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July 20, 2011
Cruise 5: R.O.S.C.o
Day 1: June 20th, 2011
8:00 AM Team members arrived on campus
9:00 AM Van and truck with trailer departed from campus to Riverside Marina in Ft. Pierce, FL
10:05 AM Arrived at Riverside Marina
10:20 AM Finished unloading vehicles. Waited on Thunderforce
12:45 PM Crew loaded the Thunderforce including the crawler and equipment
12:50 PM Loaded large mooring anchors for ship
1:15 PM Ate lunch
1:40 Departed the harbor
2:55 Left mouth of Ft. Pierce inlet
3:25 Arrived at location for ADCP retrieval
3:42 Dr. Wood and Chloe dive

Pre-Dive info: Post-Dive info:
Waves: 1-2 ft Chloe: 2700 psi
Light Wind: 5-10 knots Wood: 2600 psi
Chloe: 3100 psi Time out: 3:53 PM
Wood: 3200 psi Time in: 3:42 PM

Summary: Recovered ADCP used in previous cruise
6:15 PM Dinner
8:00 PM Set up Noodle Floats on Tether for buoyancy
7:00 PM-- Night Fishing—Caught ~15 sharks and 1 croaker
11:00 PM Picked up anchor and moved ship to different location
(closer to shore) after we were only catching sharks
Night light attracted plenty of bait and smaller fish

Day 2: June 21st, 2011
7:15 AM Wake up
7:30 Breakfast
8:15 Picked up anchors—Moving to New location to find something to see underwater
8:33 Dropped Anchor
8:30-8:45 Set up camera on crawler
9:00 Set up dive gear—Chloe and Dr. Wood
9:00 Trying to figure out power hook-ups for crawler
Discussed dive signals to communicate through camera: mainly pointing with fingers
11:15 Power supply: 220V Source didn’t work while control box is hooked up to circuit breaker
11:20 Switched wires to 110V
11:32 110V plugged into wall- light in control box turned on
11:47 Crawler finally runs on 110V wired into wall outlets
12:00 PM Deployed Crawler
Depth= 25 ft
GPS Coord.: Lat. 27 29.599 N
Lon. 80 17.181 W
12:05

Chloe and Dr. Wood dive

Pre-dive  
Post-dive  
Depth: 25 ft  
Time out: 12:35  
Visibility: Poor  
Chloe: 1900 psi  
Chloe: 2700 psi  
Wood: 1400 psi  
Dr. Wood: 2600 psi  
Waves: 1-2 ft  

Summary: Crawler dropped on rocky terrain so unable to move on angle  
Grabber stuck in hole and back end stuck in the air

Test 1:

Crawler was deployed at high noon on June 21, 2011 just north of Ft. Pierce Inlet in 25 ft of water. The water visibility was poor, less than 2 ft of visibility, which made it difficult to observe the crawler during testing. Divers entered the water at 12:05. Unfortunately, due to a rocky terrain, the crawler was unable to move. This launch was unsuccessful; we retrieved the crawler 35 min after deployment and moved to better location with better visibility.

Post Test 1:

A leak in the camera housing was noticed. Unfortunately we lost the live feed camera due to this leak. The camera was taken apart for inspection where much corrosion was found. The anchors were raised and we proceeded to move to a new location south of the inlet for clearer water. After lunch, we prepared the camera housing once again with greased seals, but this time without the camera to test for leaks.

12:45  
Discovered leak in instrument housing and camera got wet

12:50  
Reviewed Recorded Video

1:05  
Lunch

1:50  
Moved to Location of Instrumentation pick-up site

2:15 PM  
Re-sealed instrument housing to test for leaks

Used chapstick because didn’t have silicone sealant or epoxy

Put 5200 Sealant on wiring/epoxy connection box

2:35  
Crawler Deployed

GPS Coord.: Lat. 27 26.54 N  
Lon. 80 13.607 W  

Pre-dive  
Post-dive  
Visibility: Very clear  
Wood: 1700 psi  
Dr. Wood: 3200 psi  
Chloe: 1900 psi  
Chloe: 3200 psi  

Time in: 2:43 PM  
Time out: 3:20

Summary: Grabber arm works/runs but control box/main power continue to short out/blow the breaker so we’re unable to drive the crawler forward/back. May be a problem with tether and epoxy junction box we made in which exposed wires or leakage may be causing the short. Water was clear enough and visibility was good enough that Dr. Wood, Chloe, and the crawler could all be seen from the boat deck.

