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The Argonaut-XR System and the Multi-Cell Feature

As a current profiling system, the Argonaut-XR offers exceptional value for near shore deployments. Its small size, rugged build quality, and flexible system architecture make it very attractive for both real-time operation as well as autonomous deployments. The basic autonomous system includes an external battery pack, internal recorder, compass/tilt sensor, pressure and temperature sensors. Adding on options such as a non-directional wave package or the SeaBird MicroCAT CT sensor makes an Argonaut-XR the centerpiece of a complete oceanographic system.



Fig 1.
The Argonaut-XR

Since its introduction, the Argonaut-XR has differed from other Doppler current meters in a very special way. The size and extent of the XR's sampling volume is *dynamic* and can change with changing water level. This feature has been referred to in the past as the AutoTide feature. In addition, the autonomous configuration of this product has 10 current profiling cells as a standard feature. This feature is in addition to the dynamic, single cell. The powerful combination of a single cell using AutoTide and 10 classic cells is referred to as *Multi-Cell*. Both of these features are described in the following sections.

AutoTide Feature

In basic terms, how the AutoTide works is that the Argonaut-XR uses its built-in pressure sensor to detect the surface boundary. The sampling volume (Cell) has both "Cell Begin" and "Cell End" parameters that can be pre-set by the user to be either fixed in place, or dynamic with changing water level. When using AutoTide, the Cell End is then automatically placed just below the water's surface using the formula:

$$CE = 0.9*(P - 2*\sigma P)$$

Where:

CE = "Cell End" or the maximum extent of the sampling volume near the water surface
P = Water Level as calculated by the pressure sensor

Note that the above formula accounts for wave fluctuations while also having a 10 % safety factor.

Argonaut-XR Current Profiling Feature

Current Profiling in an Argonaut-XR works much as it does in our ADP current profiler systems. Prior to deployment, the user must set the blanking distance, the number of cells, and the cell size. Once the deployment starts, the cells are fixed in place. Thus if the water level falls below the extent of the cell, the data will be lost or contaminated – just as with ordinary current profilers.

Table 1 below shows some of the specifications for current profiling with an Argonaut-XR

Argonaut-XR Acoustic Frequency	Maximum Number of Classic Cells	Minimum Blanking distance	Minimum Cell Size	Maximum Cell Size	Maximum range
3.0 MHz	10	0.20 m	0.20 m	4.0 m	4-6 m
1.5 MHz	10	0.50 m	0.40 m	8.0 m	15-20 m
0.75 MHz	10	0.80 m	0.80 m	15.0 m	30-40 m

The Multi-Cell Feature

As stated earlier, Multi-Cell is an innovative way of current profiling. Combining all the benefits of classical current profiling with the dynamic AutoTide feature, users have the best of both worlds. 3D fixed current profiles (up to 10 user-selectable cells) for studying fluid dynamic phenomena, and an eleventh integrated cell, which can be applied to endless applications in vessel navigation, mean channel flow, or mean current velocities. These data are set up and reported independent of one another truly making the Argonaut-XR the most unique current profiler on the market.

Multi-Cell Example 1

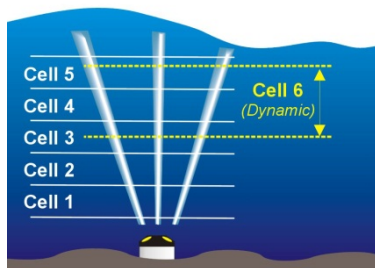


Fig 2a

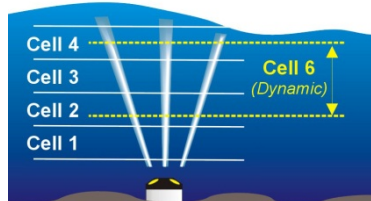


Fig 2c

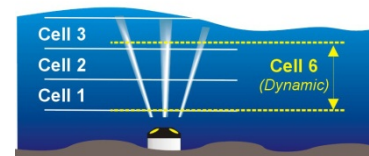


Fig 2b

In the above example, the Argonaut-XR in Multi-Cell mode is set up with 5 classical cells covering the full extent of the water column at high tide or maximum stage (Fig 1a). The 6th (dynamic cell) has both its “Cell Begin” and “Cell End” set dynamically just underneath the surface. Thus as the water level falls, data from cells 3, 4, and 5 are lost, however, the 6th dynamic cell is always positioned below the water’s surface. A setup such as this could be useful for researchers studying surface currents or for certain port/harbor applications where the currents of concern for vessel navigation always reside just below the water’s surface.

