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AUVs - A TECHNOLOGY WHOSE TIME HAS COME

Robert Wernli
SPAWAR Systems Center San Diego
(619) 553-1948
wernli@spawar.navy.mil

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OUTLINE

- MILITARY
  - THE NAVY'S NEED
  - SSC SAN DIEGO'S ROLE
- SCIENTIFIC
- COMMERCIAL
- THE FUTURE

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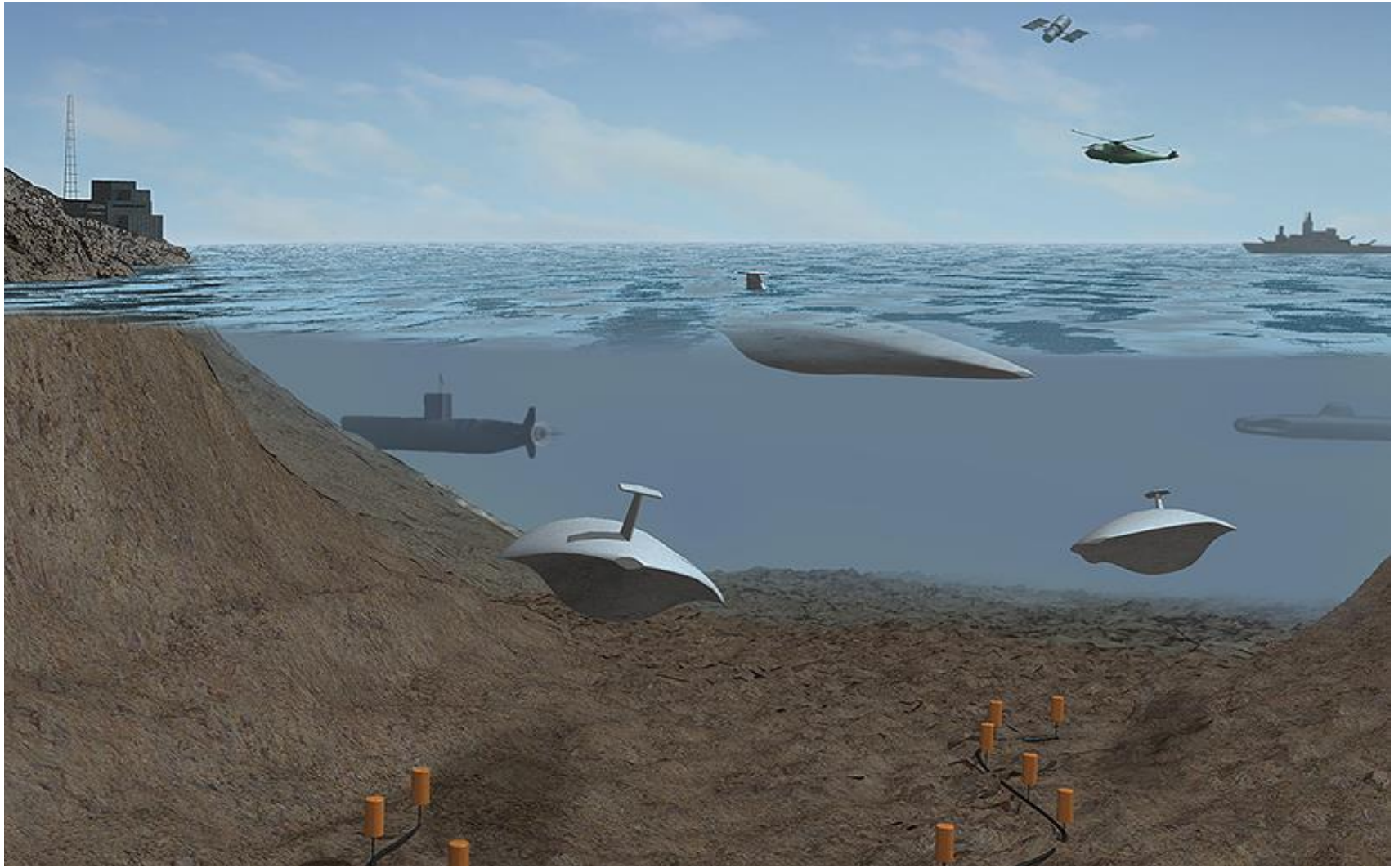
UNDERSEA ROBOTICS WILL PLAY A MAJOR ROLE IN THE NAVY'S FUTURE



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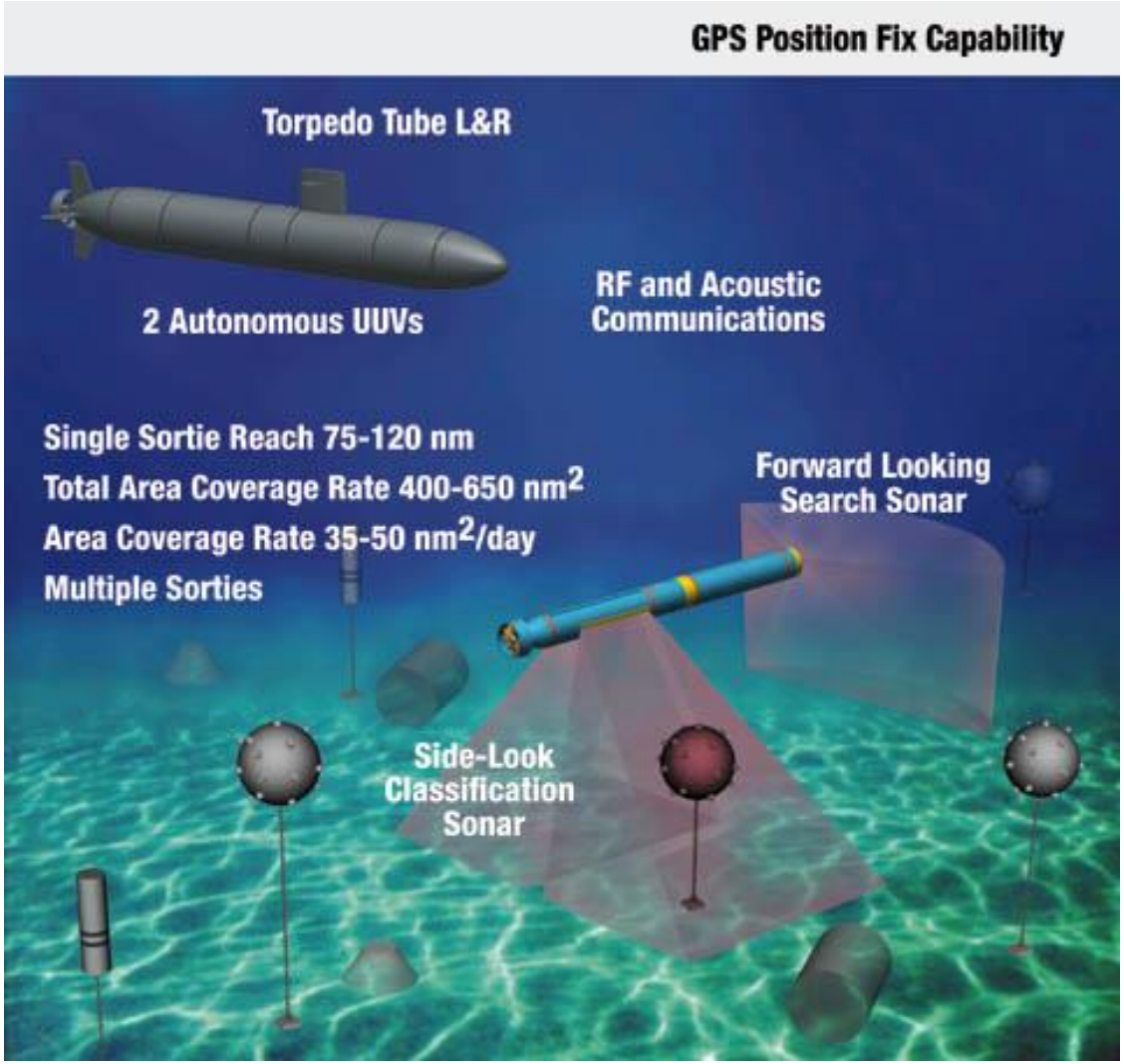
THE LONG-TERM MINE RECONNAISANCE SYSTEM (LMRS) WILL BE CAPABLE...



... BUT IS MISSION SPECIFIC...

AND COSTLY

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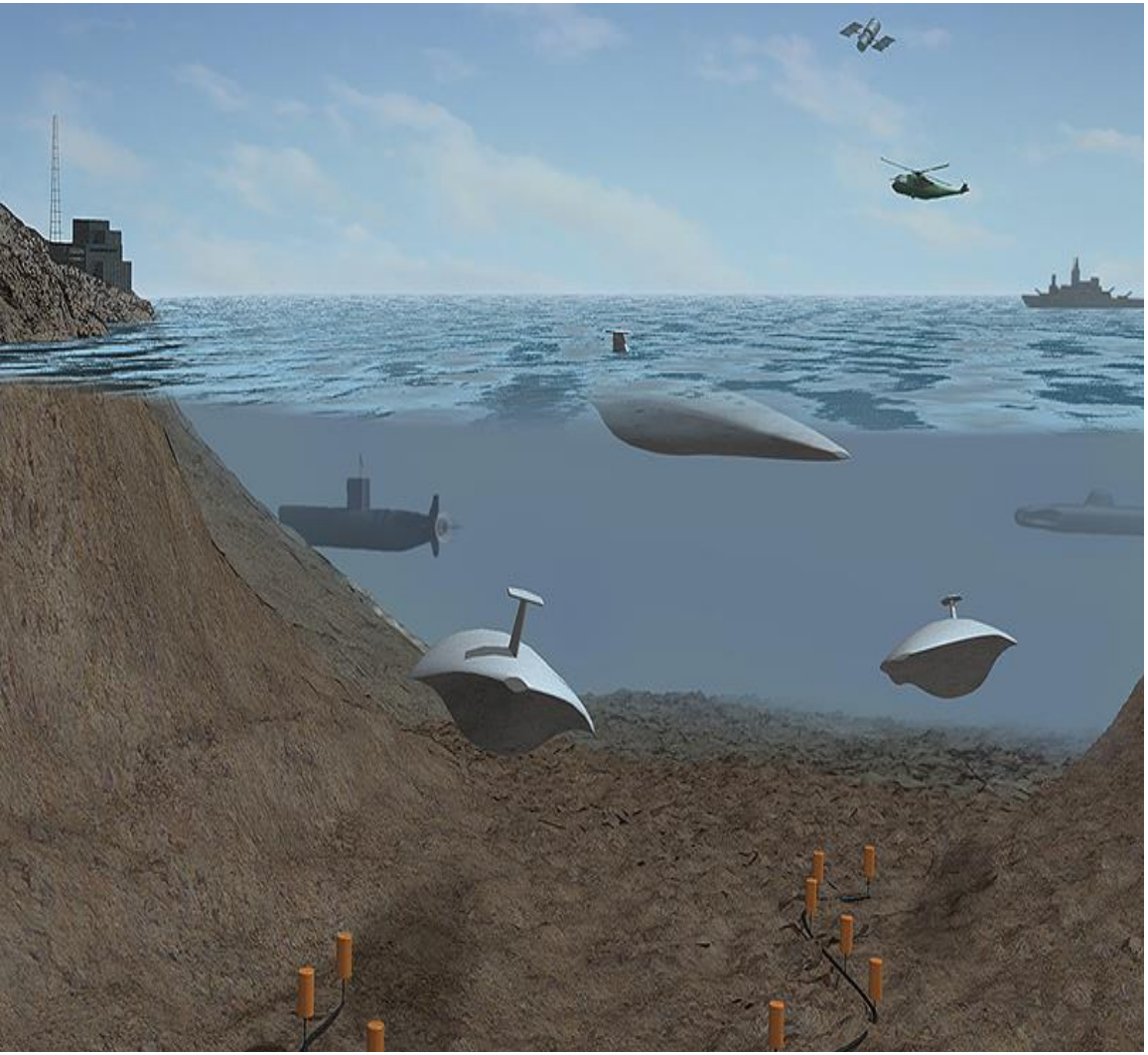
US NAVY'S UUV MASTER PLAN



