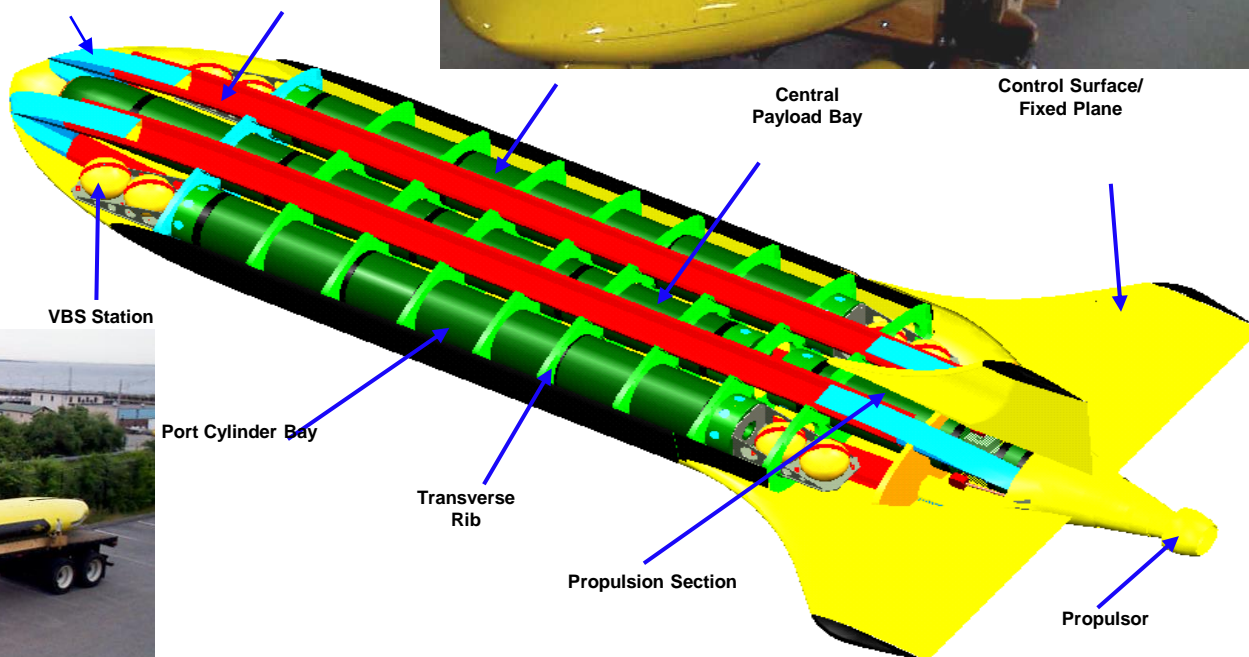
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NUWC Newport: MANTA Test Bed (MTV)



Forward Stringer

Longitudinal Rib





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SEAHORSE



Seahorse

SEAHORSE PROPULSOR



SEAHORSE TESTING ON T-AGS 64 (USNS HEEZEN)



SEAHORSE LAUNCH



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LAZARUS



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11

LAZARUS IN COCOON



COMMERCIAL UUVs

- Maridan - M600 - Diamond Offshore
- Kongsberg Simrad - Hugin C&C Tech.
- Boeing/Fugro/OI - AUV
- KDD - AE2 - Oceanscan Ltd.
- Bluefin/Thales - Sea Oracle
- Mentor/ISE - SAILARS
- SOC/Halliburton - Autosub
- SSD SD - AUSS - Ocean Workers



