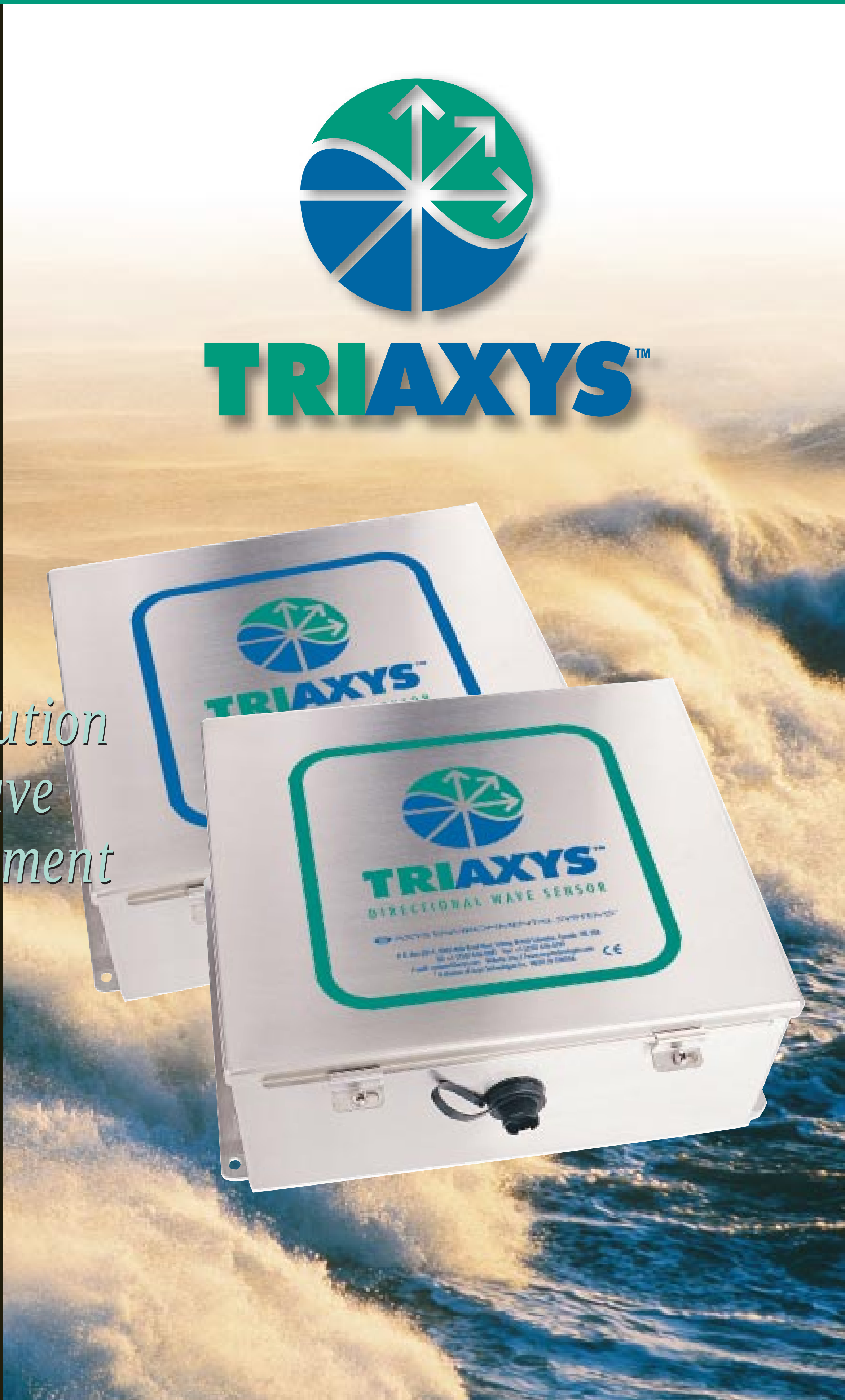
TRIAXYS™ WAVE SENSORS

TRIAXYS™ Directional Wave Sensor

TRIAXYS™ Heave Sensor

TRIAXYS™



A Revolution in Wave Measurement

Features:

- Outputs raw or analysed data
- Internal data storage
- Solid state
- Low power
- Compact

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TRIAXYS™ Wave Sensors

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TRIAXYS™ Heave Sensor

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

TRIAXYS™ Wave Sensors are precision instruments that have set a new standard for wave measurement. The innovative design incorporates new technologies that make them easy to use, rugged, and the most reliable and most accurate sensors for measuring waves and directional wave spectra.

