APPENDIX XVIII

To: DESSC
From: J. G. Bellingham and D. L. Orange
Re: Increasing Bottom Time of ALVIN

Date: June 26, 1995

At the DESSC meeting in Woods Hole June 1, 1995, we discussed the potential increases in ALVIN bottom time attainable through improved hydrodynamics or changes in available power. We felt that it would be instructive to assess these two approaches via the following analysis:

Start with the following equation for power consumption: **Eo =2(P/n)(D/ro)+P to**

- P = power consumed on bottom
- P/n = power consumed on descent/ascent (i.e. n is reduction in power used relative to power consumed on bottom)
- Eo = total energy available (present ALVIN configuration)
- ro = rate of descent/ascent (present ALVIN configuration)
- to = bottom time (present ALVIN configuration)

Write the power consumption for a modified ALVIN as: **E1 = 2(P/n)(D/r1)+P t1 = f Eo**

- f = increase in battery capacity
- r1 = modified rate of descent/ascent
- t1 = bottom time of changed ALVIN configuration

Solving for tl we get: **t1=(2Df/nro) - (2D/nr1)+ fto**

Consider two cases, both with D = 2800 m and to = 240 minutes.

(1) ro = rl = 25 m/s, f = 1.5 (i.e. descent/ascent rate stays the same, battery capacity increased 50%).

(2) rl = 2ro = 50 m/s, f = 1.0 (i.e. descent/ascent rate doubled, no change in batteries).

Discussion:

If the power used on ascent and descent is minor compared to the power used on the bottom, n becomes a large number. In this case, any increase in ascent/descent rate has a negligible effect on bottom time. Thus a 50% increase in battery capacity increases the bottom time -50% (in the limit). At the DESSC meeting Dudley commented that the power consumed during ascent/descent was very low compared to power usage on the bottom. Therefore, any increase in battery power directly increases the bottom - science - time, whereas increasing the ascent/descent rate has less of an effect on bottom time. Increased hydrodynamics could benefit the deepest dives, which may be currently limited by the length of the operational day. We feel that the largest benefit to science, though, would come from increasing the available battery power.

We sympathize with the engineering challenge presented by increasing the available battery power, and with the up-front cost inherent to a change in battery technology. However, when viewed in light of the high day rate attached to deep submergence science, the significant increase in bottom time achievable with increase battery power is worth striving for.

This appendix contains two curves based upon the formulas above.

Copies of this schedule are available from the UNOLS Office at:

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