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THE COMMERCIAL LINEUP



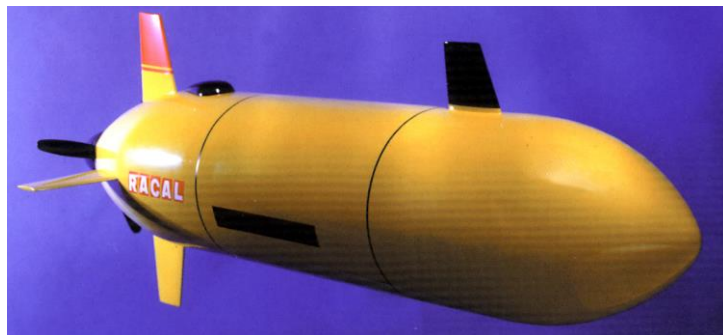
MARIDAN 600



CETUS



HUGIN



SEA ORACLE

AE 2





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THESE AUV GRANDPARENTS ARE STILL AVAILABLE OR WORKING



ARCS



AUSS

THESEUS



MUST LAB

COMMONALITY OF MOST EXISTING COMMERCIAL UUVs

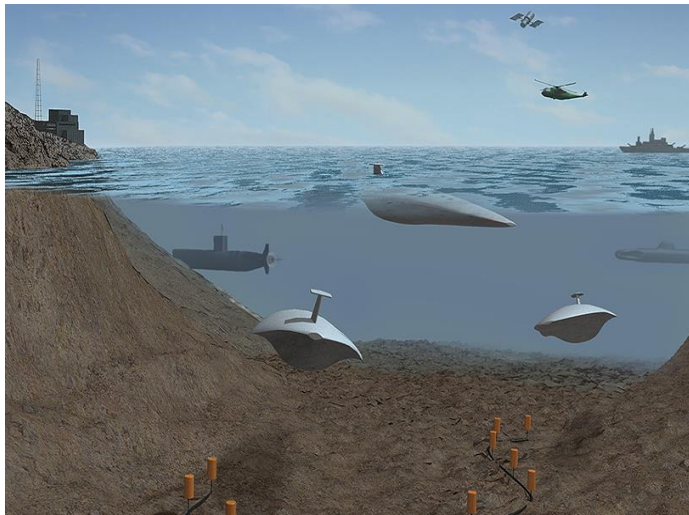
EXISTING COMMERCIAL UUVs ARE:

- MOST ARE LARGE
- EXPEN\$IVE
- LIMITED IN NUMBER

FIRST STEP TOWARD A SOLUTION

ON APRIL 20, 2000

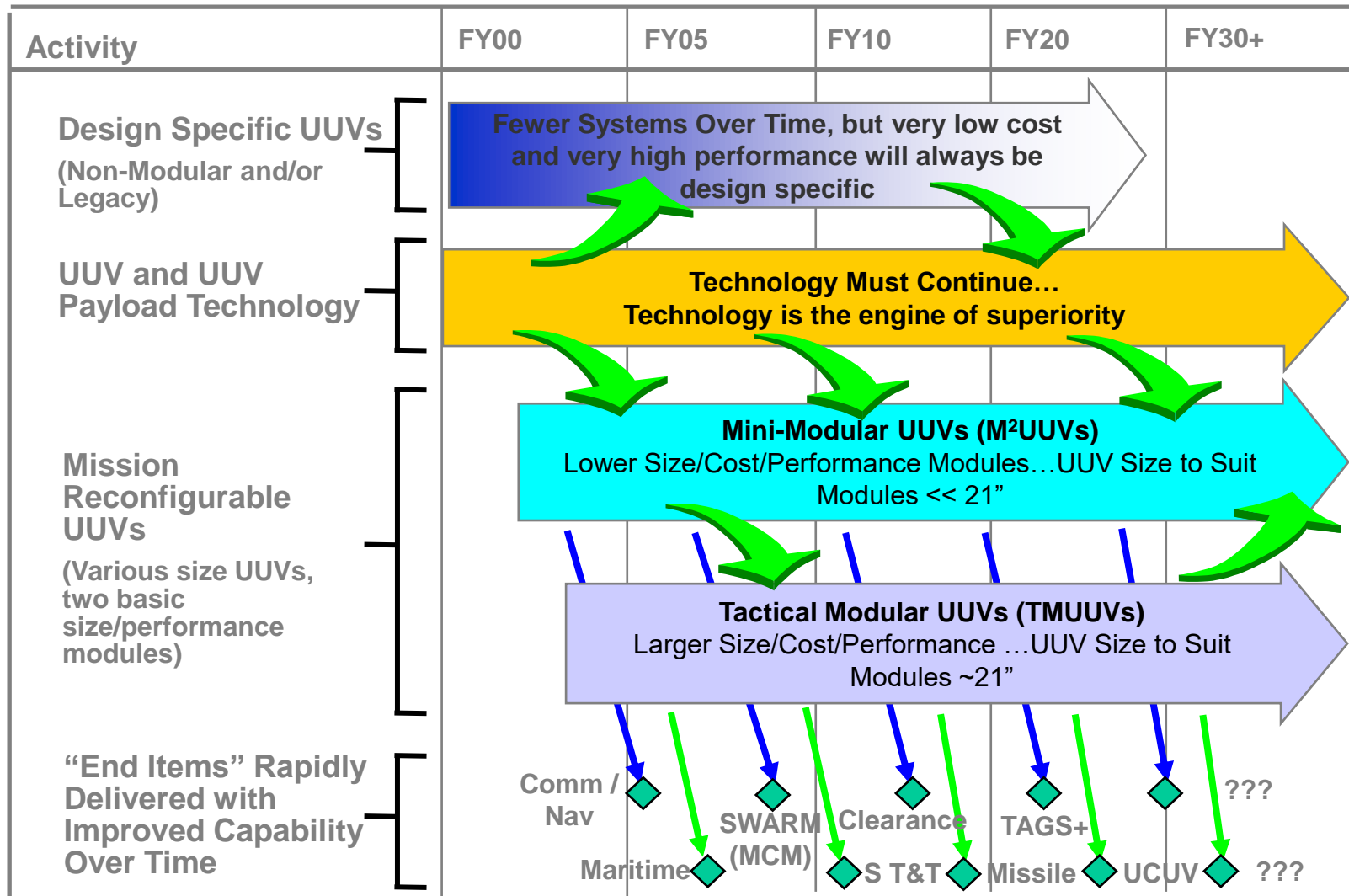
**“THE NAVY UNMANNED UNDERSEA
VEHICLE (UUV) MASTER PLAN”
WAS RELEASED!**



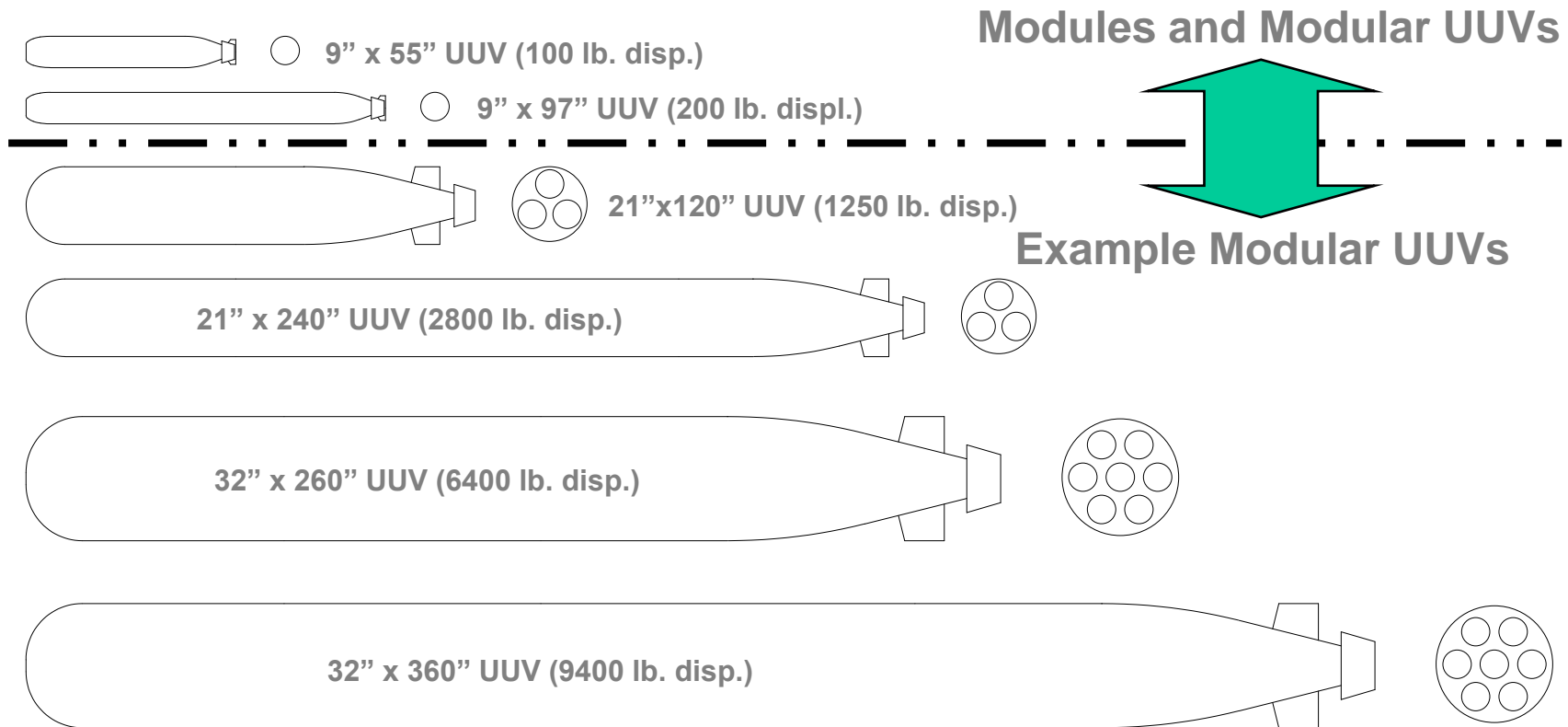
MASTER PLAN UUV MISSIONS

- **MARITIME RECONNAISSANCE**
- **UNDERSEA SEARCH AND SURVEY**
- **COMMUNICATION / NAVIGATION AID**
- **SUBMARINE TRACK AND TRAIL**

MASTER PLAN ROADMAP



MODULAR UUVs



***Large UUVs are not necessarily built from large modules...
Component performance / cost trades will drive module selection***

