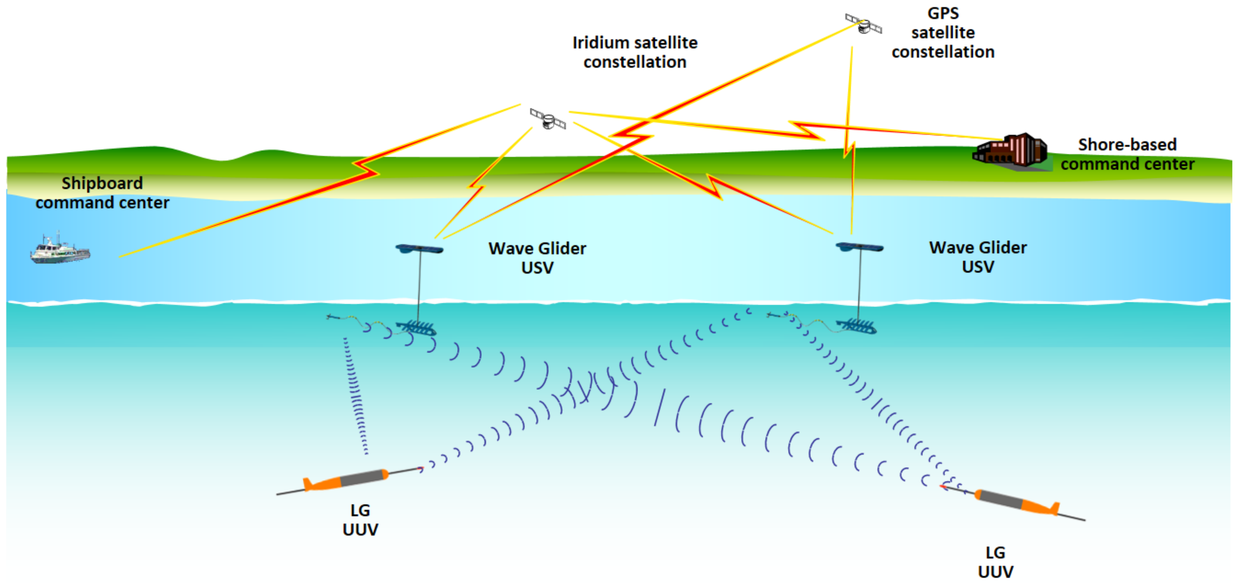
Real-time undersea networking using acoustic communications for improved UUV positioning and collaboration

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.

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