RD Instruments
Acoustic Doppler Solutions

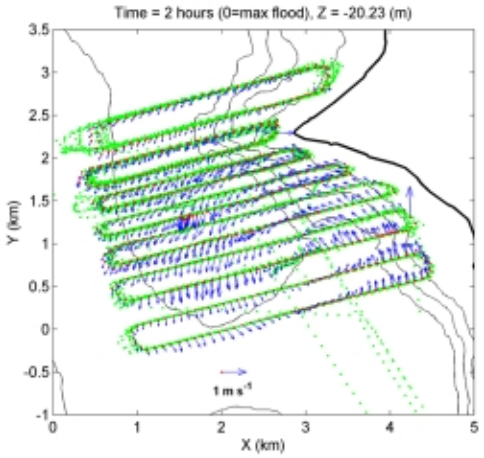
Ocean Surveyor ADCPs

Vessel Mounted Current Profilers

*The Ocean Surveyor line of Acoustic Doppler Current Profilers (ADCPs) is based on an RD Instruments (RDI) patented phased array transducer which not only delivers **longer profiling range** than the widely used piston transducer ADCPs, but does so in a **much smaller package**. The Ocean Surveyor transducers are available in the three frequencies most commonly used for vessel-mount applications (150 kHz, 75 kHz and 38 kHz) The 75 kHz is designed to fit into the same well as houses many of the existing 150 kHz (piston) ADCPs widely used on research vessels throughout the world.*

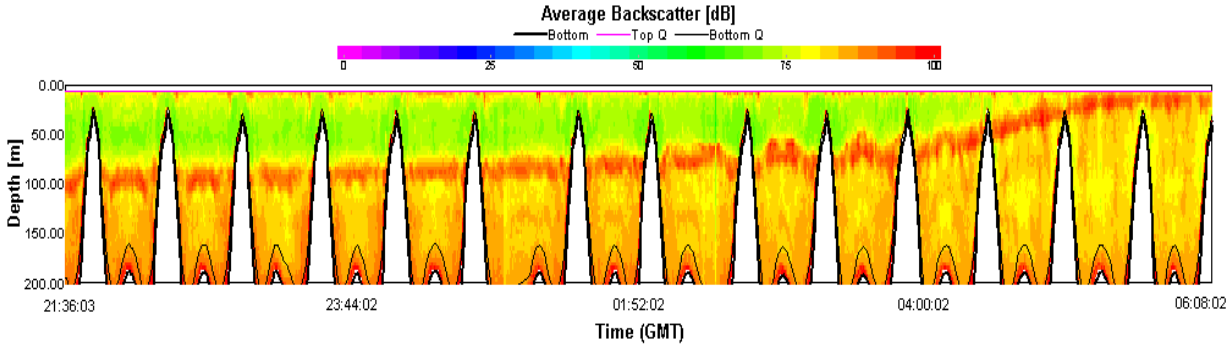
The 150 kHz Ocean Surveyor for Near-Shore Work:

With its compact size and nominal range of well over 300 m (in Long Range Mode, 200 m when operating in High Precision Mode), the 150 kHz is ideal for near-shore work. We show here some data gathered aboard the University of Washington's RV Barnes (shown to the right). For this application, the ADCP is mounted over the side rather than directly to the hull of the vessel. Parker MacCready of the University of Washington and Geno Pawlak of the University of Hawaii performed a series of repeated transects off of Three Tree Point in Washington's Puget Sound. They were specifically interested in the dynamics of an eddy regularly introduced by the tidal race through the channel.



Parker and Geno developed the display of the Three Tree Point Eddy that is shown to the right. Each of the green vessel tracks in the plot represent one day of data gathering consisting of repeated transects around that cell. The data was gathered over seven days (one day per cell) and combined for the plot by careful referencing to the known time of the flood tide.