RISK vs. TECHNOLOGY vs. CAPABILITY

	Maritime Reconnaissance		Undersea Search & Survey								Navigation/ Communication Aid			Submarine Track and Trail				
			Object Sensing & Intervention					Oceanography										
	Pass.	Active	Detct (SLS)	Class (SAS)	ID	Neut	Interv.	Bottom Char	Bathy	Volume Meas	Comm.	Nav.	Data Ex	Detct	Class	TMA	Trail	Hard-off
Communications	Yellow	Green	Green	Green	Green	Green	Green	Y-G	Y-G	Green	Green	Green	Green	Green	Green	Green	Green	Yellow
Navigation	Green	Green	Y-G	Y-G	Y-G	Y-G	Green	Y-G	Y-G	Green	Green	Green	Green	Green	Green	Green	Green	Green
Energy	Y-G	Y-G	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow	Red	Green
Propulsion	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Green
Mission Equip	Green	Green	Green	Green	Green	Yellow	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Sensors	Green	Green	Green	Yellow	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Green	Yellow	Green
Data Processing	Green	Green	Green	Yellow	Yellow	Green	Yellow	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Autonomy	Yellow	Yellow	Green	Green	Yellow	Green	Red	Green	Green	Green	Green	Green	Yellow	Yellow	Red	Yellow	Red	Yellow

• Definitions:

- Mission Equipment: Specific HW items associated with the Mission, not on-board sensors, but includes deployed equipment
- Sensors: UUV Installed Sensors Specific to accomplish the mission function
- Data Processing: Data processing and management specific to the mission requirements
- Autonomy: Software / artificial intelligence and decision making associated with performing the mission without human guidance

• Ratings for near term Acquisition (assuming minimal risk mitigation):

- Green: Low Risk ; Y-G Risk Low-Moderate dependent on size
- Yellow: Moderate Risk
- Red: Significant Risk

ONR JOINS IN

ONR BAA 01-012

“Demonstration of Undersea
Autonomous Operation Capabilities
and Related Technology Development”

