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14. ABSTRACT Over the past several decades, the USN has come up with multiple programs aimed at meeting USMC Naval Surface Fire Support (NSFS) requirements. These programs have not been fielded. At the same time, the USMC requirements have increased. This paper explores how this situation came to be, existing options, and proposes a new low cost NSFS alternative.					
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Reset

Supporting the Fight Ashore

Keith E. Patton

When the Marines ask for someone to bring the rain, the US Navy is in a drought

A 2001 Government Accounting Office report notes: “The Navy has had no credible surface fire support capability since it retired... battleships”¹. The ability of the US Navy to support troops ashore frequently comes up for discussion. Projecting power from carriers or launching cruise missile strikes is one thing; but when Marines or Special Operations forces need support, are air and cruise missiles really the best option? What is the USN doing about Naval Surface Fire Support (NSFS) requirements? The first part of this paper will explore how we got to where we are, and what options are available. The second part will focus on a potential solution using available options.

Shaping the littoral environment, raids, choke points, forced entries, sustained operations near the coast and protecting or reclaiming disputed islands or coastal areas are all operations in which land forces may have to rely on heavy fire support delivered from offshore. Examples of these operations can be seen in recent history off Korea, Vietnam, Falkland Islands, Lebanon, Iraq and Yemen. All these conflicts involved naval assets providing NSFS. Given that history, it seems unlikely this is a defunct mission set with no further utility. The US Army’s ATP 3-09.42 lists naval fire support as one of the most likely means of fire support during airborne operations. If NSFS has been required for these low intensity and regional wars, is there any reason to believe it won’t be required in similar situations in the future contingencies, or in a major war? While it may be far preferable to land troops where an enemy is not, an adversary will react to where the troops are. This necessitates the ability to provide fire support for the forces ashore. Furthermore, options for deploying troops from sea to shore may be limited. Having insufficient fire support could be a telling disadvantage for forces coming ashore initially, or during sustained operations.

Fire support needs to be timely, sustainable and effective. Timeliness is important because of the fluid nature of a battlefield, especially if forces are calling for fire against emerging threats. This requires a response time of minutes against emerging threats or mobile targets. The current requirement is 2.5 minutes from call to fire until weapon response. This is actually a loosening of the previous requirement, which mandated the 2.5 minute response to be until weapon impact.

Sustainability is another clear requirement: if logistics, maintenance, or other factors prevent the NSFS from being able to respond to prolonged or multiple requests, NSFS won't be available when needed.

Effectiveness is a third obvious requirement. If the support called for is timely, but cannot hit or defeat the target, then it is not much help. Accuracy helps here, but a precise projectile fired against a target that has moved, or whose location is inaccurate, is precisely *wrong*. Thus, effectiveness can also be the ability to saturate an area target or correct onto an imprecisely located target or track onto a moving target. Different NSFS weapon options may be needed to ensure effectiveness against hardened point targets, moving targets, or area targets. Tied into timeliness, sustainability and effectiveness is affordability. If the NSFS system is so expensive that only a few can be fielded, or its ammunition is too expensive, it may not be available when needed, or even procured. If NSFS isn't timely, sustainable or effective, the result is a serious risk to forces or inability to execute missions

To those requesting fire support, the means and method are far less important than getting timely and effective support. Currently, there are a few options for support: close air support, which isn't NSFS but provides the same effects to those needing it, traditional ship based guns, and finally rockets and missiles fired from ships. None of these currently meet requirements.

From the Air:

The United States has a demonstrated capability to deliver massive fire support from the sky. From land bases, carrier decks, helicopters and drones, the US way of war is to seize control of the air and deliver firepower from it. However, while a plethora of platforms and ordnance options make air

power very effective, it may not be timely for troops in contact. To have timely air support requires 24/7 availability, perhaps with multiple sections of aircraft (or drones) able to fly to delivery point with weapons designed to support troops on the ground. It takes time to launch alert aircraft and vector to the point of contact. To be truly timely, dedicated close air support (CAS) stations would be needed. The 24/7 requirement would require multiple aircraft carriers or very capable land bases within range. Additionally, in a contested environment, these relays of aircraft might be exposed to threat of hostile aircraft and air defense systems, making the reliability of calling them in questionable based on threat environment. While a high tech solution might be to field swarms of drones with appropriate weapons, deployed as needed to support troops ashore, such a network of armed drones does not exist yet, nor does something to deploy them in the quantities required. Extreme weather can reduce the timeliness and effectiveness of aircraft and drones. Finally, a report on the invasion of Iraq noted that CAS support was unreliable and involved an overly complex process to coordinate. If troops need NSFS, airpower may be effective, but is not reliable or timely enough.²

Bring Out the Guns:

For decades, heavy guns provided NSFS, or as it was called then Naval Gun Fire Support (NGFS). Battleships and cruisers excelled at bringing timely and effective fire support bombardment to troops ashore. While 5" guns provided volume of fire, the larger caliber guns of cruisers and especially battleships provided the ability to destroy hardened targets and reach deeper inland, supporting troops as they advanced off the beachhead. In the 70s, the US Navy experimented with up gunning destroyers with 8"/55 caliber Mark 71 guns which could fire guided shells up to 16 miles. The SPRUANCE class destroyers and TICONDEROGA class cruisers were designed to accept these larger caliber mounts. Setting an unfortunate pattern for efforts to provide enhanced gunfire support from ships, the program was cancelled.

