



CO-OPS Engineering Bulletin 19-001

Engineering Change: Use of Polycarbonate Tube for ATON Application

Systems Affected: All ATON Systems

Originating Team: Atlantic Operations Branch and Ocean Systems Test and Evaluation Program

MSCS Approval Date: N/A

Background: The Physical Oceanographic Real-Time Systems (PORTS) Coast Guard Aid to Navigation (ATON) buoy mounted current meter standard configuration utilizes a custom made fiberglass reinforced plastic (FRP) tube to house and help protect the current meter. CO-OPS has found that the FRP tubes last, on average, two years in an operational environment (barring vessel strike or flotsam/jetsam/ice damage). CO-OPS employs two standard operational lengths of FRP tubes – a 10 ft tube installed on 6ft and 8ft diameter ATON buoys, and a 12 ft tube installed on the 9 ft diameter buoys. The 10 ft tubes cost approximately \$2,400 each. During the development of the ATON system, polyvinyl chloride (PVC) tubes were tested and found to have unacceptable structural rigidity in even the lowest current situations, where a strumming effect impacted sensor data. Polycarbonate (PC) tubes were also identified as a possible alternative to FRP, but the availability and unit cost at that time were also deemed unacceptable.

The availability of extruded polycarbonate (PC) tubing has changed significantly, resulting in a unit cost price drop that today makes the PC tubing a more suitable and cost effective replacement for the FRP mounting tube in all environments. Polycarbonate benefits and features include high tensile strength over a large temperature range, high impact strength, high temperature resistance, flame-resistant, easy to drill, cut, or saw, easy to join with solvents or adhesives, and extremely high weather and UV resistance. Lengths of PC tubing other than 8 ft must be custom ordered; an order of twenty 10 ft polycarbonate tubes for use on ATON and NCOP applications will, at the present, cost approximately \$2,000 – less than a single FRP tube.

Engineering Testing and Evaluation: AOB (Roggenstein) and OSTEP collaborated on conducting a test of the PC tubing at an ATON located nearby the Chesapeake Field Office. Roggenstein coordinated the fabrication of a 10ft PC tube with 3.48 in O.D. / 2.80 in I.D. This allowed the use of standard ATON mounting hardware and equipment and 1 MHz Aquadopp sensor set up using default PORTS settings for an operational ATON sensor set to internally record data as is standard on NCOP deployments, allowing for up to a three month deployment. The ATON package with PC tube was first deployed 06/07/2016 on Buoy HC in the lower Chesapeake. The sensor was recovered 08/17/2016 and the data provided to OSTEP for review. The PC test system data was compared to nearby operational data and historic data from buoy HC, with a focus on determining if the PC tube was rigid enough to be a suitable replacement for the fiberglass tubes. Data analysis revealed no significant difference between data from the PC tube system and previously recorded data from FRP systems. As such, OSTEP recommended proceeding with the use of PC tubes for additional test deployments and analysis at a location with higher current speeds.

AOB identified the Jacksonville PORTS as a good follow-on test location. Jacksonville PORTS consistently sees some of the highest current speeds for ATON mounted sensors. Roggenstein reached out to JAX PORTS to discuss conducting a test of the PC tube on buoy 22 or 26 near their operational system on buoy 24. During these discussions, the FRP tube on the JAX PORTS LB 34 buoy was damaged, and the partner requested they be allowed to move the test to the operational buoy with the understanding that if the higher current speed showed degraded data due to PC tube flexing or strumming, the data would be flagged and the unit would require immediate replacement. The partner felt the risk acceptable and deployed the PC tube operationally on buoy LB 34 on 06/13/2017. The sensor was deployed for 6 months and showed no signs of data degradation during the operational period. Furthermore, OSTEP's post-deployment data analysis found no significant detrimental impact on data quality from the use of the PC tube. However, the PC tube did in fact fail near the end of the 6-month deployment. The failure occurred at the joint where two pieces of tube used to make up the 10 ft length were glued. This can be avoided by procuring and using only full-length PC tubes – eliminating glued joints.

Determination and Action: Polycarbonate tubes are an acceptable alternative to FRP tubes and may be used on 6 ft and 8 ft diameter ATON buoys. Polycarbonate tubes have demonstrated to perform comparable to that of the fiberglass tubes, with no loss of data quality. This Engineering Bulletin documents and approves the operational use of PC tubes for ATON mounted sensors as of March 15, 2019. FOD/AOB will coordinate the purchase of PC tubes for use with ATON systems.