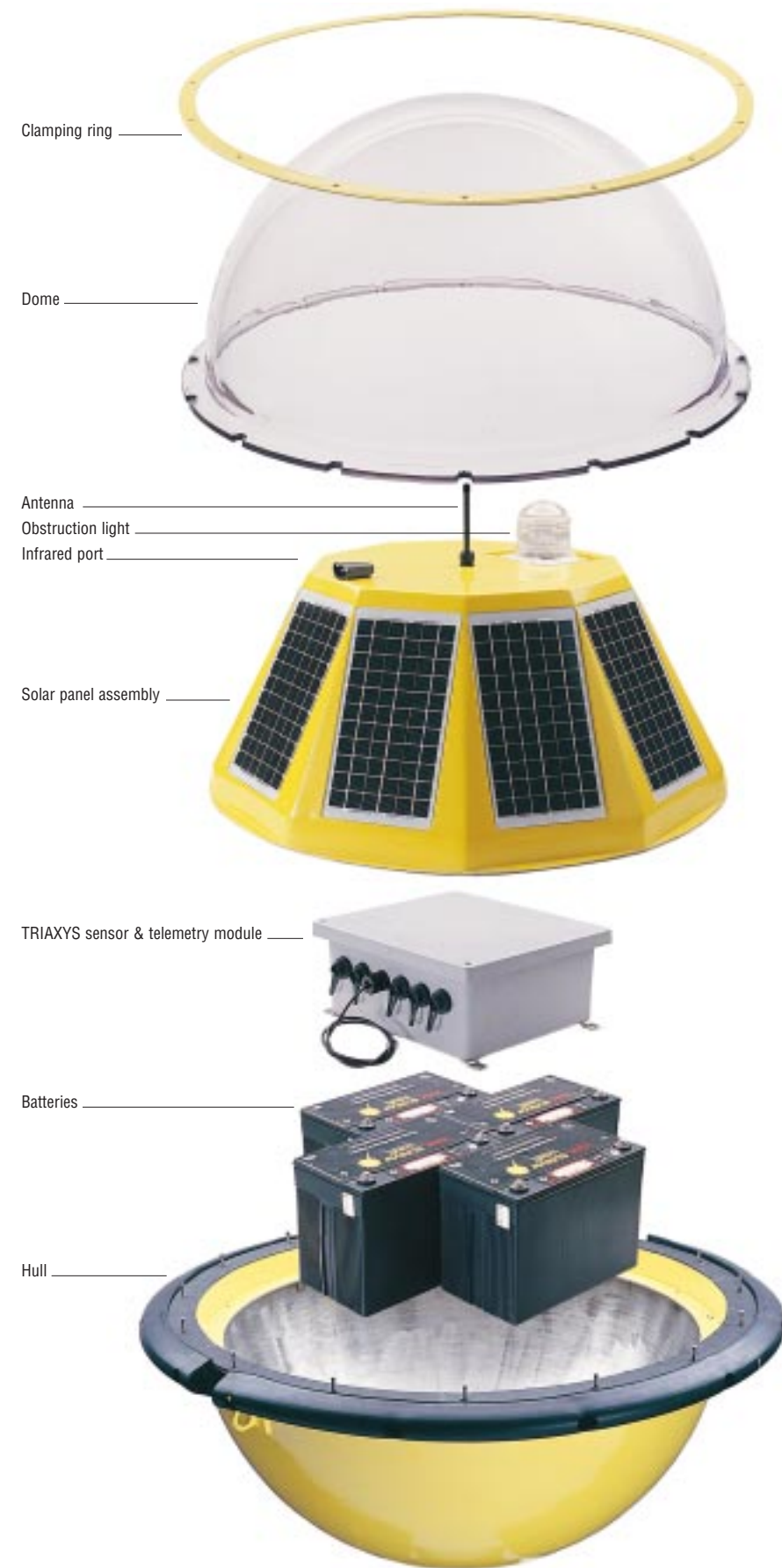




*A Revolution  
in Wave  
Measurement*



S P E C I F I C A T I O N S



<b>DIAMETER:</b> 0.9m (36")
<b>WEIGHT (INCLUDING 4 BATTERIES):</b> 197 Kg (435 lbs)
<b>WEIGHT (WITHOUT BATTERIES):</b> 90 Kg (199 lbs)
<b>SENSORS:</b> 3 accelerometers; 3 rate gyros; 1 flux-gate compass
<b>HEAVE</b>
<b>RANGE:</b> ± 20 m
<b>ACCURACY:</b> better than 2%
<b>RESOLUTION:</b> 1 cm
<b>PERIOD:</b> 1.6 - 30 seconds
<b>DIRECTION</b>
<b>RANGE:</b> 0-360°
<b>ACCURACY:</b> ± 1°
<b>PERIOD:</b> 1.6 - 30 seconds
<b>SEA SURFACE TEMPERATURE</b>
<b>RANGE:</b> -5 to +50°C
<b>ACCURACY:</b> 0.1°C
<b>OBSTRUCTION LIGHT:</b> Amber, 3 nautical mile visibility, ODAS sequence
<b>OPERATING TEMPERATURE RANGE:</b> -30 to + 60°C
<b>STORAGE/TRANSIT TEMPERATURE:</b> -40 to +70°C
<b>SAMPLING FREQUENCY:</b> 4Hz
