Replacement Human Operated Vehicle (RHOV)

UNOLS Council Meeting

October 11, 2007

RHOV Construction Approach

Two Major Components Proceeding in Parallel:

- **Design, Fabrication and Testing of the Personnel Sphere**
  Southwest Research Institute (SwRI) is prime contractor

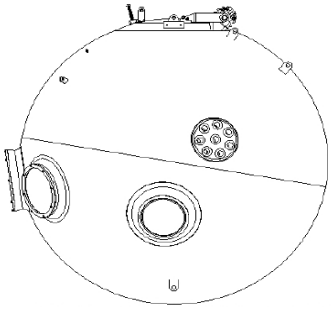
- **Design, Fabrication and Testing of the New Vehicle**
  (incl. integration with personnel sphere)
  Lockheed-Martin (Riviera Beach) is prime contractor

Other subcontracts address Buoyancy Foam and Batteries for RHOV

Monthly telecons with RHOV Oversight Committee (RHOC) to review project status

Status of Personnel Sphere

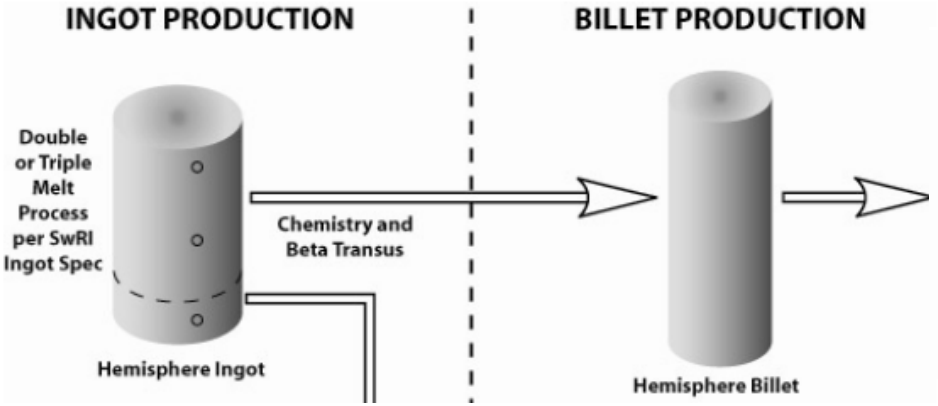
- **Dec. 12-13, 2006: successful completion of Preliminary Design Review (PDR)**
- **Feb. 7, 2006: RHOC and NSF approved Phase 1 => Phase 2 (begin personnel sphere detailed design & fabrication)**
- **Titanium 6Al-4V ELI testing completed; three titanium ingots delivered.**
- **Subcontracts with Ladish Forge (the forger); STADCO (machining and welding); Bodycoat Inc. (heat treatment and stress relief), and ABS America (certification) are in place.**
- **Sept. 5-6, 2007: Detailed Design Review (DDR) for RHOV personnel sphere successfully completed.**
- **ABS accepted hull design; concurrence by NAVSEA**
- **Ladish is fabricating tooling and homogenizing the ingots; forging begins 1st week of Nov.**

