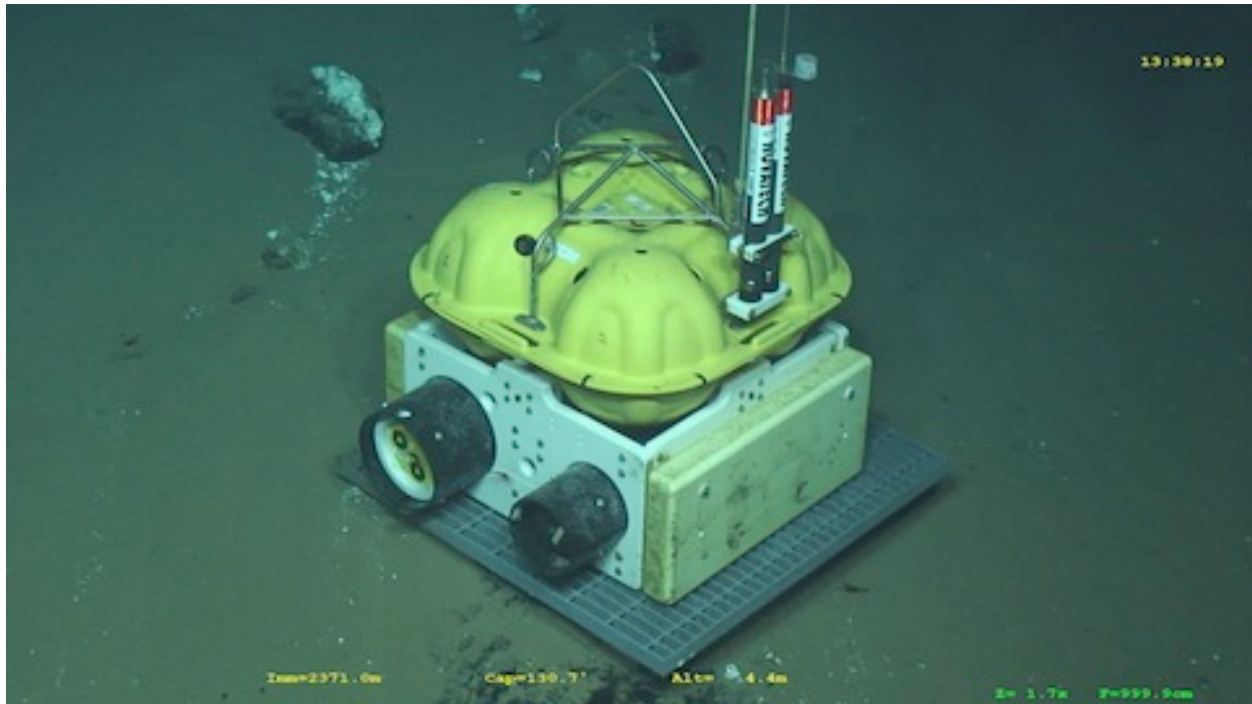


# The LC4x4-SP System

Low-Cost Hardware for Earth Applications and Physical Oceanography



Short-Period (SP) OBS on bottom.

## LC4x4 OBS System Description

The LC4x4-SP is an ocean-bottom instrument designed for use in seismic experiments that use either passive sources (e.g., earthquakes) or active sources (e.g. seismic air-gun surveys) to generate signals. It includes a 3-component seismometer and a hydrophone as sensors. A frame composed primarily of polyethylene holds the instrument together. Tubes in the frame are used to hold pressure cases for the acoustics package and for the data logger itself. A float assembly is attached to the frame (yellow hardhats) and includes brackets for mounting a flag, radio, and a strobe light to aid in locating the instrument on the sea surface for recovery. For scale, the dimension of the SP (short-period) unit is roughly 1 meter cubed.

The acoustic release transponder package includes the electronics for operating the burn wire release assembly, which is mounted in the bottom center of the frame and connects the instrument to an anchor that consists principally of a large piece of steel grating (~1 square meter). An optional configuration features two single-arm mechanical release units and a wire rope attached to a steel or concrete anchor. The data logger pressure case contains all the electronics required to digitize the sensor outputs and record the data on compact flash card storage. For the SP (short-period) unit the seismometer is housed in its own pressure case and the hydrophone is encapsulated in neoprene, both of which are mounted in the center of the frame. Both configurations can store enough primary cell lithium batteries for deployment durations exceeding 1 year.

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Lab Preparation and Shipment

In preparation for a cruise, new Lithium-Oxyhalide batteries are installed and the data logger and acoustics packages are fully inspected and tested in the lab. The pressure case is then closed with bags of fresh desiccant installed. Each case is evacuated to 25 inches of vacuum and backfilled with air passed through a drier three times, then sealed under approximately five inches of vacuum. The cases are not re-opened at sea (opened in case of a failure only).

For SP units, the main instrument package and glass ball floatation are subsequently fastened into a custom transportation and storage rack for shipment (three units per rack). Anchors are shipped independently on pallets, typically with 20 anchors or less strapped on a pallet in order to keep the weight of each pallet within reasonable bounds.

