Expedition 385T
Panama Basin Crustal Architecture and Deep Biosphere
Antofagasta to San Diego
18 August 2019 to 16 September 2019

Expedition Engineering Report
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Bean Dip and Fritos on the job

Background

The goal for the expedition was to conduct water sampling and logging in both Holes 504B and 896A, after first removing instrumented platforms and packer assemblies from each. This report will focus on the equipment preparation, deployment, and the overall results. For detailed information on the operations please see the Expedition Operations Report and the Daily Reports.

The instrumented platforms and packers, also referred to as wireline corks, were installed in 1991. One of the proponents from that cruise provided pictures, hole schematics, and overview drawings for the downhole packages (see Figures 1 through 6). Unfortunately any drawings for the platform(s) had long been lost. It was thought the center upright was fabricated from 6" Schedule 40 carbon pipe (6-5/8" OD).

First, a 3D model of the upper portion of the platform was created, based on the above pipe dimensions and scaling from blown-up pictures (See Figure 7). Once the model was finished and reviewed, it was decided that an overshot may work best for Hole 504B. An overshot is the oil-field term for a piece of equipment that "catches a fish" on its external profile. The terms "fish" and "fishing" refer to a part broken off or lost downhole or the act of retrieving said part, resp. An overshot slides over the "fish" (e.g., broken piece of pipe) and when pulled up will lock onto its outside diameter. The center pipe looked to be a good candidate for an overshot, but it was not long enough for a standard one. A Series 70, or "short-catch", overshot was selected and purchased (Figure 8).

Fishing in open water is further complicated with no hole to guide the tool down over the fish. A guide funnel was designed to go around the overshot assembly, taking into account that the thin body of the overshot could not be directly welded to (See Figure 9).

While a reasonable option for 504B, the overshot assembly was deemed unsuitable for 896A. The 896A installation had been marred by the deployment umbilical breaking, leaving an electronic release (hook) and several meters of umbilical hanging from the top of the center pipe. A "hook" was designed, using the 3D platform model to size it, to attempt to catch the platform by a portion of its superstructure (see Figures 10 and 11). The hook was also made robust so as to be able to "spear" down through the expanded metal of the platform and latch onto the substructure as well. This hook also made a good backup for the overshot option on 504B.

The upper packers were never inflated (896A) or long deflated (504B), but, just in case, 9-5/8" concave Junk Mills were also purchased and shipped. The junk mills could be used to grind up the upper head of the inflatable packers, causing them to deflate and fall. The junk mills could also push the remains/junk down the hole.

The list of remediation equipment appears as Figure 12.