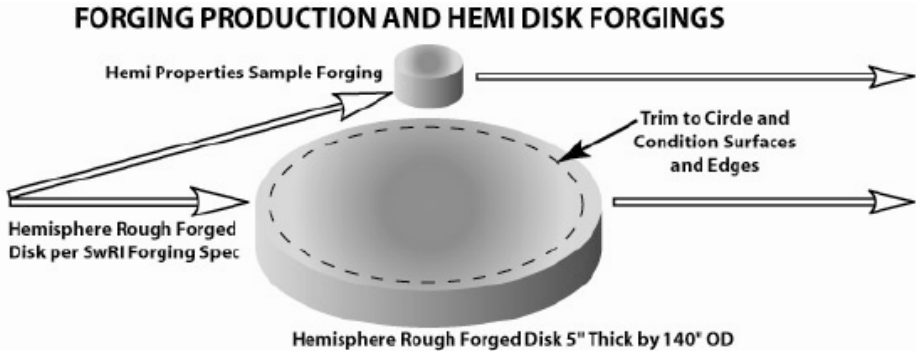


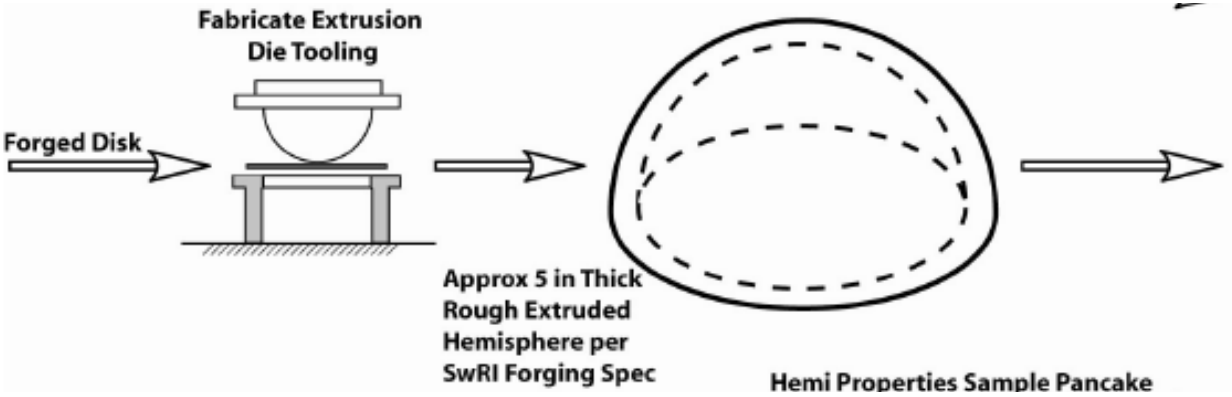
Status of Personnel Sphere

Delivery of Titanium ingots

Status of Personnel Sphere

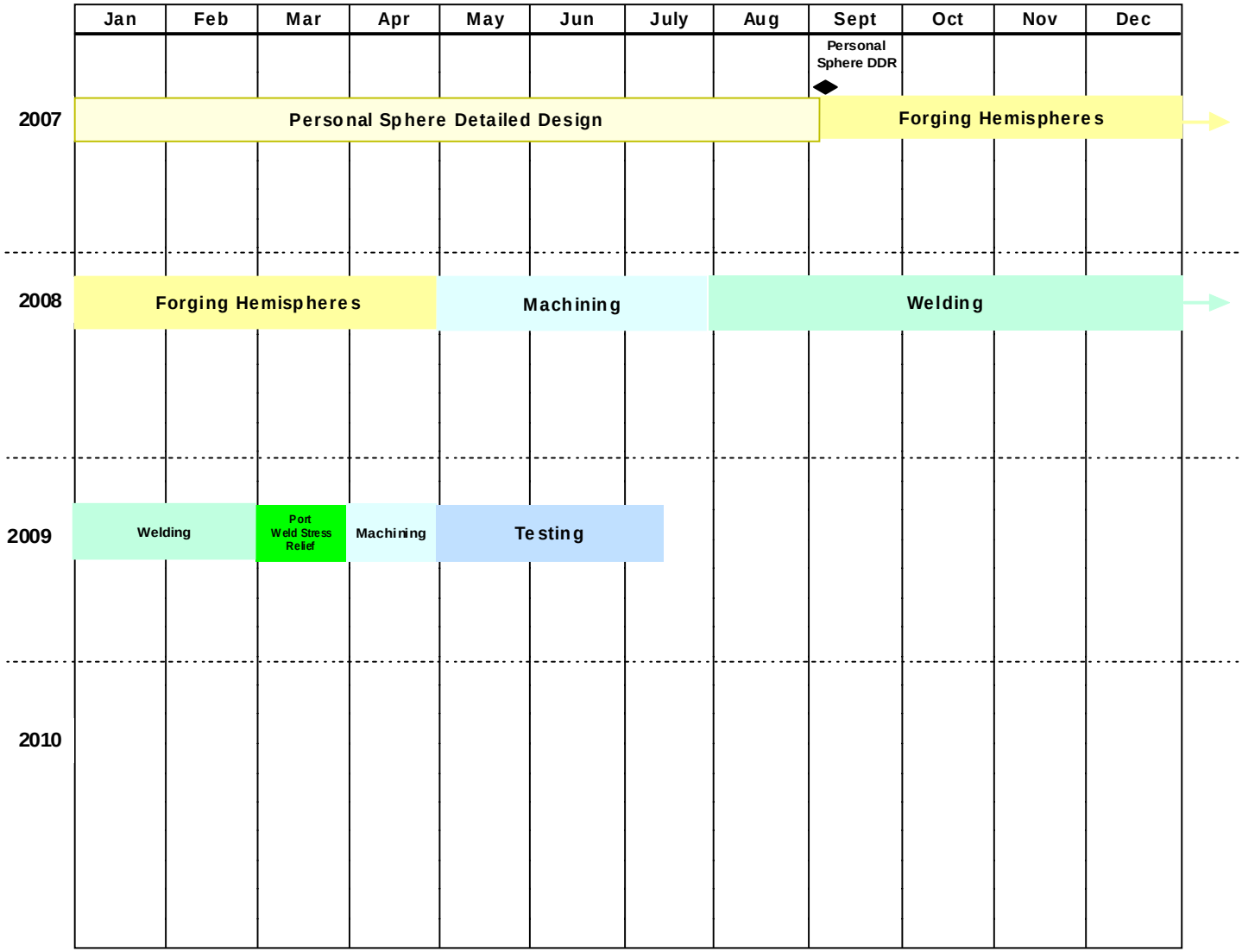






As of 4 October 2007

Schedule for the Replacement HOV



Status of Vehicle Design and Construction

- **Contract with Lockheed Martin (Riviera Beach) was signed on June 8, 2007. Only CLIN1 (preliminary vehicle design and detailed cost estimate) was executed. CLIN2 (detailed design, fabrication and testing) will be executed following PDR and detailed costing provided cost is within budget.**
- **July 24-25, 2007: RHOV Requirements Review at LM-RB**
- **WHOI-LM-RB Working Groups established for:**
  - **Variable ballast and trim**
  - **Battery selection**
  - **Command and control systems**
  - **Science basket**
- **Pre-Preliminary Design Review (PDR) scheduled for Oct. 15-16, 2007 in Riviera Beach (*Alvin* pilots)**
- **Formal PDR scheduled for Nov. 13-15, 2007 in Riviera Beach**
- **RHOC meeting to review results of PDR and detailed cost estimates planned for Feb. 2008.**

Status of Vehicle Design and Construction

Buoyancy Foam

- WHOI has been working with two manufacturers to develop syntactic foam rated for a 6500m with a density of <34 lb/cu. ft. One manufacturer has produced ~32.5 lb/cu. ft. foam; both manufacturers are pursuing a lighter (~30 lb/cu. ft.) foam. No longer considered a significant risk to project.

Batteries

- Phoenix International doing Lithium battery evaluation. Two different cell systems selected and built for testing at different depths, temperatures and charge/discharge profiles. A 250 volt battery has been cycled under the test protocol without problems. Energy source tradeoff studies still in progress.

