Jack W. Abbott

Start researching modularity in naval ship design and you'll find that all roads lead back to this guy

***Editor's note:** As this issue of* (mt) *was being prepared, we were saddened to receive word that Jack Abbott, president of AOC, Inc., died on November 18, 2018 following a two-year battle with cancer. We're grateful that he agreed to an interview a month or so before he passed away, and our thanks go out to Jack's son, Nick, and to his wife, Josephine, for helping to arrange things. For this issue focused on modularity and flexibility, talking with Jack Abbott was a natural, given his more than 50 years of experience in naval architecture and marine engineering. He did groundbreaking work creating and developing modular solutions for numerous United States Navy destroyer/cruiser vessels including DDH-280, DD-963, DD-993, CG-47, DDG-51, DDX, and the littoral combat ship. Michael R. Good, senior systems analyst at DELTA Resources, Inc. and a co-lead for this issue of* (mt)*, spoke with Abbott about these programs and the challenges he faced in making flexibility and modularity key elements in the design and service life of navy ships.*

MICHAEL R. GOOD: Jack, thanks for taking the time today. Maybe we should start with the early days...where are you from and how is it that you decided to get involved with marine engineering?

JACK ABBOTT: Actually, I didn't get involved with marine engineering until after I got out of school. I graduated from Stanford [with a degree] in mechanical engineering, and I was in the NROTC program at Stanford. I was very active and in fact, I almost stayed in the navy, but I wound up going to work for a company [engaged in] mechanical engineering activities. I got involved with the navy basically because I went to work on gas turbine engines, and this led to me being involved with putting the first gas turbine engine on the Spruance-class ship. It was my benefactor, Reuven Leopold, who hired me to come back to work in Washington. So I moved in 1972 to Washington, D.C. and became part of the NAVSEA engineering organization. I got involved with one of the first programs that addressed modularity. Chief of Naval Materiel Admiral [Isaac] Kidd Jr., back in 1972, was concerned about life cycle support, about longevity, and how to get the full life of a ship, the full expected life before it was retired because of obsolescence. I got started with what was called the SEAMOD [Sea Systems Modification and Modernzation by Modularity] R&D program. It was a supply officer who actually said, "You ought to start to make everything modular. That way you can keep updating things over the life of the system, whatever it is. Make it modular, make it have formal interfaces." So that's what got us started.

GOOD: Where are you originally from?

ABBOTT: I was born in Kansas City, Missouri, and I lived in California until 1972, and then moved to Washington, D.C. because I got involved with gas turbine engines, and gas turbine engines were just starting to be used on navy ships. The Spruance-class was the first in to use gas turbine drive, and of course, all the others followed. I went to work for Reuven Leopold, who was a very dynamic person.

GOOD: Now I see the connection, Jack. So it was really through your being first involved with gas turbines,

and I know gas turbines are contained in a module. One of the things with gas turbine maintenance was the way that the Spruance-class and then subsequent ships, the FFG-7s, the Aegis [naval weapons system] cruisers and DDGs, were all designed, was so that the gas turbines could come up and out in case they needed to be replaced for damage or maintenance.
ABBOTT: That's right.

GOOD: The whole process of modularization around gas turbine engines would be an inspiration for further work.
ABBOTT: Right. The combat system community did not sign up, particularly, for having modularity for the combat system. They had a one-off mentality, that they were going to develop the combat system from scratch, and there was no attempt to have interchangeability. So, this is the missing element, if you will, in what we now call the flexible warship. It used to be a one-off thing..."We know the threat, we know what kind of combat system we need, and it's going to last forever." Of course, it never did. The modularity and adaptability idea was a hard-fought battle with Admiral Wayne Meyer and myself. Of course, he called me the Father of Modularity, and I called him the Father of Aegis, and both were true.