Test 2:

The 2nd deployment was done after lunch around 2:35 pm. This time, we deployed south of the Ft. Pierce Inlet (GPS coordinated: Lat. 27 26.54 N and Lon. 80 13.607 W). Water was practically crystal clear in the 20 ft of water. The crawler could be seen on the sandy bottom from the vessel. The divers entered the water at 2:43 pm. This deployment was partially successful. The grabber worked perfectly (without weight) which was powered by 2 12V batteries in series for 24V of power. On the other hand, the crawler, which was hooked up the pod at 110V, shorted
out as soon as power was fed through the tether due to a leak in the wire at one of our connection points. By 3:10, the crawler was re-hooked for retrieval. The diver exited the water prior to lifting of the crawler.

Post Test 2:
That night we re-tested the crawler on deck to make sure the motors were not damaged during the shortages. Fortunately the crawler moved forward and backwards perfectly. The grabber, hooked up to the batteries, also continues to work. We attempted to fix the leak in the tether with silicon that was provided to us by the crew of Thunderforce. During the Test 2 deployment, the leak in the camera housing was found to come from the front clear cap. It is assumed that the housing, which was made by Team SPROVer in 2004/2005, was meant to be waterproofed for surface waters since the SPROVer was simply a beach profiler. Further testing with the camera housing will be done to ensure depth capabilities.

2:55 Zach and Justin snorkeling to take pictures
3:10 PM Hooked crawler and lifted back onboard
3:20 PM All divers out of water—picked up anchors to move to deploy AUV
3:55 Arrived at AUV drop-off site
4:00 Pre-deployment tests done by Cheryl and Alex
  GPS Coord.: Lat.: 27 29.914 N Lon.: 80 14.637 W
  Depth= 42 feet
4:02 Wiggle Test
4:33 1st Deployment- Forgot dropweight
4:40 2nd Deployment
5:00 Several mission attempts fail
5:30 AUV released-communication working
5:40 AUV diving to begin mission
5:45 Vehicle on course
6:30 Mission complete
6:40 Vehicle retrieved
6:45 Dinner
7:20 Fishing
8:15 Cleaned up AUV and tested crawler camera after letting it dry

Night Shifts – to make sure boat doesn’t shift
  11:00 PM- Virginia and Travis
  1:30 AM- Zach and Justin
  4:00 AM- Chloe
  6:30 AM

Pre-Test 3:
On June 22, 2011, from 10:28 am to 11:20 am, while the AUV Bluefin was running its mission, we tested our new silicon housing on the tether prepared the night before in a bucket of water. This test showed that the leak was not fixed, in that one of our team mates holding the tether was shocked. After the AUV was back on board and during a brief lunch break, we made our way back to the docks to make a quick trip to West Marine for some 5 minute epoxy. The epoxy was applied to the wire connection on the trip back to our Test 2 site of deployment. We also tested this seal in a bucket of water which was successful. By 3:00 pm the crawler was ready for its 3rd test.
Day 3: June 22nd, 2011

7:00 AM    Wake up/Breakfast
8:00 – 9:00 Set up AUV- prepare for second deployment
8:25      Tested Motors/Connection again and Failed
          Drawing too large of a power supply which causes the circuit to fail—
          tripped the circuit
8:30      Moved crawler to make room for AUV deployment on back deck
8:40 AM   Re-tested power and shorted out again
8:43      Bucket test—Chloe got shocked which means voltage is leaking from
          wires. There is a leak in our seal so water is getting in—Need to get
          heavy duty epoxy.
9:10      Vehicle in the water
9:15      Released vehicle-mission status failed- ground faults on battery-turned
          CTD off-
          -OBS failed- Behavior system failed
9:20      Restart vehicle—mission status failed—status stopped
9:36      Resending mission—several attempts fail
9:50      Brought vehicle back to ship
10:05     Relaunched AUV and sent dummy mission—completed, re-sent original
          mission—failed
10:15     Delayed due to oncoming ship in vehicle path
10:16     Changed course of vehicle to try to eliminate error in mission (zigzag
          pattern instead of rectangular)
10:24     Mission sent- vehicle driving—stopped due to communication problems
10:28     Freedom mission started, 1:38 min mission, ETA 12:06

10:43    Swimming/Fishing/Relaxing while Bluefin AUV is running its mission
11:20    AUV completed mission
11:27    Recovered Vehicle
11:36    Vehicle onboard—clean up
          Went to Bridge Dock to get resin
12:00    Lunch
12:30    Moved to museum dock to get assistance with the crawler
1:00     Applied fast drying epoxy to exposed wires to waterproof
1:30     Moved south to crawler deployment site
2:00     Finished Filling Red Plastic Cups with Resin and hardener to create new
          electrical junction box
2:10     Re-tested motors after attaching new junction box to connector and both

Figure 1: Bluefin AUV Mission Path
worked on deck
2:20 Re-assembled Instrument Housing with Bearing Grease on O-ring to aid in sealing
Need longer thru-bolts with nuts and lock washers instead of metal threads inside plastic housing to provide appropriate seal.
2:30 Took one of 3 plastic cups off connection and found the epoxy had not completely hardened. Then added a layer of epoxy and hardener to outside to try to seal cups where they melted through
2:45 Prepared for crawler deployment
2:55 Dr. Wood and Chloe dive