A First Step Towards a Vision of Dominance via Unmanned Systems

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TOP 3 UUV PLAN MISSION CAPABILITIES

Maritime Reconnaissance

- Intelligence collection
- Battle Damage Assessment
- Target Designation

Navigation / Communication Aid

- Communications relay
- On-demand navigation aid
- Subsea data exchange

Undersea Search and Survey

- Mine Countermeasures
- Object sensing and intervention
- Oceanography

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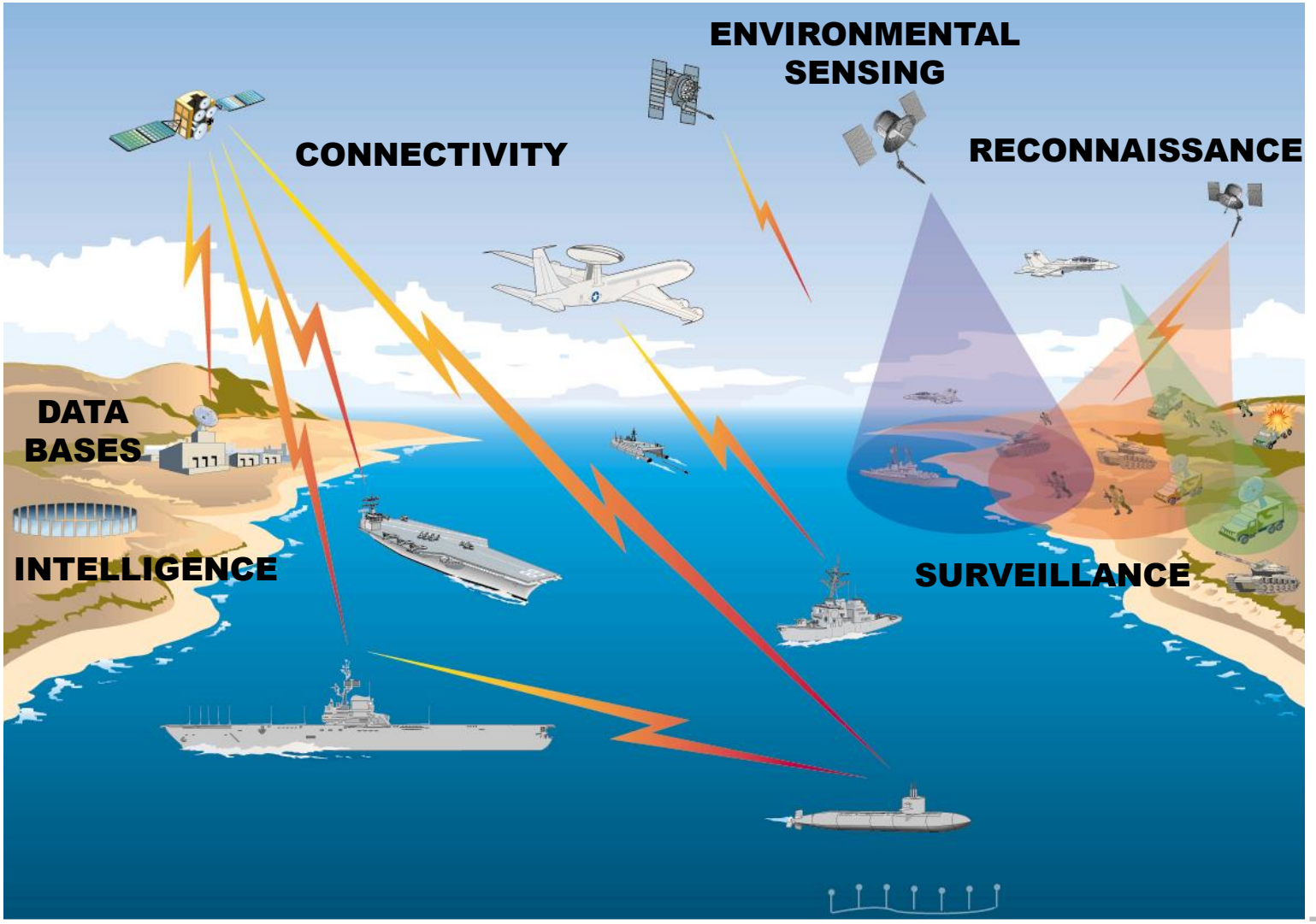
SSC SAN DIEGO
C4ISR IS OUR MISSION



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WHAT IS C4ISR?

- COMMAND
- CONTROL
- COMMUNICATIONS
- COMPUTERS
- INTELLIGENCE
- SURVEILLANCE
- RECONNAISSANCE

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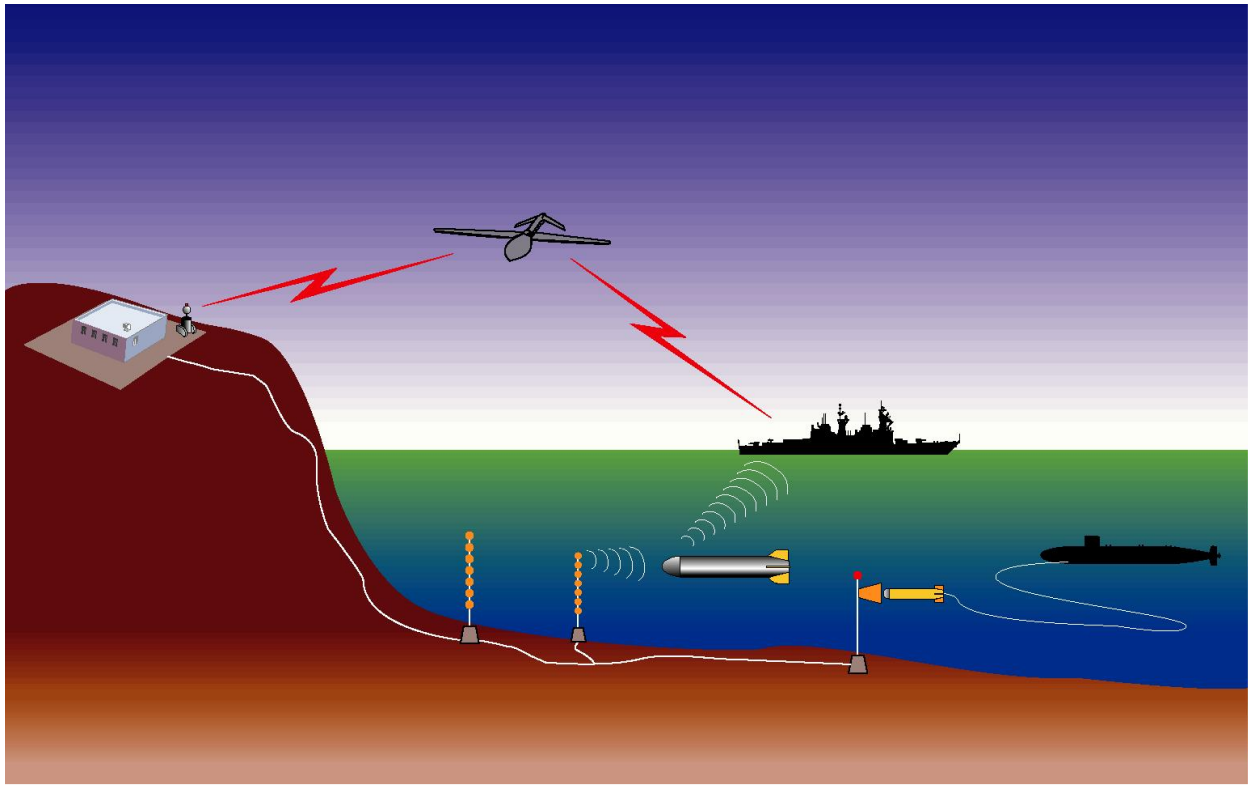
OBTAINING AND PROVIDING RELIABLE INFORMATION IS OUR JOB

WHAT'S THE BOTTOM LINE?

Autonomous vehicles (including UAVs and UGVs) will play an ever increasing role in the US Navy: collecting, communicating, and acting upon data across air, land, and sea boundaries.



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ARE THE SCIENTISTS THE REAL AUV LEADERS?