SEAMOD was the first. It was an R&D program. It studied the idea of taking the DD-963 ship, which we were building a lot of, and making it more modular, so that we could upgrade it easily. Following that was another program called SSES, which stands for Ship Systems Engineering Standards, which was aimed at developing standards for interfaces for modular combat systems. Wayne Meyer didn't worry about upgradability. All he cared about was getting that next, better combat system out to sea, and he did it. He did a wonderful job with Aegis, but the trouble was that, by the time the first Aegis system was fielded, the original one, or the configuration management of the original one was obsolete, and I tried to tell him. I had many wonderful evening discussions in Admiral Meyer's office, and it had to do with the fact that he had to think beyond just the first system to be fielded.

GOOD: That was *Ticonderoga* with the Baseline 1?
ABBOTT: Yes.

GOOD: The first group of cruisers?
ABBOTT: That's it.

GOOD: What things were difficult, what were the pain points and the successes that you saw out of those SEAMOD and SSES efforts?
ABBOTT: Those efforts wound up, in many cases, creating the standard interfaces that added weight to the ship, and when we added weight to the ship, the cost people who used weight-based cost modeling, they always claimed that the first ship would cost more money. That was a no-no to the acquisition world. They didn't want to pay more money for something that's modular. So it took a long time for them to understand that it didn't have to... just because it weighed more, it did not have to cost more, and we've now proved that. As you know, Mike, all the shipyards in Europe, they build a ship faster by having it modular because they have a much smoother transition between the design and the production. Do you understand what I'm talking about?

GOOD: Things can be done in parallel to a greater extent.
ABBOTT: Yes, you got it. The thing about the littoral combat ship (LCS), it was an experiment in, really, a "partial modularity." It was not total modularity. It was just the packages that were going to be put on as LCS mission packages. We got a lot of experience from creating the interfaces for the LCS.

GOOD: I know you've played a key role with the LCS Mission Systems and Ship Integration Team, what we call the MSSIT.
ABBOTT: Yes, that was very important because it created a document called the interface control document, or ICD. The ICD was used for all the equipment that was going to go on the LCS as a package, and the interface was specified such that the people who brought their equipment onboard had to meet those requirements, and then it would work, it would fit. So the MSSIT had to coordinate. It made sure that all the people who were going to come onto the ship had met the requirements for the interfaces, so that when it came time to put it on the ship, it would work.

GOOD: The ICD was clearly a key document. In my experience working with you, when I was the LCS Mission Modules program manager, that was our cornerstone for the program.
ABBOTT: That was the bible for the module people.

GOOD: Right. I'd call the ICD a pretty significant success story with LCS and the modules with the MSSIT work.

Jack W. Abbott *continued*

> *"It's well accepted now, and the term flexible warship lets people understand that they can modify the ship to the mission and technology that they need."*

Were there any problems with that, with people cooperating?
ABBOTT: Oh yes [laughter]. There were people who wanted to bring their system on the ship, and they didn't want to be bothered with anybody else telling them what to do and how it should look.

GOOD: The LCS MSSIT was one of your most recent efforts, and SEAMOD and SSES were very early on. But between those projects, you've been involved in a number of efforts. A couple come to mind... the Affordability Through Commonality...the AIM (architectures, interfaces, and modular systems I think it is)? And then TOSA, the Total Open Systems Architecture.
ABBOTT: These were all R&D programs that tried to capture the concepts for implementation on ships. It took a while, until finally the breakthrough came when Admiral Rowden, about five years ago, said, "We really need to understand. We have to get the full life out of these ships. We cannot afford to have them retire at 20 years." Just the change of the terminology to "flexible warships" became a tremendous breakthrough, with the understanding by the "blue suiters" of the value of having a flexible warship. The thinking changed to, "You can update this thing, change the mission, and change the technology." It took that long for the blue suiters to understand the value, but now, it's a done deal.

GOOD: So, it really took some culture change, it sounds like, and also the right kind of people in the leadership like Admiral Rowden, and I know Admiral Dave Lewis was involved at the time.
ABBOTT: Yes, absolutely. Dave Lewis was a key person.