<b>STANDARD DATA TRANSMISSION:</b> Multiple transmissions of each data set; Directional wave characteristics and spectra; Extensive wave statistics; Sea surface temperature; Battery voltage; Solar current; Error checking
<b>REAL TIME DATA</b>
<b>PROGRAMMABLE CONFIGURATION</b>
<b>TRANSMISSION OPTIONS:</b> VHF or ARGOS
<b>VHF TRANSMITTER:</b> 30-39 MHz or 39-50MHz; synthesized frequency selection
<b>TRANSMITTER POWER:</b> 3 watts @ 12 VDC; VHF Range up to 10 nautical miles
<b>BATTERIES:</b> 4 gel cells
<b>SOLAR PANELS:</b> 10 @ 6 watts
<b>POSITION:</b> GPS/ARGOS (optional)

AXYS ENVIRONMENTAL SYSTEMS

P.O. Box 2219, 2045 Mills Road West  
Sidney, British Columbia, Canada V8L 3S8  
Tel: (250) 656-0881 Fax: (250) 656-4789  
www.axystechnologies.com

\*A Division of Axys Technologies Inc.  
PRINTED IN CANADA IMAGECRAFT STUDIO LIMITED REV98



**TRIAXYS**  
DIRECTIONAL WAVE BUOY

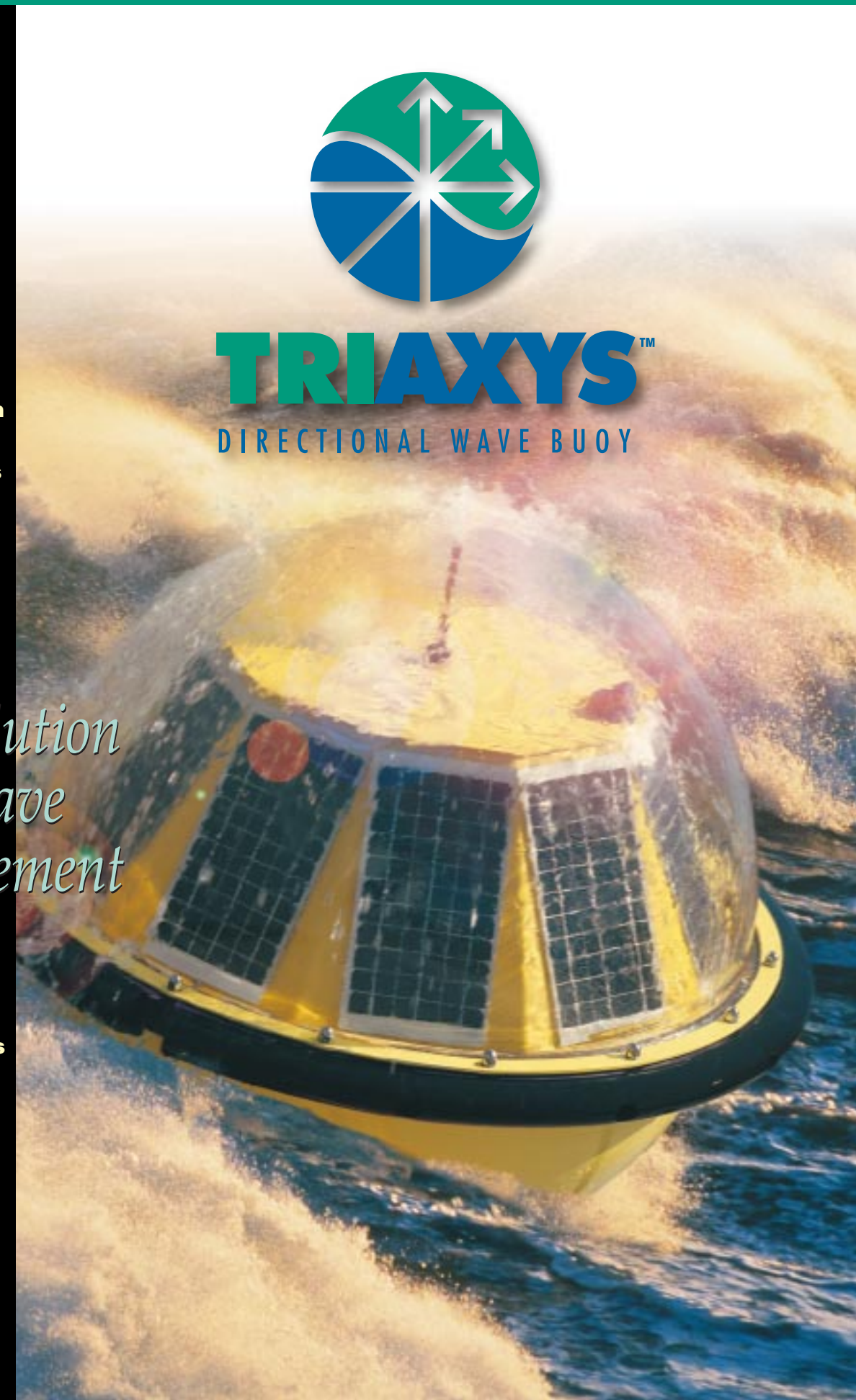
Revolutionary concepts:

- Solar powered
- Advanced material design
- State-of-the-art motion sensors
- Leading edge motion and directional wave analysis routines

*A Revolution  
in Wave  
Measurement*

The TRIAXYS™ buoy design provides:

- Lower operating costs
- Easy handling
- Wide operating and transport temperature range
- Precision measurements
- Best value





# A Revolution in Wave Measurement

## TRIAXYS™ Directional Wave Buoy

Axys and the National Research Council of Canada (NRC) leading the way to wave monitoring standards for the next millennium.

The TRIAXYS™ Directional Wave buoy is a precision instrument incorporating new technologies that make it an easy to use, rugged and economical buoy for accurate measurement of directional waves. The TRIAXYS™ sensor unit is comprised of three accelerometers, three rate gyros, a fluxgate compass, and the proprietary TRIAXYS™ Processor. The TRIAXYS™ Processor was developed from the successful low-power WATCHMAN 300™ payload processor especially designed by Axys Environmental Systems for the marine environment.

AXYS ENVIRONMENTAL SYSTEMS

NRC · CNRC

### A Joint Development by Axys and the National Research Council of Canada

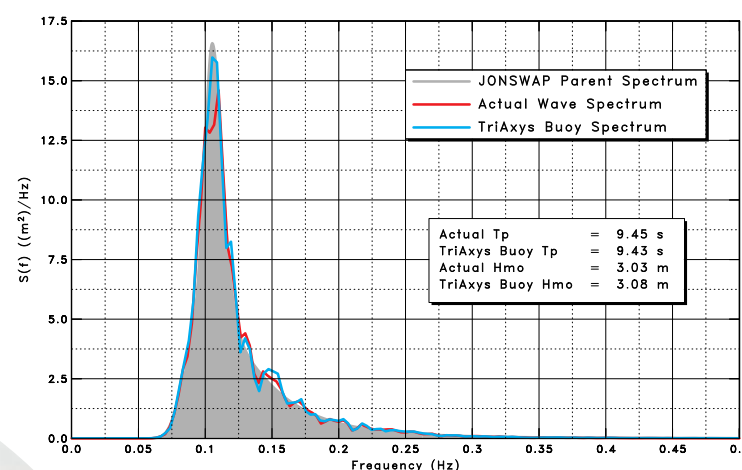
The TRIAXYS™ buoy is the result of a collaborative development and testing program between Axys and the Canadian Hydraulics Centre (CHC) of the National Research Council of Canada. The directional wave analysis software in the TRIAXYS™ buoy is adapted from CHC software.