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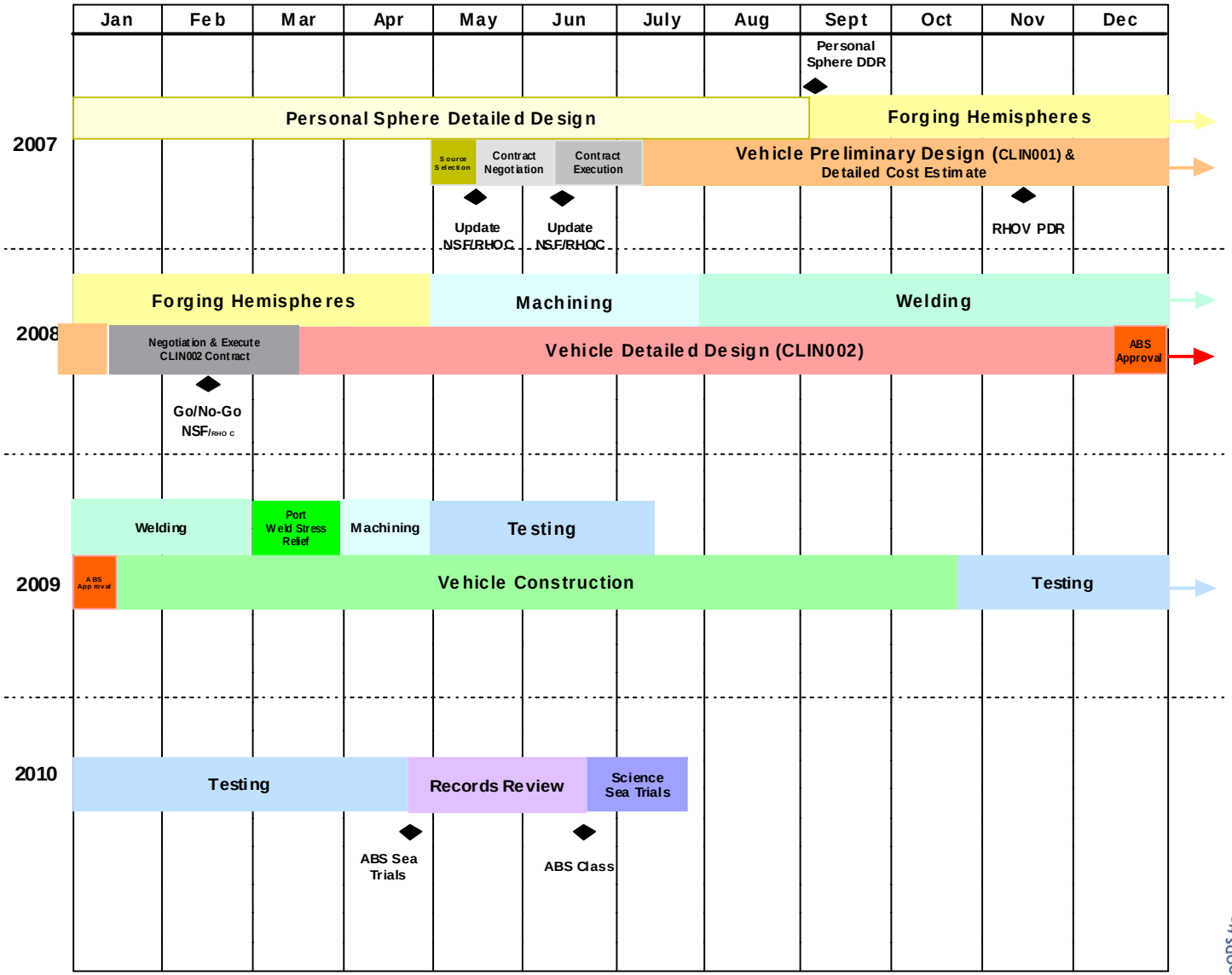
Schedule for the Replacement HOV

