



# Sea Mine Countermeasures: Exploring Neutralisation Options



Workshop on innovative solutions for  
sea mine disposal  
14-15 April 2009

NATO Undersea Research Centre (NURC)  
La Spezia, Italy

**Objective:** Assess feasibility of an MCM system for mine neutralisation based on unmanned systems by

- Identifying new candidate technologies for effective delivery of mine neutralisation weapon by a remote platform in order to reduce the cost without sacrificing key performance
- Utilize the advances in unmanned vehicles' navigation, control, and sonar processing
- Use of a priori map (from reconnaissance mission) for localization (map-matching)
- Exploit covert and non-covert solutions for mine disposal
- Evaluate the suitability of non-traditional (non-explosive) means for neutralisation
- Address gaps, hurdles, and constraints to further development
- Identifying partners for collaborative research and the establishment of a joint research programme (JRP)

The workshop will focus on answering

- Can present solutions be adapted to unmanned operations?
- Is there potential to reduce the cost without sacrificing key performance?
- Can weapon cost be close to the cost of the mine?
- Which novel techniques can be used for sonar image enhancement?
- Do new vehicle/guidance technologies offer a break-through?
- Respective merit of blast charges versus shaped charges (homing accuracy/vehicle size trade-off)?
- Can gliding and buoyancy control be enough for weapon actuation?
- What merit in non-explosive sweep/jam warhead?
- How/when is identification performed?
- What is the optimal task sharing between unmanned systems for MCM?
- How to deploy a mine neutralisation weapon from unmanned platform?
- When/how to track/guide weapon from unmanned platform?

The use of unmanned systems has the potential to transform the MCM capability, from a Cold War legacy focused on post-operations clearance with surface ships, to a quickly deployable (air/sea lift), scalable (more/less unmanned platforms) system which offers an order of magnitude increase in speed of operations and reduction in cost over existing systems.

With the continuing move towards the use of remote systems for MCM and the reduction in numbers of dedicated MCM assets, it is also important that this neutralisation can be achieved from remote platforms.

Neutralisation of all sea mines will be considered even unexploded ordinances (UXO).

The workshop will include a mix of specialist presentations and discussion periods, and will produce electronic published proceedings.

The workshop is open to researchers, military personnel, and civilian personnel from NATO member countries. Some restrictions may apply. Registration Form and Visit Request need to be filled out. There is no registration fee, but travel and subsistence costs must be borne by participants.

The agenda is TBD for now but it is being prepared. Input from the participants on what they would like to cover in the workshop is strongly appreciated.

Please contact:           Dr. Vladimir Djapic, Systems Technology Dept., Auto MCM,  
NURC, Viale S. Bartolomeo 400  
La Spezia 19126, Italy  
[djapic@nurc.nato.int](mailto:djapic@nurc.nato.int), +39 0187 527 284



# Sea Mine Countermeasures: Exploring Neutralisation Options



Workshop on innovative solutions for  
sea mine disposal  
14-15 April 2009

NATO Undersea Research Centre (NURC)  
La Spezia, Italy

**Preliminary** Programme:

## 14-April-08

- 8:20 Collect entry passes at NURC
- 8:45 **NURC Welcome and Introduction** – Dr. Joseph Arbour (CAN), Deputy Director, NURC
- 9:00 **Autonomous Naval Mine Countermeasures System** – Marc Pinto (FRA), NURC
- 9:30 **Mine Neutralization: Way ahead in NATO and NURC** – Vladimir Djapic (USA), NURC  
- All mines considered, IEDs, UXOs; limitations of current approach; non-covert and covert ideas; behavior-based control; other means of neutralization  
Presentations by attendees (**Current State of The Art in Mine Disposal**)
- 10:00 **Working with MCMVs in sea mine neutralization** – CAPT Paolo Vittorio Maggiani (ITA) and LCDR Ettore Ronco (ITA), COMFORDRAG
- 10:30 *Coffee break*
- 11:00
- 11:30 **Operational concepts of Mine Disposal Vehicle (MDV) and Expendable Mine Disposal System (EMDS), comparison and feedbacks** – Dominique Mallet (FRA), ECA  
The presentation will focus on describing both systems, the reasons for evolution to EMDS and current trends in employing EMDS from UXVs
- 12:00 **Discussion**
- 12:30 *Lunch*  
Presentations by attendees (**New Systems for Mine Disposal**)