•SUPPORTS THE UUV MASTER PLAN

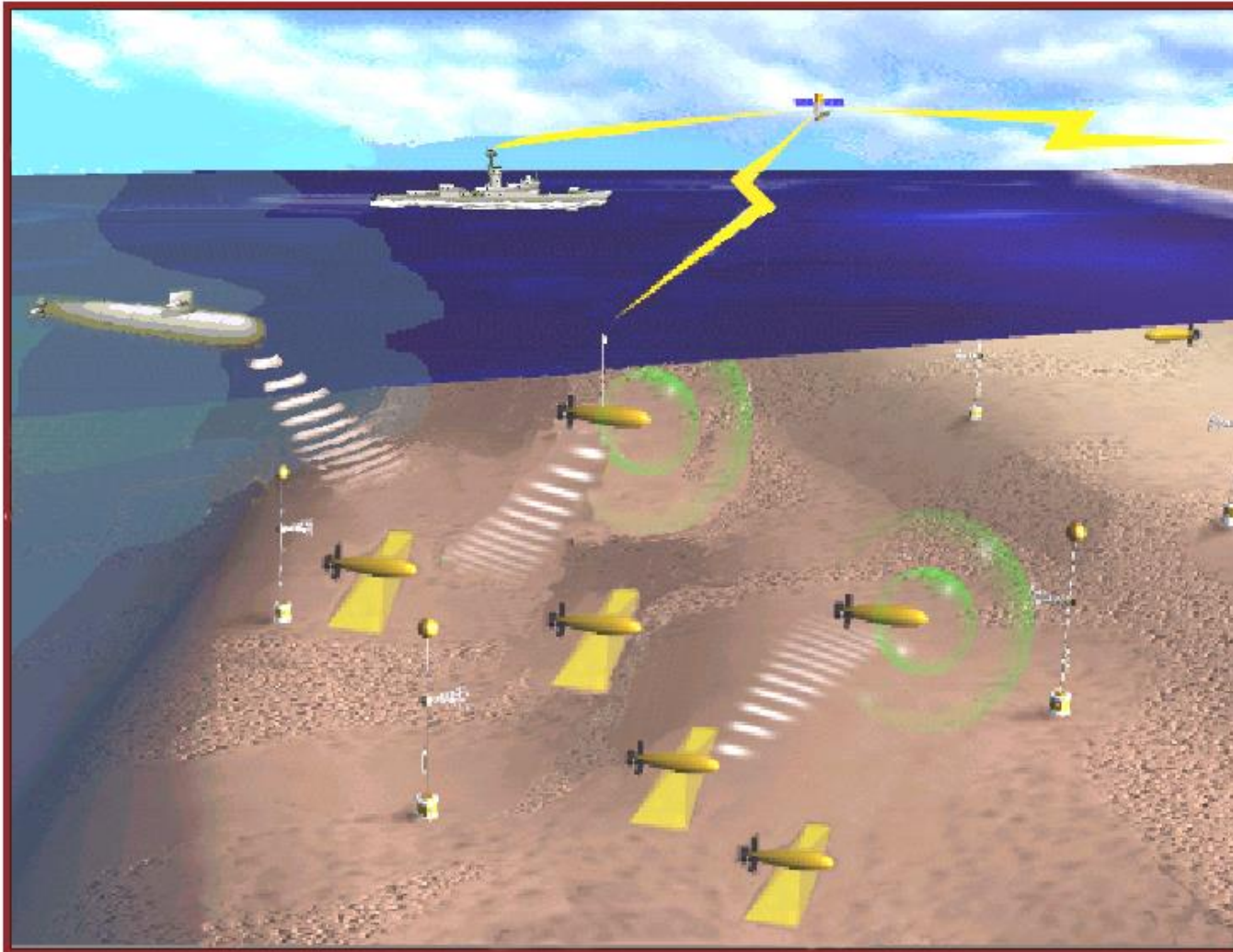
ONR BAA KEY THRUSTS

- **SMALL UUVs**
- **LOW COST**
- **MULTIPLE VEHICLES**
- **COOPERATIVE BEHAVIOR**
- **MISSION ORIENTED**
- **FIELD TODAY'S TECHNOLOGY**
- **PLAN FOR FUTURE TECHNOLOGY**

TECHNOLOGY CONCERNS

- COMMUNICATION
- NAVIGATION
- ENERGY
- SENSORS
- AUTONOMY
- **SIZE, WEIGHT AND ENERGY**
- **BUT CLOSE ENOUGH FOR GOVERNMENT WORK!**

ONR BAA - MULTIPLE UUVs



\$HOW ME THE MONEY

- **MARITIME RECONNAISSANCE**
 - \$14,000,000 through FY2004
- **UNDERSEA SEARCH AND SURVEY**
 - \$14,000,000 through FY2005
- **COMMUNICATION / NAVIGATION AID**
 - \$16,000,000 through FY2005

