

Maintenance

MARCH 2026

Project Title: Evaluation of Unmanned Surface Vessel-Based Topographic and Bathymetric Survey System in Flood Conditions

Task Number: 3926

Start Date: January 1, 2022

Completion Date: November 30, 2026

Task Manager:

Larry Baumeister
Transportation Engineer (Electrical)
Larry.Baumeister@dot.ca.gov

DRISI Division Chief:

Prakash Sah, PE
prakash.sah@dot.ca.gov



DRISI provides solutions and knowledge that improves California's transportation system.

Evaluation of Unmanned Surface Vessel-Based Topographic and Bathymetric Survey System in Flood Conditions

Investigated the use of unmanned survey system for use in hydraulic studies.

WHAT WAS THE NEED?

The California Department of Transportation (DOT) (Caltrans) conducts topographical and bathymetric surveys vital for modeling channel water flow and early detection of bridge scour. Deep water surveys can be especially hazardous under wind and flood conditions such as fast flowing currents, submerged and unobservable debris, blockades, sensitive habitats and the potential of getting stuck on mud.

A small Unmanned Surface Vessel (USV) platform with integrated topographic and bathymetric mapping sensors enable surveys to be conducted in challenging environments such as high-flow flood conditions and shallow water where using a manned boat is unsafe.

WHAT WAS OUR GOAL?

The goal of this project was to improve efficiency and safety by developing a fully integrated bathymetric mapping system on a USV that can be deployed rapidly and safely in shallow and deep water conditions.

WHAT DID WE DO?

This research successfully developed and field-tested a USV bathymetric survey platform, achieving over five hours of operational time and a top speed of 2.1 m/s (6.9 ft/s), while also enhancing Caltrans crewed boats with bathymetric survey capability.

The project demonstrated successful bathymetric surveys using USV, an inflatable crewed boat, and a dive boat. The Norbit MBES software-configurable field-of-view (FOV) feature

on the USV proved essential for gathering data from bridge piers up to the water surface and is a valuable addition to bathymetric survey systems.

WHAT WAS THE OUTCOME?

The outcome of this research showed that there needs to be more development of this prototype to refine some of the equipment and operational issues. During some of the testing the motor in the USV occasionally had some overheating issues. Launching the USV into the water can be challenging depending on the survey site location. Recreational boat launch sites can be far away from a project site. Deploying the USV from a riverbank can be hindered by steep terrain, thick vegetation, muddy and slippery slopes, or rocky embankments.

WHAT IS THE BENEFIT?

The USV mapping system enables Caltrans to perform early detection and identification of bridge scour. It improves the safety of the traveling public, while also reducing the hazards and exposure of sending manned boats and/or divers into swiftly flowing water.

IMAGES

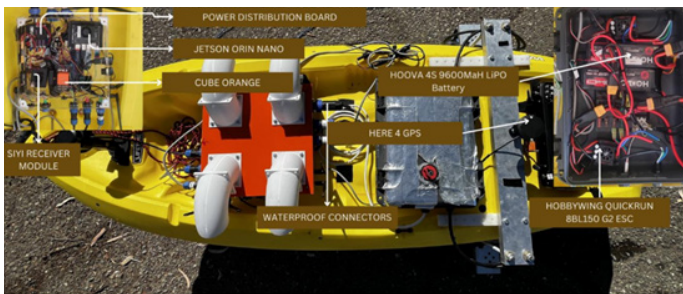


Image 1: Unmanned Service Vessel.



Image 2: Unmanned Services Vessel during testing.