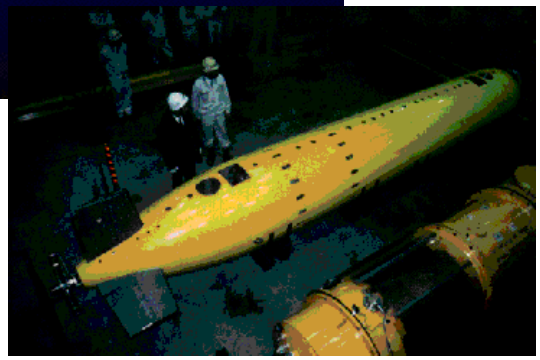
MORPHEUS

ODYSSEY

AUTOSUB

ABE

R1



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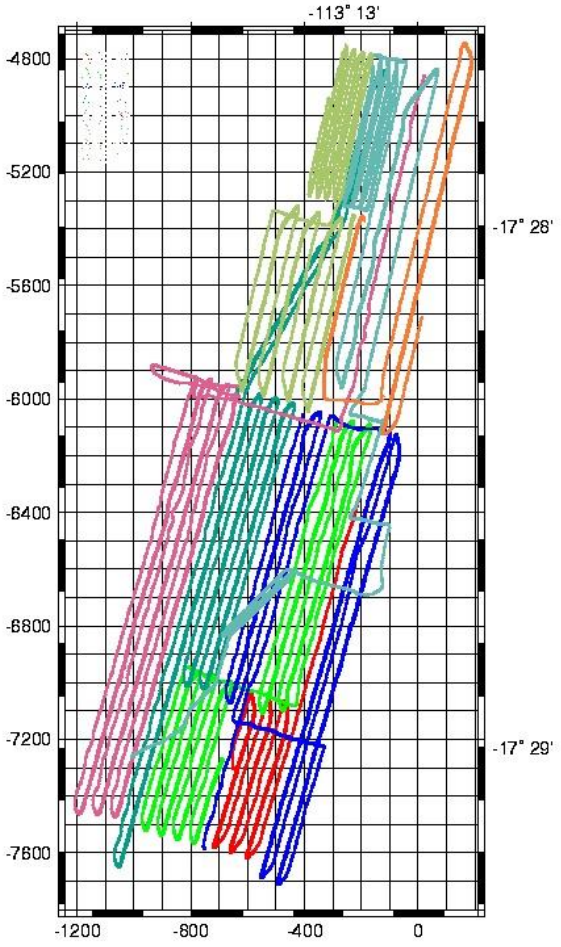
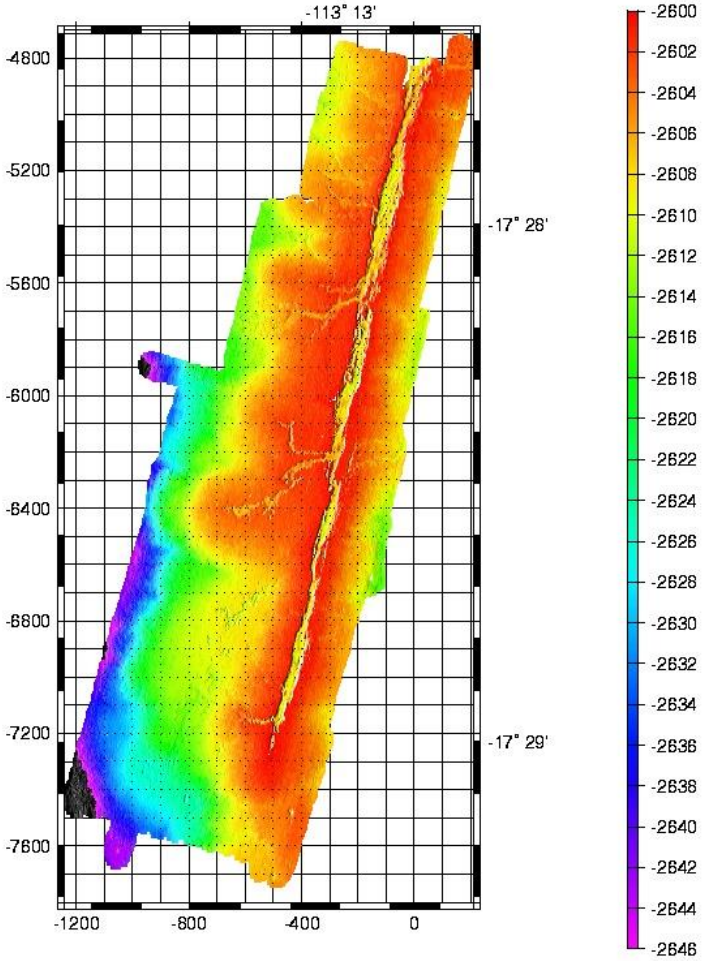
ABE SEARCH RESULTS





COURTESY WOODS HOLE OCEANOGRAPHIC INSTITUTION

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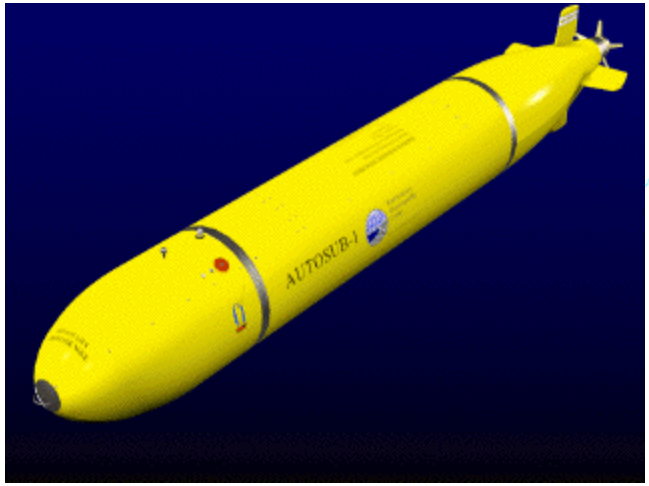
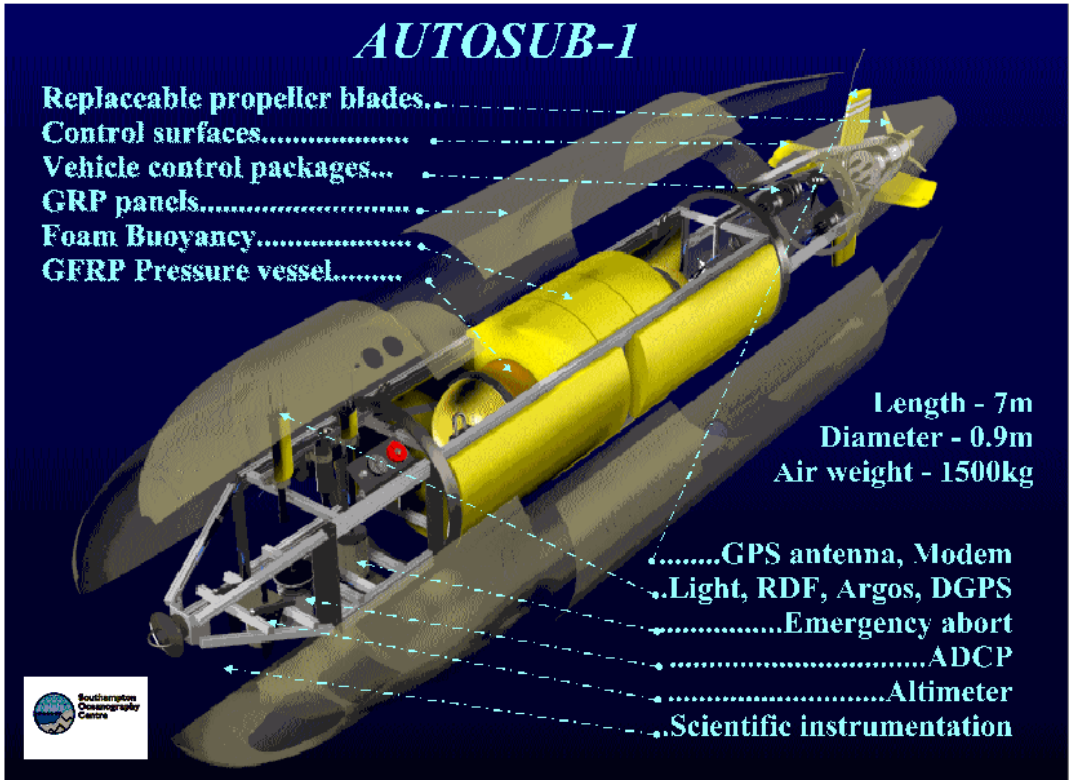
AUTOSUB IS WORKING YEAR ROUND





COURTESY SOUTHAMPTON

OCEANOGRAPHY CENTRE

THE NEW "KID" ON THE BLOCK

JAMSTEC'S URASHIMA

JAPAN, R1 ROBOT

AUV COMPARISONS

Name	Length	Range	Depth
URASHIMA	9.7 m	300 km	3,500 m
R-One (Japan)	8.3 m	100 km	400 m
AUTOSUB-1 (UK)	7.0 m	110 km	500 m
Theseus (Canada)	10.7 m	700 km	1,000 m
AUSS (USA)	5.2 m	30 km	6,000 m
UUV (USA)	6.4 m	100 km	500 m

COURTESY OF JAMSTEC

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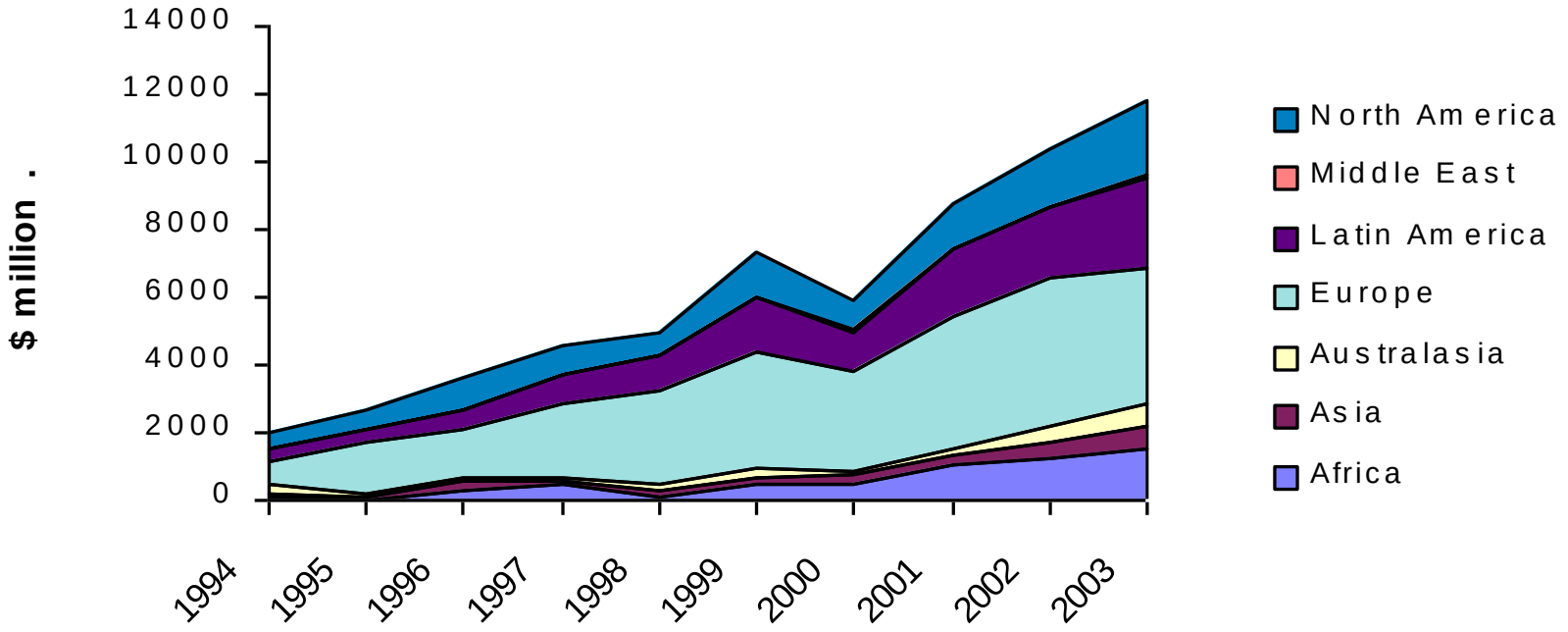
IS THERE A COMMERCIAL MARKET OFFSHORE?

