

# Environmental Baseline Documented by Remotely Piloted USVs Conducting METOC and TURBIDITY Services

## CHALLENGE

Acquire extensive, accurate data for analysis to establish a reliable baseline for turbidity levels.

## SOLUTION

Deploy two unmanned surface vehicles (USVs) with one sortie to acquire metocean (meteorological and oceanographic) data and the other sortie to estimate particle suspension in water for a turbidity baseline.

## RESULTS

- Confirmed with the METOC services sortie that currents and wave profiles are conducive for optimal future USV data acquisition missions.
- Established a good baseline for particle suspension from the TURBIDITY services sortie, with the backscatter measurement method apparently responding better to changes in the turbidity.



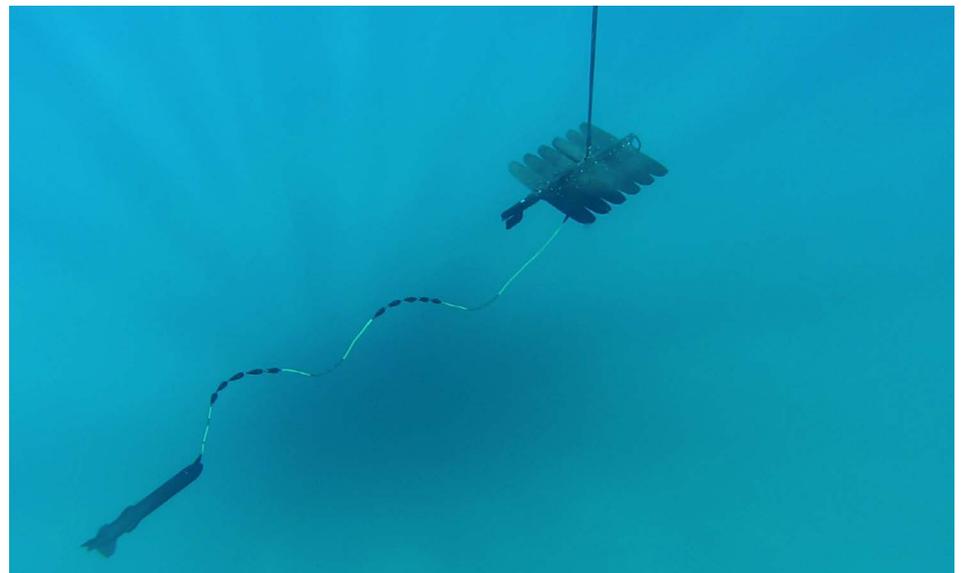
## Baseline data acquisition

A major operator working off the coast of North West Australia needed to demonstrate environmental compliance by setting a baseline for particle suspension in the water column prior to beginning a full-scale dredging operation to lay a pipeline. Subsequent surveys during and after the dredging would reference the baseline.

## Dual sorties for autonomous data gathering

Schlumberger Robotics Services recommended using two instrumented USVs to autonomously collect the required data. The project would be conducted in two sorties:

- METOC services: The sortie to collect meteorological and oceanographic data would be conducted over a 14-day lunar cycle to establish the current profiles and bathymetry of the region via a planned route.
- TURBIDITY services: This detailed study to measure and analyze particle suspension in the water column would be performed over a subsequent 14-day lunar cycle. The baseline data would be collected using two independent sensor measurement techniques.



*Autonomous marine vehicle conducting a TURBIDITY services baseline study off the coast of Australia.*

## CASE STUDY: Remotely piloted USVs conduct METOC and TURBIDITY presite surveys, Australia

### Reliable environmental baseline for current and turbidity data

The METOC services sortie employed an acoustic Doppler current profiler (ADCP), from which the data was processed for seabed bathymetry plus sea current direction and speed. Data from acoustic Doppler current profiler (ADCP), from which the data was processed for seabed bathymetry plus sea current direction and speed. The water column, to a maximum depth of 60 m, was mapped in detail throughout the survey. Postsurvey analysis showed peak tidal currents in and out of the shallower areas at a period of about 6 hours, with decreasing severity as the USV moved toward deeper water zones.