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

AXYS ENVIRONMENTAL SYSTEMS

NRC · CNRC

The TRIAXYS™ sensors are 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 wave analysis software in the sensors is adapted from CHC software that has been in use in their wave testing facilities for many years.

Physical Attributes

The sensor is packaged in a small stainless steel box that needs only a single connector for power and data. The output from the sensor is fully processed wave data. As an option, data can also be stored in the sensor on a flash RAM disk.

Sampling regime

The sampling regime for the sensor is user-selectable, with sample lengths from 5 to 35 minutes and sample intervals from 5 to 1440 minutes.

Location

TRIAXYS™ wave sensors can be located anywhere on the floating body to measure motion at a specific point or – using embedded software – to calculate the motion at another point on the body (e.g. the centre of gravity).

Sensors

The TRIAXYS™ Directional Wave Sensor contains three force balance servo accelerometers that measure the total acceleration along the three mutually orthogonal x, y and z axes of the floating platform. It also contains three angular rate sensors that measure the rotation rates about the roll, pitch and yaw axes and a gimballed fluxgate compass to measure the magnetic heading of the sensor. The TRIAXYS™ Heave Sensor also has three accelerometers. It has just two angular rate sensors and does not need

n in Wave Measurement

a compass since wave direction is not required.

Software

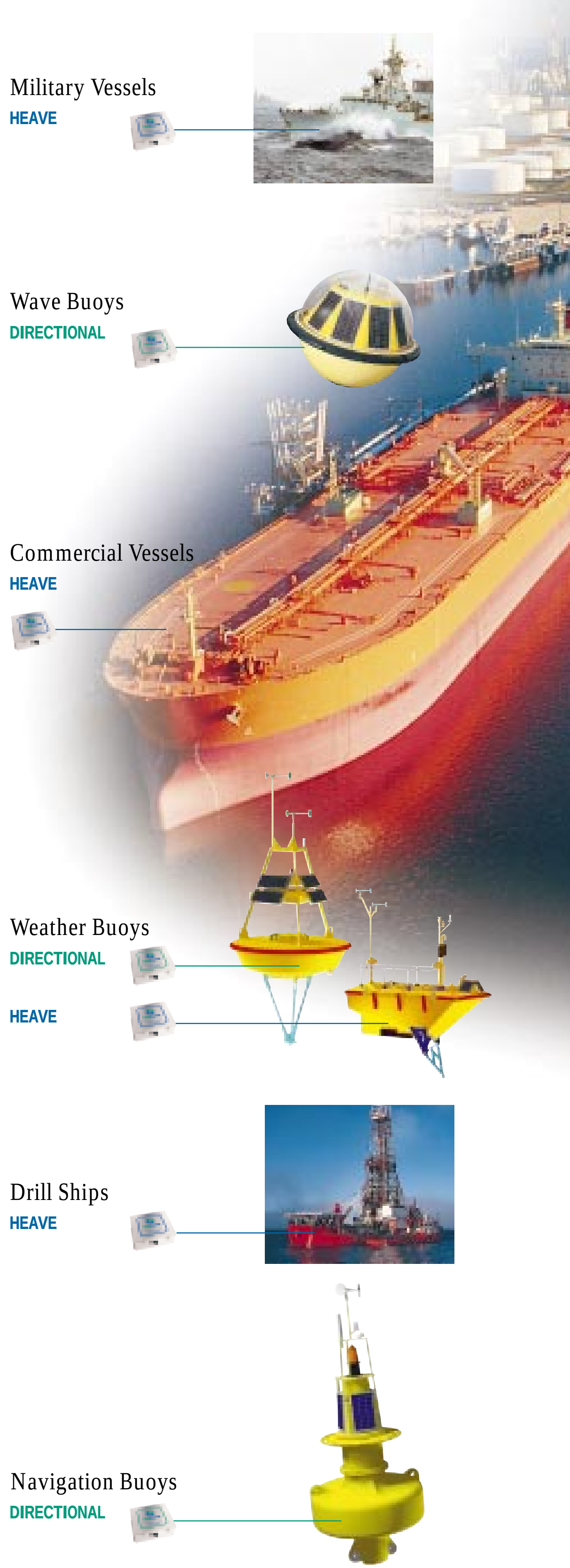
All data processing is performed in the sensor by proprietary software developed by the Canadian Hydraulics Centre (CHC) of the National Research Council of Canada. An iterative algorithm is used to solve the full non-linear equations that define the sensor motions relative to a fixed reference frame in terms of the raw data from the motion sensors. Motion analysis is performed in the frequency domain using specialised Fast Fourier Transform (FFT) integration techniques. This complete motion analysis procedure, including all six degrees of freedom, allows the vertical displacement and the north and east velocities of the platform to be measured with very high accuracy because no simplifying approximations have to be made regarding earth gravity terms, cross-coupling terms or other spurious effects.

