

**Project Number**

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## Florida Department of Transportation Research

# Unmanned Surface Vessel (USV) Systems for Bridge Inspection

*August 2016***Current Situation**

The Florida Department of Transportation (FDOT) maintains thousands of bridges across the state, where coastal environments are a constant threat. Yet, Florida's bridges rank above the national average in structural integrity. This is the result of FDOT's regular schedule of bridge inspection and its commitment to maintenance. Research plays a key role in this mission as new inspection and repair methods continue to be sought and studied.

**Research Objectives**

Florida Atlantic University researchers studied the use of unmanned surface vessels (USVs) for bridge inspection. The general concept is that a bridge inspection team would use an USV to perform an initial survey of structures underwater and at and slightly above the waterline as well as the nearby river bottom or seafloor, helping inspectors identify areas that a dive team should focus on for targeted inspection and testing.

**Project Activities**

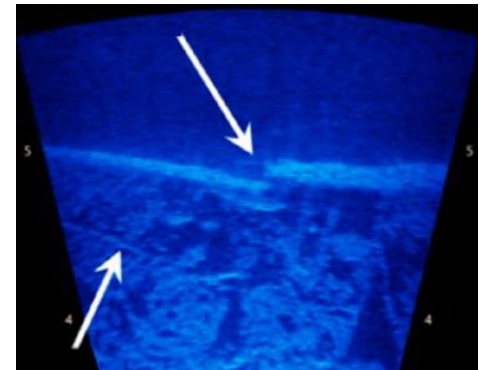
The researchers considered a range of choices for the components of a USV inspection system, choosing a vessel with an appropriate hull design, capacity, and propulsion system, imaging systems, and data acquisition and control systems. A twin-hulled vessel was selected for its blend of stability, maneuverability, and weight. The researchers chose acoustic imaging as the most broadly reliable in the over-water and underwater environments in which the USVs would be working. Designing a control system capable of maintaining course and/or position under the influence of currents and wind forces was a demanding issue.

Based on what they learned about the various components of the USV system, the researchers adapted an existing USV for a proof of concept bridge inspection. The adapted USV was operated from a land-based control station that displayed real-time video images of the USV's environment as well as acoustic imaging.

Once proof of concept was established, field trials were conducted at the Florida Atlantic University SeaTech marina, in the Carrabelle River that feeds Apalachicola Bay, and at Port Jacksonville. The USV performed well in more protected locations, but its controller could not compensate for crossing actions of wind and waves in more exposed locations. In most cases, the sonar system performed well and delivered useful images. Results of the trials led to recommendations to FDOT for how best to use USVs in bridge inspections.

**Project Benefits**

This project provided valuable insights that may lead to implementation of the USV as a tool for bridge inspection, one that will allow for more comprehensive inspections and better maintenance of Florida bridge infrastructure.



*The upper arrow in this sonar image points to a break in a seawall. The lower arrow points to an underwater cable.*

*For more information, please see [dot.state.fl.us/research-center](http://dot.state.fl.us/research-center)*