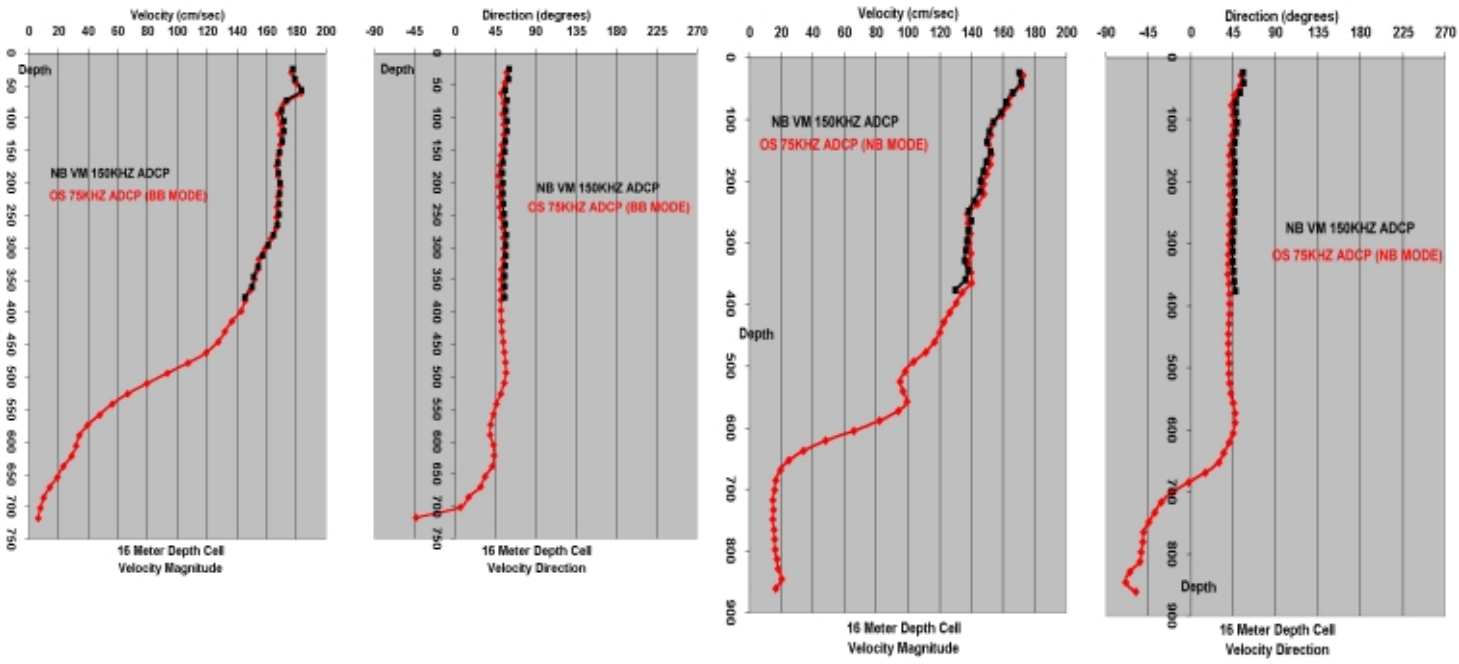
The echo intensity data collected by ADCPs can also be used to monitor zooplankton movement. We show below the backscatter measured from one of the repeated transects shown to the right. That the zooplankton are congregated in a layer at about 100 m depth is quite evident, as is their migration upward in the latter part of the record (after sunset). On this plot the x axis is time (GMT) and the y axis is range from the ADCP. The white area is the ocean bottom, so this dataset shows a little more than fourteen repeated cycles for this particular cell.



The 75 kHz Ocean Surveyor as a Replacement for a 150 kHz NB ADCP:

Much of the world's research fleet has been outfitted with RDI Narrowband ADCPs operating at 150 kHz. Because these vessels have already incorporated a sea chest and hull mounting scheme for the older narrowband ADCPs, RDI took maximum advantage of the smaller phased array transducers of the Ocean Surveyor to allow an easy retrofit of the 75 kHz Ocean Surveyor directly into the existing mounting hardware for the NB 150 kHz ADCPs. One such vessel that has been retrofitted is the RV Endeavor (shown to the left).