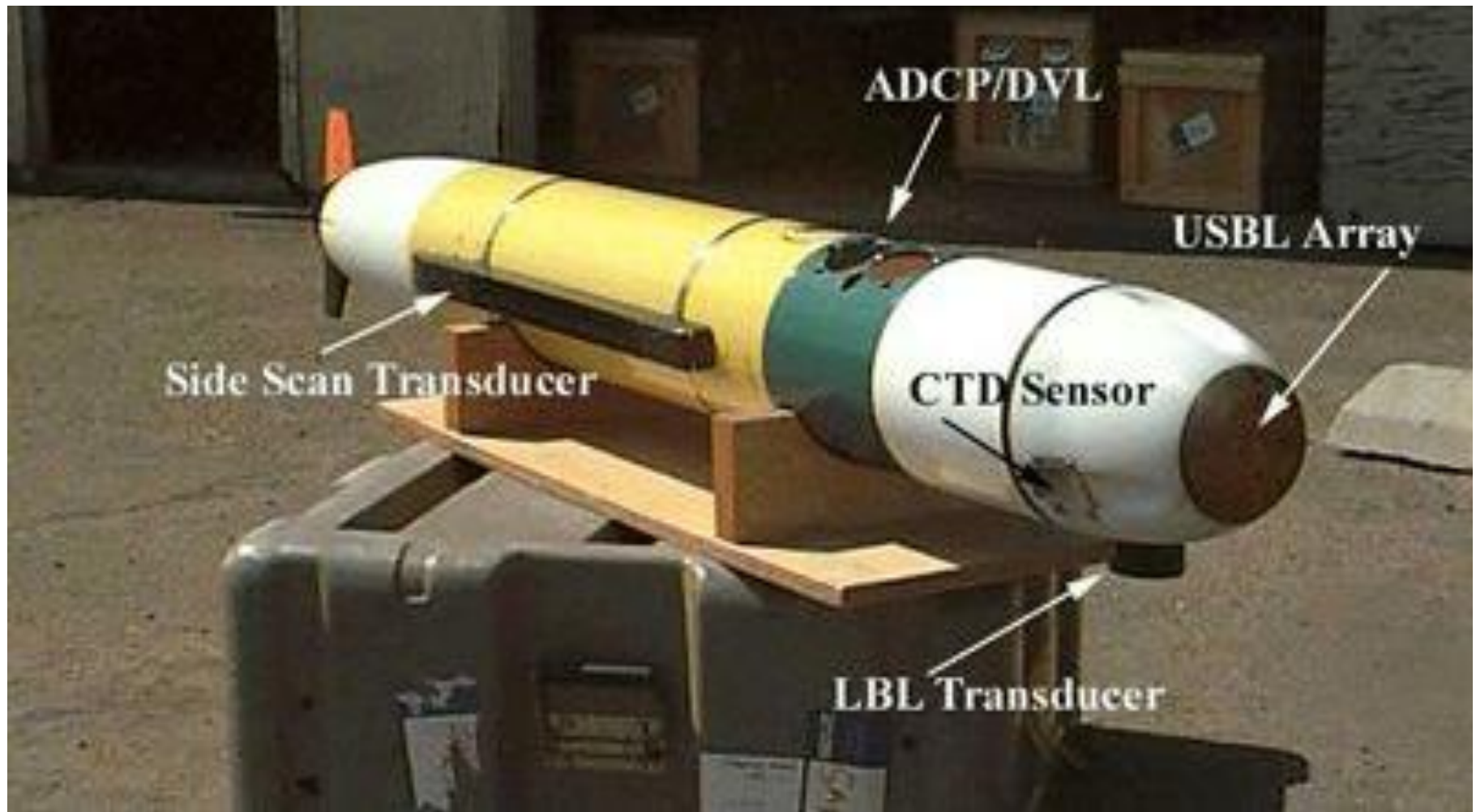
A NEW PARADIGM

DEVELOPER	VEHICLE	PROGRAM
WHOI	REMUS	SHARV/SAMS
SSC SD	FLYING PLUG	PRIOR ONR
MIT/LM	CETUS II	ONR/EOD
NEKTON	MICROHUNTER	DARPA
WHOI	ABE	ONR
FAU	MORPHEUS	TBD
FAU	OCEAN EXPLORER	SACLANT TRIALS

PROOF IS IN THE PUDDING

- **SHARV Tests**
- **Chemical Sensing in the Marine Environment (CSME) Program**
- **AUV Fest' Demonstrations**
- **Military Exercises (Kernel Blitz, 3/13/01)**

USSOCOM'S SHARV





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OCEAN EXPLORER AT AUVFEST '99



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30

CETUS AT AUVFEST '99





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NAVAL POSTGRADUATE SCHOOL'S AIRES UUV