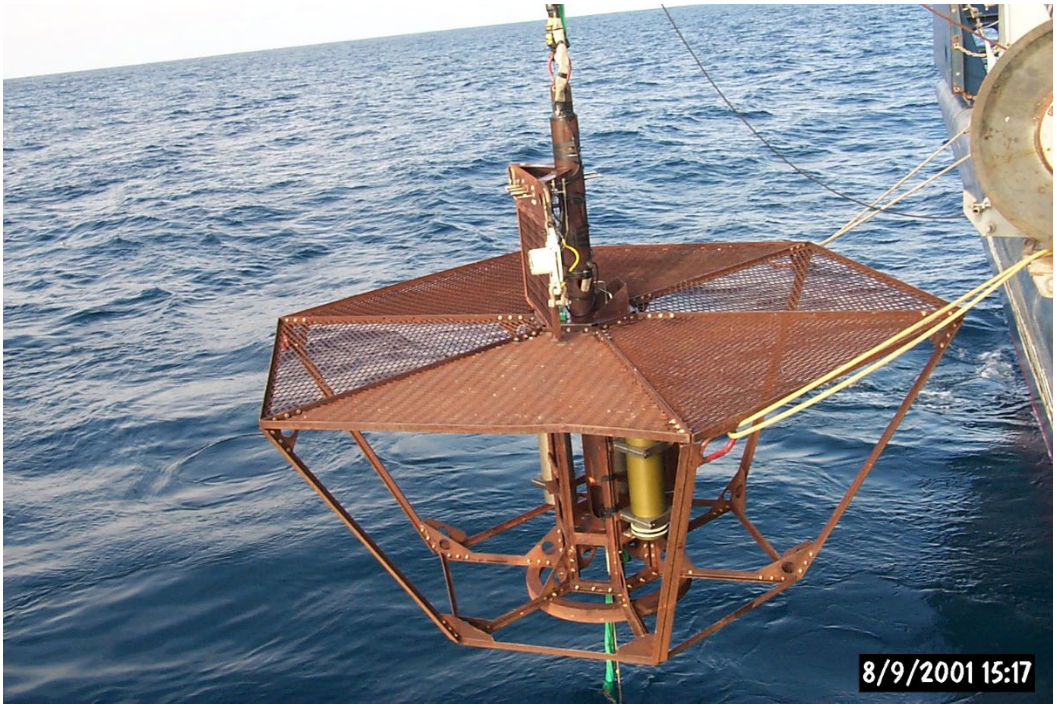


Figure 1 Platform during deployment

Figure 2 Lead-In Package and Lower Packer

Figure 3 Upper Packer

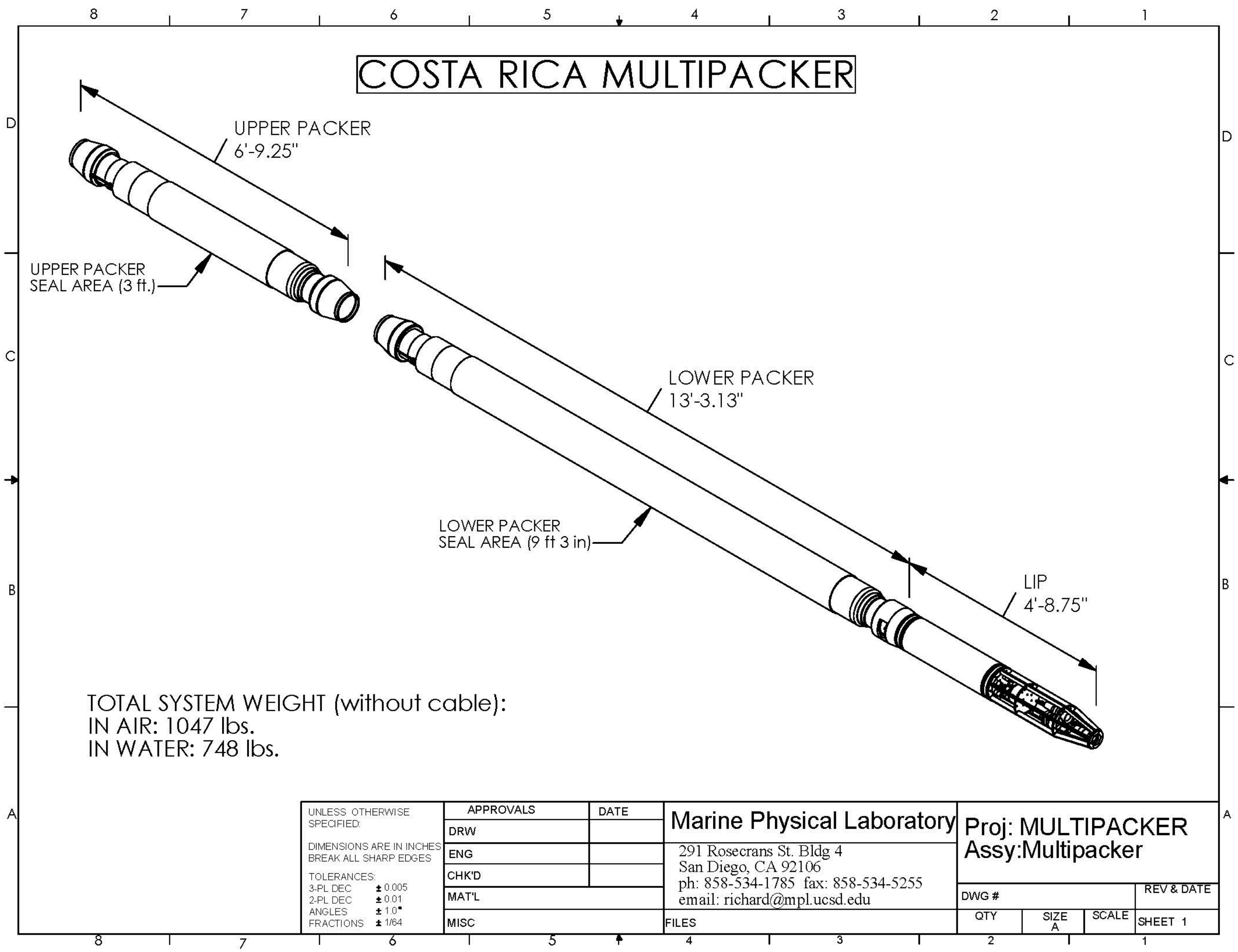


Figure 4 Schematic of Downhole Portion

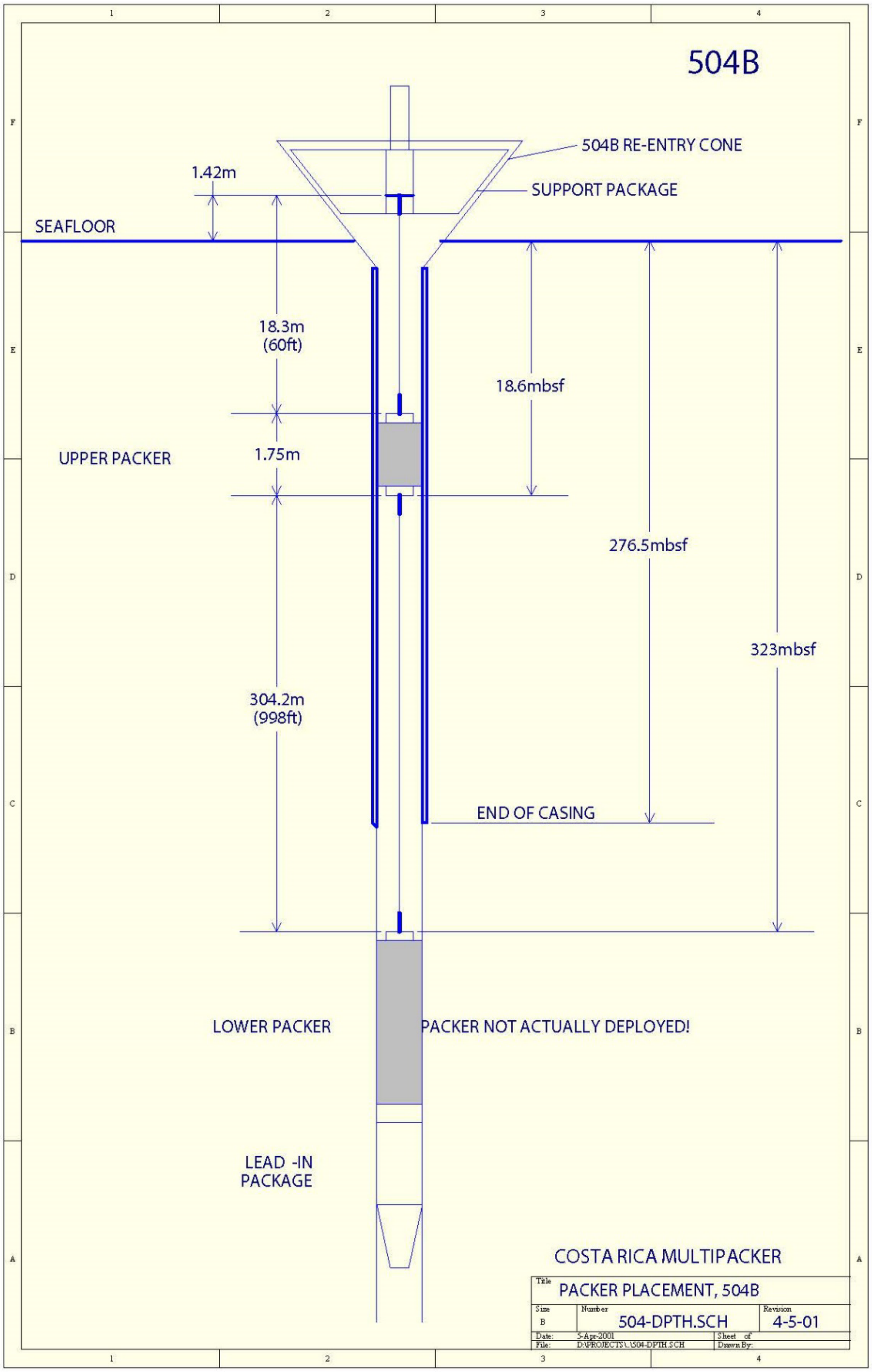


Figure 5 504B Installation

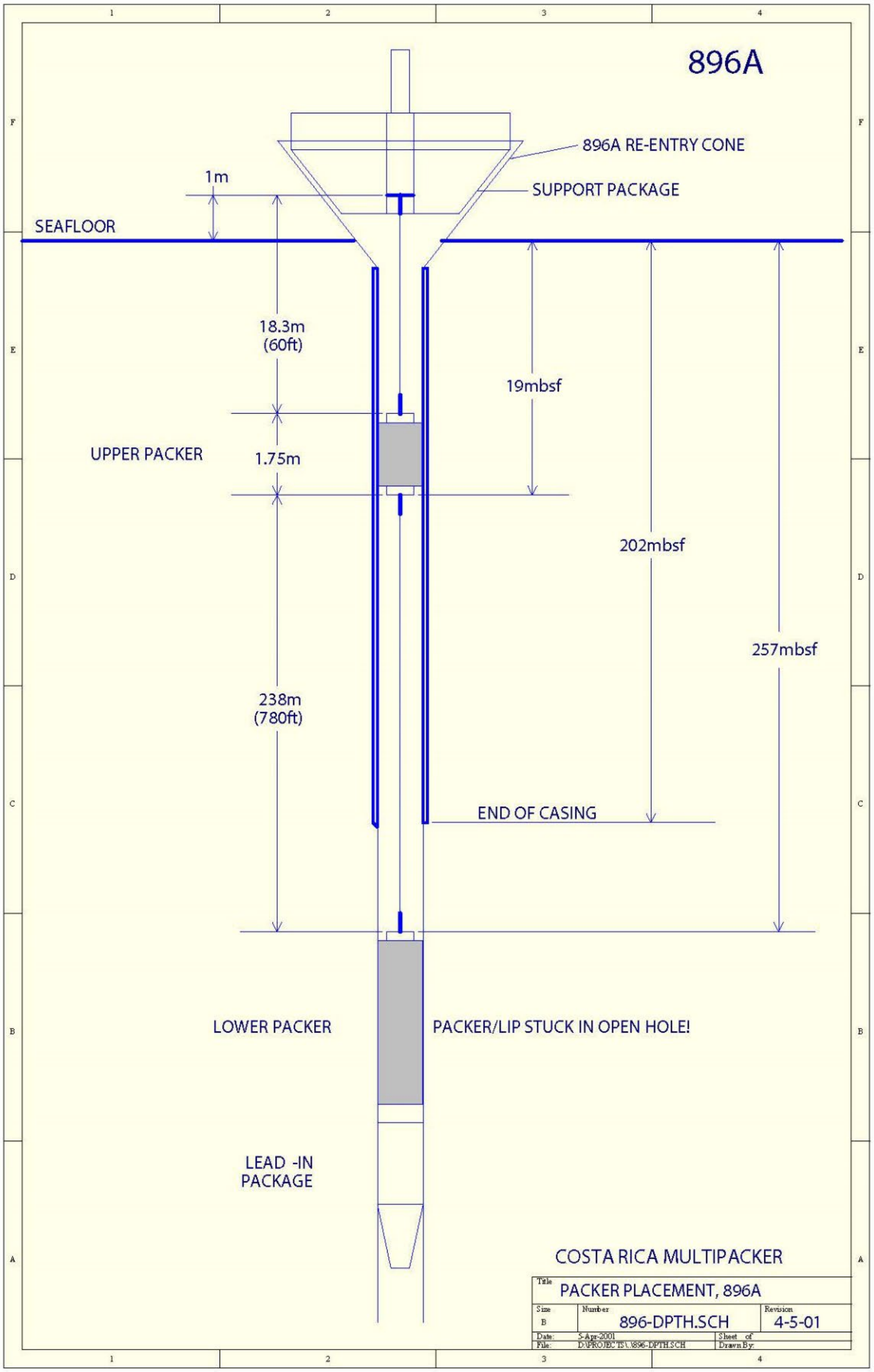