The primary advantage of incorporating the lower frequency Ocean Surveyor into these existing mounts is range. However, it is also noteworthy that all Ocean Surveyor systems support both broadband and narrowband measurement capability. Rather than immediately replace the existing narrowband system on the Endeavor, it was originally left in place for comparison and validation of the 75 kHz Ocean Surveyor system. We show below a comparison of the averaged velocity magnitude and direction plots between the 150 kHz narrowband system and the Ocean Surveyor in both broadband and narrowband mode (Ocean Surveyor data is plotted in red):

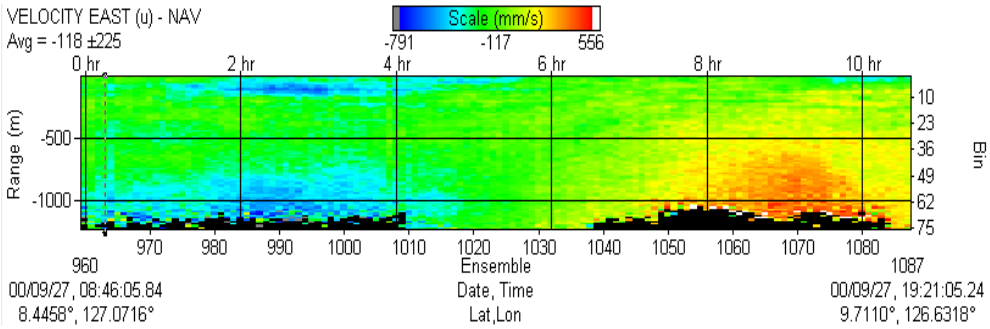


The broadband data is shown on the left and the narrowband is shown on the right. Both data sets use 16 m bins for comparison purposes, but the real advantage of the Ocean Surveyor's ability to switch between the modes is that it allows high resolution broadband data to be gathered simultaneously with long range narrowband data.

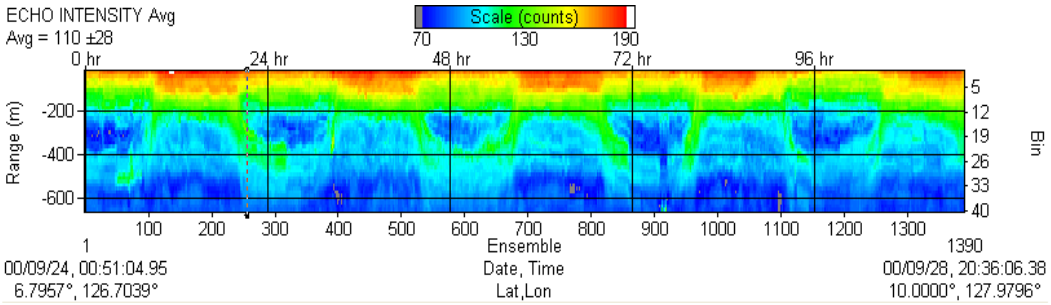
The 38 kHz Ocean Surveyor for the Deep Ocean:

With a nominal profiling range of over 1000 m (in Long Range Mode, over 700 m in High Precision Mode), the 38 kHz Ocean Surveyor is commonly installed in the newly-built vessels plying the deep ocean. We show some exceptional data (over 1200 m range) that was gathered in the Western Pacific by the JAMSTEC R/V Kaiyo (a swath-type research vessel shown to the left).

We show below the eastern velocity field as measured by the 38 kHz Ocean Surveyor while steaming at 13 kts off the coast of Mindanao (Philippines). Again, the x axis is ensemble number (five minutes per ensemble), the y axis is range in meters and the velocity range is indicated by the color bar at the top of the plot. Note the deep, strong eddy centered at 1,000 m depth.