The world subsea production market



source: The World Subsea Report

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SURVEY HAS THE LARGEST INITIAL POTENTIAL FOR AUVs

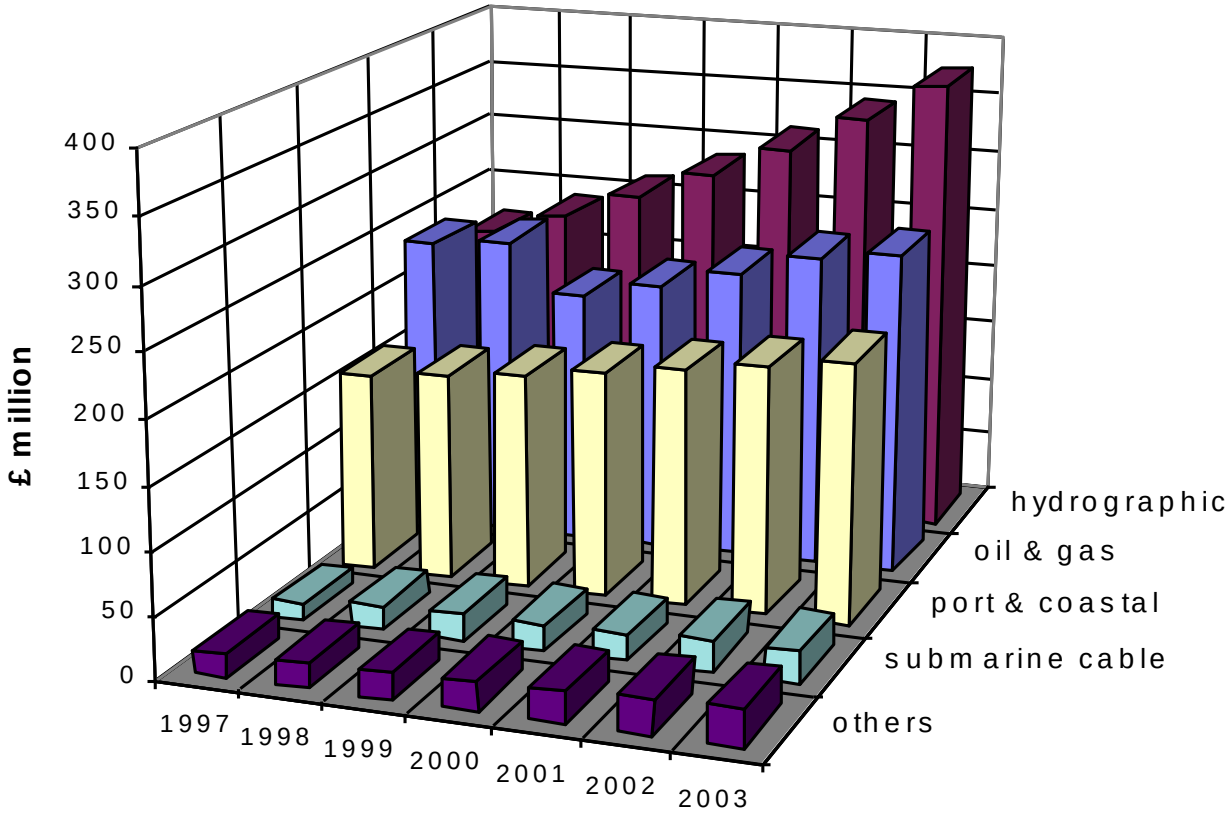

Figure : The Survey & Positioning Market to 2003

source: Ocean Survey – The World Market

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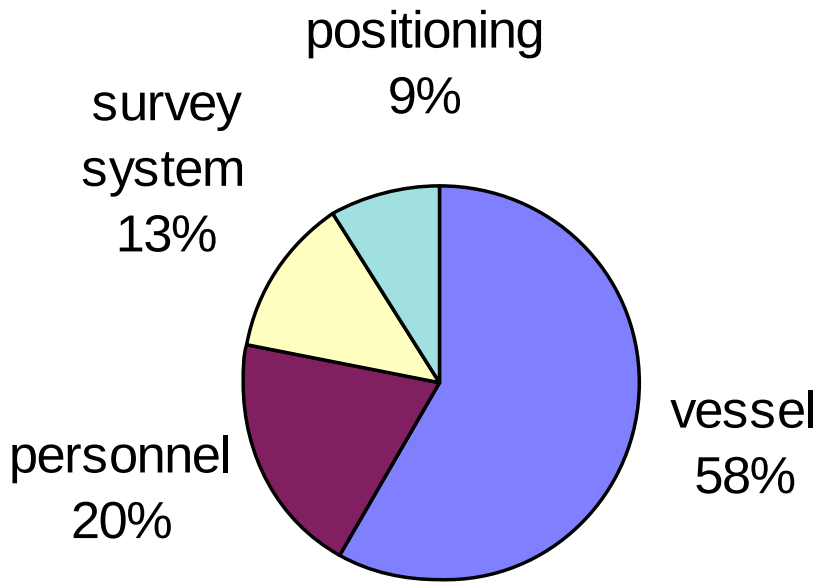
REDUCED SHIP TIME = $$$$$$$ SAVED



Survey Operation Costs

The chart shows that a total of 78% of the costs of a typical survey operation are associated with the ship and the survey personnel.

Source: *'Ocean Survey – The World Market'*

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AUVs ARE MAKING THEIR MOVE

UUV OPERATIONS REVENUE ($M)

Operations ($m)	*2000*	*2001*	*2002*	*2003*	*2004*	*00-04*
Work-Class ROVs	501	565	695	747	817	3325
AUVs	2	9	26	59	112	207
total $m	503	574	720	806	928	3532

Source: Douglas-Westwood Ltd

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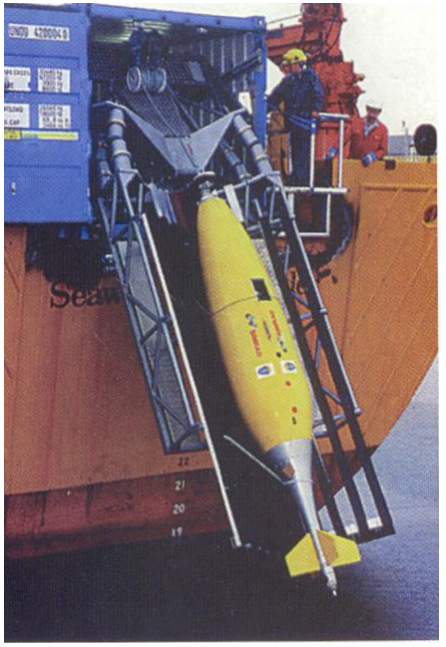
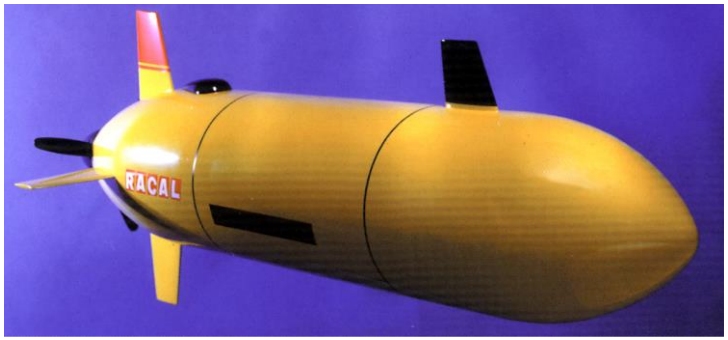
WHICH COMMERCIAL AUVs ARE ACTUALLY PLAYERS?

CETUS

MARIDAN 600

HUGIN





SEA ORACLE

AE 2

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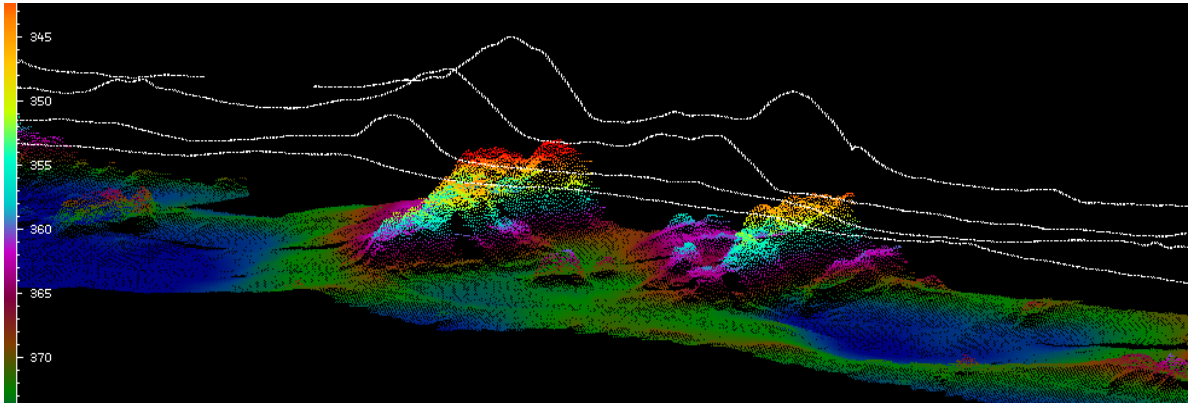
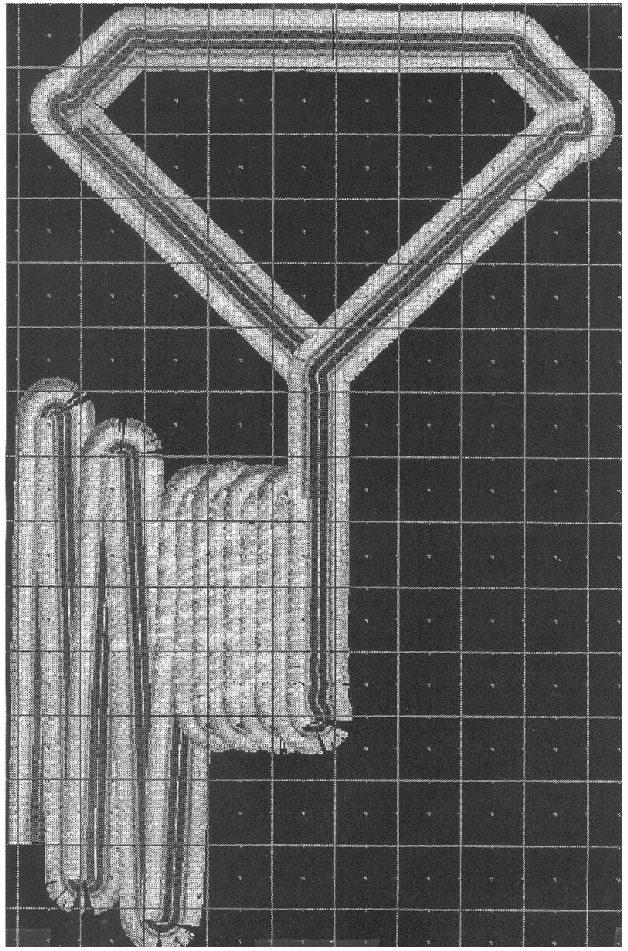
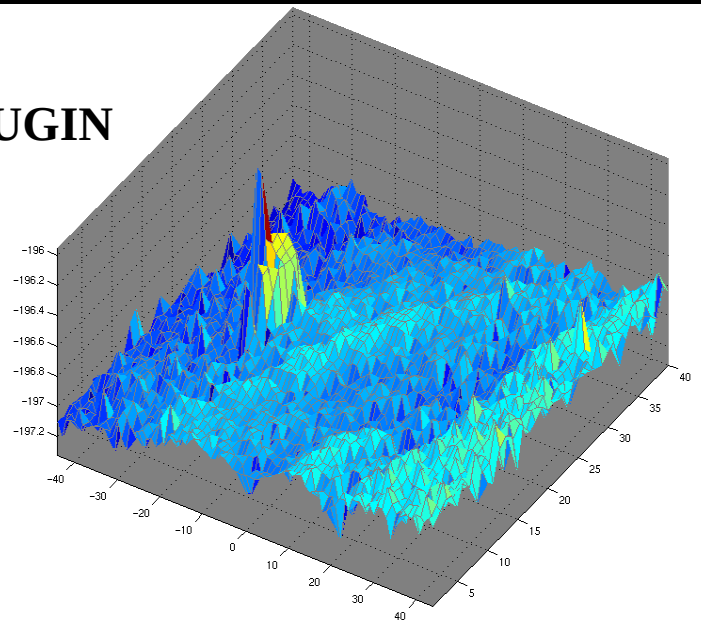
THE DATA SHOWS THAT AUVs CAN DO THE JOB