Figure 6 896A Installation

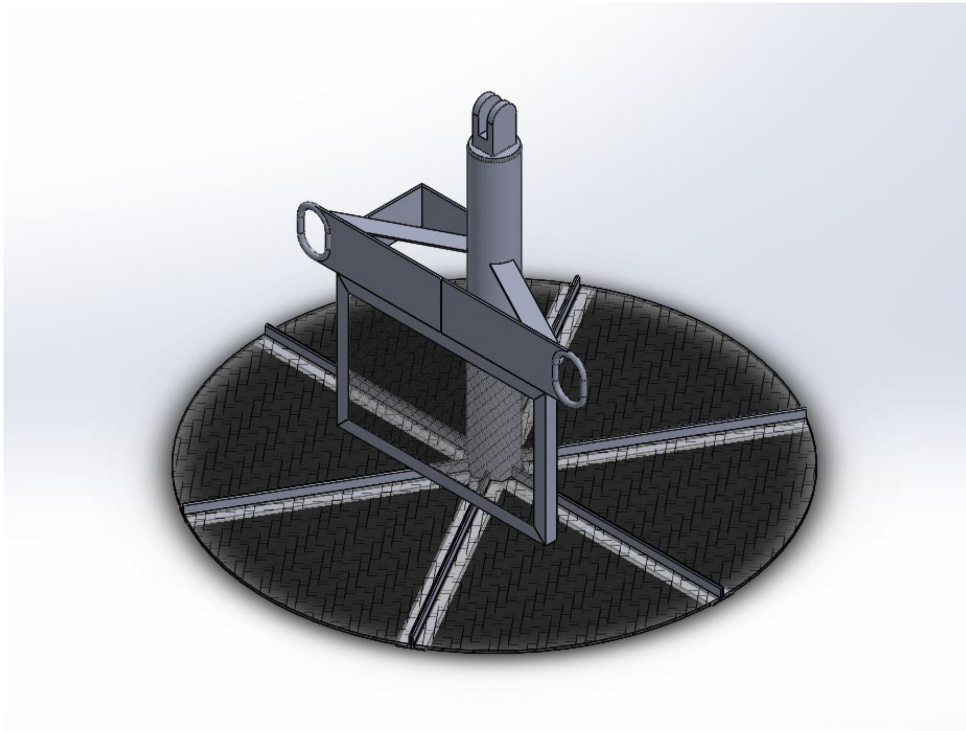


Figure 7 3D Model of Platform

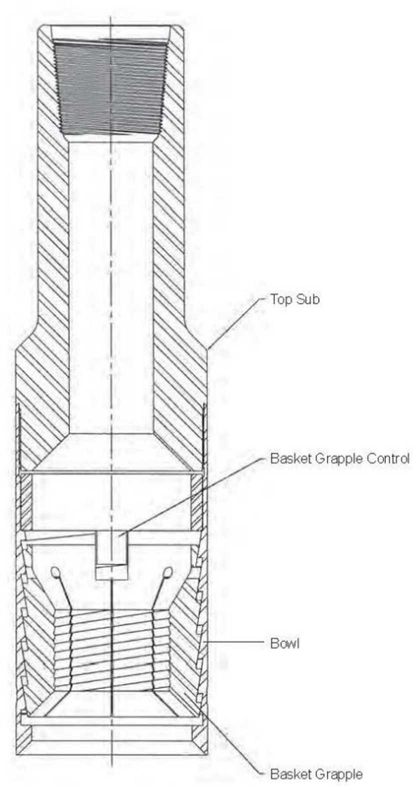
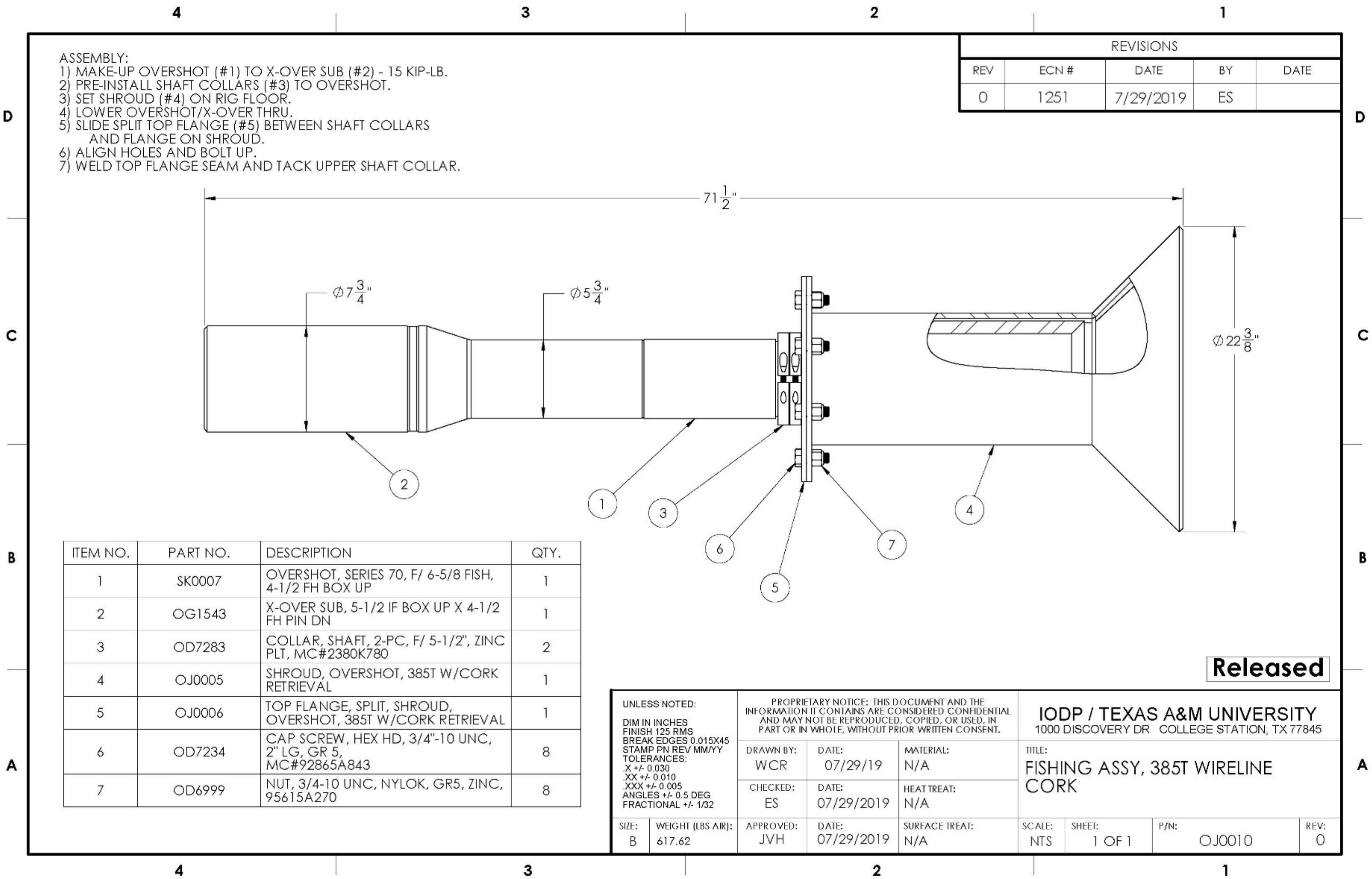


Figure 8 Series 70 "Short-Catch" Overshot



ITEM NO.	PART NO.	DESCRIPTION	QTY.
1	SK0007	OVERSHOT, SERIES 70, F/ 6-5/8 FISH, 4-1/2 FH BOX UP	1
2	OG1543	X-OVER SUB, 5-1/2 IF BOX UP X 4-1/2 FH PIN DN	1
3	OD7283	COLLAR, SHAFT, 2-PC, F/ 5-1/2", ZINC PLT, MC#2380K780	2
4	OJ0005	SHROUD, OVERSHOT, 385T W/CORK RETRIEVAL	1
5	OJ0006	TOP FLANGE, SPLIT, SHROUD, OVERSHOT, 385T W/CORK RETRIEVAL	1
6	OD7234	CAP SCREW, HEX HD, 3/4"-10 UNC, 2" LG, GR 5, MC#92865A843	8
7	OD6999	NUT, 3/4-10 UNC, NYLOK, GR5, ZINC, 95615A270	8