Pre-dive Post-dive
Wood: 1700 psi Wood: 400 psi
Chloe: 1900 psi Chloe: 400 psi
Time in: 2:55 PM Time out: 3:22 PM
Waves: 1-2 ft
Visibility: Very Clear
Lat. 27 26.527 N Lon. 80 13.531 W
Depth = 25 ft
Summary: Recorded video of crawler maneuvering underwater
3:00 Deployed vehicle (crawler)
3:05 Wiring issues
3:10 Crawler moves fwd for first time underwater—moves fwd/bkwd and up/down
3:15 Justin jumps in as snorkeler/surface swimmer to get a surface view and help relay crawler position
Threw a 35-lb. anchor in water for crawler to lift and move around
3:22 Divers surface—change tanks

Pre-dive: Post-dive:
Wood: 3200 psi Wood: 750 psi
Chloe: 3200 psi Chloe: 1400 psi
Time in: 3:35 PM Time out: Chloe: 4:20 PM, Wood: 4:25 PM
Summary: Attempt to lift anchor
Treads tend to jam up due to bottom debris

Test 3:
This time around, divers entered the water first at 2:55 pm in order to capture footage of the deployment from the water. Divers were at a safe distance of at least 50 ft from the vessel. The crawler was then deployed at 3:00 pm. Finally, the crawler made its first crawl. For the first test run underwater, we had the crawler move forward 75ft with the grabber down, and then move backwards the same distance. Because we no longer had a live feed camera, the divers gave pre-determined signals to a snorkeler on the surface who shouted out the command to the driver of the crawler. Underwater footage was recorded during the 25 minutes of the dive. At 3:22 pm, divers switched to new tanks and re-entered the water for another 45-50 minutes for further testing of the crawler. A 35 lbs anchor was dropped into the water for an initial grabber lifting test. Unfortunately, the crawler was unable to scoop up the anchor due to miscommunication between the divers and the surface snorkeler. Instead, the divers placed the anchor on the grabber to proceed with testing. The crawler moved forward and made a slight turn to the left with an attempt to turn the crawler around. Somehow this created a slight shift of the tracks on the guide wheels causing the cogs to bind up on the tracks when moving backwards. This made it difficult to drive the crawler back to the boat which complicated the retrieval process. Power was shut off; divers exited the water to switch tanks once again and to take a 10 min surface interval. The crane hook was lowered into the water where both divers
guided it to the crawler to hook it up for lifting. At 4:55 pm, the crawler was back on board along with the two divers.

3:40 Zach is on surface of water relaying direction to Travis at control box
3:45 Chloe surfaces to explain current crawler position and plan—she dives again
4:22 Chloe out of water—back in to snorkel
4:28 Everyone out of water
4:44 Chloe and Dr. Wood Retrieve crawler

<table>
<thead>
<tr>
<th>Pre-dive:</th>
<th>Post-dive:</th>
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<tbody>
<tr>
<td>Wood: 3200 psi</td>
<td>Wood: 2600 psi</td>
</tr>
<tr>
<td>Chloe: 3200 psi</td>
<td>Chloe: 3000 psi</td>
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<tr>
<td>Time in: 4:47 PM</td>
<td>Time out: 4:55 PM</td>
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Summary: Divers hooked A-frame hook onto crawler to bring it on board

Post Test 3:
Crawler was thoroughly rinsed off with fresh water, tether re-spooled and control boxes unplugged from the pod. Thunderforce made its way back to the docks where we waited for high tide. At 2:00 am on June 23, 2011 we sailed to port to unload the crawler and to load on the mini wing wave for the next group. As soon as that was finished, we made our way back to the docks and waited for the next group to arrive by car around 8:00 am.

4:55 Crawler retrieved
5:10 Thunderforce heads back to Museum dock to wait for high tide
5:30 PM Dinner

Day 4: June 23rd, 2011
2:00 AM Unload crawler and load wing wave
8:00 AM Unload and leave Ft. Pierce

Additional Notes:
Dive Signals: Hands Up= Stop
Point with Fingers for Direction
Wood spinning fingers upwards means bring crane up

Tests:
Forward/Reverse
Grabber Up/Down
Camera
Dive Signals
 Turns Left/Right

Camera:
On slight angle inside of housing during first test—needs to be adjusted from inside
Need to aim camera angle downwards to be able to see tongs and path directly in front

Notes from June 21st:
Problem with epoxy connection—wires are wet inside electrical tape
Camera housing leak in front (clear acrylic) cover
Longer bolts next time to add nuts and lock washers to make seal tighter. Metal inserts in plastic housing may not provide a good enough seal