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32

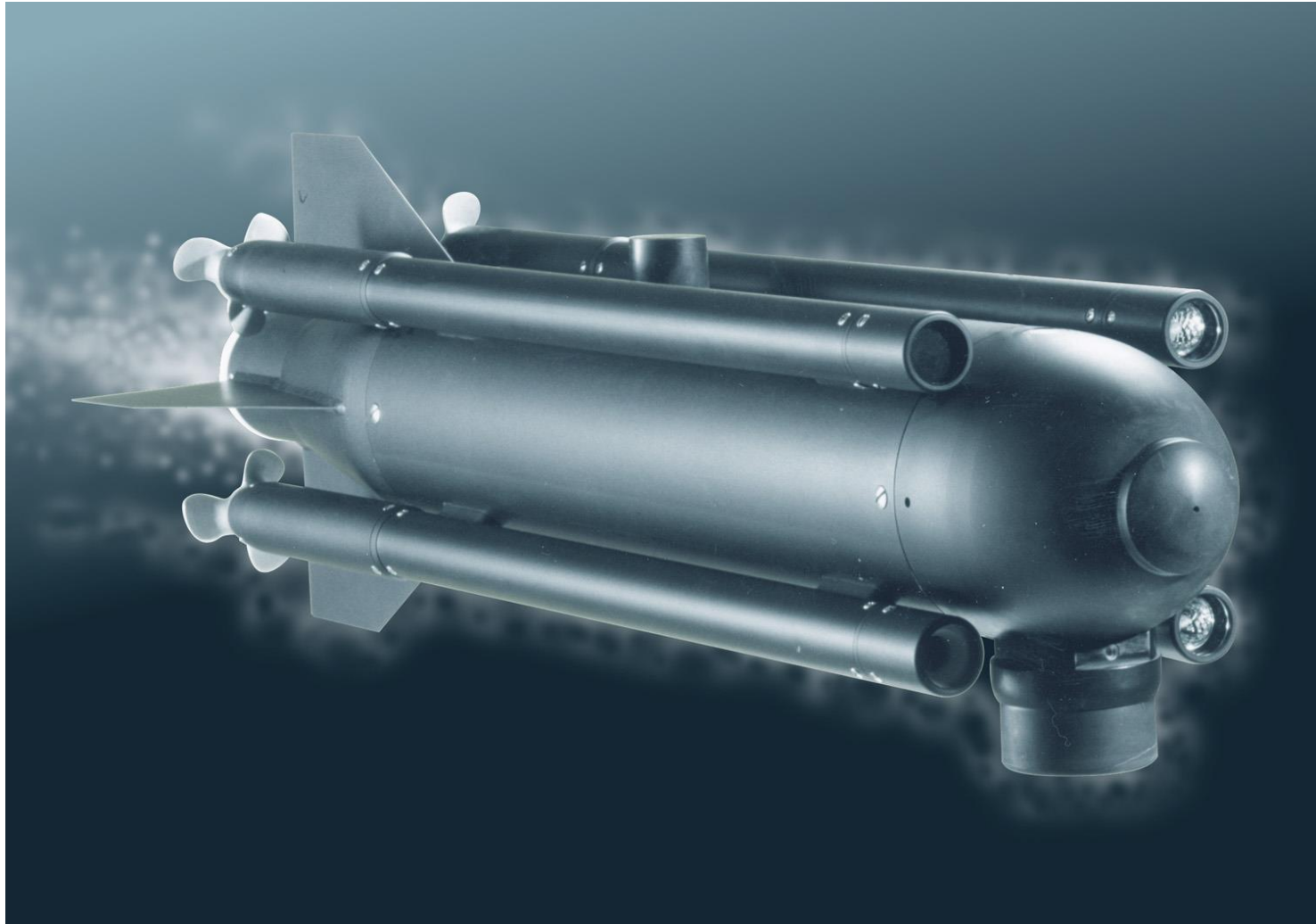
TWO PERSON L&R





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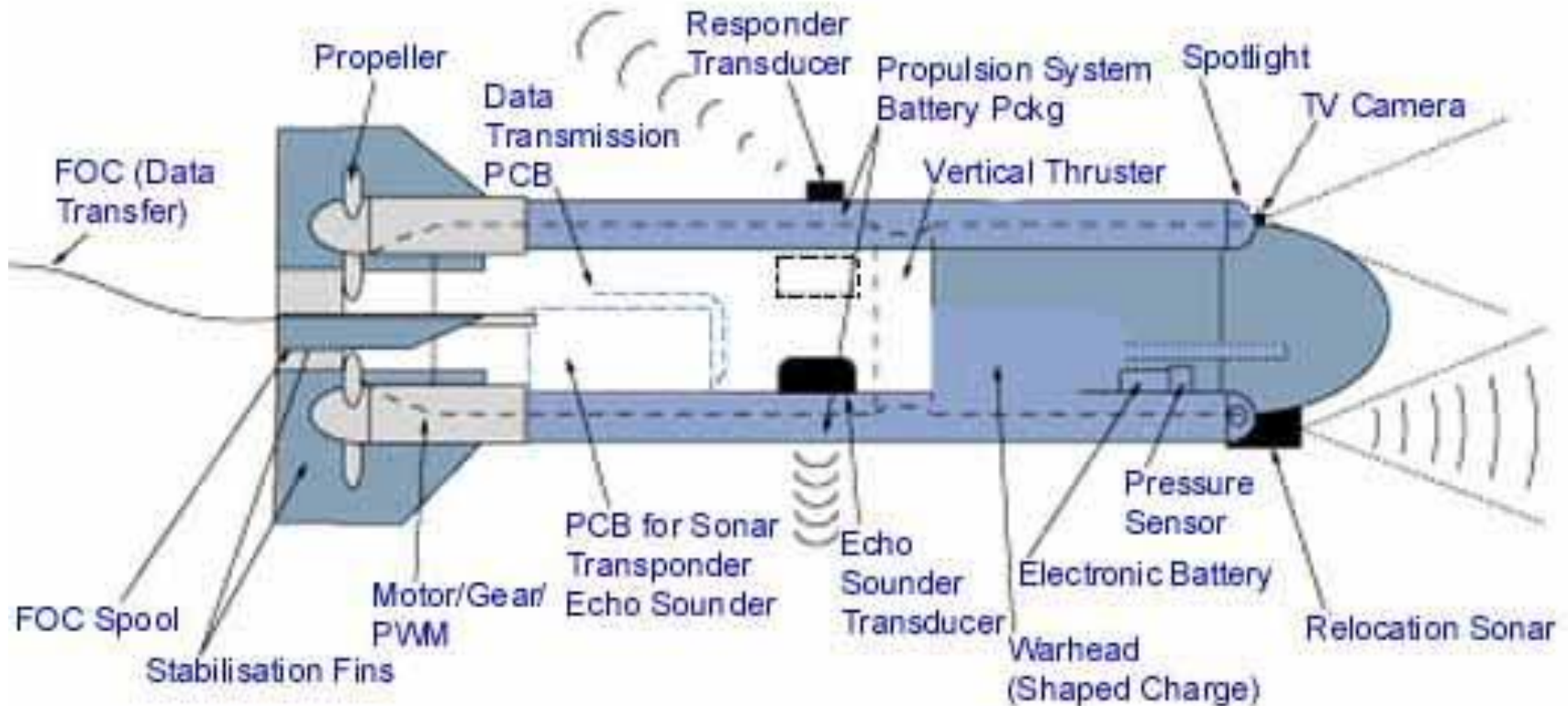
AIRBORNE MINE NEUTRALIZATION SYSTEM (AMNS)