HUGIN



MARIDAN 200

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THE AUV GRANDPARENTS ARE STILL AVAILABLE OR WORKING

ARCS

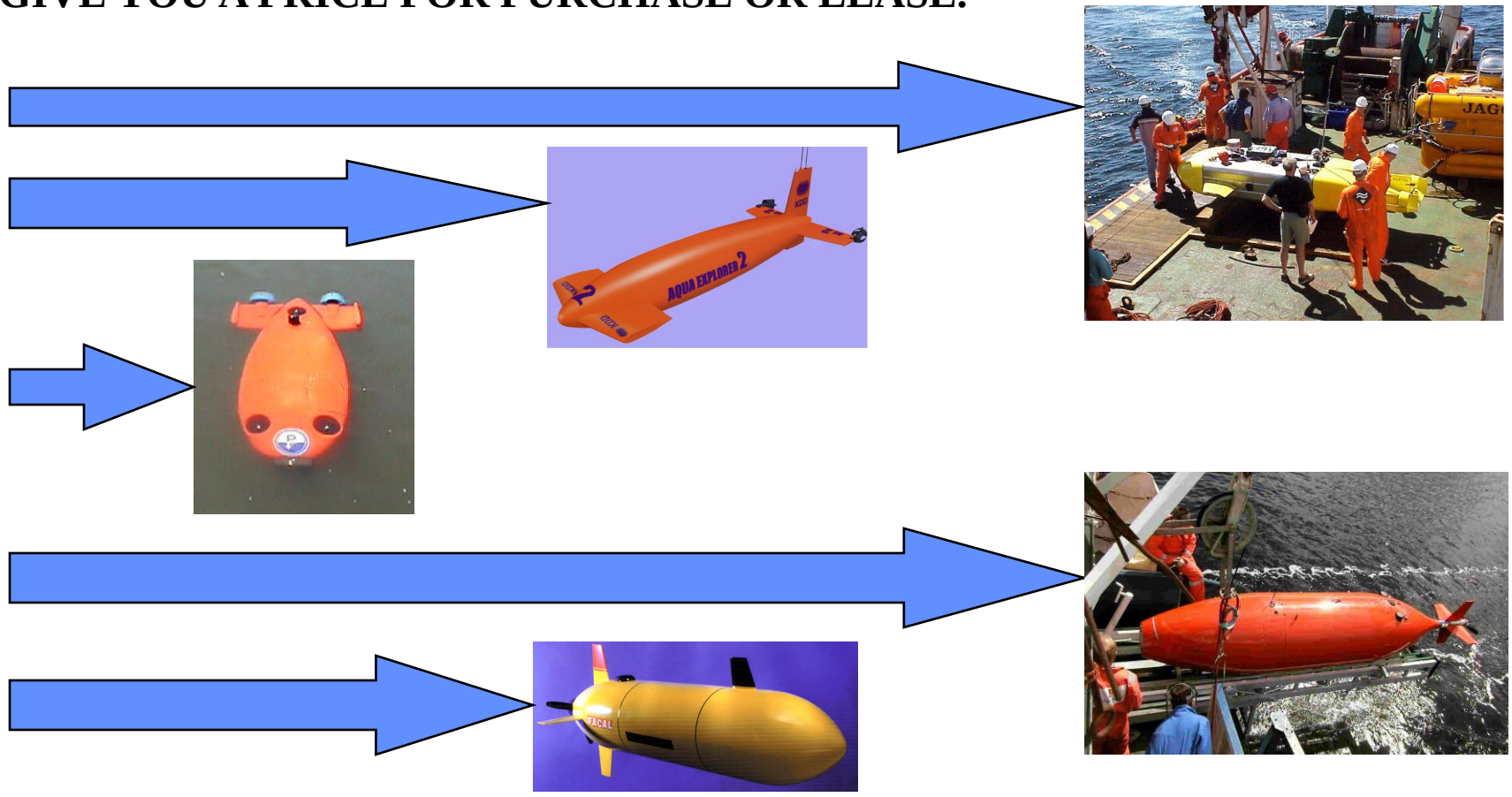
AUSS

MUST LAB

THESEUS

SO WHO'S LEADING THE PACK?

LEADERS HAVE COMPLETED CONTRACTS, HAVE SALES AND CAN GIVE YOU A PRICE FOR PURCHASE OR LEASE.



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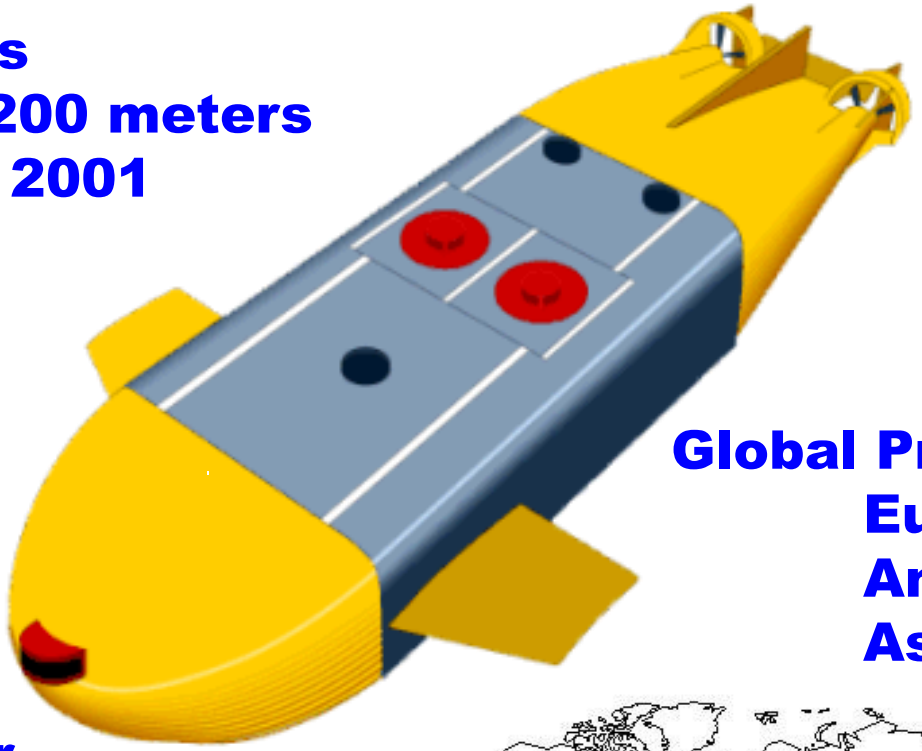
MARIDAN

10 years experience in AUV design, manufacture and operation

MARIDAN series
150, 600 and 1200 meters
3500 meters in 2001

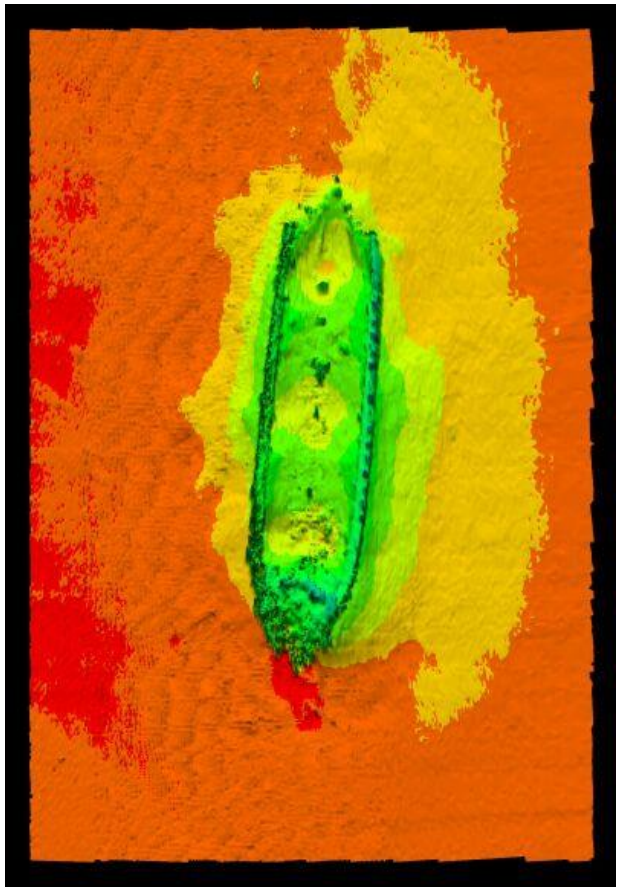


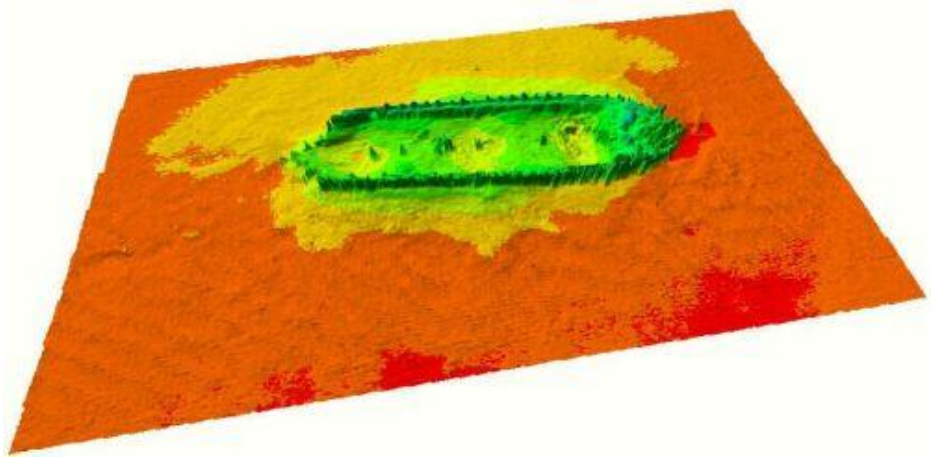
Offshore Oil&Gas
Telecom
Scientific
Military

Global Presence
Europe
Americas
Asia

Flatfish AUV design
Multiple payload sensor
- **Bathymetry**
- **Side Scan Sonar**
- **Sub Bottom Profiling**
- **Digital Still / Video**

MARIDAN'S SELANDIA





"Livlig" Wreck

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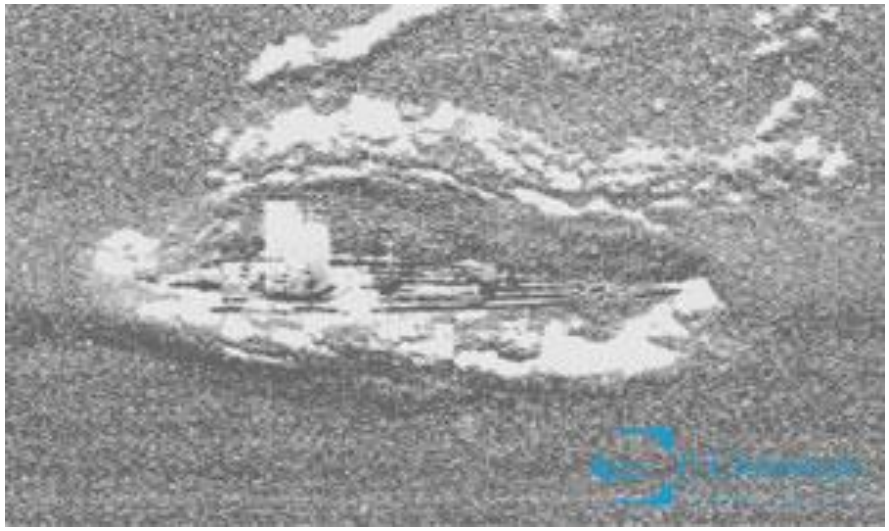
MARTIN PERFORMS UNDERICE SURVEY

