Europa Varietas Institute

Deep Lake Demining Project

Europa Varietas Institute

is an Independent, Swiss-based Think-Tank on Strategic & International Affairs. The main profiles of the international research groups of the Institute are foreign and security policy researches, development of European policies and innovation projects. Our researchers live, work or have gained many years of experience in many European and non-European countries.

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Our strengths

• independent think-tank with a young, dynamic international team
• highly qualified and internationally experienced and recognized expert base
• international, network-based analysis team
• flexible adaptation to the needs of our clients
• international references in the public, private and business sectors
• continuous on-site experience

About the Europa Varietas Institute

Created by the Europa Varietas Foundation, and managed actually by the Swiss-based Europa Varietas Association, Europa Varietas Institute is an on-line international research center of policy issues and international relations based on an independent network.

Our researchers have recognized expertise in the field of European security and defense, they work as advisers to government, NGOs and businesses in Europa and North-America. Our profile includes developing innovation projects and writing EU policy analyses. During our projects, we pay special attention to utilization in the public sector or for business purposes.

The Europa Varietas Institute is a research and analysis centre organized in a network system in accordance with the needs of the 21st century. Our multilingual, professional researchers supplement their professional knowledge with up-to-date information and background knowledge by staying in the target countries and conducting research there.

We work or have worked at or as external collaborators at numerous renowned European or international research institutes (EUISS, AWEU Defence Committee, CERIUM ROP, IRSEM, etc.) and universities (Sorbonne – Paris 3, Harvard, The Fletcher School, etc.).

Our projects have been prepared for, among others, NATO, the European Defence Agency, the European Parliament, the European Commission, and for the Hungarian Presidency of the European Union.

DEEP LAKE DEMINIG PROJECT

Objective:
To bring to the surface in large quantities, efficiently, 4 mm - 20 cm, 0.4 g - 50 kg ammunition from a depth of 150-220 meters, even from a 2-meter layer of sediment. Their material is iron, the detonator is copper, brass or aluminium.
Estimated quantity: 8200 tons.

Solution proposal:
Innovation team of our institute proposes a 3+1-phase complex work plan based on the creation of a special diving bell, taking into account the high explosive hazard of the work and the ecological aspects.

Target error:
The expected strength of the explosion (in kT) in the event of a possible explosion is not precisely determined in the objective. This must be specified in order to manufacture the target device.

Phase 1

During the first phase, we propose the use of sonar to localize the main metal waste-slags at the bottom of the lakes and mark their location with buoys.

It is not possible to send a diver, a deep-diving diver could only reach a depth of about 40-50 meters, the lakes are too deep, they could stay down for too short a time, they would have to perform very professional firefighting work, which is also highly dangerous. A depth of 200 meters means a pressure of about 20 bar.

The use of bathymetric LiDAR for laser 3D detection of deep lake-beds could also be useful if they can be operated from remotely controlled underwater drones. *(The traditional, optimal application range of LiDARs extends to depths of 25 meters.)*

Phase 2

In the second phase, the marked areas are scanned using industrial magnets connected in series to a chain, like a net. The magnet can be "mown" by moving the chain vertically, swinging it, which would make it penetrate the mud better, but would not get stuck in it.

In our opinion, this would allow a significant amount of lighter ammunition, not too deep, to be brought to the surface.

In order to protect the ecosystem (see phase 3), oxygen replenishment of the studied deep lake area must be ensured.

The technology could be applied using a towed method similar to the fishing method proposed in Phase 3.

Reference: Although the method is at a significantly lower depth, it has been successfully applied on several sections of the Danube, including in Hungary.

Phase 3

The essence of Phase 3 is the creation of **a special, innovative diving bell**, with which we will provide a quasi-“dry land” environment for special robots for mining clearance. The explosion-proof diving bell would create a safe, delimited, relatively ecologically protected, localized workspace for the intervention.

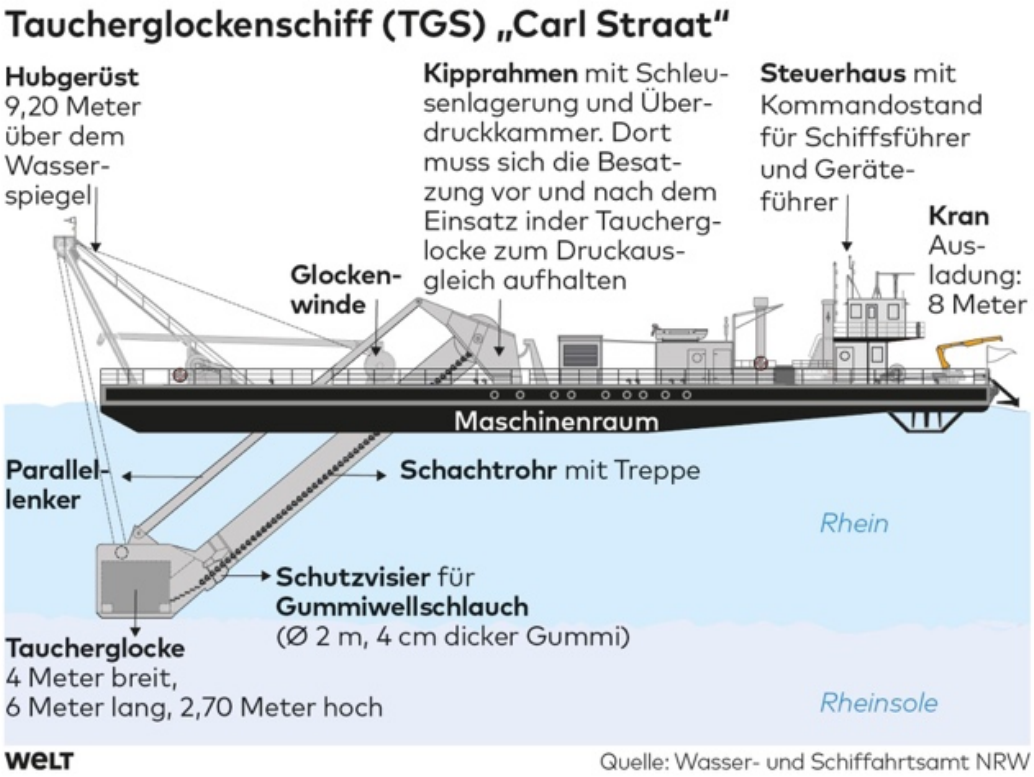
We recommend the diving bell technology of the Carl Straat ships, which has been used on the Rhine since 1963, for study. The essence of the diving bell method is that a pressurized chamber is lowered to the bottom of the river/lake, in which the "dried" riverbed can then be studied practically like a riverbank.