GOOD: Seemed like there was a synergy between the head, Admiral Rowden, of the sponsor organization in the Pentagon, the director of surface warfare in OPNAV N96, and then you had Admiral Lewis as PEO Ships over on the acquisition side. I remember meetings where they would seem to really energize each other on why we needed to do this kind of thing.
ABBOTT: You hit the nail on the head, Mike.

GOOD: It sounds like you feel we've turned the corner, after a number of years of working on this idea, that now navy leadership has recognized that things like flexibility, adaptability, changeability, upgradability, and possibly using modularity as a way to do that, that leadership has finally seen the wisdom of this and is ready for it now.
ABBOTT: I think that's the case. It's well accepted now, and the term flexible warship lets people understand that they can modify the ship to the mission and technology that they need.

GOOD: How do you see the future? How do you see this playing out?
ABBOTT: Well, there are obstacles. People will go off and develop their own system. They don't pay much attention to how or what's going to happen when it goes to be put on the ship. So, they don't worry about integration. There's always this concern whether the people that are building the next widget, the next best mouse trap, if you will, understand that they may have to make adjustments on their interface with the ship that they're going to go on. I think the idea that they have to change to make things work, that's the thing that's changed at the top.

GOOD: At the recent American Society of Naval Engineers symposium in June, we had a number of speakers, and it wasn't just the acquisition folks...it was leaders from the navy staff in the Pentagon, senior civilians, as well as some mid- and senior-level naval officers. The words I consistently heard were, "Flexibility and adaptability are our number one priority," which is quite a change.
ABBOTT: They didn't care about that at all 20 years ago. They used to do point designs, if you think about it. Take *Arleigh Burke*, DDG-51. Everybody was going to make that the perfect ship. Well, the point is that it might have been a perfect ship at one point, but not over time. Over time, things change, requirements change, and technologies change. Suddenly you've got a requirement that came out of nowhere. Are you flexible enough to be able to adjust the design and the interfaces, so that you can accommodate the new requirement? Change is a matter of fact for design of ships.

GOOD: You need to be able to adapt, in order to survive.
ABBOTT: Yes, right.

GOOD: Let me ask you a question about your Admiral Meyer history. One of the steps down the path toward real implementation around modularity was the change from the first Aegis cruisers, *Ticonderoga*, the Baseline 1. They had the Mark 26 double-arm missile launchers.
ABBOTT: Yes.

GOOD: Then, we moved to the Mark 41 Vertical Launch System (VLS).
ABBOTT: Right.

GOOD: Were you involved with that effort in your work with Admiral Meyer?
ABBOTT: Absolutely, I worked with Martin Marietta in Florida. We worked on all the interfaces for the VLS.

GOOD: That's been a huge success story over the years.
ABBOTT: It certainly has. Not only could they change the whole module as a big block, they could change any...there were 61 cells. It would house 64 cells, but they needed 3 cells for a strike-down system that could lower the missiles, the Tomahawk missile containers. They could lower them into the cell. So they would have 61 missiles, and they could change out any one of them or all of them. The idea, the flexibility for that weapon system to be loaded out however you wanted it to, that opened a lot of eyes.