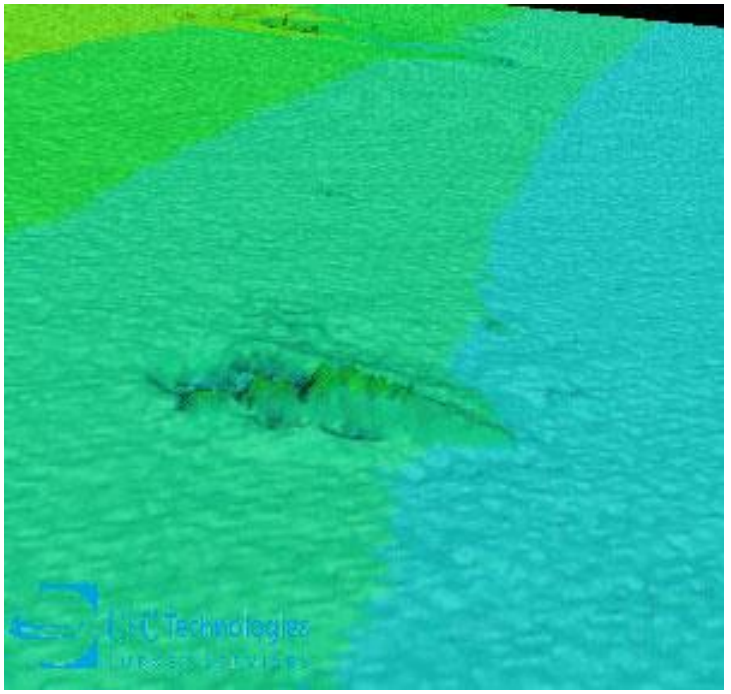
COMMERCIAL UUVs

- 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

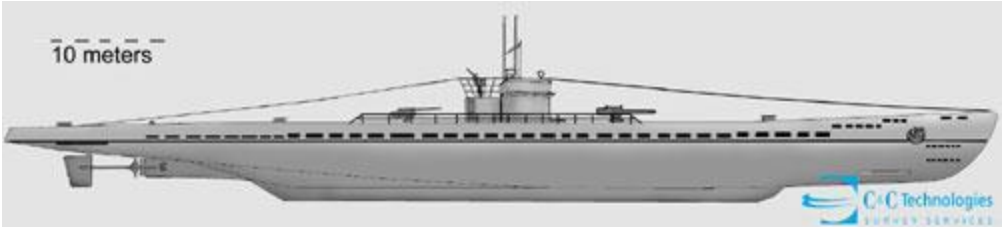
HUGIN



Gulf of Mexico
U-166 German Sub
Sidescan Sonar
1 Mile Deep



Rendering of U-166 Bow



HUGIN

Gulf of Mexico

Sigsbee Escarpment

1100-2200 Meter Depth

Resolution - 8 inches or .02% of water depth

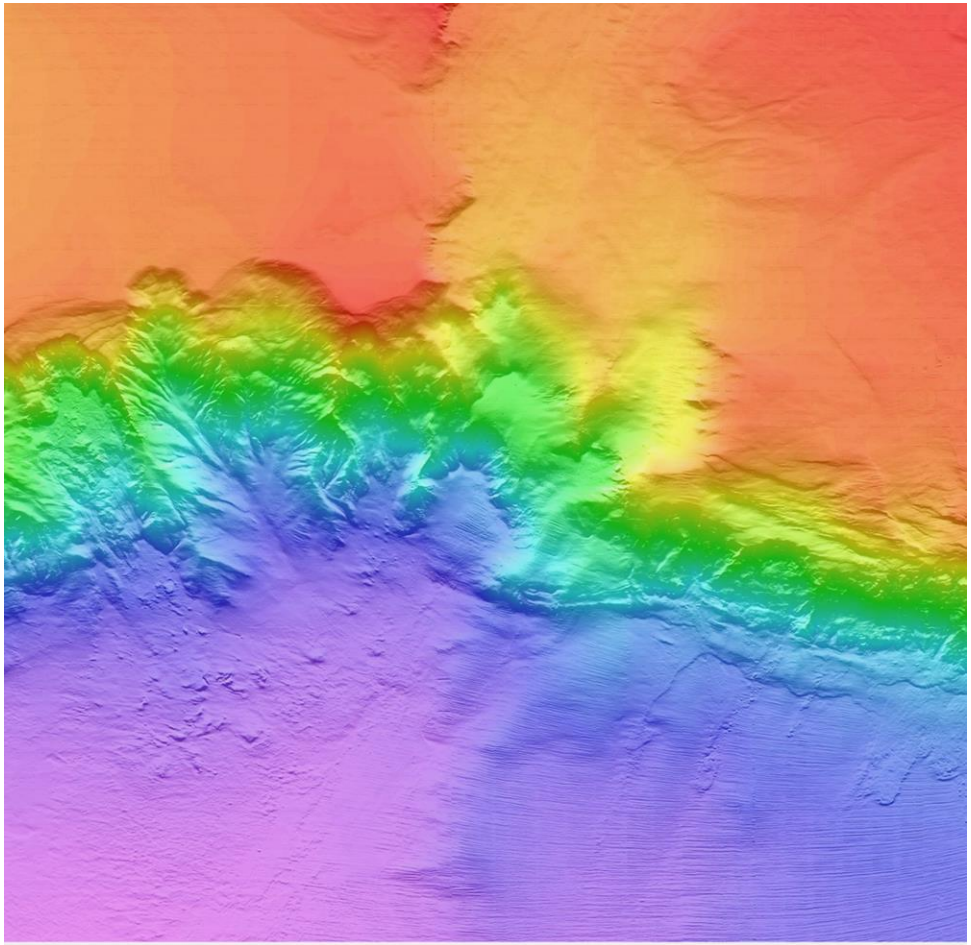
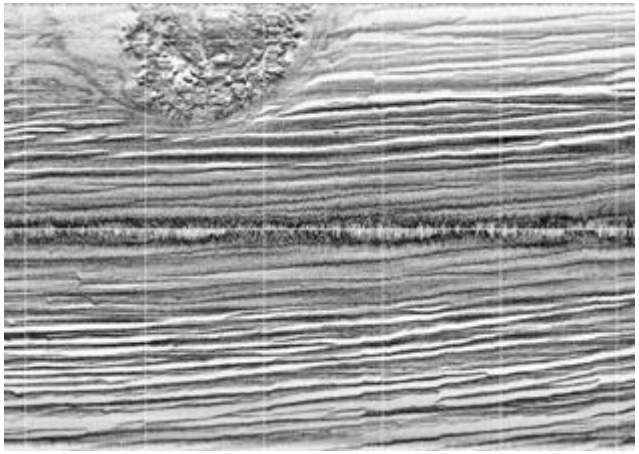


Figure 3. Shaded relief map with light-source shading. The bathymetric data was processed at 3-meter bins. Note the topographic expression of slump deposits and furrowed seafloor at the base of the Sigsbee Escarpment.

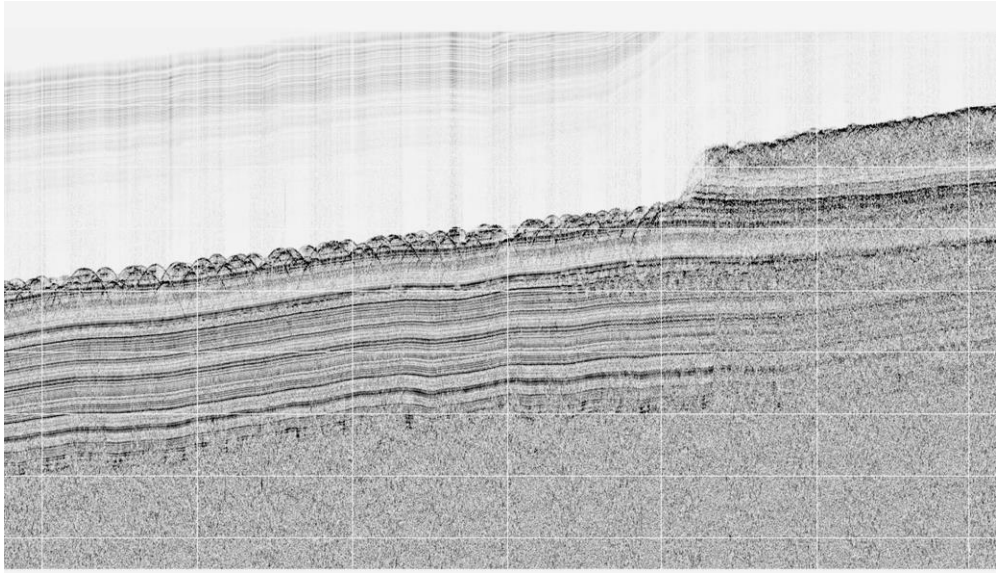
HUGIN



Gulf of Mexico - Sigsbee Escarpment

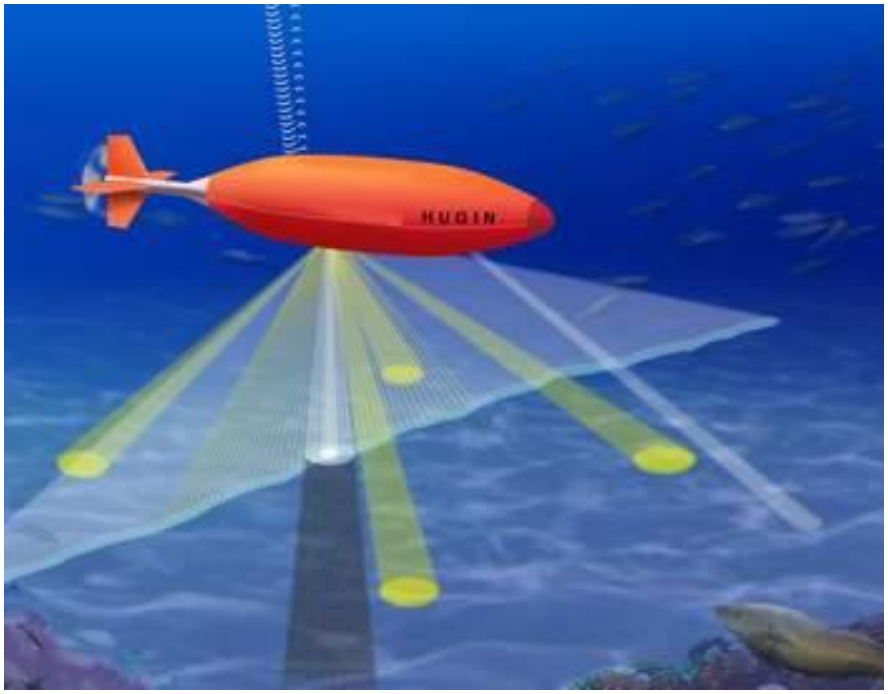
Sidescan Sonar Data

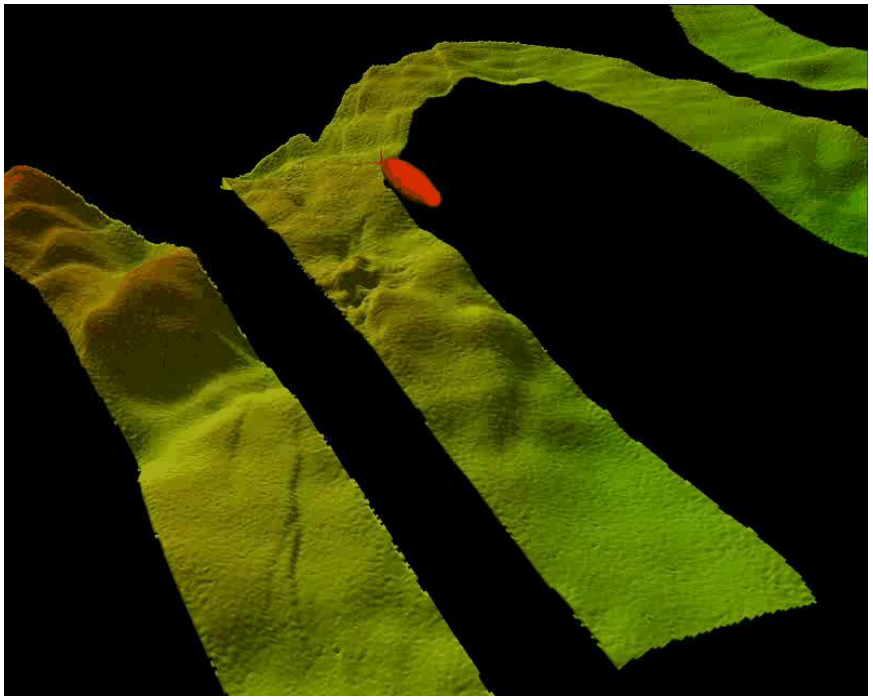
Furrows are 5-50 meters and 1-3 meters deep



