

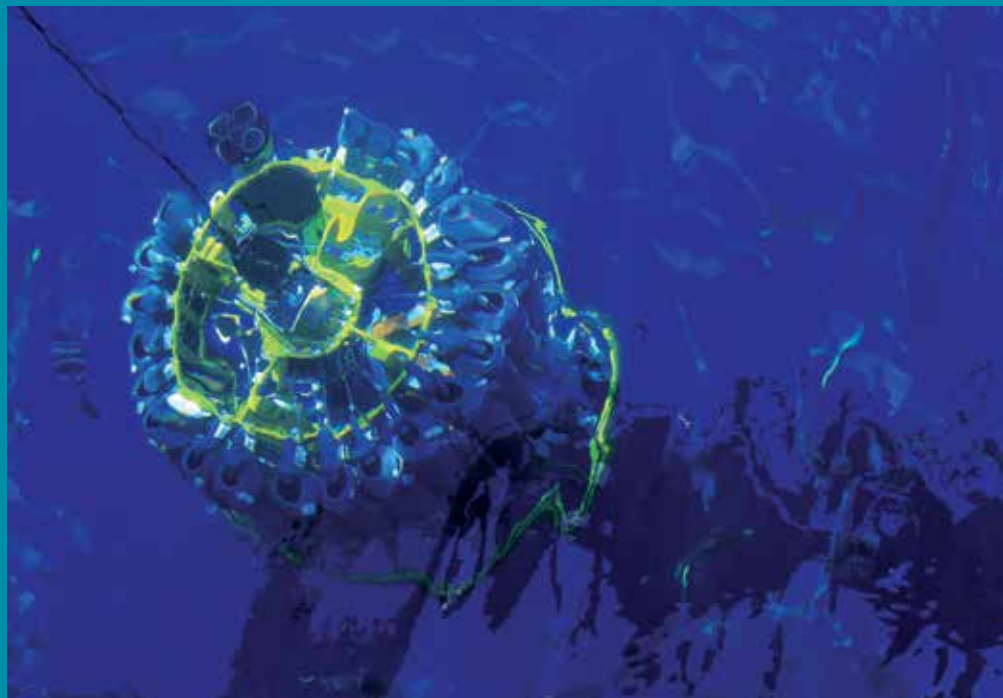
## Oceanographic research

Oceanographers seek to understand the dynamics of the ocean and observe changes across seasons and over decades, to better understand weather, climate and how changes impact fisheries, offshore infrastructure and coastal developments.

To study large ocean processes, scientists deploy moorings on the ocean's surface and below the waves, in various locations around Australia. These moorings enable scientists to put scientific equipment into the ocean to continuously collect data from sensors over a period of one to two years. Sub-surface moorings are deployed in ocean depths up to 4,000 metres and contain sensors and equipment along the length of a mooring line. The top of the mooring is at least 20 metres below the ocean surface to remove any impact from waves, swell and passing ships.

Oceanographers also use CTD instruments, which stands for conductivity, temperature and depth. This enables oceanographers to calculate the density of sea water, which just like the density of air in our atmosphere, drives ocean circulation. The CTD is also fitted with a circular frame holding up to 36 water sampling bottles, each able to sample up to 12 litres of seawater at depths of up to 7,000 metres. This enables water samples to be collected to calibrate the CTD and to measure various chemical and biological properties of sea water.

The CTD instrument has long been a fundamental research tool for marine scientists. Besides its basic function to measure temperature and salinity in the ocean, it allows scientists to fit a wide variety of instruments to measure other properties, including oxygen and other dissolved gases, phytoplankton, biological matter,



suspended particles, and the depth that sunlight penetrates the ocean.

A CTD may also be deployed as a towed instrument. Scientists will be able to use a TRIAXUS system, which is a towed undulating CTD system which can collect data up to three kilometres behind the ship,

and to depths of 350 metres, in an undisturbed environment. It carries electronic sensors that measure conductivity (salinity), temperature, oxygen, light levels, the wavelengths involved in photosynthesis, turbidity, and the quantity of phytoplankton.