Demonstration:
https://www.youtube.com/watch?v=IPmajGRTKok&ab_channel=wocomoMOTORS

Source: https://www.welt.de/

The diving-bell solution was used, among other things, around 1628, during the accident of the Swedish warship Vasa, to find and bring to the surface the objects (including cannons) of a ship that had sunk to a depth of 32 meters.

The difficulty of the solution is that, although the technology is relatively simple and well-known, ships equipped with bells are currently only used on the Rhine at depths of 7-10 meters and have extensive experience only at this depth.



Source: https://www.welt.de/regionales/nrw/article244131997/Carl-Straat-Warum-der-Bund-gegen-eine-Eintragung-des-Schiffs-als-Denkmal-klagt.html

This means that the use of the German ship structure for the given purpose must be further developed with innovative tools.

This means that the current technology of the diving bell itself **and the discharge-connecting pipe / cylinder (See the picture : *“Schlachtrohr mit treppe”*) on the ship delivering the bell to the site must be modified.**

The current, **tiltable rigid pipe should be replaced by a telescopically collapsible, (possibly modularly assembled), also tiltable pipe system, which would allow the bell to be lowered to a depth of 220 meters**. The proposed technology for use can be similar to that of oil platform drilling tubes.

In the case of the Carl Straat ship on the Rhine, the discharge pipe is connected to a staircase, which is not applicable in this case and should be replaced with a specially designed freight elevator.

The pressure of about 20 bar at a depth of 200 meters also poses a serious challenge, therefore, and due to the dangerous nature of the work, we recommend using robots in the bell tower.

We can make further suggestions for the range of robots to be used if the project is accepted. If appropriate, a cost-effective tool and platform can be designed and printed with a 3D printer.

The new bell tower of the Carl Straat ship, which was used a couple of years ago, was manufactured by the German **HAUX-LIFE-SUPPORT GmbH**. Our institute contacted the company regarding whether it would be able to construct a diving bell designed for a significantly greater depth (150-200 m).

The company formulated the following questions regarding the project, which would still need to be clarified if it were to be implemented:

"(…) So we can work on specifically designed containerized modular Deep Diving Systems. For further evaluation it would be important to get more specific info about your idea about specific dive procedures. Specifically maximum bottom time and type of diving equipment divers should use. Furthermore how many divers in the Diving Bell?

- *Due to the maximum depth, we assume it should be a closed diving bell ...*

< The solution proposed by us therefore does not propose a closed unit, we have not yet communicated this to the manufacturer, but this option can also be examined if required. >

- *Furthermore it would be important to know if there are weight restrictions of single modules of the system and if geometric dimensions of standard 20-feet-CSC-container would be OK ...*

- *Furthermore it would be interesting your understanding of a "moderate" UW-explosion ...*

< The tender specifications did not include the potential explosive power in kT of the munitions to be extracted. It should be clarified in case of implementation of the project >

(…)
T. H.
Managing Director
HAUX-LIFE-SUPPORT GmbH"

If necessary, an **innovative inflatable flexible skirt** can be installed at the bottom of the diving bell to eliminate adhesion problems resulting from the unevenness of the lake bottom, such as the skirt of hovercrafts. The continuous oxygen supply of this skirt would also provide oxygenation of the work area environment (under controlled conditions).

In the diving bell, for example, the ground investigation would be carried out using the **VALLON VX1** differential magnetometer. Thanks to its extreme sensitivity, this robust device can locate buried bombs, grenades and other steel objects in the ground.

The measurement result is displayed on a display in terms of polarity and signal strength. In addition, the iron detector has data recording connectors, so it can also be used for computer-assisted localization (RS232, USB and Bluetooth®). It can detect the searched devices **at a depth of 3-6 meters**.
The project will also need a special remote-controlled digging robot.

4. Post-use issues

The question may arise as to how the post-use of a ship purchased or built for this purpose is possible, after the Swiss lakes have been de-ammunitioned.

- The Confederation could also use it for nature conservation reasons. Biologists could use it to study the effects of climate change, environmental impacts, etc. It could also be a useful target for lake-habitat reconstruction projects on Swiss deep-lakes up close. It could also be a useful target for habitat reconstruction projects.

- Such devices could be used in flood protection developments and dam construction works.

- The ship could also be used with great benefit by underwater archaeology, searching for traces of Swiss prehistory and history.

- Possible tourist use, for observing lake life at a depth of 20 meters.