Solar Powered Autonomous Surface Vehicle Development

Overview:

A fleet of long-duration solar powered Autonomous Surface Vehicle (ASV) platforms is being developed to provide a low-cost solution to enable oceanographers and other researches to acquire in-situ oceanographic and atmospheric measurements in support of activities such as satellite sensor calibration/validation, air-sea flux research, harmful algal bloom monitoring, hurricane research, weather forecasting, and environmental monitoring. The platforms may also support applications including spaceport range safety, homeland security, harbor surveillance, and search & rescue.

The solar powered marine vehicles provide a reusable and reconfigurable platform designed to provide power, protection, mobility, and communication to payloads. Whether deployed individually or as a fleet, the platforms can serve as an integral component of sensor webs that incorporates data from satellites, aircraft, UAS, weather balloons, buoys, and fixed stations.

Emergent provides support for vehicle research and development, engineering, production, payload integration, testing, mission operations, and maintenance. Emergent also develops the ground systems and communications interfaces that facilitate control and monitoring of the vehicles.

Home port for the solar ASV fleet is the NASA Goddard Space Flight Center's (GSFC) Wallops Flight Facility (WFF) located in Wallops Island, Virginia. WFF provides easy access to the waters of the DELMARVA region including the Chesapeake Bay, Chincoteague Bay, and Atlantic Ocean. Testing and scientific operations have been underway in the DELMARVA region and beyond since early 2005.

Vehicle Specifications:

Mechanical:

- Fiberglass Deck/Hull
- Self-Righting
- Weight: ~3000 lbs.
- Length: ~18ft.
- Width: ~5ft.
- Draft: ~2 ft.
- Mast: ~11 ft.
- Radar Reflectors / Day Shapes

Electrical:

- Solar Powered
- Wind Generator (optional)
- Deep Cycle Lead Acid Battery Bank
- 24 Volt Main Bus
- Navigation Lights

Propulsion:

- Cruise Speed: ~1.5 - 2.0 knots
- Electric Propulsion and Steering

Payload Support:

- Payload Bays (Forward, Center, Aft)
- Water Flow-Through / De-bubbling System
- Power: 24V & 12V
- Capacity: ~500-800 lbs
- Bow Mast (optional)
- Vertical Profiling (optional)
- ADCP Portal

Communications:

- Two-Way Real Time Communications
- Iridium Satellite – Global
- Cellular – Regional
- 900MHz Spread Spectrum – Line of Sight
- WAN / LAN – Integration & Test
- Proximity Ops R/C – Deployment/Recovery

Navigation Modes:

- Free Drift
- Remote Control
- Waypoint Path Tracking
- Station Keeping
- Adaptive Feature Tracking

Operator Interface:

- Graphical User Interface
- Vehicle Commanding & Configuration
- Telemetry Monitoring (Plots, Tables)
- Summary State Download
- Nautical Chart Display (Planning & Monitoring)
- Google Earth Visualization
- Onboard Camera View
- External Command/Telemetry Interface

Oceanographic Measurements:

- Wind Speed / Direction
- Barometric Pressure
- Atmospheric Temperature
- Relative Humidity
- Sea Surface Temperature
- Salinity
- Chlorophyll Fluorescence
- CDOM Fluorescence
- Phycoerythrin Fluorescence
- Bathymetry
- Current Profiling
- Carbon Dioxide
- Dissolved Oxygen

Users/Customers:

- NASA Wallops Flight Facility
- NASA Goddard Space Flight Center
- NOAA
- Columbia University
- Carnegie Mellon University
- University of Maryland

Oceanographic Applications:

- Harmful Algal Bloom Monitoring
- Carbon Eddy Flux Research
- Estuary Monitoring
- Reservoir Water Quality Monitoring
- Coastal / Cross-Shelf Transects
- Station Keeping Weather Buoy
- Current Profiling
- Water Column Sampling
- Hurricane / Storm Monitoring
- Satellite Calibration / Validation

Civil Applications:

- Spaceport Range Safety
- Port / Harbor Surveillance

- Pollution / Spill Monitoring
- Homeland Security
- Search & Rescue

Benefits:

- Autonomous Operations
- Longer Duration / Persistent Operations
- Solar Powered
- Rugged
- Reconfigurable
- Environmental Friendly (Clean / Quiet)
- Large Payload Capacity (500-800 lbs)
- Water Flow-Through System
- Deployable/Recoverable from Trailer & Ship
- Low Cost Compared to Traditional Approaches

Support Services:

- Onboard Systems Development & Integration
- Ground System Development & Integration
- Operations Center Integration
- Research & Development
- Mission Planning
- Mission Operations
- Field Support
- Payload Integration
- Platform and Ground System Customization
- Maintenance
- Production

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