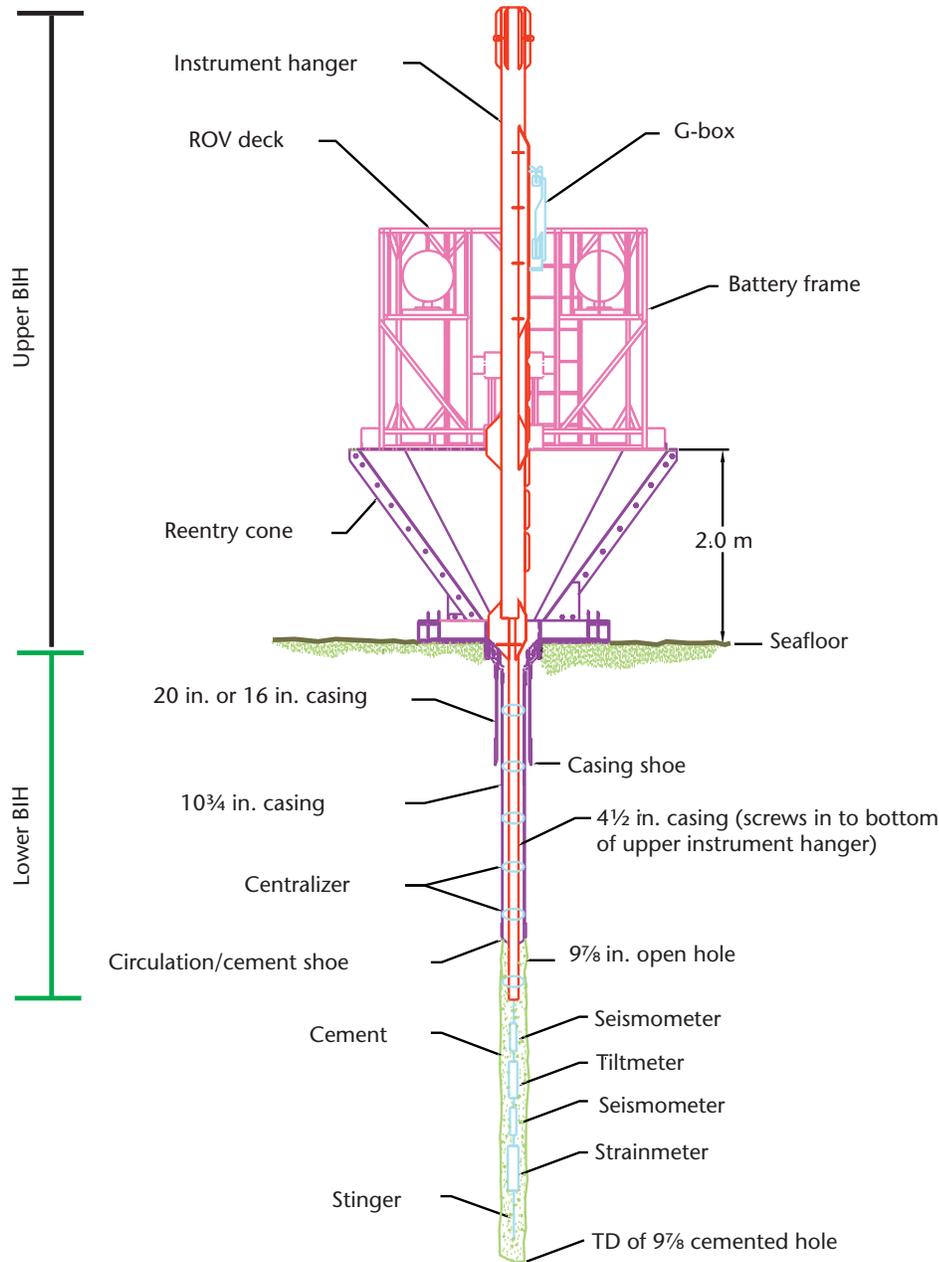


**Scientific Application**

The Borehole Instrument Hanger (BIH) evolved along with the CORK and ACORK completion systems. The BIH provides a flexible tool that can be customized to install scientific instruments (e.g., seismometer, tiltmeter, strainmeter) in permanent boreholes for enhanced long-term downhole measurements. A key advantage to this design is that the data loggers are on the outside of the upper BIH (also known as a riser or wellhead) to provide access at the seafloor. Data can be recovered from the borehole by other types of oceanographic vessels using submersibles or a remotely operated vehicle (ROV) (i.e., the ODP drillship is not required).

**Tool Operation**

The instrument hanger completion normally begins with the installation of a standard ODP reentry cone and 16 in. or 10¾ in. casing. The BIH is composed of an upper section (above the reentry cone) and 4½ in. casing (below the reentry cone). The BIH is deployed and landed inside the reentry cone on top of the casing hangers. An ROV platform, which sits on top of the reentry cone, is installed around the upper BIH. The platform serves as a landing pad for submersibles and/or ROVs to access the data



**Schematic of a strain-tilt-seismometer BIH completion.**

loggers and as a support frame for the batteries that power a seismometer.

The ROV platform also provides a frame to mount ancillary instrument packages that may be attached to the instrument hanger. The seismic instrument packages are typically suspended in the hole on 4½ in. (or other) casing. Electrical cables are attached to the side of the casing to connect the instruments in the hole with the data loggers attached to the upper BIH. The various instruments may be cemented in place, if required, to seal the open hole from the ocean tidal effects and to acoustically isolate the seismic instruments to reduce background noise.

## Design Features

### 1) Installation and Support

A standard ODP reentry cone and 10¾ in. casing are typically set before installing the BIH.

*Benefit:* The reentry cone stabilizes the upper borehole and provides a method to reenter the casing.