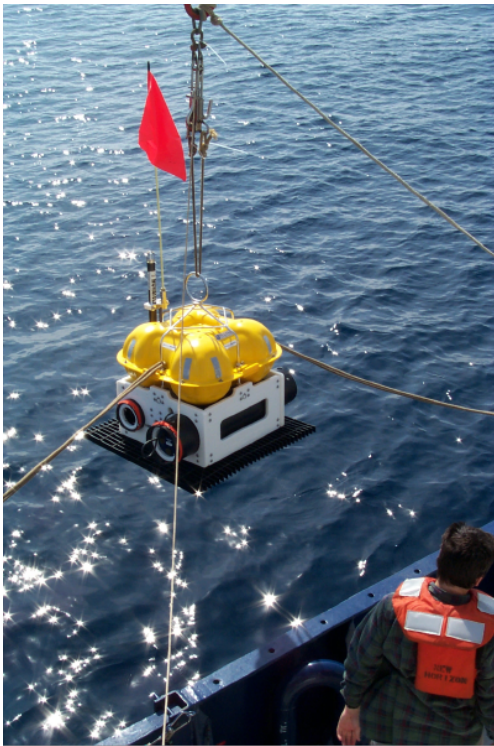
All seagoing surface gear (i.e. computers, tools, test boxes, etc.) is transported in Zarges aluminum shipping boxes.



<b>SP Instrument component weights in air</b>	<b>LBS</b>
SP anchor	98
Black plastic pallett	22
SP glass float w/titanium bale	77
SP frame- no logger, no acoustic	92
Small syntactic block	20
Novatech w/batteries	4
Lithium 12DD pack	6
Data logger- no batteries	57
Acoustic unit w/battery pack	25
Battery bottle- no batteries	57
SP rack- empty	175
<b>Shipping weights- full battery load</b>	<b>LBS</b>
Loaded SP rack- w/acoustics & loggers	1018
Rosette 24 empty	491
Rosette 12 empty	472
<b>Deployment weights- full battery load</b>	<b>LBS</b>
SP- fully assembled for deployment	427
Rosette 24- fully loaded	1091
Rosette 12- fully loaded	772
<b>Recovery weights- full battery load</b>	<b>LBS</b>
SP- fully assembled at recovery	329

### *Field Operation Procedures*

**DEPLOYMENT OVERVIEW:** To prepare an instrument for deployment, an anchor is first placed on a frame mounted on deck at a convenient height. Next, an instrument frame assembly is removed from the rack and placed on the anchor. While one person removes the data logger pressure case and carries it into the ship's lab for checkout and preparation, two others assemble and test the release that holds the frame to the anchor and mount the float frame, flag, radio and flashing light on the package.



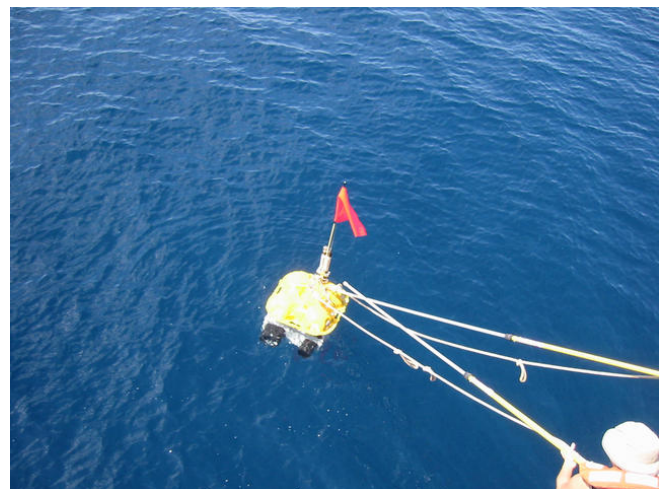
Checkout equipment requirements are minimal. Commercial test equipment includes a computer with a compatible serial or Ethernet link to serve as a terminal, a digital voltmeter and a GPS clock with programmable outputs. In addition, three custom test boxes are employed. The preferred communication with the instrument uses a 12-KHz hull transducer from the ship connected to a topside acoustic transceiver (if available). Alternatively, an over-the-side portable transducer can be deployed toward instrument-ship communication.

A small crane is normally used for the deployment itself. A “pelican hook”, that can be released by pulling on a line, is attached to the end of the boom, and connected to the lifting bale on the instrument with a loop of rope. The instrument is usually deployed with the acoustics system enabled. Once the instrument is in the water, confirmation is made that the system is descending properly. It may be tracked to the bottom if sufficient time is available, and an acoustic relocation survey can be done to refine instrument location on the bottom. The acoustics system is normally disabled before leaving the site, both to minimize depletion of the batteries and to prevent

confusion between replies from different instruments when establishing locations.

**RECOVERY OVERVIEW:** Upon returning to the site, acoustic enable and release commands are sent to the instrument (via 12 KHz hull or over-the-side transducer). Here, the metal anchor is released and is left on the bottom while the instrument floats to the surface. Once it is on the surface, the ship is brought alongside and a lifting line and tag line (if required by the sea state) are attached using removable hooks fitted to the ends of extendable 16 foot-long poles. Once on deck and rinsed with fresh water, the data logger pressure case is removed and carried into the lab.

There, the instrument timing is checked to within a fraction of a microsecond using the GPS Clock, and all data is downloaded from the internal compact flash storage. The pressure case is again evacuated and returned to the instrument frame, which by that time has been returned to one of the storage racks on deck.



# GENERALIZED SCHEMATIC OF SP LC4x4 SYSTEM:

TOP VIEW (Floats removed)