The TURBIDITY services sortie used dual techniques to estimate particle suspension in water. The C-Star sensor was used to measure the transmissivity of light through the water to determine the turbidity. Simultaneously, an ECO Puck backscatter sensor measured the backscatter of light due to the turbidity of the water. Both techniques established a good baseline for turbidity measurements prior to dredging operations occurring in the vicinity of this environmentally sensitive area.

The METOC services sortie achieved its objective to survey the area and document that the currents and wave profiles were conducive for future USV sorties. The TURBIDITY services sortie similarly established a good baseline of particle suspension in the water. The backscatter method appeared to respond better to changes in the turbidity. The survey's main limitation was biofouling of the turbidity sensors after 21 days of operation, which was successfully mitigated during future missions.

#### Specifications

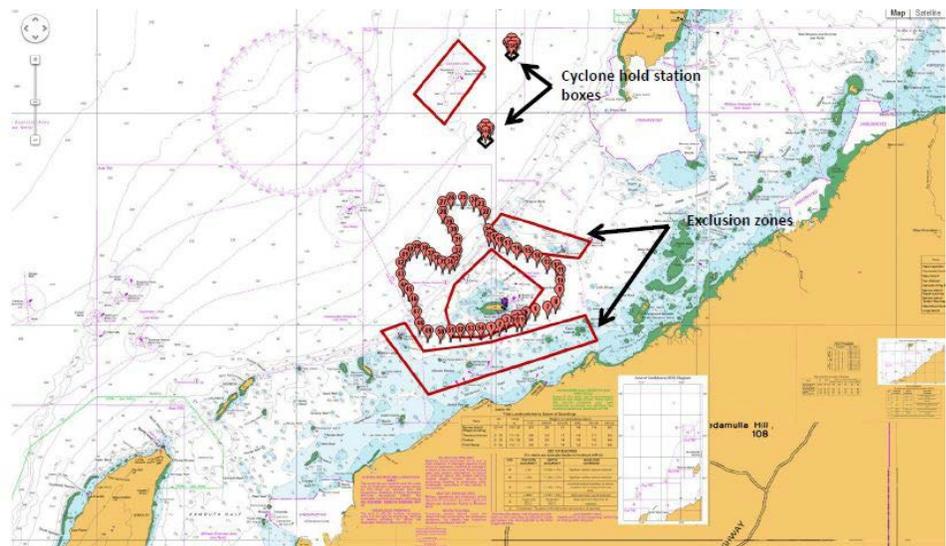
Sortie	Days in Water	Average Speed	Maximum Speed	Distance Traveled
METOC	16	1.33 knots	2.15 knots	445 nautical miles
TURBIDITY	44	1.14 knots	1.89 knots	982 nautical miles

#### ECO Puck Fluorometer

Mechanical		Electrical	
Diameter	6.3 cm	Digital output resolution	12 bit
Length	5.0 cm	RS-232 output	19,200 baud
Weight in air	0.28 kg	Connector	Customer defined
Weight in water	0.02 kg	Input	7- to 15-V DC
		Current	Typical: 80 mA
		Sample rate	To 8 Hz

#### C-Star Fluorometer

Mechanical		Electrical	
25-cm pathlength	47 cm × 6.4 cm × 9.3 cm	Output resolution	14 bit
10-cm pathlength	29.2 cm × 6.4 cm × 9.3 cm		
Weight in water	2.2 kg (plastic)	Data output	0–16,380 counts, 0–5 V
	3.6 kg (aluminum)	Connector	MCBH-6-MP
		Operating current	Standard: 35 mA Maximum: 50 mA
		Sample rate	To 8 Hz



USV survey waypoint markers around Thevenard Island, Australia.

[slb.com/robotics-services](http://slb.com/robotics-services)

**Schlumberger**