

## Jeff McDonald

WHOI-NAVSEA CERTIFICATION ENGINEER

“This list is my tracking mechanism for how we progressed through the assembly and the testing of every system on the submarine. There are probably over 1,000 line items on it that detail the receipt inspection, assembly, installation, and testing for every penetrator, window, piece of foam, parts of the frame, the ballast system, life-support system—every certified component on the vehicle.

If we went down to the floor and walked around the vehicle, you could actually point to any component on *Alvin*, and this list would let you know where it stood.

We compiled design packages for the *Alvin* upgrade and sent them to the Navy. They reviewed our designs, and they gave us comments—sometimes as few as seven, sometimes as many as a hundred, depending on the system. And we have to address every one of those.

Then the Navy comes in and does an on-site inspection to validate that the guys down on the floor in the *Alvin* high bay are building the vehicle in accordance with the approved drawings, and that they used the right parts and the right techniques.

The whole point of my job, the whole point of Navy certification, is to get the maximum reasonable assurance of safety for the three occupants and the vehicle. We certify the design, operation, and maintenance of the vehicle to ensure that safe operations for *Alvin* continue into the future.

## Lisa Smith

SENIOR ADMINISTRATIVE ASSISTANT

“These are the *Alvin* records going back for decades. We have to keep every piece of correspondence with the Navy. The Navy certifies us—they have to give the OK on all certified items before we can dive.

Each binder is one system on the sub. So for instance, there's one for emergency batteries. Everything to do with them is in there—all of the documentation, all of the drawings, the schematics, the different revisions. We'll submit the original designs and any changes for each system, and the Navy may come back with comments asking for changes, so then we'll submit a revision. We have to track everything. All of this has to be kept forever, so that we have traceability on anything to do with the emergency batteries.



Cherie Winner/WHOI



Tom Kleindinst/WHOI

I have a degree in ocean engineering from Virginia Tech. I started working for Woods Hole in 2007, sailed with the *Alvin* Group for three years, and then I came ashore in 2011. Before WHOI, I spent eight years as a Navy officer on submarines. So I have a Navy background, understanding the rules and intricacies of that world; and having operated as an *Alvin* tech and trained to be an *Alvin* pilot, I also have a unique understanding of that world.

Very rarely do I get the opportunity these days to go down to the assembly floor. It's unfortunate, because that's what I used to love to do. I used to get to turn the wrenches.

Now my job is to know all the designs of the submarine, pass all the engineering data back and forth, and coordinate with the Navy to ensure all their questions are answered. I can tell you every bolt and nut. I can tell you where all the metal for our hull was mined.

Building a submarine, it's all in the details. ▲

Sometimes our engineers get a new idea for how to do something. They create a drawing, they actually build that system, and then it's, 'You know, that didn't quite work out as we thought it would. Let's tweak it.' But in order to do that, you need to submit a revision to the Navy.

One thing that we have worked on for quite a while is a hazard analysis, which is basically looking at the vehicle and seeing where there's a potential for anything that could go wrong. Here's one, 'Submersible launched in excessive water depth.' That's a hazard, because *Alvin* is only certified to 4,500 meters. The form shows how we prevent it from happening.

We are working right now on the *Alvin* operations manual. It has already been through many revisions. This is the manual that tells you, step by step, what to do, every day you're out there. This has everything in it. We're actually required to keep this in the submarine.

I've been at WHOI and working with the *Alvin* Group since 2011. The whole time since I arrived, they were here, working on the upgrade. It's really different when they go to sea. Then I book their travel, submit timecards, basically take care of anything they aren't able to do while at sea. It's been great with them here onshore—to get to know them so well. I'm just sad that they go out to sea again. ▲