### 2) Instrument Hanger Design

The upper portion of the BIH houses data loggers and ancillary instruments and provides a means for downloading the data loggers using an ROV or submersible. The BIH may be modified to accept almost any type of downhole instrument.

*Benefit:* Different types of instruments (e.g., seismometer, tiltmeter) can be deployed with the BIH while maintaining access to the data loggers via submersible or ROV.

### 3) Submersible/ROV Operations

The upper BIH provides access to the instrument data loggers via submersible or ROV.

*Benefit:* Data can be collected at any time without relying on the *JOIDES Resolution*. In some instances, complete data loggers may be recovered and replaced via submersible or ROV.

## Instrument Hanger Specifications

The BIH is deployed by the *JOIDES Resolution* on the drill string after setting a reentry cone and casing. The BIH can be configured to land in any size ODP casing hangers.

## Instrument Hanger Limitations

- All instruments attached to the upper BIH must fit within a 30 in. diameter circle (minus the diameter of the upper BIH body) to allow the vibration isolated television (VIT) frame to pass over the BIH during reentry operations. Height above the ROV deck is virtually unlimited.
- Instruments to be inserted through the 4½ in. casing must

fit through the casing's inner diameter. If an instrument will be attached to the outside of the 4½ in. casing before the BIH is installed, then the instrument must fit within an 8½ in. outer diameter by 4½ in. inner diameter annulus to fit through the upper casing strings and open hole.

## Considerations for Usage

- The limitations on instrument size both above and below the seafloor must be considered.
- Physically handling the instrument hanger with instruments attached during deployment must be considered when determining what instruments to install (contact ODP for details regarding specific installations).
- Cables and attached instruments are exposed to some impact from the VIT frame during deployment of a BIH because the vibration isolated television frame must be lowered over the entire instrument hanger for reentry.
- The extra time required to make the water-tight electrical connections in the instrument cables must be considered in the overall deployment time.
- Borehole stability must be considered in determining the probability of achieving a successful installation.