The echo intensity measurements provided by the 38 kHz are also of interest. We show below several days worth of echo intensity data gathered along the cruise track of the Kaiyo. Note the clearly repeated vertical diel migration of the nekton to a depth of 400 m:

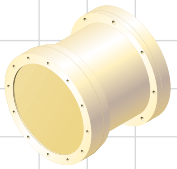


Combined OS38/OS150:

For maximum coverage, some vessels are now mounting both a 150 kHz and a 38 kHz Ocean Surveyor. The 150 kHz allows operations in much shallower water, and also allows gathering of high resolution data near the surface of the open ocean. The 38 kHz allows long range profiling in the open ocean. Royal Caribbean Cruise Lines has equipped the Explorer of the Seas (shown to the left) with a complete oceanographic/meteorological suite of instruments and is currently gathering data on repeated transects across the Gulf Stream and through the Caribbean Sea.

Ocean Surveyor Vessel-Mount ADCP

FOR LONG-RANGE 3-D CURRENT PROFILING



Technical Specifications

Water Profiling						
Long-Range Mode	**38 kHz**		**75 kHz**		**150 kHz**	
Vertical Resolution Cell Size[3]	Max. Range (m)[1]	Precision (cm/s)[2]	Max. Range (m)[1]	Precision (cm/s)[2]	Max. Range (m)[1]	Precision (cm/s)[2]
4m					*325-350*	*30*
8m			*520-650*	*30*	*375-400*	*19*
16m	*800-1000*	*30*	*560-700*	*17*		
24m	*800-1000*	*23*				
High-Precision Mode	**38 kHz**		**75 kHz**		**150 kHz**	
Vertical Resolution Cell Size[3]	Max. Range (m)[1]	Precision (cm/s)[2]	Max. Range (m)[1]	Precision (cm/s)[2]	Max. Range (m)[1]	Precision (cm/s)[2]
4m					*200-250*	*12*
8m			*310-430*	*12*	*220-275*	*9*
16m	*520-730*	*12*	*350-450*	*9*		
24m	*730-780*	*9*				

[1] Ranges at 1 to 5 knots ship speed are typical and vary with situation.
[2] Single-ping standard deviation.
[3] User's choice of depth cell size is not limited to the typical values specified.

Profile Parameters

Velocity long-term accuracy (typical): ±1.0%, ±0.5cm/s
Velocity range: -5 to 9m/s
# of depth cells: 1-128
Max ping rate:
38 kHz: 0.4 75 kHz: 0.7 150 kHz: 1.5

Bottom Track

Maximum altitude (precision <2cm/s):

38 kHz	75 kHz	150 kHz
1700m	950m	600m

Echo Intensity Profile

Dynamic range: 80dB
Precision: ±1.5dB

Transducer & Hardware

Beam angle: 30°
Configuration: 4-beam phased array
Communications: RS-232 or RS-422 hex-ASCII or binary output at 1200-115,200 baud
Output power: 1000W

Standard Sensors

Temperature (mounted on transducer)
- Range: -5° to 45°C
- Precision: ±0.1°C
- Resolution: 0.03°

System Power

AC input: 90-250V AC, 47-63 Hz
Power: 1400W

Environmental

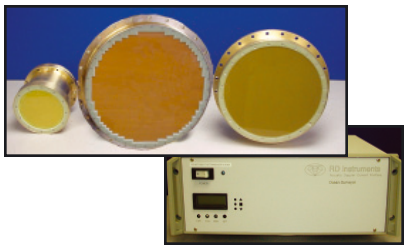
Operating temperature: -5° to 40°C
Storage temperature: -30° to 50°C

Software

Use RDI's Windows-based software for the best results:
- **VMDAS**—Vessel-mount data acquisition system
- **WinADCP**—Data display and export

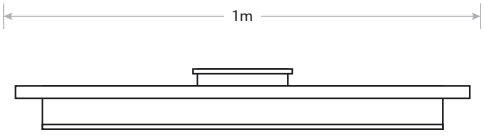
System Components

- 38, 75, or 150 kHz transducer
- 19" rack-mount electronic chassis

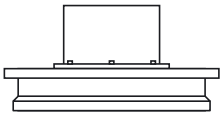


User to supply compass input or GPS navigation data and NMEA tilt information.

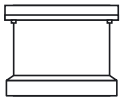
Dimensions



38 kHz transducer



75 kHz



150 kHz

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