

Elevated Temperature Borehole Sensor

Scientific Application

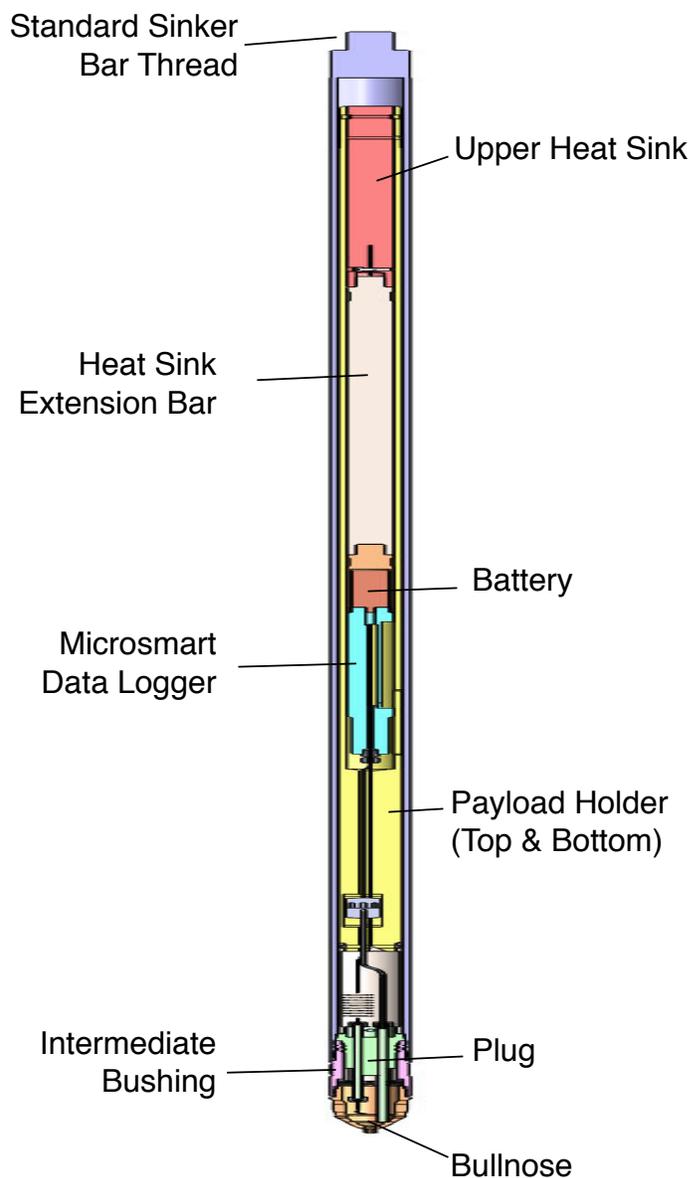
The International Ocean Discovery Program (IODP) accepted the Ultra High Temperature-Multi-Sensor Module (UHT-MSM) from the University of Miami in 2018. IODP updated the technology and renamed it the Elevated Temperature Borehole Sensor (ETBS) tool. Unlike other JRSO downhole temperature tools, the ETBS is designed for borehole water temperature measurements, rather than sediment-based monitoring (see APTC-3 and SET2 tool sheets at <http://iodp.tamu.edu/tools/logging/index.html>). The ETBS is also faster and easier to assemble, thus maximizing science time when borehole water temperatures are needed in higher temperature environments. Additionally, the ETBS is used to evaluate the feasibility of deploying downhole logging toolstrings in high-temperature settings.

Operation

The tool contains both external and internal temperature measuring sensors, a Micro-Smart Systems™ data logger and power system, as well as a thermally protective vacuum Dewar housing. These features offer more precise measurements and robust performance in harsh deep ocean environments and can be operated with minimal assembly and preparation by technicians. At a maximum external temperature of 400°C (752°F), the Dewar flask is rated to maintain an internal temperature not to exceed 77°C (171°F). Operation for 10 hours is possible, if the average temperature does not exceed 232°C (450°F).

Modifications include a complete revision of the internal electronics with updated temperature sensors, power supply, and data logging subsystem as well as new data collection, analysis, and reporting software.

The ETBS thermal protection shield comprises the Upper Heat Sink and Heat Sink Extension Bar.



Schematic of the ETBS assembly. Not to scale; compressed to increase width. Overall tool length is 267.7 cm (105.0 in).

Features

The Elevated Temperature Borehole Sensor tool contains:

- both external and internal temperature measuring sensors
- a Micro-Smart Systems™ data logger
- thermally protective vacuum Dewar housing
- single battery cell powers both memory sensor modules in the data logger simultaneously; packs are comprised of one (1) 3.6 volt, 180°C rated moderate-rate lithium thionyl chloride cell

Dimensions

Length

Section	Length, cm (in)
Gauge Housing	35.5 (14.0)
Battery Pack Housing	16.5 (6.5)
Heat Sink Housing	64.8 (25.5)
Extension Bar	43.9 (17.3)
Dewar Flask Housing	248.9 (98.0)
ETBS Overall Length	266.7 (105.0)

Diameter

Dewar flask 5.59 cm (2.2 in)

Specifications

Temperature Measurements

Maximum external temperature 400°C (752°F) for four (4) hours exposure time

Range: 0° to +400°C (32°F to 752°F)

Resolution: 0.001°C

Data Storage

64920 measurements (e.g., 18 hr of 1 Hz data)

Operating Range

Temperature Range

0°C to 450°C (842°F) (tool survival range is higher than measurement range)

Limitations

This tool is used only for borehole water temperature measurements at higher temperature ranges. The measured post-drilling temperature in the borehole represents a value that ranges between the actual formation temperature and the temperature of the drilling fluid (seawater). How closely it approaches the actual formation temperature is a matter of the geothermal gradient and the timing of the ETBS tool deployment after drilling.



Photo of the ETBS tool laid out in assembly formation.