Figure 9 Overshot with Guide Funnel

Figure 11 Hook and Platform Model

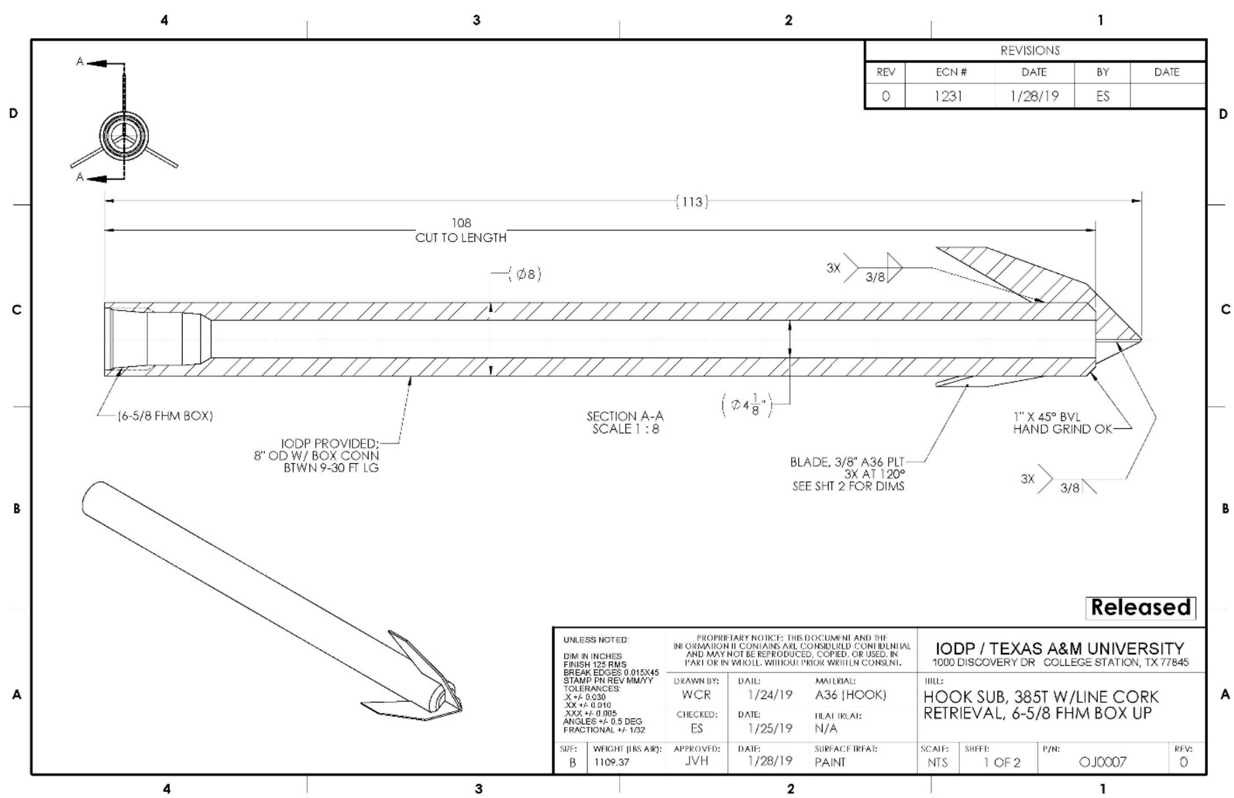


Figure 10 Hook

Equipment for Exp 385T Cork Pulling

Total Cost **$27,253**

O	S	JR	Item No.	IODP Part NO.	Rev Num	Description	Qty	Units	Unit Cost	Total Cost	Req. #	Purchase Date	Vendor
X			1	OJ0007	0	HOOK SUB, 385T W/CORK RETRIEVAL, 6-5/8 FHM BOX UP, 8" OD	1	EA	$733	$733	1901128WCR	28-Jan-19	Brazos
X			2	OJ0005	0	SHROUD, OVERSHOT, 385T W/CORK RETRIEVAL	1	EA	$1,000	$1,000	1901128WCR	28-Jan-19	Brazos
X			3	OJ0006	0	TOP FLANGE, SPLIT, SHROUD, OVERSHOT, 385T W/CORK RETRIEVAL	1	EA	$588	$588	1901128WCR	28-Jan-19	Brazos
X			4	OG1543		X-OVER SUB, 5-1/2 IF BOX UP X 4-1/2 FH PIN DN, 7-3/4" OD, 3" ID, 36" OAL -NOT FOR CORING-	1	EA	$1,536	$1,536	1902001REM	1-Feb-19	Houston Downhole
X			5	OF7101	0	Junk Mill, Concave Bottom, 9-5/8" - 9-3/4", 6-5/8 Reg Pin Up, 10" Fishing Neck, without Wear Pads - #CM-27-NPN	2	EA	$4,020	$8,040	1702040DFL	29-Jan-19	Applied
X			6	N/A		SC-17, 8-1/2" OD GOTCO TYPE SH, SERIES 70 SHORT CATCH OVERSHOT DRESSED WITH BASKET GRAPPLE & CONTROL TO CATCH 6-5/8" OD FISH. COMPLETE WITH SHORT TOP SUB WITH 4-1/2" A.P.I. FH BOX UP	2	EA	$4,268	$8,536	1808065WCR	9-Aug-18	Applied
X			7	N/A		SC-17-4, BASKET GRAPPLE	2	EA	$926	$1,852	1808065WCR	9-Aug-18	Applied
X			8	N/A		SC-17-5C, GRAPPLE CONTROL	2	EA	$230	$460	1808065WCR	9-Aug-18	Applied
X			9	OD0556	0	LIFTING PLUG (BAIL), F/ 6-5/8 FH BOX CONN, CAST STEEL	2	EA	$570	$1,140	1903010REM	5-Mar-19	Applied
X			10	OD0651	0	LIFTING PLUG (BAIL), F/ 5-1/2 IF BOX CONN, CAST STEEL	2	EA	$483	$966	1903010REM	5-Mar-19	Applied
X			11	OD0654	0	LIFTING PLUG (BAIL), F/ 4-1/2 FH BOX CONN, CAST STEEL	2	EA	$450	$900	1903010REM	5-Mar-19	Applied
X			12	OD7234	0	CAP SCREW, HEX HD, 3/4"-10 UNC, 2" LG, GR 5, MC#92865A843, PACKS OF 5	3	PK	$8	$23	1903012WCR	5-Mar-19	McMaster
X			13	OD6999	0	NUT, HEX, NYLOK, 3/4-10 UNC; # 95615A270, PACS OF 10	2	PK	$7	$15	1903012WCR	5-Mar-19	McMaster
X			14	OD7283	0	COLLAR, SHAFT, 2-PC, F/ 5-1/2", ZINC PLT, MC#2380K780	4	EA	$197	$790	1903012WCR	5-Mar-19	McMaster
X			15	N/A		Steel Eyebolt with Shoulder - for Lifting Zinc-Plated, 3/4"-10 Thread Size, 2" Thread Length 3014T255	4	EA	$15	$59	1903012WCR	5-Mar-19	McMaster
X			16	N/A		Low-Carbon Steel Sheet with Decarb-Free Surface, 24" x 48" x 1/4" 1388K183	1	EA	$423	$423	1903104REM		McMaster
X			17	N/A		Low-Carbon Steel 90 Degree Angle, 3/16" Wall Thickness, 3" x 3" Outside Size, 3 FT LG, 9017K244	4	EA	$20	$80	1903104REM		McMaster
X			18	N/A		Low-Carbon Steel Square Tube, 0.120" Wall Thickness, 2" x 2" Outside Size, 3 FT LG, 6527K384	4	EA	$29	$114	1903104REM		McMaster

Figure 12 Remedial Equipment List

Retrieval

504B Overshot

The first attempt at retrieving the package from 504B involved the use of the Series 70 overshot assembly with the custom-made guide funnel. The overshot, crossover, and a 15 ft drill pipe pup were made-up and laid out horizontally on the rig floor. The split rings were installed onto the machined groove on the overshot body. The funnel guide was then slid on, the top flange pieces inserted, and the assembly bolted and tack welded. See the BHA report for the rest of the BHA components.

