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MULTI-SENSOR ARCHITECTURE FOR DYNAMIC SIGNAL PROCESSING AND GLOBAL COMMUNICATION

Abstract

This paper presents a multi-sensor architecture for real-time information and communication and dynamic signal processing (RTICA). RTICA is a localized, architecture with a global 2-way communication that is geographically agnostic. RTICA is a distributed, dynamic network of autonomous platforms combining multi-spectral circuits, sonar, RF, active RFID (aRFID), and laser communication and power technologies, and microsatellite relay. RTICA functions from the bottom floor, through the entire water column, on water surface, ground level, and into the atmosphere and beyond. Its undersea platforms execute the real-time acoustic and non-acoustic signal processing.

RTICA encompasses either novel or enhanced measuring circuits, parametric telemetry, models, and communication components residing on Light Detection and Ranging – Electromagnetic – RF Communication Sonar Buoy, Power-RF Sonobuoy, Group ADCP (a mix of Acoustic Doppler Current Profilers – ADCP platforms, Conductivity, Temperature, Depth – CTD platforms), Autonomous Underwater Vehicle (AUV), Echo Ranging System Spectral Radiometry Platforms, Bobbing Automated Water Profilers, and constellation of microsatellites in Low-Earth (LEO) polar orbits.

A constellation of LEO microsatellites supports RF communication with the planned buoys, AUVs, and, if networked in the architecture, with ships and aerial manned and autonomous platforms. A relay of 3 – 5 microsatellites would enable the real-time communication over a localized region. For the global coverage, a basic 30 microsatellite system in polar orbits will support real-time RF communication with intended assets.

RTICA and most of its platforms will continuously transfer data at 200 – to – 700Kb/s and, discretely, 10GB every 10 minutes using Earth-to-Space Forward Link transmit power of 20 Watts at the RF Transmit Frequency of 9750 MHz and Space-to-Earth Return Link transmit power of 25 Watts at the RF transmit frequency of 8600 MHz.

We describe optimization of platforms (modularity and composition) for a specific operational scenario, payloads of optimized modular platforms, and aRFID-enhanced ADCP and CTD instrumentation prototypes. Exemplified in an aRFID-enhanced ADCP, the following models will be described: (1) assignment of an aRFID code to an analog acoustic time series, (2) conversion of the acoustic analog data in a digital time series, while preserving the assigned aRFID code, (3) concatenation of the telemetric aRFID code, the ADCP aRFID code, and time stamp uniquely identifies the electronic parcel, (4) models residing on ADCP.