

# DWSBD™

## DIRECTIONAL WAVE SPECTRA BAROMETER DRIFTER



Scripps Institution of Oceanography's

**LAGRANGIAN DRIFTER  
LABORATORY**

### ABOUT THE DWSBD

The Directional Wave Spectra Barometer Drifter (DWSBD) is a cost-effective wave rider that returns, in real time, accurate data on the three-dimensional directional wave spectra of surface gravity waves, GHRST (<https://www.ghrsst.org>)-compliant sea surface temperature, and sea level pressure.

The DWSBD measures orbital wave motion, and in its standard configuration is capable of a one-year-long mission with a six-hourly duty cycle. The device is customizable. The interval between measurements is programmable over the air, and each sensor's data can be retrieved at different intervals to optimize data collection and buoy lifetime. Using the Iridium satellite system, the DWSBD returns its sensors' data to shore, including engineering parameters used to assess the buoy's health and performance.

### DEPLOYMENT METHODOLOGIES

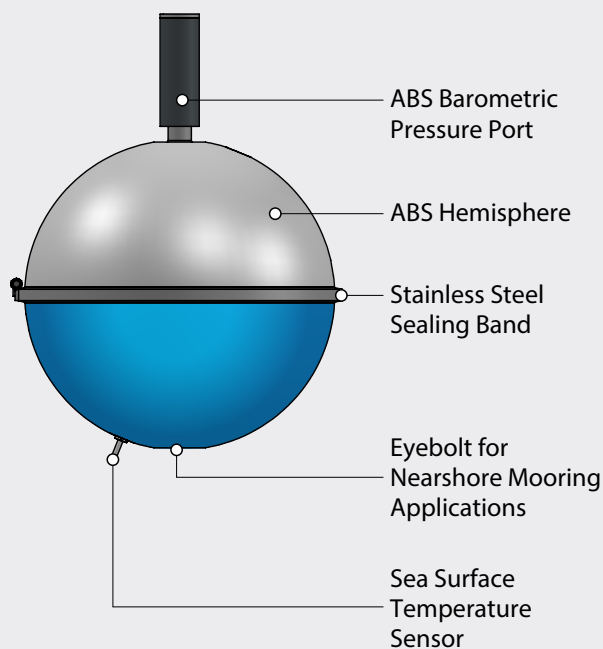
**AIR DEPLOYMENT:** The DWSBD can be deployed using custom build partially biodegradable packaging. The overall dimensions of the deployment packages are 18" × 18" × 30". Upon impact with water, the parachute and rigging are separated from the biodegradable box via a water release mechanism.

**SHIP DEPLOYMENT:** The small air deployment boxes can be quickly adapted for ship deployment by removing the parachute and rigging.

### BENEFITS

- Low cost
- Data can be displayed on a variety of systems used at several major weather services' forecasting centers and assimilated into wave forecasting models
- Robust design with no external moving parts
- Turn-key solution for all wave monitoring requirements
- Device purchase can be bundled with airtime arrangements and cost

### HIGHLIGHTS



- 35 cm sphere surface float
- GPS-based tracking and wave engine
- Iridium Short Burst Data (SBD) telemetry
- Onboard datalogger with up to 16 GB of storage
- Fourier coefficients  $a_0$ ,  $a_1$ ,  $b_1$ ,  $a_2$ ,  $b_2$
- 1/256 Hz bandwidth from 0.03–0.50 Hz
- Sea level barometric pressure sensor ( $\pm 0.4$  hPa accuracy)
- User-programmable sampling window
- Sea surface temperature ( $\pm 0.05^\circ\text{C}$  accuracy)
- Freely drifting or restrained mooring configurations
- One-year lifespan

# DWSBD FEATURES



## Barometric Pressure Sensor

The DWSBD carries a barometer to measure sea level pressure. The air pressure sensor is an integrated, high-quality barometer with an accuracy of  $\pm 0.4$  hPa.



## Wave Engine

The heart of the DWSBD is a high-performance GPS chipset paired with proprietary software algorithms for onboard computation of the directional wave spectrum. The DWSBD is designed as a turnkey solution for all wave monitoring requirements.



## Hardware

The DWSBD's hull has a diameter of 35 cm and is made of recycled acrylonitrile butadiene styrene (ABS). A bioplastic housing is an available option. A thermistor is mounted in the bottom part of the surface buoy, 18 cm below the flotation line. The bench accuracy of the sea surface temperature measurements is  $\pm 0.05^\circ\text{C}$  across the sensing range of the thermistor ( $-5^\circ\text{C}$  to  $40^\circ\text{C}$ ).



## Electronics

A Lagrangian Drifter Laboratory designed digital controller handles the duty cycle of the data collection (typically once per hour, but it can be changed underway using the two-way Iridium communication) and formats the data (sea surface temperature, barometric pressure, and position) for satellite transmission. The duty cycle for each sensor is user-programmable so that the lifetime, range, and bandwidth are customizable. Users should contact the Lagrangian Drifter Laboratory if interested in this option. A comprehensive set of diagnostic data that are crucial to monitoring the health of the drifter array, such as the battery voltage or the hull's internal pressure, temperature, and humidity, are also formatted and appended to the data message.