Multi-Cell Example 2

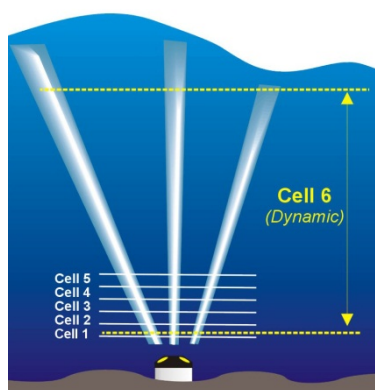


Fig 3a

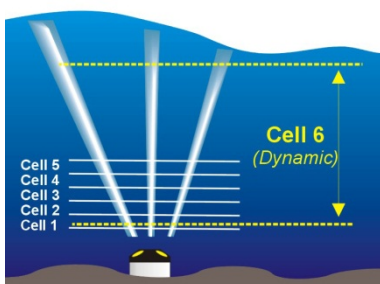


Fig 3b

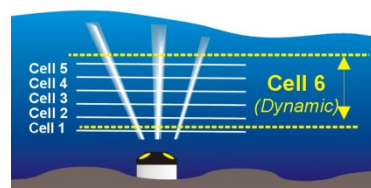


Fig 3c

In this example, the user is more interested in the detailed velocity profile close to the bottom, thus 5 cells have been set up closely spaced near the bottom. The 6th dynamic cell has been set with the “cell begin” fixed near the bottom, and the cell end automatically changes with the water level. A set up such as this might be useful in a river or channel where the sixth cell could be used to compute channel flow, and the 5 classic cells used for studying the near-bottom dynamics

The Autonomous Argonaut-XR system



Fig 4. Autonomous Argonaut-XR system with base mounting plate

The autonomous Argonaut-XR package is particularly attractive because it contains all of the following as standard equipment:

- Argonaut-XR (3.0 MHz, 1.5 MHz, or 0.75 MHz)
- External battery pack and cable
- Multi-cell current profiling (10 cells plus one dynamic cell)
- Base mounting plate
- Compass/Tilt Sensor
- Temperature Sensor
- Internal recorder
- Pressure sensor