To fix these deficiencies, the four IOWA class battleships were returned to service multiple times. They saw service in World War II, Korea, Vietnam, off Beirut and in Desert Storm. In Desert Storm, significant minefields, shallow waters and coastal-defense cruise missile batteries made closing the Kuwaiti shore hazardous, but the two battleships were able to fire over these impediments to further the deception that the coalition was planning an amphibious landing. Had NSFS support not been available, it seems less likely that Iraq would have committed as many forces to defending the coast against this feint. A variety of ideas to improve the effectiveness of the IOWA's main guns were considered, including Mk.23 nuclear shells, the EX-148 that dispensed bomblets against area targets more effectively, sabot rounds with range that exceed the current USMC interim threshold of 63nm, and guided rounds. Despite the effectiveness of the IOWAs and data indicating that the 16in main guns were the most effective weapons for many NSFS missions, the decision to retire the battleships was based on the warships high operating and maintenance costs.

The idea of reactivating the IOWA class battleships continues to come up, but the remaining infrastructure to support them was dismantled in 2010, and the remaining ammunition and main gun barrels scrapped. All remaining battleships have been turned into museums and the Navy no longer funds any maintenance. Trying to rebuild infrastructure and develop long range munitions would seem to violate the affordability check, and with only one to four battleships, they may not be available when needed.

The USMC requirement for support by naval fires is between 41-63nm, but has revised this request upwards to 200 nm for naval surface fire support in the future.³ This was based on the concept of the USMC conducting assaults from at least 25nm offshore. The USN has attempted to support the low end, near term threshold with a variety of programs including the Autonomous Naval Support Round, the Barrage Round, and the Extended Range Guided Munition (ERGM) which could be fired from newer 5" 62 Caliber deck guns on USN destroyers. However, each of these programs was eventually

canceled, like the previous 8" and 16" programs. The Vertical Gun System with a 155mm cannon firing guided rounds was explored to meet the longer 63nm interim requirement. This eventually became the Long Range Land Attack Projectile (LRLAP) fired from the Advanced Gun Systems (AGS) of 32 DD-21 destroyers. This was reduced to 24 DD-21 destroyers, which the USMC had stated was the minimum required. The LRLAP also fell victim to rapidly rising costs, making it more expensive than missiles that traveled orders of magnitude farther and with much higher payloads. The DD-21 program itself was not completed as planned, with three DDG-1000 ZUMWALT class being the end result, carrying just 6 AGS between them. Even with the USN contemplating using the Excalibur guided round for these 6 guns, Excalibur does not meet the low end interim range threshold, nor do only three ships ensure one will be available when needed.

For current USN gun based NSFS, there is another concern: ammunition quantity. Modern warships carry far fewer NSFS rounds than their predecessors. The US Navy's Concept of Operations for Surface Combatant Land Attack Warfare 2005-2015 projects that an ARLEIGH BURKE class DDG will only have 244 5" rounds available for NSFS, and a cruiser 389. It further calculates that an average fire mission will be 22 rounds, and during an assault NSFS support will be needed every 4.5 minutes, lowering to every 20 minutes during sustainment. The result of this is a destroyer running out of NSFS ammo in 1-4 hours, and a Cruiser in 1-6 hours, necessitating multiple warships to provide sustained support. An additional issue is rate of fire. The sustained rate of fire for the DDGs single gun is 2-4 rounds per minute. Per SW300-BC-SAF-010, firing more than 50 rounds in 4 hrs (12.5rds/hr) results in a hot gun situation and risk to ship. This could prevent a DDG from responding to more than 2 calls for fire in 4 hrs, when twelve are expected by the Navy during sustained operations. This could result in the DDG being unable to sustain NSFS fires during an assault, and barely able to do so during follow on operations. This is noted in the Army's ATP 3-09.42 which states "Single 5-inch gun mounts on destroyers lack a sufficient rate of fire over an extended period to support volume fire requirements."

Vessels of previous eras had more rounds available per turret than predecessors from the 30s to 80s, and the older ships had far more turrets and higher rates of fire and thus could saturate an NSFS target faster and engage more before needing to reload ammunition. Current USN gun systems cannot meet range, lethality or sustainment thresholds to be effective NSFS weapons. This leaves the entire concept of NSFS support of troops in littorals, or even artillery raids by ships, untenable.