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CTD data collected have allowed scientists to discover the southward movement of the East Australian Current (EAC). As the EAC moves south, ecosystems are changing, bringing warmer water species to the seas around Tasmania.

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# Equipment capability

## Autonomous sea surface temperature (SST) radiometer

The SST radiometer uses infrared radiation measurements to determine the temperature of the sea's surface.

## Circulating clean seawater

Clean seawater constantly supplied to laboratories and instruments throughout the ship.

## CTD

A device used to profile the conductivity and temperature of the water column. Extra sensors can be added to measure other variables such as phytoplankton, oxygen fluorescence and turbidity.

### 24 bottle carousel and frame

A cluster of 24 water sample bottles and sensors that is attached to a CTD.

### 36 bottle carousel and frame

A cluster of 36 water sample bottles and sensors that is attached to a CTD.

### Trace metal CTD system

Including a trace metal clean winch 12 bottle trace metal CTD. Trace metal clean chord to 300 metres which can be connected to further wires to an ultimate depth of 6,000 metres.

### CTD deployment boom

The CTD laboratory is a complete system for CTD deployment and recovery.

## Deck incubators

Four 0.25 m<sup>3</sup> deck-mounted, temperature controlled incubators. There are also other seawater containment areas on the deck used for conducting experiments and observations of phytoplankton activity.

## Drop keels

Two drop keels that can be lowered or raised as needed.

- ◆ Camera – 360°
- ◆ EK60 with transducers working at 18kHz, 38kHz, 120kHz, 200kHz and 333kHz
- ◆ Water intake
- ◆ ADCP 75kHz + 150kHz
- ◆ Hydrophone

## Forward looking drop keel camera

A drop keel mounted camera for monitoring scientific equipment and marine life.

## Full ocean depth multibeam system

The Kongsberg/Simrad EM122 is a deep water 3D sea floor mapping system, capable of working to full ocean depth.

## Laminar flow cabinets

Provide ultra clean air environment for undertaking contamination sensitive analyses.

## Laboratory incubators

Two 300 litre Steridium incubators.

## Milli-Q systems

Ultra-pure filter for water used in laboratories. Outlets in Hydrochemistry, Preservation Lab, Clean Wet Lab and Dry Lab but water available for use elsewhere.

## Multi-frequency hydrophones

Four self-noise monitoring hydrophones. Used for the detection and recording of underwater acoustics.

## Multi-frequency scientific split-beam echo sounders

The EK60 system with transducers working at 18kHz, 38kHz, 120kHz, 200kHz and 333kHz.

## Sound velocity probe

The sound velocity probe is located in the drop keel and is an integral part of the sea floor mapping sonar systems. It is used to measure the speed of sound.

## Trace metal clean seawater

Seawater is pumped through the drop keel which is distributed to the Underway Seawater Laboratory, the clean wet laboratory and the General Purpose Dry Laboratory and can also be directed to the container space on the main deck where the trace metal clean laboratory container can be located upon request.

## Trace metal in-situ pumps

Is a 50 kilogram sampling device (64cm x 36cm x 69cm) that is deployed using a synthetic line into the ocean, to sample for marine particles. It filters large volumes of sea water (1000 litres over 1-2 hours) to capture particles. The pump is brought back on board and the filters are analysed for trace elements, such as iron and other marine particles like organic carbon and phytoplankton.

## TRIAXUS

A towed undulating CTD used to collect horizontal profile measurements of the water column.

## Thermosalinograph

Continually measures surface temperature and salinity along the track of the ship using the underway seawater system originating in the drop keel and the output is located in the CTD laboratory.

## Trawl monitoring systems

A system to report on the status of a towed trawl net. The system reports the height, width and depth of the mouth of the net.

## Ultra short baseline (USBL) acoustic positioning system

The USBL system that determines the position of instruments deployed off the side or the stern of the ship, reporting their position relative to the ship.

## Underway water analysis instruments

These instruments are in located in the underway seawater laboratory and measure pCO<sub>2</sub>, O<sub>2</sub>, and chlorophyll, and they include bio-optical sensors.

## XBT system

An expendable Bathythermograph, used to collect temperature profiles to calculate sound velocity data.

