The research associated with this application will develop a comprehensive suite of miniaturized biological sensors capable of characterizing the concentration, community composition and physiological state of phytoplankton. Specifically, miniaturized Fast Repetition Rate Fluorometers-Oxygen (FRRF-O2) will be constructed and integrated with spectral absorption and backscatter sensors providing an integrated bio-optical sensor suite capable of calibrating satellite imagery while simultaneously characterizing photosynthetic quantum yields and hyperspectral particle absorption. These systems will be integrated into a nested fleet of Autonomous Underwater Vehicles (AUVs), which will be flown under high-resolution ocean color imagery collected by the new generation of satellite systems to provide 3-D maps of phytoplankton community composition on a seasonal basis off the West Coast of Florida.
The flight patterns of the AUVs will be directed by real-time satellite imagery and CODAR derived surface current fields, providing high resolution maps (250 m) of fronts/slicks, and by onboard theoretic decision-making software allowing the AUVs to analyze their own environmental data. Data from the AUVs will be transported back to shore on an hourly basis allowing for vicarious calibration of satellite imagery and adaptive sampling using ships. This nested observational system will be used to assess the seasonal evolution of toxic red-tides blooms of Karenia brevis. K. brevis blooms annually in the Gulf ofMexico and our goal will be to collect high-resolution 4-D maps of red tide and the associated physical/chemical/biological factors associated with bloom initiation and maintenance.

The CODAR system is an HF radar system that provides real-time maps of surface currents within the coastal ocean. These systems are the same as those already operating off the New Jersey coast under the call sign WA2XXF.