After tripping, lowering the camera, and positioning the vessel over 504B, three attempts were made to latch onto the platform. The assembly was stabbed over the center pipe using the guide funnel and then set all the way down onto the superstructure, each time with progressively more weight (Fig 13). And each time the overshot failed to "grab" the 6" center pipe. The drill pipe was tripped out of the hole and the overshot assembly removed.

896 Hook

Next, the hook assembly (Fig 10 again) was made-up onto the same BHA and run in hole. The plan had changed – first fishing at 896A, abandoning that structure on the sea floor, and then retrieving the 504B package and pulling back up to the ship. This would save a pipe trip, with the time saved worth more to the science party than the 896A package.

With the pipe over 896A and the camera down, the ship was maneuvered over the platform several times. The hook was run just along the top of the expanded metal that made up the floor of the platform, with the intent to hook the underside of the superstructure. Instead, a well-timed downward heave pushed the hook through the expanded metal, catching on the substructure support. The pipe was pulled up, with the platform, for 10 stands (more than the length of the overall installation – see Figure 14).

The pipe was again lowered as the ship offset, first away from the hole and then back toward the hole, trying to see if the upper packer and the lower lead-in package had been retrieved with the platform. Their presence could not be confirmed. Next, the pipe was worked up and down, trying to release the platform. The pipe was lowered further to work the platform up and down off the sea floor, and yet the platform hung on. The pipe was pulled to surface with the platform.

Once in the moon pool (Fig 15), it was confirmed the upper packer and lead-in package were not attached, with the supporting cable parted just a few meters beneath the platform. The platform was flame-cut on one side, allowing it to safely slide off the hook onto the moon pool doors.

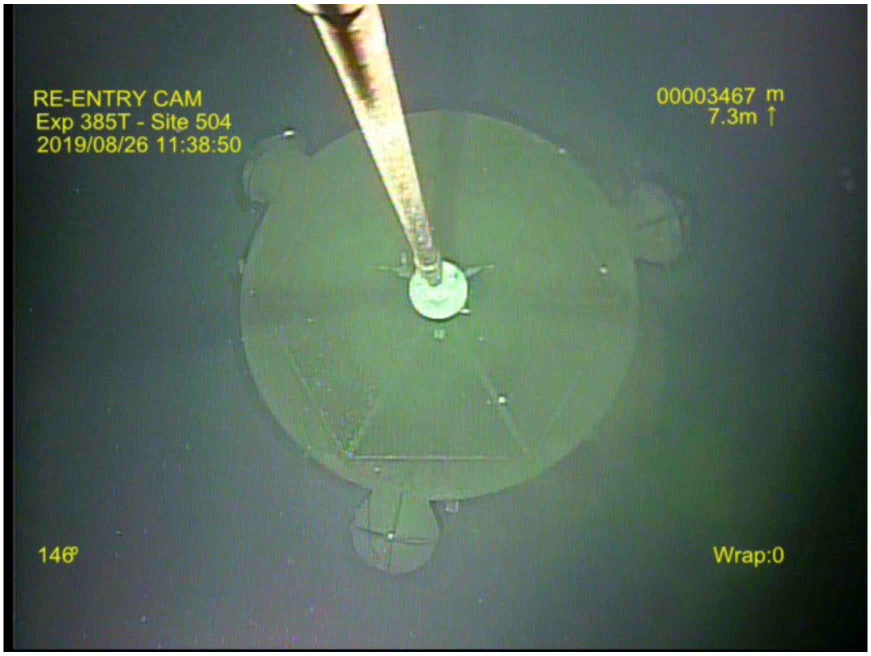


Figure 14 Overshot on 504B

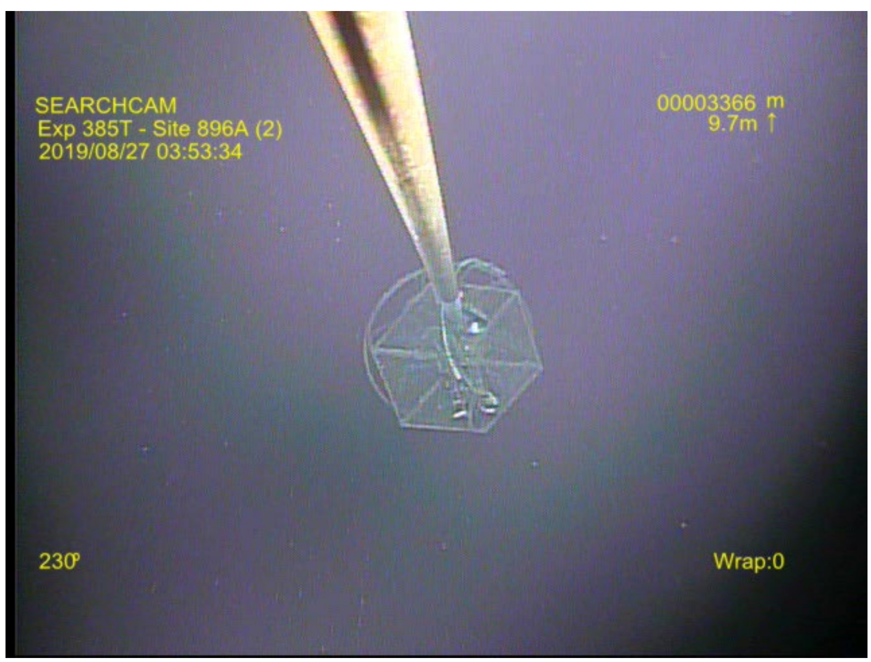


Figure 13 896A Platform on the Hook

Figure 16 896A Platform in the Moon Pool

Figure 15 896A Remains

Later, one of the original proponents removed some key components from the platform. The rest was cut up as scrap (Fig 16).