The processor in the **TRIAXYS™ Heave Sensor** uses the measured sensor motions to perform wave analyses which include:

- a zero crossing analysis of the wave elevation record to produce time domain wave statistics.
- a spectral analysis that computes the non-directional wave energy spectrum, which defines the distribution of wave energy as a function of frequency.

In the **TRIAXYS™ Directional Wave Sensor** the analysis also includes:

- a directional spectral analysis, using the wave elevation and the north and east velocity components, that computes the directional wave spectrum. This defines the distribution of wave energy as a function of frequency and direction of propagation. The analysis uses a unique version of the maximum entropy method developed by Canadian Hydraulics Centre of the National Research Council of Canada.
- calculation of the mean wave direction and the directional spreading width as functions of frequency.



SPECIFICATIONS

TRIAXYS™ Directional Wave Sensor		TRIAXYS™ Heave Sensor
Flexure suspension servo (x, y, z axes)	**Accelerometers**	Flexure suspension servo (z axis) Solid State (x, y axes)
Piezoelectric vibrating gyroscope (x, y, z axes)	**Rate sensors**	Piezoelectric vibrating gyroscope (x, y axes)
Microprocessor controlled fluxgate	**Compass:**	None
± 0.5 degrees	**Accuracy**	
Better than 2%	**Sensor Accuracy**	Better than 2%
35cm x 35cm x 20cm (13" x 13" x 6")	**Sensor Size**	35cm x 35cm x 20cm (13" x 13" x 6")
13 Kg (29 lbs)	**Sensor weight**	13 Kg (29 lbs)
+12 to 14 VDC	**Power Supply**	+12 to 14 VDC
0.134 Amp-hour	**Power Consumption (per 20 minute sample)**	0.1 Amp-hour
Power and data through Bulgin connector	**Input/Output**	Power and data through Bulgin connector
19,200 baud, 8 bits, 1 stop bit, no parity	**Communications**	19,200 baud, 8 bits, 1 stop bit, no parity
-30°C to +65°C	**Operating Temperature Range**	-30°C to +65°C
-40°C to +70°C	**Storage Temperature Range**	-40°C to +70°C
4 Hz	**Sampling frequency**	4 Hz
0.64 Hz (1.56 seconds) to 0.030 Hz (33.33 seconds)	**Frequency range**	0.64 Hz (1.56 seconds) to 0.030 Hz (33.33 seconds)
0.005Hz	**Frequency Interval**	0.005Hz
Variable (5 minutes to 35 minutes)	**Sample Length**	Variable (5 minutes to 35 minutes)
Variable (5 minutes to 1440 minutes)	**Sample Interval**	Variable (5 minutes to 1440 minutes)
Variable (up to 123)	**Frequency Bands**	Variable (up to 123)
Ability to calculate motion at any point of the body	**Location of sensor**	Ability to calculate motion at any point of the body
Internal up to 128 MB flash RAM	**Data storage**	Internal up to 128 MB flash RAM
U (Velocity on x axis) V (Velocity on y axis) H (Heave on z axis) • Spectral Analysis Statistics *Significant Wave Height (Hmo)* *Mean Direction* *Peak Period (Tp, Tp5)* *Mean Spectral Period (Tz)* *Mean Spread* • Zero Crossing Statistics *Significant Wave Height (Hs)* *Maximum Wave Height (Hmax)* *Height of Highest 10% of Waves* (H_{10}) *Average Wave Height (Hav.)* *Average Wave Period (Tav.)* *Average Period of* H_{10} (T_{10}) *Significant Period (Ts)* *Zero Crossings* • Power (non-directional) Spectra *Energy for Each Frequency Band* • Directional Spectra *Four Fourier Coefficients* *for Each Frequency Band*	**Data Output Options**	H (Heave on z axis) • Spectral Analysis Statistics *Significant Wave Height (Hmo)* *Peak Period (Tp, Tp5)* *Mean Spectral Period (Tz)* • Zero Crossing Statistics *Significant Wave Height (Hs)* *Maximum Wave Height (Hmax)* *Height of Highest 10% of Waves* (H_{10}) *Average Wave Height (Hav.)* *Average Wave Period (Tav.)* *Average Period of* H_{10} (T_{10}) *Significant Wave Period (Ts)* *Zero Crossings* • Power (non-directional) Spectra *Energy for Each Frequency Band*

TRIAXYS™

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