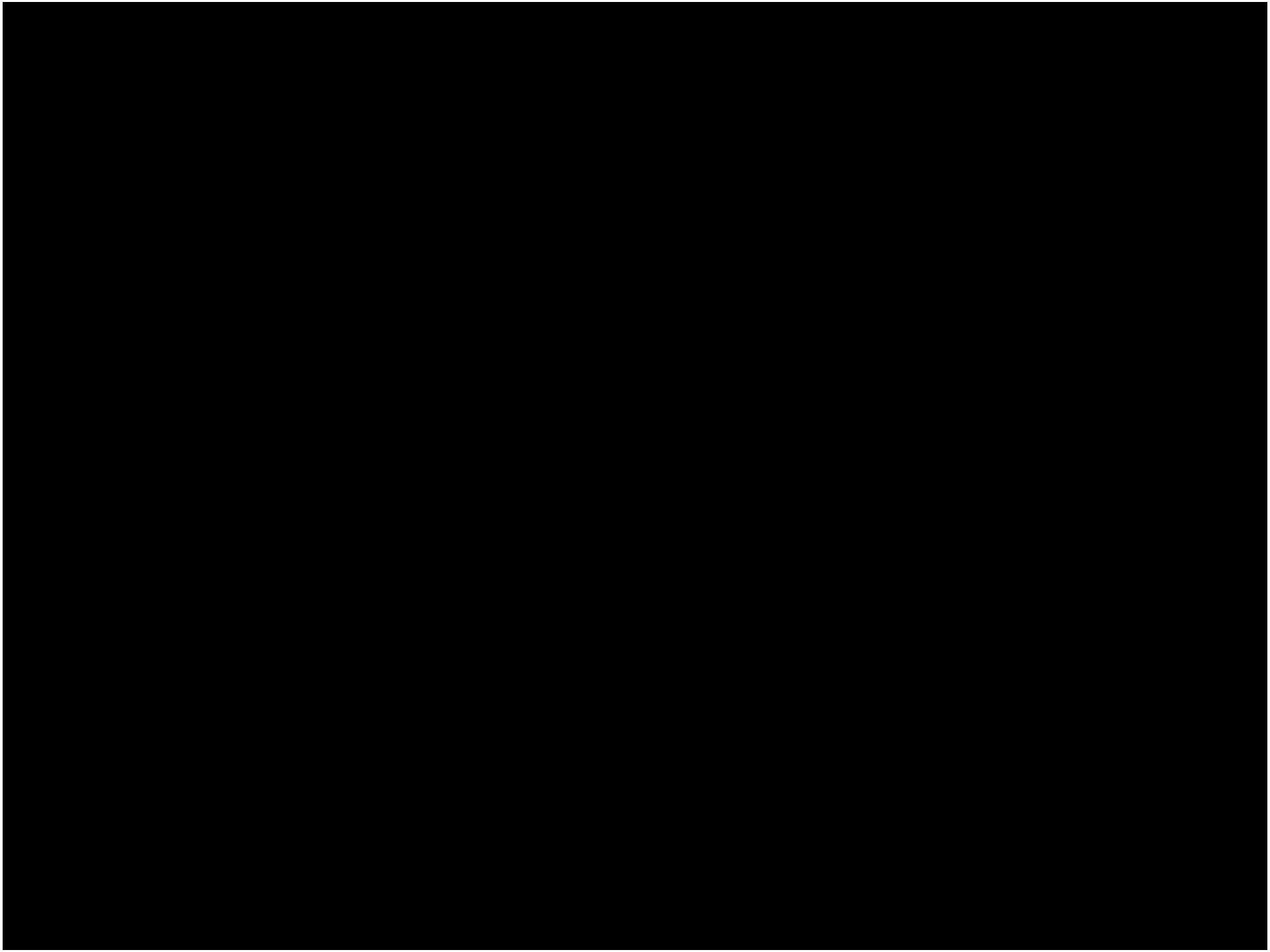


RHOV Construction Approach

Personnel Changes in RHOV Project

- **Anthony Tarantino (a former Alvin pilot) hired as Assistant Project Manager for RHOV**

- **Robert Brown resigned as Project Manager for RHOV effective Oct. 1, 2007. Brown to be replaced by Thomas Lewis, currently a Deputy Program Manager for the Naval Sea Systems Command. Lewis has over 20 years of experience managing large deep submergence design and construction projects for the Navy.**