Slump Deposits from above using a Sub-bottom Profiler

C & C TECHNOLOGIES





Bluefin's Sea Oracle for RACAL

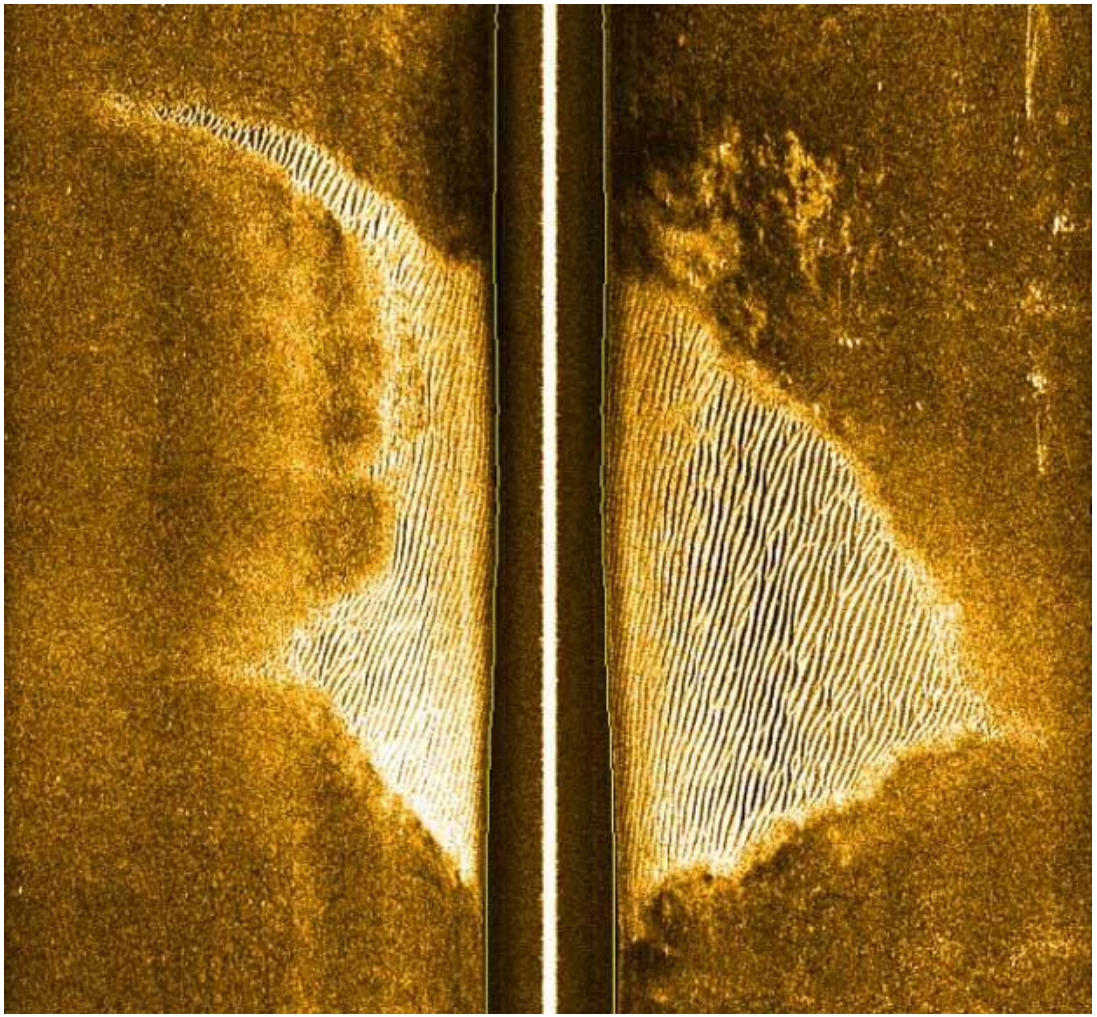
BLUEFIN

ORACLE III

Sidescan Sonar

Resolution - 3x4 inches

Range - 50 meters



AUVs IN THE QUEUE

USA:

- **OSIRIS**

Germany:

- **DeepC**

France:

- **Alister**
- **Alistar 3000**
- **Swimmer**

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BOEING, US - OSIRIS

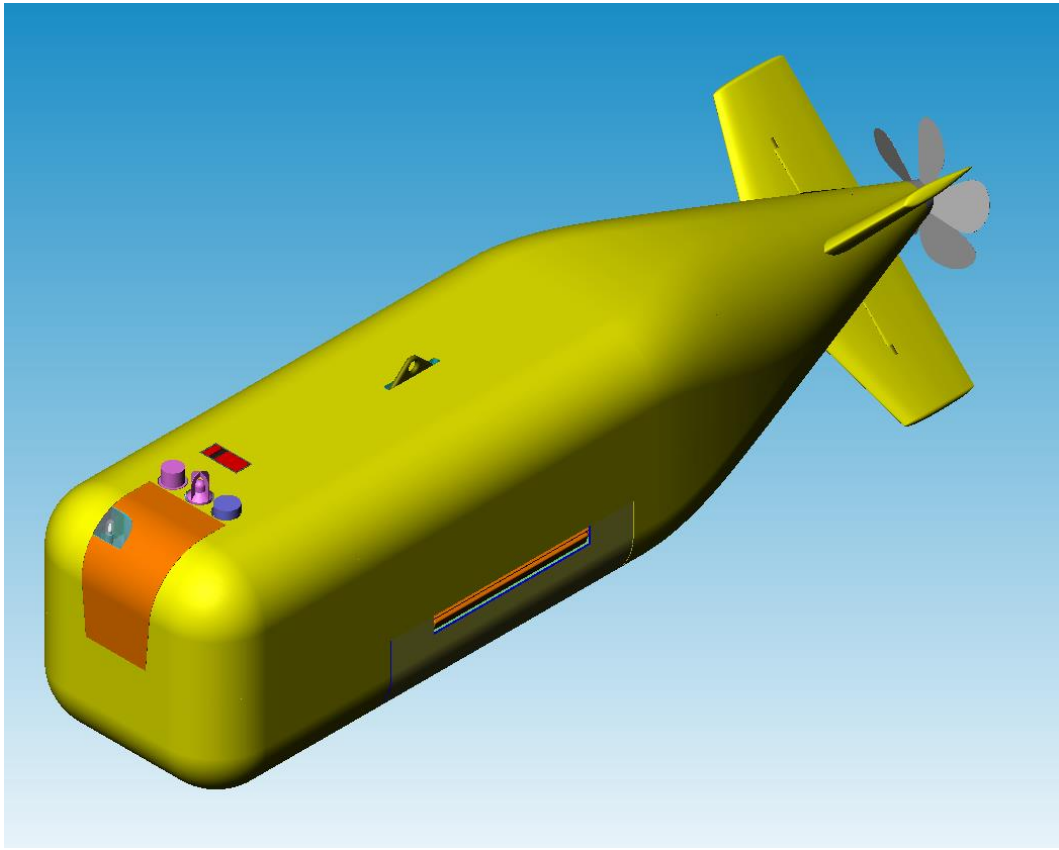
DEVELOPMENT TEAM:

BOEING

FUGRO

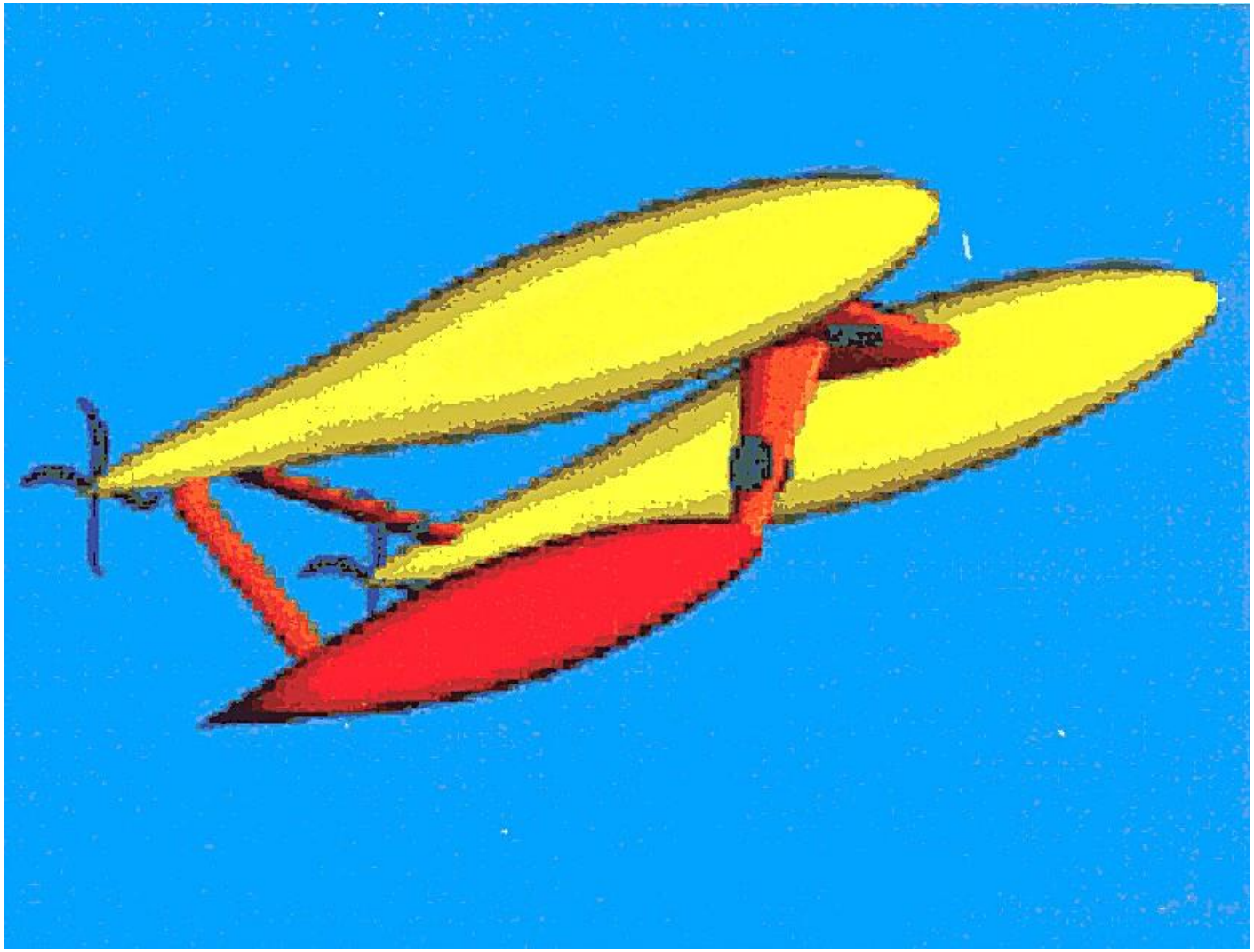
OCEANEERING

- **Max. Depth = 10,000 fsw**
- **Max. Speed = 8 knots**
- **Vehicle Length: 18.5 ft**
- **Vehicle Width/Height: 50.0 in**
- **Vehicle Dry Weight: 10,800 lb**
- **Active Ballast & Trim**
- **Integrated Navigation System**