504B Hook

The hook BHA assembly was again run down and positioned over Hole 504B. A similar procedure was attempted, running just across the expanded metal floor and trying to hook the superstructure. After several attempts, the hook was stabbed down through the top of the platform. However, this time the pipe offset toward the outer edge of the platform and latched on there (see Fig 17). The pipe and platform were lifted up 12 stands, offset, the camera retrieved, and the pipe tripped up.

Back at the moon pool it was discovered the 504B platform has slipped off the hook. One of the prongs on the hook was severely bent, possibly against the side of the reentry cone, allowing the platform to slide off (Fig 18).

Reentry

A logging/sampling BHA, with a cleanout bit and no float valve, was made up and run in. Hole 504B was entered and the pipe lowered. Please refer to the Expedition Operations and Daily Reports for specifics, but the pipe encountered an obstruction at approximately 20m in the hole. Weight was applied, but the obstruction could not be dislodged.

The pipe was pulled up and out of 504B, and the ship was moved in DP mode to 896A. Reentry was completed and again an obstruction found, this time at about 47m down. Again, attempts to push the junk down with the BHA were unsuccessful. The pipe was tripped back.

Milling

The only equipment in the top of each of these holes would be the upper packers. The packer in Hole 504B was ~2.4m long and had been inflated (18 years earlier). The packer in the upper portion of 896A was shorter, 1.5m, and had never been inflated.

A milling assembly, consisting of one of the new 9-5/8" concave junk mills, two junk baskets, collars, and transition pipe (see BHA reports) was assembled and run. The assembly was lowered into 504B, the slow circulation rates recorded, and milling started. After ~10 hours, and little progress, the assembly was pulled from 504B. The ship was offset to 896A and the same operation repeated, for two hours, again with no success.

Four more milling runs were done in 504B (the primary focus). A 5^{th} run was cancelled due to issues with the reentry camera. While we retrieved (3) junk basket trips of 34-35 lb each and pushed the fish down to ~147 mbsf, we were unable to remove the obstruction. See the expedition/daily reports for specific run data.

What Went Well

- Prepare backup options for risky operations (i.e., hook as backup to overshot, mills for stubborn packers).
- Assembly of the fishing overshot, with its slide/bolt-on design, went smoothly.

Lessons Learned

- The Program should receive manufacturing, or fishing, drawings (electronic preferred) of all equipment deployed in Program boreholes.
- It should be assumed that deploying long-term monitoring equipment in a borehole may mean the end of the scientific value of that borehole when the monitoring experiment ends.

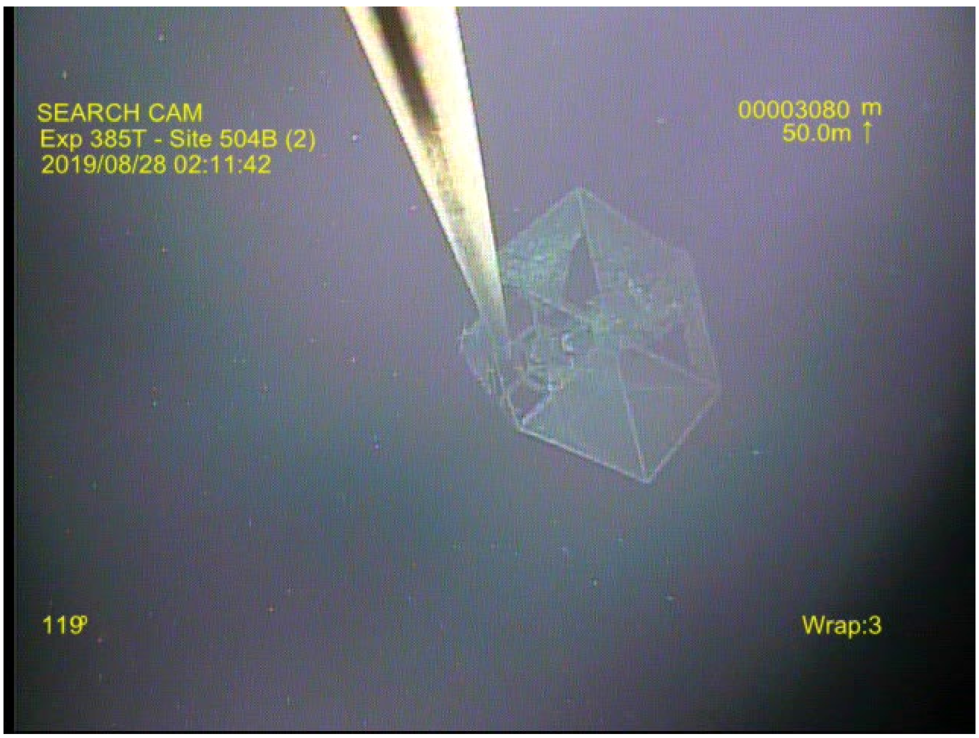


Figure 17 504B Platform on the Hook

Figure 18 Bent Hook and No 504B Platform

- **VIT Fiber Optic Rotary Joint (FORJ) Failure**

During the fifth (5^{th}) reentry operation, all VIT video feeds failed due to VIT system power failure. The nature of the failure was found at the 480VAC 3ϕ main contactor where the contactor fuses were found to be blown, indicating a short in the power sub-system. Siem electrical technicians performed a short troubleshooting exercise while the VIT system was still suspended, to determine the cause of the problem with no joy. The VIT system was then recovered to the moonpool deck, and a more extensive examination of the power system was undertaken to determine the cause of the electrical short.

- **Short Circuit Discovered in Fiber Optic Rotary Joint (FORJ)**

During the subsequent inspection of the complete VIT main power circuit, a short circuit issue was found in the power contacts within the FORJ (IODP part number OM3027, serial number 1519). The unit was replaced using the IODP spare (serial number 1518), and the power system was put back into service.

Figure 19. Alpha Slip Ring Serial Number 1519 taken out of service and returned for repair.

Total downtime for the VIT system was approximately twenty-four (24) hours, with the majority of this time spent performing the fiber optical splicing. It was mentioned from Siem electronic technicians that there had been a substantial time lapse since the initial fiber optical splicing training performed by IODP personnel and this event.