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SonTek Technical Notes

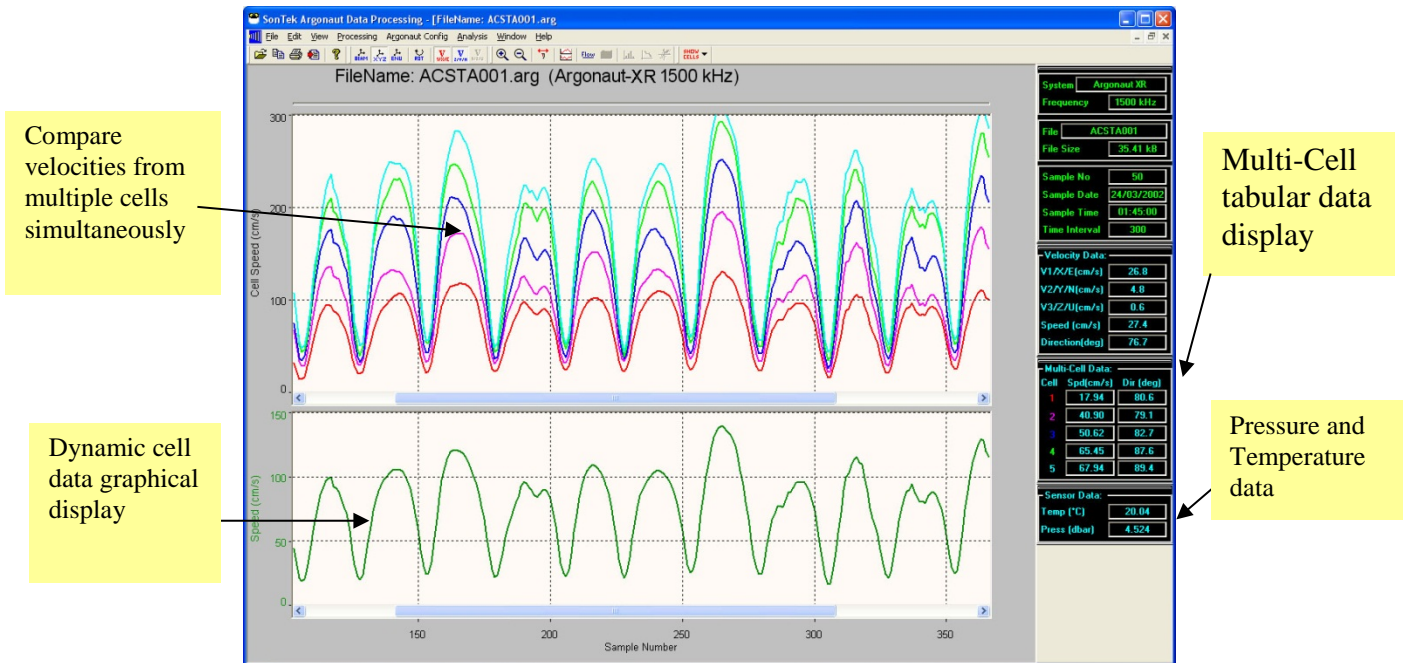
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One of the advantages of the Argonaut product line is that it features low-power CMOS circuitry enabling longer deployments than other Doppler profilers. Because the XR requires only a fraction of a watt to operate, the autonomous system has enough battery power for about 60 days of continuous operation and internal storage for over 20,000 individual samples when 10 cells are selected. With this capacity, the XR could easily be deployed for over six months recording 15 minute data with a 2 minute averaging time. Longer deployments are possible by using less cells or longer averaging intervals. The external battery casing makes battery change outs a snap.

Argonaut-XR Software

ViewArgonaut

The ViewArgonaut for Windows software allows you to setup, deploy, retrieve data and postprocess data from your Argonaut-XR. This software comes standard with the Argonaut-XR and is also available for download from our website. An example screen shot showing multiple cell data is shown below:






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Argonaut-XR Optional Features

In addition to the standard items listed in previous sections, the utility of the Argonaut-XR can be extended by the additional of enhanced capabilities or externally integrated sensors. The following lists some of the possibilities presently offered by SonTek

- **SeaBird MicroCAT CT** – Representing state of the art in oceanographic CT measurement, the MicroCat is frequently the choice of oceanographers. The MicroCat can be externally cabled to the Argonaut-XR and all data stored onto the Argonaut's recorder.
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- A photograph of a SeaBird MicroCAT CT sensor. It is a cylindrical, metallic device with a blue label that reads "SBE" and "MicroCAT CT". The sensor has several ports and a cable attached to it.
- **Non-Directional Waves** –The SonWave upgrade transforms the Argonaut-XR into a combination non-directional wave gauge and current profiler. With SonWave the Argonaut is able to both record and output significant wave height, peak period and wave frequency spectra.
 - **High resolution (RPT) pressure sensor** – The standard Argonaut-XR is delivered with a piezoresistive type of pressure sensor which is commonly called a strain gauge. Typically these sensors are accurate to 0.1% of their full scale range. As an upgrade option, SonTek also offers a Resonance Pressure Transducer (RPT) that works that works on the principle that an oscillating crystal changes its resonance frequency as pressure changes. The RPT sensor is not only more accurate (0.01%) but also more stable with much higher resolution.

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