

Operation Alpine Recovery

An Expanded Technical and Conceptual Proposal

Prepared in response to the Swiss Federal Office for Defence Procurement (armasuisse) idea competition regarding submerged munitions in Alpine lakes.

Abstract

Operation Alpine Recovery was developed as a conceptual and technical framework addressing the presence of more than 12,000 tonnes of historical military munitions disposed of in Swiss Alpine lakes between 1918 and 1964. Resting at depths of up to 220 metres, these materials represent potential long-term environmental and safety risks. This proposal outlined a phased, environmentally responsible strategy combining precision mapping, underwater robotics, encapsulation technologies, and long-term ecological monitoring. The project emphasized minimal sediment disturbance, scalable deployment, and research-oriented implementation rather than immediate full-scale recovery.

1. Background and Historical Context

From 1918 to 1964, the Swiss military disposed of unused or obsolete ammunition in several Alpine lakes, including Lakes Thun, Lucerne, and Brienz. At the time, deep-water disposal was considered a practical solution. Modern environmental standards and long-term ecological concerns have since shifted perspectives, prompting renewed interest in assessing potential risks and evaluating remediation strategies.

2. Problem Statement

The submerged munitions may pose chemical, ecological, or physical hazards. Key uncertainties include corrosion rates, explosive stability, sediment interaction, and potential contamination pathways. Any intervention must carefully balance risk mitigation with the preservation of fragile lake ecosystems.

3. Project Objectives

- Conduct high-resolution mapping to establish an accurate geospatial inventory.
- Minimize ecological disruption during survey and intervention activities.
- Deploy robotic systems to reduce human exposure to risk.
- Provide a scalable and research-informed technical pathway for future pilot initiatives.

4. Proposed Multi-Phase Methodology

- Phase 1: Precision mapping using sonar and magnetometer technologies to identify and classify submerged objects.
- Phase 2: Deployment of Autonomous Underwater Vehicles (AUVs) and Remotely Operated Vehicles (ROVs) for targeted inspection and retrieval.
- Phase 3: Controlled encapsulation of unstable or high-risk items where extraction presents elevated environmental risk.
- Phase 4: Secure transport and controlled disposal consistent with environmental and safety regulations.
- Phase 5: Long-term monitoring of water quality and ecosystem indicators.

5. Environmental and Risk Mitigation Framework

Environmental stewardship formed the core principle of the proposal. The strategy emphasized low-impact navigation systems, precision manipulation tools, sediment control techniques, and real-time environmental monitoring. A precautionary approach guided all phases of conceptual design.

6. Governance and Strategic Positioning

Operation Alpine Recovery was positioned as a research-oriented conceptual framework. It did not assume immediate large-scale implementation but instead proposed a pathway for feasibility studies, pilot projects, and interdisciplinary collaboration among government agencies, research institutions, and industry partners.

7. Team and Industry Engagement

The proposal was developed by a small interdisciplinary team. Preliminary engagement was established with two Canadian industry representatives interested in supplying specialized underwater survey and robotics equipment. The collaboration model emphasized flexibility, modular deployment, and international knowledge exchange.

8. Conclusion

Operation Alpine Recovery provided a structured, technically grounded, and environmentally cautious proposal addressing the complex challenge of submerged munitions in Swiss Alpine lakes. By integrating precision mapping, robotics, encapsulation technologies, and long-term monitoring, the framework aimed to inform future research and policy discussions while prioritizing ecosystem protection.