

## CRITICAL FINDINGS

# Model Roundup and Extension for the Current- and Wave-induced Burial, Re-exposure, Mobilization, and Migration of UXO and DMM

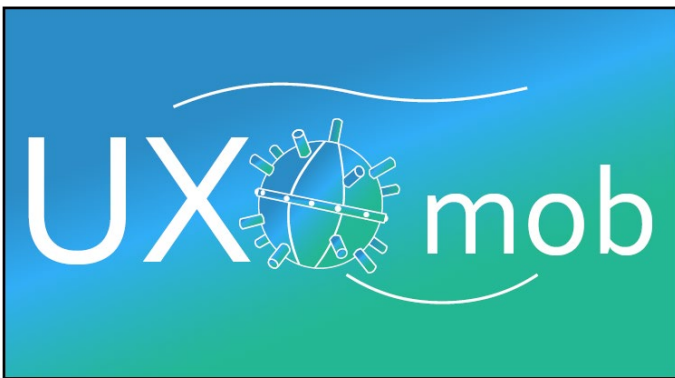
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## TECHNOLOGY DESCRIPTION

UXOmob is a software tool that enables site managers to simulate the burial, re-exposure, and mobilization of objects on the seafloor. For this purpose, different burial models, such as the new DRAMBUIE 3.0 model, can be chosen by the user.

Mobilization simulated, using the Morrison Equation. The forcing is derived from field measurements and/or models, delivering spatiotemporal morphodynamics and waves. These input data are then analyzed for wave-time series, orbital velocities, and currents close to the seabed, utilizing different wave models, wave breaking models, and wave spectra.

The UXOmob software system was extensively tested and documented, is highly parallelizable, and extremely flexible and open for extensions, such as new burial or mobilization models, drift, and impact burial. The user interface as well is completely flexible and can be a local graphical user interface, web browser interface, command prompt, or Representational State Transfer-application program interface, which can be defined in close dialog with and on demand of the end user.



*Logo of the UXOmob software*

## CRITICAL FINDINGS

- It was possible to combine the different models with a huge spread of temporal (sub-seconds to years) and spatial (cm to km) scales in a single model.
- A new burial model was developed and implemented, combining DRAMBUIE, the results of Friedrichs and AI-based methods.

- The critical dimensionless coefficients for drag, lift, and added mass were derived from wind tunnel experiments and Computational Fluid Dynamics simulations. The results were published and provided to the SERDP community.
- A close site manager dialog was held. As a result, a very compact site manager report, consisting of maps and short statements was required. For technical support, Corps of Engineers – Huntsville Center required a fully-documented software and the ability to reproduce the results by themselves.
- The input data quality, such as unexploded ordnance definitions and site definitions (bathymetry, waves, currents), was crucial for good results.

## ADVANTAGES OVER ALTERNATIVES

- A future-proof professional software was developed, tested, and documented and prepared for end-user application.
- The input data can be delivered from different sources and models.
- The output data are delivered as geographical information system-compatible files.
- UXOmob is a fully deterministic model, which can make predictions for site managers in real spatial and temporal scales within an acceptable timeframe.
- All processes and models can be selected separately and can be supplemented by alternative or new approaches. For most models (e.g., burial, wave-orbital velocities, wave breaking, wave time series, and spectra), alternative approaches are already implemented.

## About SERDP

The Strategic Environmental Research and Development Program (SERDP) is the Department of Defense's environmental science and technology program, executed in partnership with the Department of Energy and the Environmental Protection Agency. SERDP invests in basic and applied research and advanced development.

## Point of Contact

Paul B. Hatzinger, Ph.D.  
[peter.menzel@corvus-works.com](mailto:peter.menzel@corvus-works.com)

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