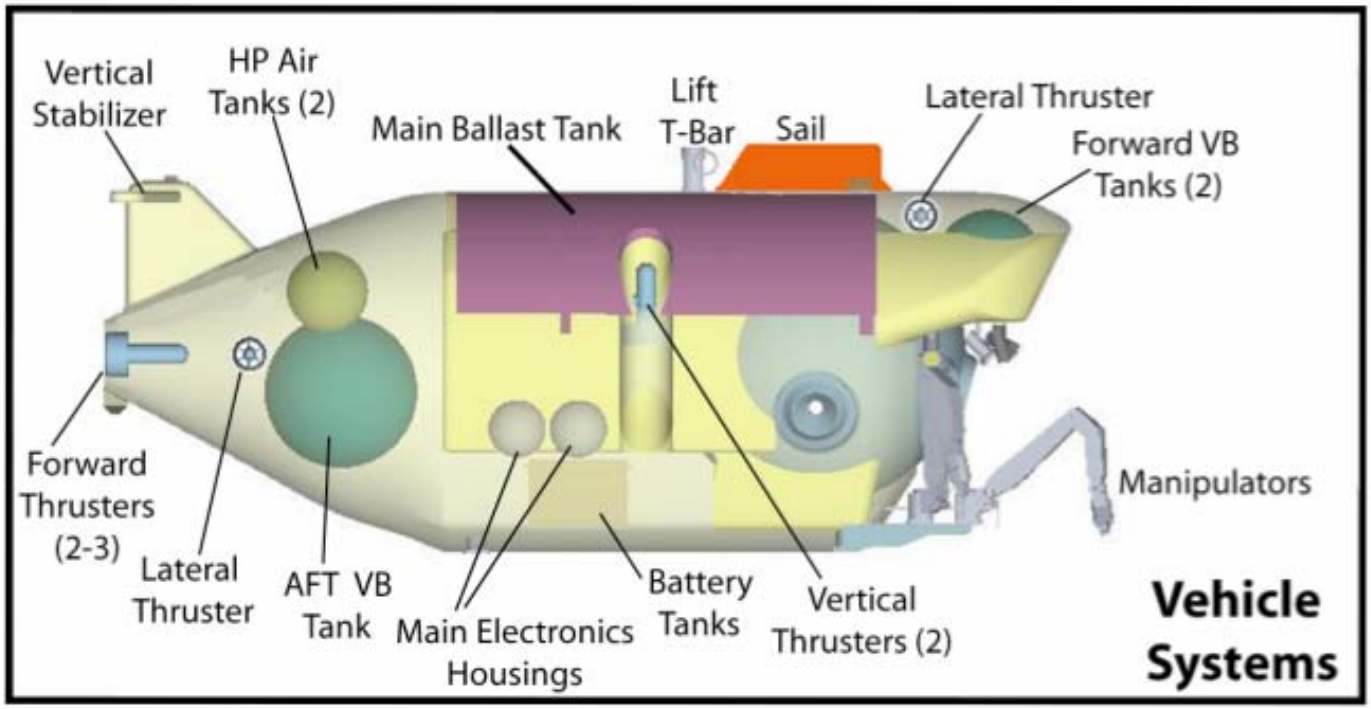


RHOV

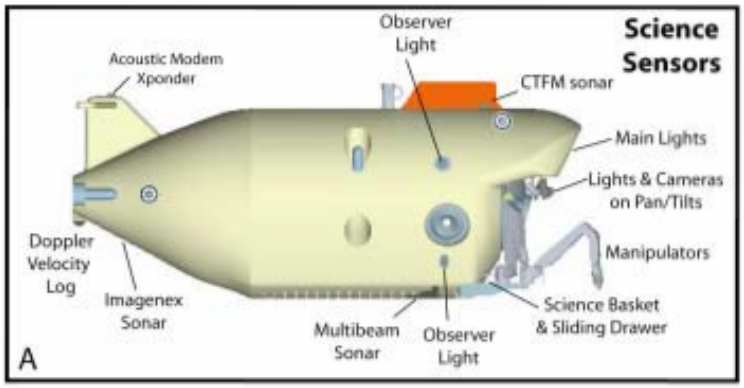
Performance and Science Specifications

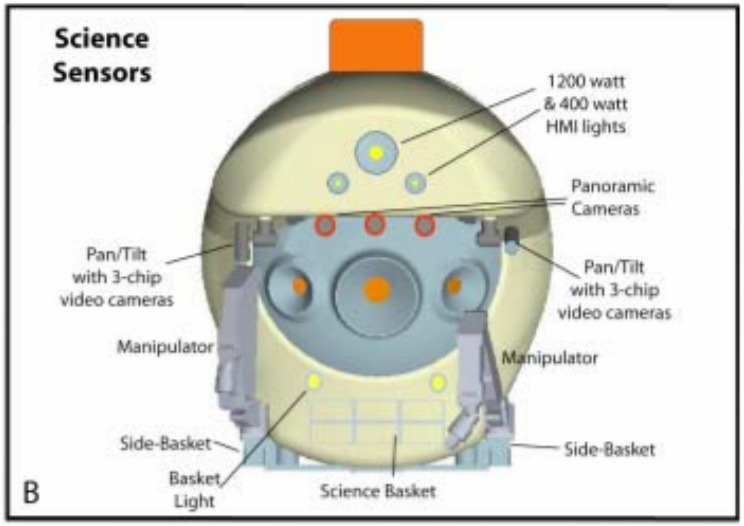
	Current *Alvin*	HOV Replacement
Depth	4500 M	6500 m
Sphere Volume	144.2 cu. Ft.	170.8 cu. Ft.
Science Payload (Ext)	Typically 275 lbs	400 lbs
Science Payload Volume (internal)	6630 cu. in. of 19" rack space	12,300 cu. in. of 3U high 19" rack space
Max speed forward	2 kts	3 kts
Max speed lateral	Minimum lateral ability	0.5 kts
Max speed vertical	30 m/min	48 m/min
Trim (fwd/aft)	+/- 7.5 deg	+/- 15 deg
Ascent/Descent Method	Steel drop weights	Water ballast
Positioning Control	Manual w/ auto heading	Auto DP w/ auto heading and auto track following control

RHOV Vehicle Systems



RHOV Science Systems





Status of Vehicle Design and Construction

Options to reduce costs

- **Loosen/modify technical specifications**
- **Reduce programmatic requirements**
- **Shift more work to WHOI**
- **Cross-deck more *Alvin* equipment**