## Telemetry

All drifters carry a satellite modem for data telemetry via the Iridium satellite system. The main advantages of Iridium telemetry are that the data are received by the drifters' operators in a short time (typically 1 minute) and the positions are measured with a Global Positioning System (GPS) engine that yields typical geolocation accuracy of 2–50 m (rms).



## Batteries

DWSBD's are fitted with diode-protected, alkaline D-Cell, 12 V, 56 Ah battery packs. The user can alternatively opt for a lithium, 285 Ah battery pack.



## Data Quality

Onboard processing enables computation of First-5 Directional Fourier coefficients  $a_0$ ,  $a_1$ ,  $b_1$ ,  $a_2$ ,  $b_2$ . First-5 coefficients can be used to compute wave parameters such as significant wave height, swell direction, and directional spread, among others. References detailing intercomparison studies have been published.

# DWSBD SPECIFICATIONS

## Sea Surface Temperature Sensor Range and Resolution

- Temperature Range:  $-5.0^{\circ}\text{C}$  to  $35.95^{\circ}\text{C}$
- Temperature Resolution:  $0.01^{\circ}\text{C}$
- Thermistor Accuracy:  $\pm 0.05^{\circ}\text{C}$

## Barometric Pressure Range and Resolution

- Barometric Pressure Range: 850 millibar to 1,054.7 millibar
- Barometric Pressure Resolution: 0.1 millibar
- Integrated Pressure Transducer Accuracy: 0.55 millibar

## Wave Sensor Range and Resolution

- Significant Wave Height: 0 m to 655 m, resolution = 0.01 m
- Wave Period of Spectral Peak: 2.08 sec to 32.0 sec
- Mean Wave Period: 2.08 sec to 32.0 sec, resolution = 0.05 sec when First-5 disabled, 1/256 sec when enabled
- Direction of Wave at Spectral Peak:  $0^{\circ}$  to  $359^{\circ}$ , resolution =  $0.2^{\circ}$  when First-5 disabled,  $0.01^{\circ}$  when enabled
- Nondirectional  $a_0$ : 0 to  $1,677 \text{ m}^2/\text{Hz}$ , resolution =  $0.001 \text{ m}^2/\text{Hz}$
- Directional  $a_1, b_1, a_2, b_2$ :  $-1.0$  to  $1.0$ , resolution = 0.001

## Programming Over the Air Using Iridium SBD

- Sampling Rate/Duty Cycle per onboard sensor (sea surface temperature, barometric pressure, waves; see table)
- Enable/Disable First-5 Fourier coefficients over Iridium
- Enable/Disable onboard sensor (waves, barometric pressure)

## Spectral Bandwidth

- 1/256 Hz from 0.031 Hz to 0.481 Hz (customizable)

## Battery Pack Options

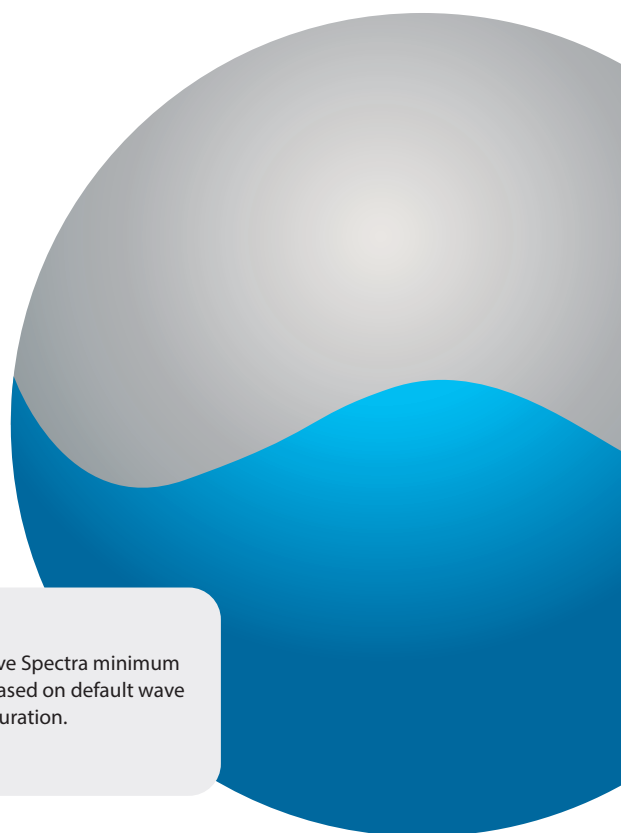
- 56Ah Alkaline Battery Pack
- 285Ah Lithium Battery Cartridge

## Programmable Flasher (Light) Option

- Yes

## Shipping/Export Control

- HS CODE 9015.80.8080
- ECCN 8A992.E



Sensor	Minimum	Maximum
Sea Surface Temperature	5 minutes	1,440 minutes
Barometric Pressure	5 minutes	1,440 minutes
Diagnostic Sensors	5 minutes	1,440 minutes
Directional Wave Spectra	30 minutes*	1,440 minutes

\*Directional Wave Spectra minimum sampling rate based on default wave measurement duration.



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**Learn More**

<https://gdp.ucsd.edu/ldl/>

**Questions?**

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