

# Alvin Gets an Interior Re-design

Sub's new sphere will provide a little more room and comfort

For more than four decades, scientists have forgone a few creature comforts to see animals, volcanoes, and shipwrecks at the bottom of the sea.

On a typical dive in the research submersible *Alvin*, a pilot and two scientists climb through a narrow hatch into a 6-foot-diameter titanium sphere crowded with equipment. Once sealed inside, they have no room to stand up, no seats, and no bathroom. For up to eight hours, they sit on thin pads on the floor and peer out windows, or viewports, the size of teacup saucers. The pilot drives while perched on a small metal box.

"It sort of equates to sitting in a phone booth with two of your closest friends, all day long," said Patrick Hickey, *Alvin* operations manager at Woods Hole Oceanographic Institution (WHOI), who has logged 636 dives as the sub's pilot.

"Being on the smaller side is definitely a plus when you dive in *Alvin*," said Bruce Strickrott, who, at 6 feet 3 inches, is currently *Alvin*'s tallest pilot.

But now engineers at WHOI have begun planning a multimillion-dollar overhaul that will ultimately allow *Alvin* to stay down longer (up to 12 hours) and dive deeper (6,500 rather than 4,500 meters). To withstand greater pressures at greater depths, a new, stronger titanium sphere has been forged (see page 12). It is 3 inches, rather than 2, with an interior diameter that is 4.6 inches wider than *Alvin*'s current sphere. That increases the interior volume by 18 percent, from 144 to 171 cubic feet, and that additional space has opened up a range of new possibilities.

"The buzzword is ergonomics," said Anthony Tarantino, a former *Alvin* pilot. He is part of a team of marine engineers at WHOI who have donned the hats of interior designers to make *Alvin*, a workhorse of the oceanographic community, a little more comfortable.

## Space constraints

Even before thinking of a redesigned interior, engineers on the project considered the shape and weight of every item that must fit inside the submersible on each dive. All told, the list includes about 300 items. Every system to power, navigation, and alarms, every storage shelf, camera control device, ethernet switch, emergency flashlight, and even the pilot's small seat must be weighed to ensure that *Alvin* has enough buoyancy material to keep the submersible upright and stable during a dive.

Once all the equipment is inside, what space remains goes to the pilot, two scientists, and the small bags of items that they bring down with them (typically, a snack, notepads or other recording devices, and extra warm clothing).

Fitting it all inside the sphere is like piecing together an enormous puzzle inside a big ball. In a laboratory on a dock in Woods Hole, engineers created a prototype fiberglass version of the new sphere to give people a sense of the available space and help them figure out where everything might go.

To represent each item that will go into the sphere, engineers built cardboard mock-ups of computer monitors, video displays, handheld cameras, and dozens of other pieces of equipment to help work out how to fit people and components harmoniously together.

In spring 2010, Chris German, chief scientist for deep submergence at WHOI, distributed a 20-question survey to *Alvin* users, seeking their opinions on changes they would most like to see in the new sphere's interior. More than 110 biologists, geologists, microbiologists, geochemists, and engineers responded.



Tom Kleindinst, WHOI

Scientists test a mock-up of the new *Alvin* sphere at Woods Hole Oceanographic Institution, offering feedback on ways to make it more comfortable and efficient.

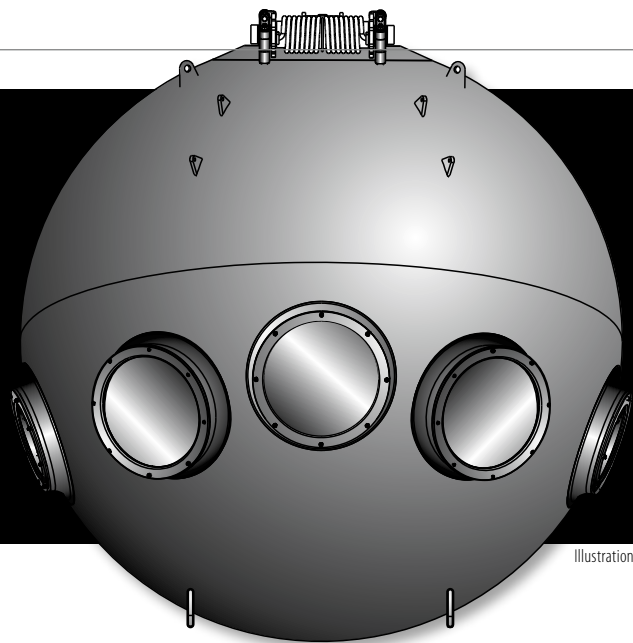


Illustration by E. Paul Oberlander, WHOI

	Old Alvin	New Alvin
Viewport Number	3	5
Viewport Diameter	5 inches	7 inches
Sphere Thickness	2 inches	3 inches
Interior Diameter	~6.5 feet	7 feet
Interior Volume	144 cubic feet	171 cubic feet

### Seats, sights, and heights

The survey also asked people about their height and vision. German said the information will help make the interior set-up of the sphere more user-friendly, and when possible, adjustable to accommodate different needs.

