Meeting at JDR to discuss MTM2 residual strength results and options.
June 22, 2005 - Rotterdam
Present: A. Hamilton (MBARI), Phil Roscoe (JDR)

Agenda:
- Discuss residual strength results from MTM2 and discuss possible changes to cable design to mitigate problems.
- Discuss options for clamping floatation section to cable.
- Discuss impact of MBARI slipping the "Go/No-Go' date on the production schedule

Notes:
Residual Strength Issues: We discussed at length the residual strength results from the MTM2 deployment, the possible causes of the three weakened locations, and possible mitigation approaches for each. Specifically:
- There are probably two separate mechanisms affecting the weakened cable above the floated section, kink-band formation due to compression of the fibers, or, abrasion of one fiber over the next due to bending and tension cycling. If it is the former, limiting the bending is the only option. If it is abrasion related, data indicates that a little more vectran can go a long way in extending the lifetime. Essentially, Phil R. has done tests that indicate the number of cycles to failure increases as 1/sqrt(loadperfiber). So, decreasing the average load per fiber a little can extend the lifetime significantly. A quick look at Phil's test data indicate that a 20% increase in vectran may correspond to a 50% increase in life, if the failure mode is abrasion. For this reason, it is critical we dissect the damaged sections of the cable and look for signs of abrasion, i.e. vectran powder in the cable lay-up.
- More practically, the fact that there were no weakened sections of cable which were stiffened by the fish-bite protection seems significant. Extending the fish-bite throughout the entire cable is an efficient way to gain the stiffness in Phil's opinion. It is not uncommon to employ this type of double jacket approach for cables that require high ruggedness. There is a weight penalty for doing this of 145kg/km. This is at the upper end of what may be acceptable for the 3000m deployment with the buoy we've been employing. If further analysis indicates this weight penalty is intolerable, it's possible to use a tightly would high-modulus synthetic in place of the fish bite to gain stiffness at a smaller weight. The wires currently used are 304SS, and the added fish-bite protection adds $12/meter to the cable cost. Phil is going to re-quote this in light of the increased length, and suggests the possibility of going to galvanized wire for a cost savings here.

Floatation Attachment Issues:
- Phil continues to suggest the use of a polyethelyne overmould onto the cable jacket. A 100mm long piece that increases the cable diameter by 10mm appears to be strong enough to easily hold a 2000lb axial load. The suggestion here is to fashion a simple Delrin (or similar) collar to capture this bump, this scheme should still provide adequate mechanical interference after cable compression at depth. Phil also questions the compression tests we've done because we allowed the cable to go into axial compression

during the test. My main concern with this simple scheme is that we're relying completely on the strength of the polyethylene jacket, the absence of a compressive clamp limits the load transference into the inner layers of the cable. One refinement of this idea is a tapered section, so axial load translates to compressive load, helping with the load transference problem, and potentially reducing the rattle of the collar on the cable which is inevitable otherwise. We also discussed the possibility of creating a mechanical interference by removing the outer jacket and exposing the fish-bite braid. A clamp would then clamp down against the fish-bite itself, with a mechanical interference on the remaining outer jacket. Although cheap and simple, exposing this braid to seawater is a little risky, a low oxygen environment inside the jacket could create significant corrosion problems. Phil is going to finish the quoting process he started with his sub-contractor to help determine if these ideas are viable. We agreed sufficient testing is needed, and that using a piece of the deployed fish-bite protected cable is appropriate before attempting this on the real cable.

Schedule
The original production estimate of six weeks was predicated on factory load levels at that time. Changing loads and the approach of summer holidays changes the ship date estimate to 8 weeks, -1/+2 weeks, from the date we give the go ahead to the ship date. If we change to an all fish-bite cable, the dry weight goes up significantly, making air shipping even less attractive (and potentially affecting the winch loading operation).

Other
Shipping drum, I requested the shipping drum on future orders be battened shut and agreed to provide dimensions for shaft diameter to fit our spoolers.

Actions:
- Andy to dissect weakened pieces of MTM2 cable looking for signs of abrasive failure.
- Andy to ship a 10m piece of fish-bite protected cable to JDR for Phil to do a test over-mould on.
- Phil to investigate total cost of running the SS fish braid through the whole cable, cost reduction measures such as using galvanized steel wire may also be investigated.
- Phil to provide flooded wet weight of this cable in addition to the currently specified wet weight which assumes a dry interior.
- Phil to provide refined quote for polyethylene overmould for clamp, including test piece.
- Andy to provide shipping drum dimensions to JDR.