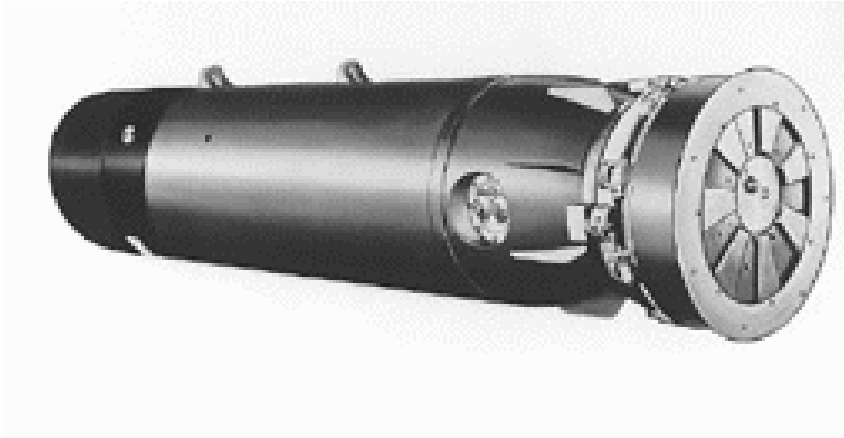
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AIRBORNE MINE NEUTRALIZATION SYSTEM (AMNS)



- Lockheed Martin and STN Atlas, Germany (Seafox)

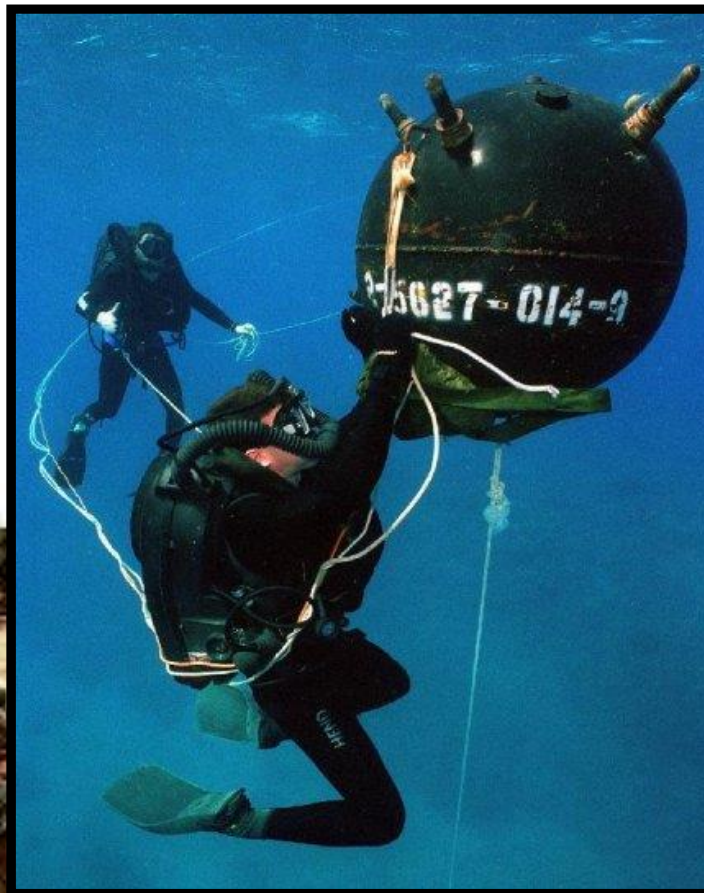
MCM IS THE KEY





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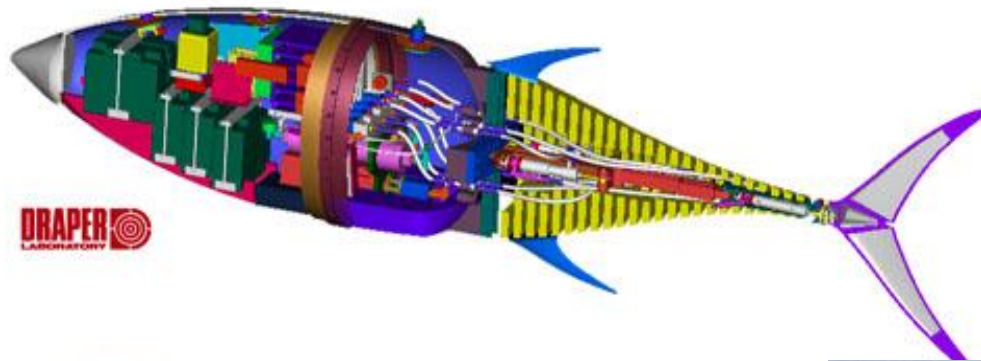
TODAY'S AUTONOMOUS MCM SYSTEMS





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TOMORROW'S AUTONOMOUS MCM SYSTEMS





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ARE WE PUSHING HARD ENOUGH?

**NOW IS THE TIME
TO LOSE SOME
UUVs!
(NOT DIVERS)**