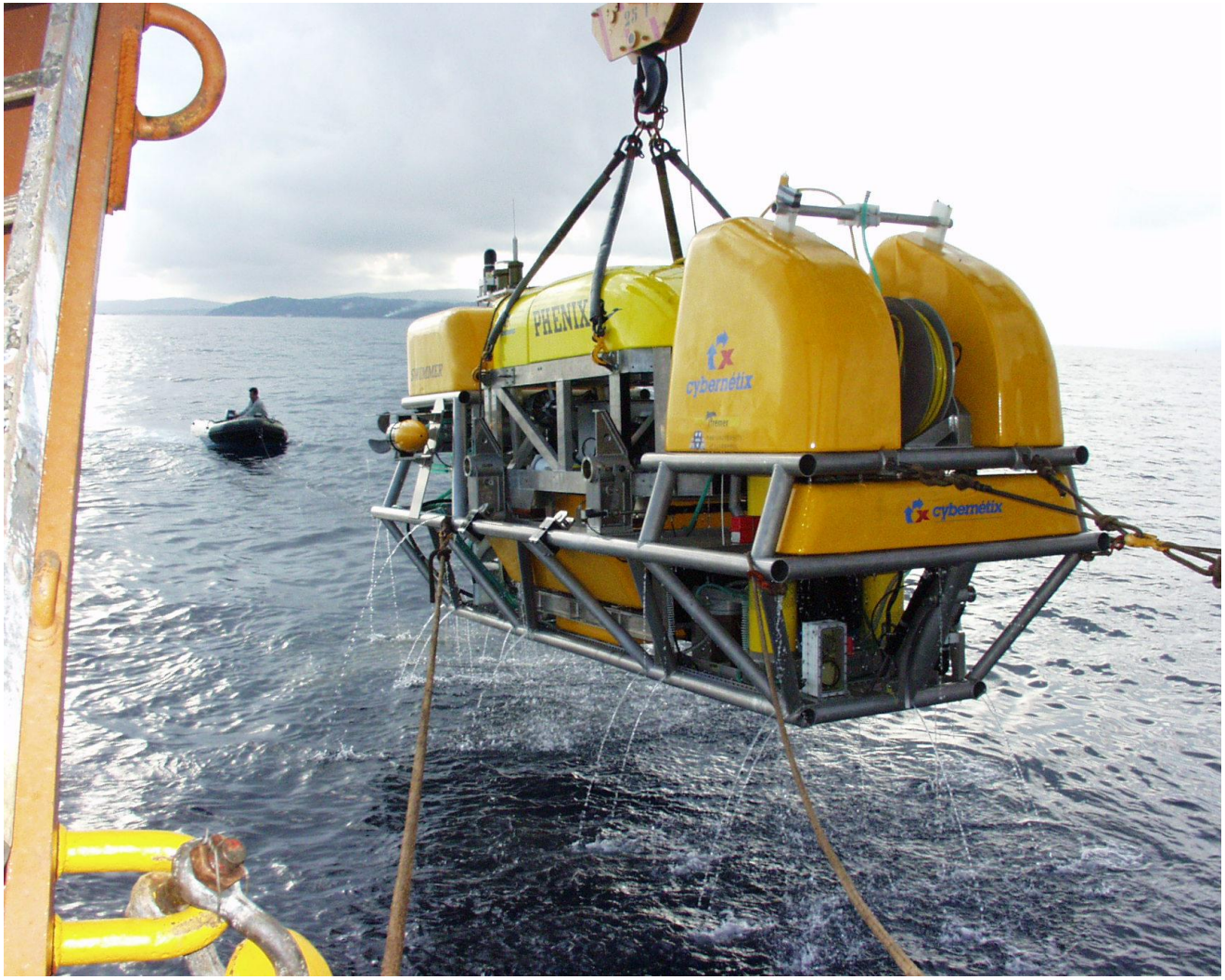
Courtesy of Boeing

STN ATLAS, GERMANY - DeepC



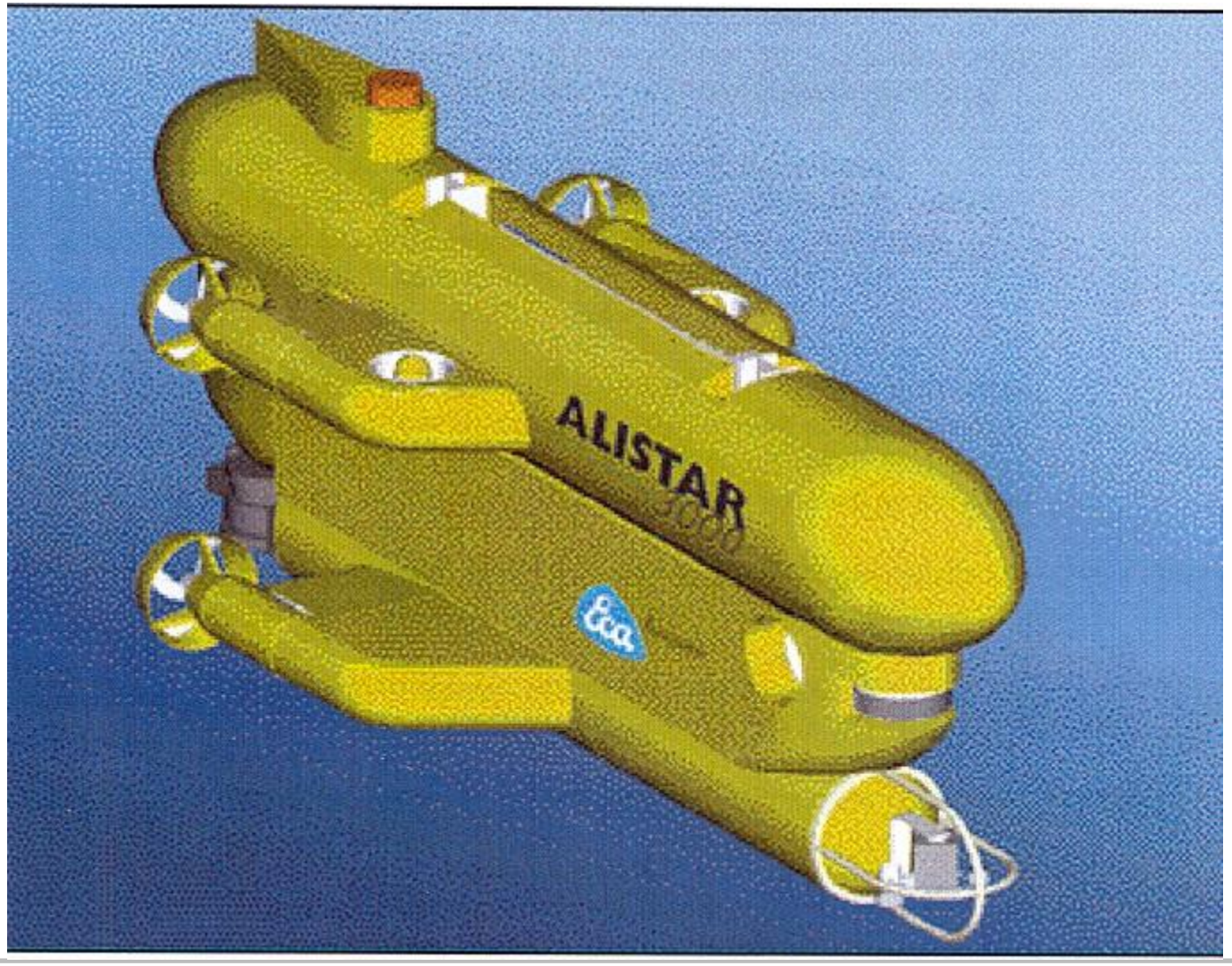
WHOI's ABE

IFREMER, FRANCE - SWIMMER



ECA, FRANCE - ALISTER MILITARY

ECA, FRANCE - ALISTAR 3000 COMMERCIAL



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A TECHNOLOGY WHOSE TIME HAS COME?

- **DESIGN**
- **NAVIGATION**
- **ENERGY**
- **COMMUNICATIONS**
- **PROCESSING**
- **NEED**

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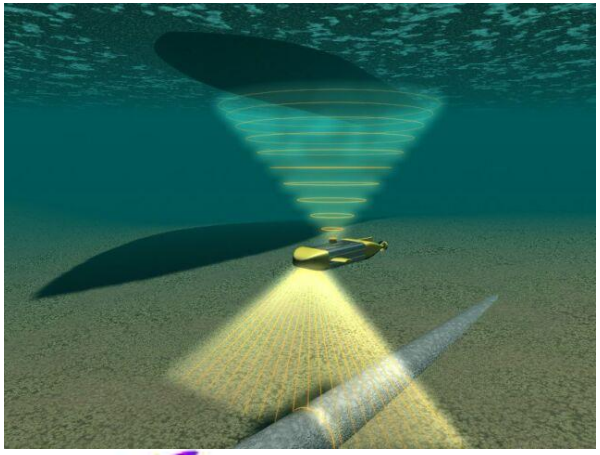
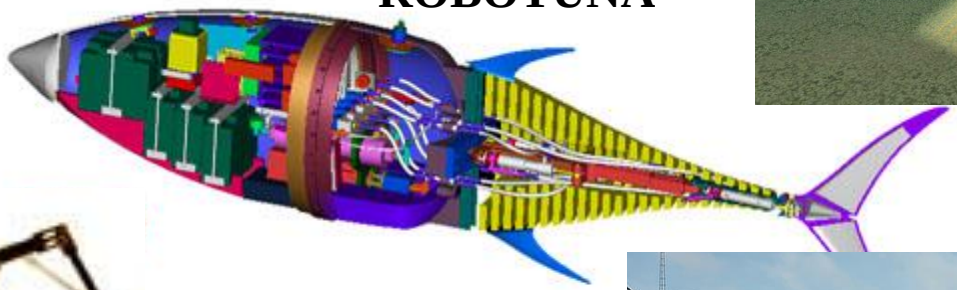
THE FUTURE WILL BE EXCITING

ABE 2

MARIDAN



ROBOTUNA



ALUV

MANTA