



Calhoun: The NPS Institutional Archive
DSpace Repository

CRUSER (Consortium for Robotics and Unmanned Systems Education and Research) Faculty and Researchers' Publications

2016

Real-time undersea networking using acoustic communications for improved UUV positioning and collaboration

Smith, Kevin; Cristi, Roberto

Monterey, California: Naval Postgraduate School

<https://hdl.handle.net/10945/57044>

This publication is a work of the U.S. Government as defined in Title 17, United States Code, Section 101. Copyright protection is not available for this work in the United States.

Downloaded from NPS Archive: Calhoun



Calhoun is the Naval Postgraduate School's public access digital repository for research materials and institutional publications created by the NPS community. Calhoun is named for Professor of Mathematics Guy K. Calhoun, NPS's first appointed -- and published -- scholarly author.

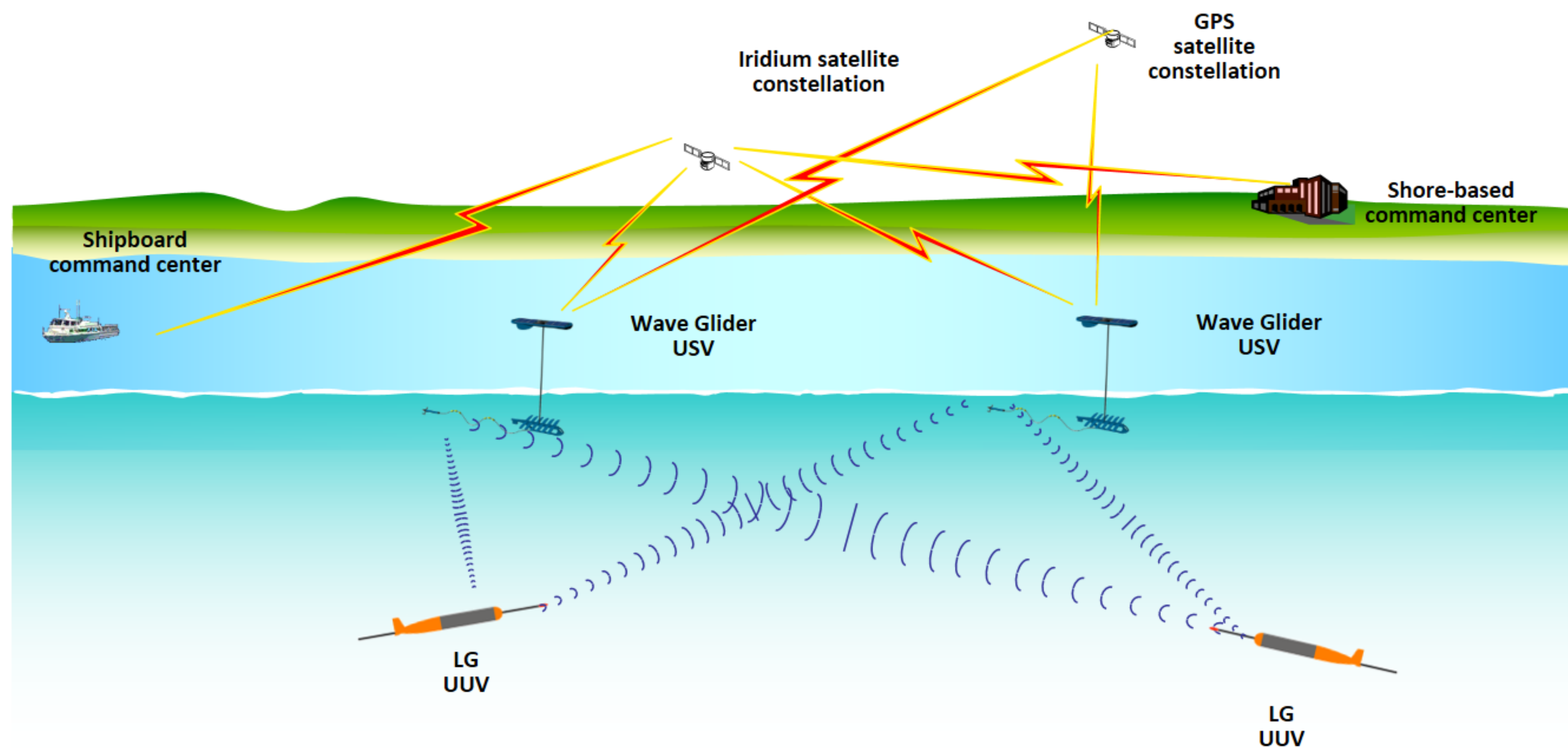
Dudley Knox Library / Naval Postgraduate School
411 Dyer Road / 1 University Circle
Monterey, California USA 93943

<http://www.nps.edu/library>

Real-time undersea networking using acoustic communications for improved UUV positioning and collaboration



NAVAL
POSTGRADUATE
SCHOOL



Concept of operations for networked USVs and UUVs using underwater acoustic communications.

Technical Approach

- Development of dynamic Kalman Filtering of navigation data using time-of-flight measurements between platforms, as well as UUV heading and speed measured during submerged operations.
- Utilize acoustic ray model to predict multipath propagation response based on measured sound speed data and bottom bathymetry/acoustic properties.
- Evaluate correlation of modeled response to measured impulse response for improved estimation of range between transmitter and receiver.
- Investigate improvements in tracking utilizing new, directional acoustic modems.

Background

- Navigational accuracy of UUVs found to quickly degrade during submerged operations due to currents and inaccurate inertial navigation models.
- Research program initiated under CRUSER in FY14 to investigate the ability to accurately track UUVs using acoustic modems deployed from USVs.
- In FY14-15, two NPS Wave Glider SV2 units upgraded with integration of new tow-fish systems for deploying Teledyne-Benthos acoustic modems.
- In FY14-15, integration of Teledyne-Benthos modems into two Littoral Glider UUVs with interface to science computer and C&C network completed.
- Initial at-sea testing of acoustic network between multiple UUVs and USVs completed in FY15.

Research Goals

Successful outcomes of this research effort will support the following goals in future operations:

- Enhance the navigational and positioning accuracy of autonomous underwater vehicles through a network of autonomous surface vehicles.
- Establish continuous command and control during UUV submerged operations using acoustic comms.
- Compact data exfiltration from UUV during submerged operations using acoustic comms in near real-time.