

NSWCCD Ship Design Group hosts modular ship design pioneer

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The Naval Surface Warfare Center, Carderock Division Ship Design Group recently hosted Jack Abbott of AOC Inc. where he presented a lecture on the subject of "Modularity in Ship Design – Hindsight and Foresight." The presentation is part of a series of brown bag presentations that are part of NSWCCD's mentoring program. This particular lecture concentrated on lessons learned over his career as well as what he sees as the future of this concept.

Abbott has been involved with the development of modular ship building since its beginnings in the mid 1970s. He has written several papers on the subject that are considered seminal in the field of modular ship design. He served as chief engineer aboard the USS Brane (DD 630) and in leadership positions for 13 major projects over his 51 year career. He is also a Life Fellow and Distinguished Service Awardee with the Society of Naval Architects and Mechanical Engineers and winner of the American Society of Naval Engineers "Jimmy Hamilton" Award.

One important lesson Abbott wants to pass on is very basic but key to seeing the value of modular ship design: change is inevitable. For a ship to remain useful for the Navy, it must be able to adapt to changing mission requirements and be able to incorporate new technology and improvements easily and affordably. He pointed out recent classes of surface combatants (DD963, DD993 and CG47) have all been retired before the end of their planned service life; an average of 20 years instead of 35. This has been a result of technology obsolescence and expensive upgrade costs to remain relevant.



Jack Abbott, of AOC Inc., speaks to NSWCCD employees during the Ship Design Mentoring Group meeting in West Bethesda, Md., Oct. 9, 2014. (U.S. Navy photo by Timothy E. Hunt/Released)

Abbott identified cost reduction during refits and modernization as the primary motivator in early Navy modular shipbuilding efforts. The value of modular design and building techniques during the initial design and construction did not catch on until the concept was proven by private industry and foreign navies; the British and Swedish navies in particular.

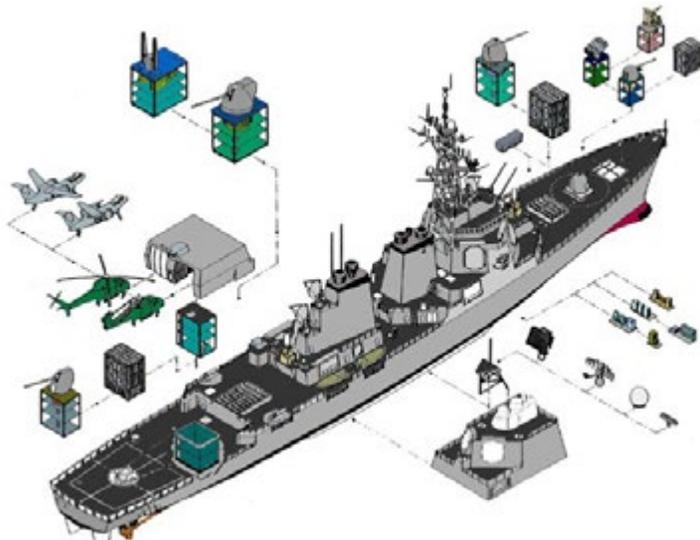
He also noted a shift in thinking that has occurred in terms of the importance mission re-configurability, pointing to ships such as the DDG 51 and Littoral Combat Ship (LCS) designs as examples of this thinking.

Interests in modularity at the Department of Defense level started with the Open Systems Joint Task Force (OSJTF) in 1994. The OSJTF approach, called the Modular Open Systems Approach (MOSA), establishes the process for developing a modular and open technical architecture. Going forward, the U.S. Navy has endorsed this approach as part of the Flexible Warship Initiative begun by

OPNAV N96 in 2013. This latest interest by Navy management is a desire to lower total ownership costs while providing technical and mission relevance over the life of the ship. Along with a review of earlier modularity programs Abbott presented details on these recent Flexible Warship efforts.

Abbott also provided some observations of technology trends that he believes will have significant impact on ship capabilities as modules are created and replaced going forward. He sees ship capabilities increasing as future technologies combine with existing functions into smaller and lighter packages. This will lead to modules being repartitioned or subdivided further, allowing additional systems to be added in the newly available spaces. The end result would be an increase the capabilities of the ship and extending the useful service life of the platform, with a minimum impact on the hull, displacement, or ship support services.

Abbott concluded his remarks by pointing out the need for engineers to shift their design approach from creating ships that "barely fit" initial payload systems on the platform, also known as "optimized design", to one where the platform can easily support module placement and integration for a range of present and future payloads. He also emphasized that for modularization to be successful, design goals and requirements must be identified early in the design process. Modularization design principles must also be actively embraced and not only by ship designers but by system developers.



The Arleigh Burke-class destroyer is an excellent example of how ship modularity concepts are currently employed in Navy shipbuilding. Modules center mainly around weapon and sensor systems due to the need for frequent upgrades. However, more recent developments are moving the modularity concept toward a mission rather than system oriented focus. (Graphic provided by Jack Abbott, AOC Inc.)