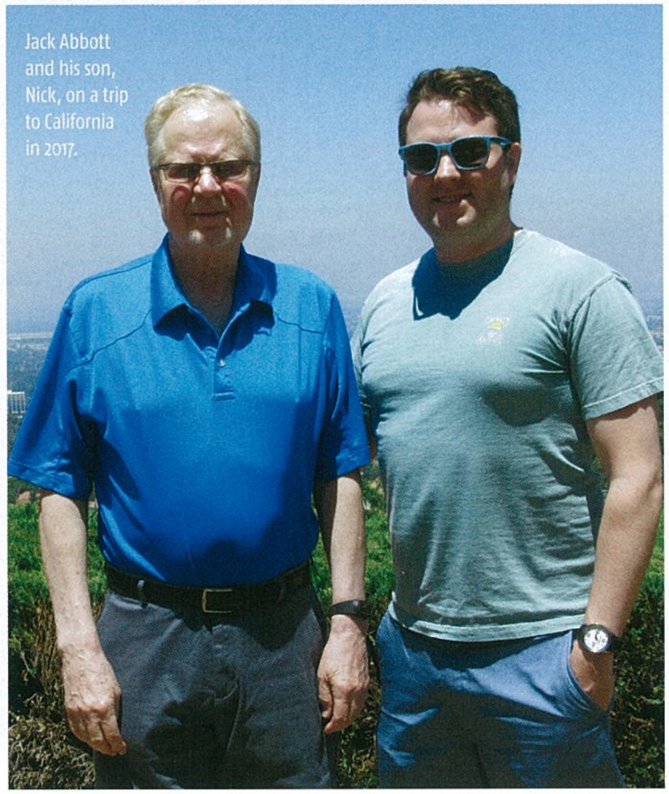
GOOD: How did that come about? How early was it that you were in these conversations about moving to a new missile launching capability and the idea of doing a modular launch with it?
ABBOTT: This was 1981 or '82, somewhere in there. We worked with Martin Marietta. Then they moved it up to Baltimore, and that [became key] for the whole idea for the missiles, the modularity part. What they didn't understand is that they may need modularity for other parts of the combat system.

GOOD: So, the first five Aegis cruisers—*Ticonderoga*, CG-47 through *Thomas S. Gates*, CG-51—those are the Baseline 1 cruisers that had the Mark 26 twin arm missile launcher. For a lot of folks in the navy, the blue-suiters, the surface warfare officers... it really came home for them when we found those first five ships were so difficult to upgrade because they didn't have a modular approach. They were all decommissioned in 2004 and 2005. We lost five frontline cruisers because they were too hard to upgrade.
ABBOTT: What can I say? We kept pushing them in that direction, but they were used to the point design mentality. What we now have I think is a full recognition that what you want is a completely flexible warship. Which means that all the systems, if you want to change them and change the mission and change what it can do, you build that into the ship to begin with, with both space and weight. Now, the other thing was the cost modeling. We now realize, from shipyards in Europe, that we're making a mistake by thinking that weight is the only basis for reducing costs, and a lot of the shipyards realize that you can do more, even when something weighs more as far as cost is concerned, because you can build it faster. It's the labor hours that cost money, not the material.

If you want to talk to people about the cost, of course, they're like a special group and they've hung on to this "weight is cost and cost is weight" thing for all these years. It's pretty hard for them to let go. It's slowly but surely easing up where they're going to allow people to look at different ways of modeling the cost.

GOOD: Jack, how did you originally get involved with SNAME?
ABBOTT: I got involved when I started to work on the DD-963. I went to work for Litton, which received the award to build the 963 class and I joined SNAME in 1982, I think.

GOOD: How do you feel that membership and your involvement with SNAME have been helpful to you and your career?


Jack Abbott and his son, Nick, on a trip to California in 2017.

ABBOTT: I loved it. I used to run the papers committee, and I used to be involved with the selection of the annual program. It was very helpful professionally, to stay engaged with colleagues and learn about what other people are doing.

GOOD: You've mentioned European shipyards, and I've also heard you mention that you were in wider dialog on these ideas, collaborating and interacting with colleagues and people in the profession. You've mentioned that you have worked with people in Europe?
ABBOTT: I was trying to make this happen in the United States Navy. Herr Sadler, who is a really neat guy, who worked for Blohm+Voss, he was making the MEKO ships, which, of course, was the same idea. He convinced his management that they should start to build modular ships, and they did. They've been a success ever since. They convinced them that the weight had nothing to do with it. They were able to build the ships cheaper, and they were able to sell to third-party markets because it was modular. They could tailor the combat suite to whatever the customer wanted.

Herr Sadler was my buddy. He could never understand why the United States Navy did not grab onto this thing right away. I said to him, "Well, I can only tell you that by the time I got through briefing the last admiral, all the way up the chain of command, the next thing I knew I had a brand new admiral at the bottom, and I had to start all over." **MT**