NPS TSSE 2016 Design Project - Minutemen Ship Class

Minutemen Class: “Answering the Call by Sea”

NPS Total Ship Systems Engineering (TSSE) 2016 Design Project

Each year students in the NPS Total Ship Systems Engineering (TSSE) program pursue a group project to design an interesting new class of ships for the Navy. The July-December 2016 cohort included 10 U.S. and allied naval officers in the Systems Engineering, Mechanical Engineering and Physics curricula. Problem statement:

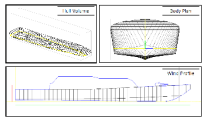
- Sea control traditionally provided by capital ships is increasingly difficult as advanced sea-denial strategies reduce global maritime security.
- Distributed Lethality (DL) has the ability to overcome these challenges by forcing adversaries to disperse their defenses into a countering position.
- To accomplish this mission, conceptual design of an affordable surface vessel capable of offensive surface operations for sea control is needed.

Using modern naval architecture techniques together with operationally relevant design goals, the group produced the conceptual Minutemen class.

- Concept of Operations (CONOPS) including tactically useful missions.
- Analysis of alternatives for equipment, weapons, propulsion, fuel, water.
- Reduced manning and maintenance requirements, austere but livable.
- Damage Control Ethos: minimal, can take 1-2 hits then abandon ship.
- Greater access to small ports, increased flexibility in forward logistics.
- Under $100M production cost, potential repeatable production at scale.

The Minutemen Class Design Project slideset summarizes the findings of this capable group. This significant report shows that a cost-effective small combatant can indeed be designed and produced to fill a gap in the Navy's force structure.

Also available: Minutemen flyer and Minutemen poster from Surface Navy Association (SNA) 2017 Symposium, plus TSSE brochure and TSSE website.



Project Motivations, Execution, and Potential Influence

The NPS TSSE project pursued a specific small-combatant design challenge. It found a solution space, i.e. a range of system parameters, showing that quantity production of a small single-purpose combatant is a feasible construct for U.S. construction and budgets.

This TSSE concept study included multiple in-depth tradeoffs guided by faculty and participant experience, cross-disciplinary systems engineering principles, current engineering practice, and modern computational tools for ship design. Of note is that software support is steadily becoming more comprehensive and able to handle multiple inputs across multiple interrelated system domains.

The ship design was produced by active-duty naval officers who fully understand the requirements of at-sea operations by a real live crew. An enabling consideration: smaller ships that can be forward deployed with coalition partners do not necessarily have to be underway a majority of the time.

About 40 naval professionals were in attendance at the project outbrief on 13 December 2016. No arrogance or magical thinking was noted in any of the student presentations. Pointed questions were offered and answered during the discussion period.

Wartime is risky and dangerous. Survival was not the #1 requirement - the crew goes into the water with survival gear to await rescue. Increased support for that scenario recommended as future work (slide showing available technology is pretty lean). It has been observed that reduced livability and survivability, for bearable periods during wartime, is not completely at odds with classic Navy ships and crews who intended to go in harm's way.

As with any ship design, there are numerous competing and interlocking tradeoffs. This group attempted to break past contemporary fiscal blockers to small-ship combatant design by emphasizing primary mission objectives and relaxing secondary requirements. Engineering evaluation of this candidate design versus Minutemen Class goal requirements is interesting and appears near the end of the slideset.

The project was not presented as a final recommendation for construction, rather it explored a design space. Further work is necessary on every aspect to build such a ship.

Several important studies relating to Navy force structure were published at the beginning of the year. It surprising that none of them examined the potential of small combatants in much detail. One might conclude that such ships are not currently considered to be a viable option for the future Navy.

- Ronald O'Rourke, Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress, Congressional Research Service, 2 February 2017.
- Bryan Clark, Peter Haynes, Jesse Sloman, Timothy Walton, Restoring American Seapower: A New Fleet Architecture for the United States Navy, Center for Strategic and Budgetary Assessments (CSBA), Washington DC, 9 February 2017.
- Peter M. Swartz, American Naval Policy, Strategy, Plans and Operations in the Second Decade of the Twenty-First Century, CNA, Arlington Virginia, January 2017.
- John McCain, Restoring American Power: Recommendations for the FY 2018-FY 2022 Defense Budget, U.S. Senate, Washington DC, 16 January 2017.

The Minutemen Ship Class design provides an excellent baseline for consideration of future littoral operations. Now in planning: we expect that this design can stimulate continued exploration in upcoming NPS courses, theses, wargames and studies. Having a buildable ship example (rather than a notional concept) helps downstream analysis to better apply small-ship concepts when considering opportunity/cost/risk/benefit relationships.

Given that the notional Minutemen class is not a proposed program for competition, it nevertheless can provide real value in our studies here at NPS. Having a plausible capability that might exist in 10+ years helps to keep future-alternatives analyses grounded in art of the possible. A meaningful small-ship exemplar also helps focus activity in areas that need work (such as deployment and sustainability of unmanned systems), related acquisition needs, and even topics that might otherwise not be considered (such as abandon-ship crew survivability).

Another observation: "we don't have to mumble any more" about what is achievable. Future NPS graduate-student efforts can provide even-sharper insight on a range of technical, tactical, operational and strategic possibilities.

The Minutemen work is highlighted on the Network Optional Warfare (NOW) blog because small single-purpose combatants are stealthier with less need of constant communications. Such command and control approaches support the operational concepts of Distributed Lethality (DL).

Caveats: no classified information was utilized or considered. Students from partner nations provided important value. If the NPS student team can produce such a potential ship design, then other teams (friendly or not) can also accomplish the same.

Personal assessment: the group's investigation has shown that rebalanced operational requirements for small combatants can be feasible, affordable and repeatable. Future work along multiple vectors is needed and has important potential value for the Navy.