### Precision

The CHC developed the buoy's software to analyse data from the six motion sensors and the fluxgate compass. The system processing software uses an iterative algorithm based on fast Fourier transform (FFT) analysis to solve the full non-linear equations of motion of the buoy in six degrees of freedom as defined by the measured accelerometer and angular rate gyro signals. Roll, pitch and yaw angles, as well as displacements, velocities and accelerations for heave, surge, sway can be computed at any reference point on the buoy. Since the full nonlinear equations of motion are used, accurate

motion data are obtained for extreme conditions with roll and pitch angles up to 60 degrees. As a result, the directional wave characteristics are computed with much greater accuracy. The use of surge and sway velocities, (instead of the roll and pitch angles used in some other buoys) also provides a much better measure of the wave kinematics that define directional wave properties.

Test Case D6R2:  $T_p = 9.5$  s  $H_{mo} = 3.0$  m Mean Wave Direction = 40 deg



Furthermore, full directional wave spectra can also be computed by the CHC maximum entropy method (MEM) in addition to the mean wave direction and the spreading width as functions of frequency. The software also performs a zero-crossing analysis to compute various time-domain wave parameters. Most of the data analysis is performed in the buoy with final presentation

storage, the internal batteries can be charged by connecting a 12 volt DC power supply.

### Hybrid Buoy

The buoy has a stainless steel 316 hull and a polycarbonate Cyrolon® ZX dome, which are environmentally sealed with a wide footprint silicon gasket. The hull features a high strength to weight ratio, corrosion-resistant SS316 shell, and secure mooring and lifting points. The optically clear polycarbonate Cyrolon® ZX dome allows sunlight to reach the solar panels, while maintaining a low profile, impact resistant product. Other benefits of this design include the internal protection of the radio antenna, obstruction light and infrared RS232 serial data link.

Cyrolon® ZX meets ASTM D3763 and ISO 6603-2 impact test standard specifications.

### Obstruction Light

A programmable amber light with visibility up to three nautical miles is set to the standard ODAS buoy sequence (group flash 5 every 20 seconds); 250 other sequences are available.

and data logging performed on a remote PC base station.

### Solar Powered

Four 100 Amp-hour rechargeable batteries are powered by ten 6-watt solar panels. The buoy will operate for many years under normal conditions without the need for battery replacement. For long term

### Data Transmission

Standard 30-39 or 39-50 MHz synthesized one-way VHF radios coupled with 1200/2400 baud digital modems are used for primary telemetry, giving a

The base station Digital Directional Receiver (DDR) when coupled to the Axys proprietary WaveView™ software allows for full presentation and logging of data along with diagnostic



range of 10 nautical miles under typical direct line-of-site operating conditions. The standard data transmission from the buoy includes an extensive suite of wave statistics, directional and non-directional wave spectra, buoy configuration and status data. The transmission consists of the most recent data from the previous reporting period transmitted repeatedly along with error checking for data validation.

utilities. ARGOS satellite telemetry is optional.

### On/Off Switch

The buoy power can be switched off for transportation or storage without removing the dome. This is done by placing an external magnet on the outside of the hull at the switch location. Removing the magnet restores power.



### Robust Construction - Low Maintenance

The overall design of the TRIAXYS™ buoy has produced a rugged system with low maintenance costs. The buoy, sensors and payload electronics are capable of withstanding any rigors associated with deployment and recovery operations, specifically impact shock, spinning and temporary submergence. The buoy can be deployed, stored and transported under all climatic conditions without damaging the sensors or payload. Since the buoy is solar powered with rechargeable batteries, it is environmentally friendly and the annual operating costs are significantly reduced.

### Easy Handling

The TRIAXYS™ buoy is very easy to handle in the field and in the warehouse. Because of the clean design and rugged sensors, the buoy can be rolled off any deck for deployment without any concerns for damaging the buoy by spinning. Servicing the buoy is simple, with all modular components including batteries (if ever requiring replacement) easily accessed by removing the dome.

### TRIAXYS™ Processing Unit

The heart of the TRIAXYS™ directional wave buoy has been developed from the Axys WATCHMAN 300™ sensor-processor unit designed specifically for

met-ocean buoy applications. This system has gained worldwide acceptance in our large buoy platforms for reliability and ease of use. The processing unit integrates all sensor systems, onboard data analysis, data storage, telemetry and diagnostic/set-up routines. The unit incorporates high performance, low power PC104/80C552 microprocessors with 12 bit A/D signal inputs.

The processing unit is connected to the user's external computer either via RS232 hardware or infrared RS232 links through the dome. Once connected, the user is directed through a series of simple menus to set buoy parameters such as: sample duration, sample interval, processing, transmission intervals and test parameters.