Lessons Learned

- Refresher training for all technicians tasked with performing fiber optic splicing operations should be suggested on an annual or shorter, basis, with IODP supplying training materials (i.e., optical fibers and splicing materials)

Action Item: IODP to replenish the supplies in the fiber optics splicing kit

- **Inspection of OV0841 Cable**

One of the OV0841 HD Video cables on the "Survey" camera was initially suspected to have caused the electrical short, as that camera had experienced a transient video failure in several previous reentry operations, although the failure was short lived (i.e., the feed came back spontaneously on its own) The cable and camera were removed for inspection and it apparent arc-burns were found in the camera end of the cable (See Figure XXX below). It was determined that there are no IODP spares for this part, and as such, the cable was cleaned as best as possible and returned to service.

Action Item: JVH to order one (1) spare OV0841 cable from supplier

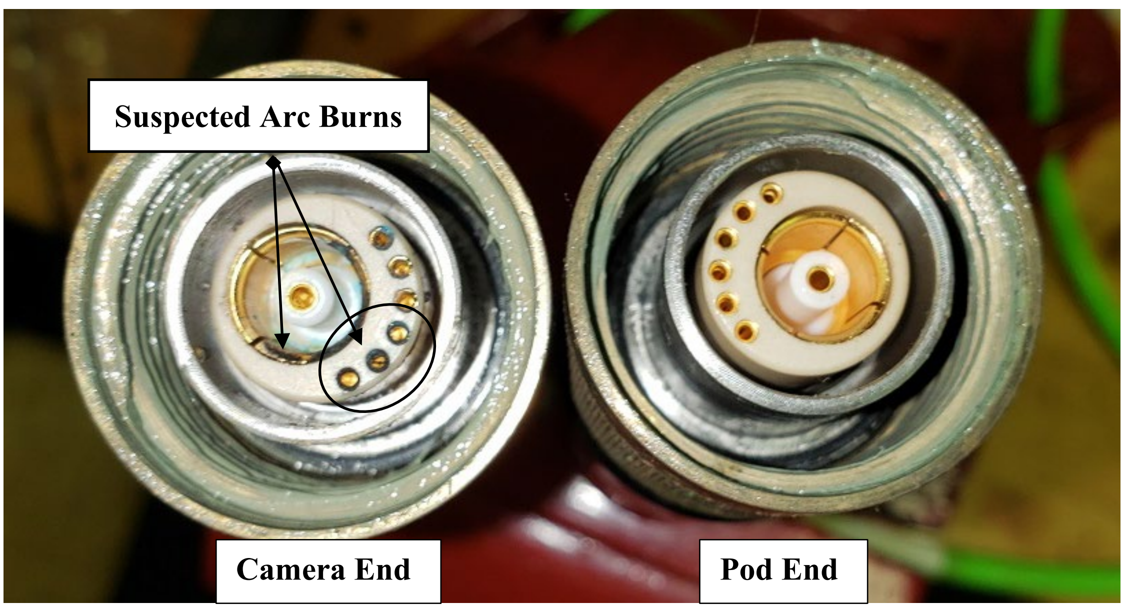


Figure 20. Suspected Arc Burning on OV0841 Cable

- **Unknown Errors in OTDR Testing Results**

Following the repair of the VIT FORJ, we utilized the Fluke Opti-Fiber OTDR to verify the fiber optical connections from the j-box located in the subsea shack and the VIT umbilical end at the VIT telemetry pod, which would also prove the connection through the new FORJ. Although the testing did indicate the correct fiber sections (i.e., 130m from the OTDR to the J-box through a jumper fiber, 27m from the J-box to the FORJ, and 7330m from the FORJ to the telemetry pod), there were unknown reflectance errors indicated on the test results. While the results do indicate the repairs and the fibers are all operational, a written procedure and training would likely improve the confidence in OTDR testing results.

Action Item: JVH to work with Mike Meiring to develop OTDR testing procedure protocol.

- **SS→DP video feed failure and repair**

Once the OTDR testing was concluded, the video feeds from subsea shack to the DP office were verified. Video feeds for two of the camera channels were shown to be in operation, however one camera feed was found to not be functional (it was not indicated which two feeds were operating, and which feed was not). Subsequent troubleshooting by the Siem electronic technician indicated a broken fiber at the subsea J-box going forward to DP. The fiber was repaired and the feed was put back into service.

- **O-Ring transient leaks in main telemetry pod connector (Seacon MINR)**

During the initial troubleshooting process following the failure of the VIT FORJ, I had a discussion with the Siem electronics technician (Eugene) where we discussed the possibility of leaking o-rings in the various end devices located on the VIT frame, and he had indicated the tendency for the main telemetry pod cable connector (MINR connector) to "roll" the sealing o-ring that provides the majority of the sealing action for that critical unit.

Action item: Mike to verify the O-rings are correct for the connector, and verify they are sealing correctly.

Tooling preparations

- **ETBS (OM6000)**

In anticipation of running the ETBS, all components were disassembled, threads wiped clean of old thread lubricant, and the memory on datalogging gauge S/N 7052/7053 was cleared using the Micro-Smart Smart Data software. All components were ready to be deployed, but due to hole conditions, the tools were never put into service. Following end of site, the tool was assembled (minus a battery pack) with hand-tight connections, and placed into storage racks for use on subsequent expeditions.
The operations manual was under rewrite during this expedition, and will be completed and released as

Figure 21. ETBS Assembly Laid Out

Action Item: JVH to verify ETBS part numbers are all entered into AMS

Action Item: JVH to complete ETBS manual update and release

- **Kuster FTS (OM7000)**

Likewise with the Kuster Flow-Through Sampler (KFTS), the tools were prepared for deployment first by removing all old thread anti-seize compound from the joints threads, running a custom-designed “bottle brush” through the inner lumen of the sample chamber, and performing a final wash using deionized water and ethanol, as the samples were to be used for microbiological study. The new “sleeve” components were test fit and new centralizers were machined on the ship from Delrin plastic, just in case the 3-D printed centralizers were crushed through hydrostatic pressure. However, it was determined through running the 3-D printed units down on one of the VIT re-entries, the 3-D printed units held up well to 3500msw, with only a small amount of water being entrained in the matrix.

Action Item: JVH to verify KFTS part numbers are all entered into AMS

Action Item: JVH to verify KFTS tool sheet is developed and released

New/Revised Tool Capabilities
During various discussions the following tooling inquiries came up and will be investigated:

- Revise APCT3 cutting shoe to provide pore water grab sample (Wheat)
- Provide the ability to stack KFTS tools for multi-water sample collections (Orcutt)
- Modify the KFTS “sleeve” to allow for it to poke out through RCB/XCB bit (internal)
- Possible borehole camera integrated into wireline (Wheat)

Installed Fluke LinkWare™ software on Engineering and DHML desktop systems

Requested new renewal codes for RigWatch software