Half of the respondents reported that they are nearsighted. “During the average dive, people are constantly looking out of a viewport, then back to a computer screen or notepad to record what they are seeing, or to interior video screens showing live video feeds of areas around the submersible,” German said. “It means they are constantly refocusing their eyes. That’s important to know because it helps us decide where we are going to put key components like video monitors,” especially in relation to where scientists will position themselves inside the sphere.

As to how they will position themselves, scientists will have more options. The new locations of the viewports necessitated changes in seating, which gave engineers an opportunity to build in some more comfort. Now, passengers often sit on the floor, with their heads on opposite sides of the sphere and their legs poking into shared space in the center, trying not to kick each other or the pilot’s metal box seat. To get people off the floor, engineers have proposed adjustable benches that allow passengers the choice of kneeling, sitting, or lying flat.

### Built for depth, not for comfort

With such an expensive and carefully crafted investment, why not make the new sphere really snazzy by adding reclining leather seats? a reporter suggested. How about a few cozy cashmere blankets and an Italian coffee maker, which would fight the chill that comes as the sub lingers in cold seawater? Tarantino laughed and shook his head.

Weight limits prohibit too many frills, he said. Safety considerations also add constraints. To prevent a fire inside the submersible, electronics must meet strict criteria before they are allowed in. Fabrics covering the foam pads also must be fire-resistant

and made from a material that would not emit noxious fumes, if it did catch fire.

“We’re never going to be able to provide luxury,” said German. “It’s not like flying business class.”

But lack of comfort is part of the experience. Sharing a ride in *Alvin* bonds people, he said, in the same way that people sometimes feel a shared experience after making an arduous car journey.

“People know that they have endured one of the more uncomfortable rides on Earth to be a part of a really special group,” German said.

Hickey, *Alvin*’s operations manager, was confident that people would enjoy improved creature comforts in the new sub. But he forewarned future passengers that they still won’t find one thing on board: indoor plumbing.

—Amy E. Nevala

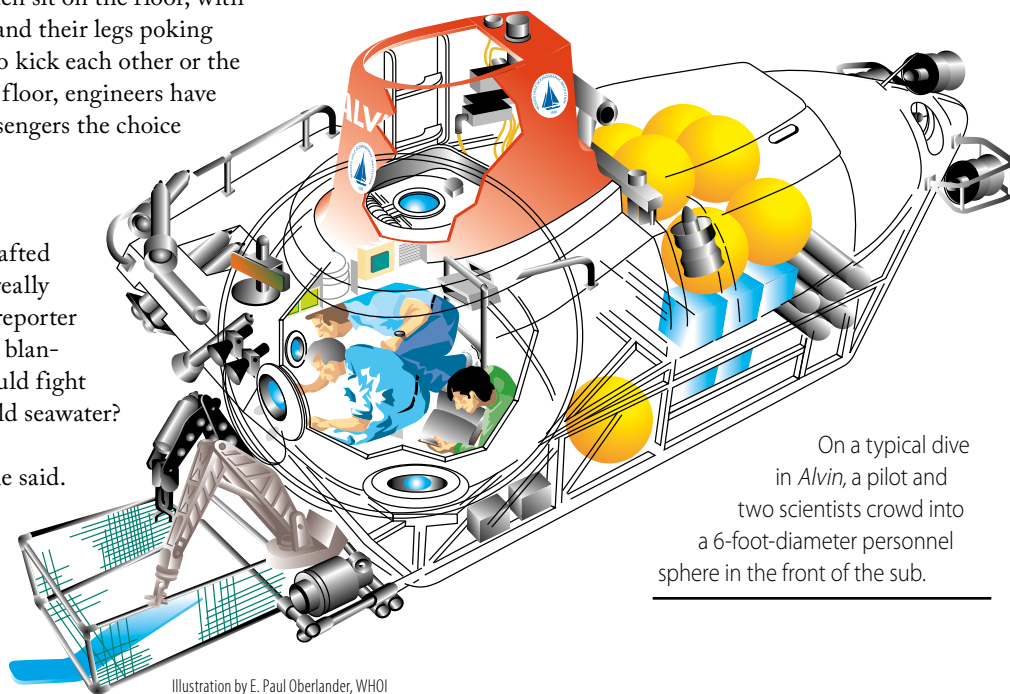


Illustration by E. Paul Oberlander, WHOI

On a typical dive in *Alvin*, a pilot and two scientists crowd into a 6-foot-diameter personnel sphere in the front of the sub.

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