13:30 **Talisman / Archerfish Autonomous Underwater System - ???? (GBR), BAE (TO BE CONFIRMED)**

14:00 **Needs of DGA in scope of Mine Disposal System – Frederic Devie (FRA), GESMA**

The presentation will be about questions DGA try to answer concerning the future mine warfare system that will be based mostly on UxV, and specifically in Identification and Neutralisation of mine purpose. Our Immediate work is to define what could be the best way to conduct operations using UxV. We need to define the robots, the boat, and the concept of operation that could (should) be distinct from the actual concepts. Communication and positioning capabilities between systems and objects are a key feature in defining the autonomy of the robots, and the clever of the software provided to operator. Past evaluations of AUV made by GESMA (REDERMOR, GAVIA, REMUS), and actual ones of demonstrator like VAMA, AUV REA, AUV GDM, USV SPARTAN, DUBM 44 are used to design a tool that could house other system in the future. Ending the presentation, a focus will be made on first results of AMAV demonstrator.

14:30 **Seafox Mine Disposal Vehicle - Walter Wagner (DEU), Atlas-Elektroniks**

15:00 *Coffee break*

15:30 **Simultaneous localization and mapping (SLAM): theory and applications - José Neira (ESP), Universidad de Zaragoza**

The problem of navigation and mapping using vehicles equipped with sensors has been an extremely active research area in robotics during the last 20 years. In this talk I will give an overview of some of the most notable results, discuss current difficulties and limitations, and describe some indoor, outdoor and underwater applications.

16:00 **Discussion**

16:30 Adjourn

18:30 NURC hosted Cocktails at Hotel Doria, Lerici

## **15-April-08**

8:50 Collect entry passes at NURC

Presentations by attendees (**New Systems for Mine Disposal**)

9:00 **Detachable mine destruction device for a single shot mine disposal vehicle -**

Lech Rowinski (POL), Gdansk University of Technology

Qualification tests of a new single shot vehicle have just finished. The reasons that initiated development of a detachable shaped charge and two axis articulated head are described. The solution has a few advantages. One of the interesting features is possibility to easy exchange destruction devices according to local conditions. These devices can utilize various phenomena to destruct a mine or its fuses. Further development leads to a new old idea of releasable destruction device that offers substantial reduction of cost of equipment that is lost during average mine counter mission. Possible solution of future device is outlined.

9:30 **Underwater GPS guided bomb: a new concept for mine neutralization - Yann Le Page (FRA), ACSA**

This presentation highlight how new technologies bring efficient solutions to

positioning, guidance and supervision requirements encountered in mine countermeasure operations.

10:00 **Recent advances in Forward Looking Sonars** – Warren Fox (USA), Blueview Technologies

10:30 *Coffee break*

11:00 **Implementing autonomous behaviours with MOOS and IvP Helm** -

Arjan Vermeij (NLD) and Vladimir Djapic (USA), NURC

11:30 **Discussion**

12:00 *Lunch*

13:00 Presentations by attendees (**New Payload Systems for Mine Disposal**)

13:30 **The choice and support of disposal ordnance** – Richard Gibson (GBR), QinetiQ

traditional explosive weapon and the issues surrounding it – pre. e.g. delivery, safety, arming and identification; during e.g. alignment and triggering; post e.g. measures of effectiveness the SAP cannon

14:00 **Novel ideas for neutralization payload for mine disposal mission** – ????

14:30 **Versatile Expendable Neutralisation device** - LCDR Rob Cornick (GBR), NURC

Support the capability to counter the (modern) mine threat by using an inexpensive (approximately 1.5 K Euro), non-explosive electronic mine neutralization device (END). This technology offers great versatility against modern sea bed mines and should prove more cost effective and cheaper in through life cost than the traditional explosive counterpart. Additionally it can be used in areas in which conventional systems have no capability due to constraints of depth or manoeuvring room. Because of its non-explosive nature it can be easily transported and recovered.

15:00 *Coffee break*

15:30 **Establishment of a joint research programme (JRP)** – Marc Pinto (FRA), NURC

16:00 **Avenues for Collaborative Research** - Edoardo Bovio (ITA), NURC

16:30 **Discussion**

17:00 Adjourn

20:00 No-Host Dinner, Lerici

-

22:00

## **16-April-08**

09:00-10:30 **Points of collaboration for innovative solutions for sea mine disposal**

10:30-11:00 **Coffee**

11:00-12:30 **Round-Table Discussion of collaboration**

12:30 End