Rockets' Red Glare:

For as long as there has been gunpowder, there has been another option for fire support: rockets and missiles. In World War 2, the USN fielded a small number of Landing Ship Medium (Rocket) that mounted 1000 short range rockets. In a modern twist, a few People's Liberation Army Navy (PLAN) frigates have been converted to carry five 50-tube rocket launchers and two twin deck guns, presumably to meet their NSFS support requirements, giving them more NSFS power than any other vessel in service in the world. In the 90s, the USN looked at meeting the USMC's long range requirement with the Land Attack Standard Missile (LASM, or SM-4) which could be fired from the VLS cells proliferating across the fleet. LASM, however, did not have sufficient lethality against hardened or mobile targets, nor did it meet the 200nm range threshold. It would also take up a VLS tube that could be used by the much longer range Tomahawk cruise missile.

The newest Tomahawk, the Tactical Tomahawk, offers a long-range, large warhead option (with unspent fuel adding to explosive potential) weapon that can be re-targeted in flight. However, engaging a mobile target, or the risk of the reported target position being slightly off, resulting in a very expensive Tomahawk detonating in precisely the wrong place, limits its utility in a confused and fluid littoral combat environment. Like SM-4/LASM, it also competes for valuable VLS storage space. Response time is also a serious concern. Even if launched with 2.5 minutes of request, its subsonic speed makes it no more responsive than tactical aircraft. The Tactical Tomahawk is a strike weapon, not a valid option for NSFS.

Where we stand today:

For various reasons, the US Navy has failed to provide NSFS that meet USMC's stated requirements for over fifteen years. This means forces ashore in littorals cannot rely on effective, timely fire support beyond what they brought with them. The USN currently relies on 5" guns to provide NSFS, which have low lethality against hard or moving targets, insufficient range and limited ability to sustain combat operations. They are also all mounted on high-end multi-role warships and thus NSFS tasking must compete with other missions for which the US cruisers and destroyers are actually better suited. In the 2003 invasion of Iraq, Royal Navy and Royal Australian Navy warships were considered more capable in providing NSFS.⁴ This situation severely limits the ability of US ground forces to operate in a contested littoral environment, or the USN to respond quickly to a land threat in a littoral environment: for example a recently detected coastal defense cruise missile (CDCM) battery.

Numerous programs were started, but ultimately not procured. The latest idea to meet the NSFS gap is yet another USN gun round, this time compatible with multiple weapons. This is the Hyper Velocity Projectile (HVP), designed to be a common round used by the USN 5", USN AGS, USMC 155mm artillery and the Electromagnetic Rail Gun (ERG). The HVP is fitted with a sabot when fired from the larger bore weapons. If fielded, this round would meet the USMC's interim threshold when fired from existing US naval gun systems. However, even the rail gun variant of the Hypervelocity Projectile, which requires both it and the rail gun to be fielded, is advertised as reaching only 100nm, well short of the USMC's ultimate requirement. So, in the end, it does not meet the range threshold, and given the known deficiencies of 5" shellfire against hardened targets, the lethality of the HVP could be questioned if fired from anything but the railgun. The problem of the small warhead resulting in diminished area of effect would lead to a large number being needed for any area or uncertain target locations, complicating the sustainment and effectiveness criteria. Finally, given the track record of USN NSFS programs, one could doubt whether it will ever be fielded. There is, however, another existing option.

The USN test fired the MGM-140 Army Tactical Missile System (ATACMS) from the deck of the USS MOUNT VERNON (LSD-39) back in 1995. This was replicated in 2017 with a USMC HIMARS firing an ATACMs from the deck of the USS ANCHORAGE (LPD-23). The ATACMs is guided, and the current model reaches over 160nm, greatly exceeding the USMC's interim requirement and nearing the 200nm threshold. The rapid time of flight and guidance to a pinpoint target will allow it to distribute sub-munitions over a target area, BAT sub-munitions would engage moving targets, and a unitary warhead option is also available for hard targets. The extended range ATACMs currently under development reaches the 270nm treaty limit, and will incorporate a seeker head to give it a moving target and anti-ship capability. If certified for shipboard use, this would provide timely and effective fire support to the depth the USMC desires. One drawback is that it takes up a full Vertical Launch System (VLS) cell, thus competing with other weapons on combatants. This might be somewhat eased by installing VLS on more ships, including the planned 16 VLS cells on LPD-17 class, which could then bring both Marines and supporting firepower. However, even if only a single ATACMs was required to service a NSFS target, they would run out quickly with no way to reload at sea (unlike guns). A basic solution might be to simply park Army or USMC MLRS or HIMARs on the flight decks of warships, as in the LSD-39 and LPD-23 tests. However, this strategy requires that mobile weapons be held back from the landing force, ties up valuable deck space, and still exposes the valuable warship carrying them to risk. The ammunition constraint remains the same: only a limited quantity of large rockets can be carried. This is a cheap, but inelegant partial solution, and not a proper way to support troops in the littorals. A less vulnerable way of bringing NSFS close to the fight, with enough onboard ammunition to sustain the fight, is needed.

Seeding the NSFS Clouds:

Bringing the fight in close:

If cruisers and destroyers aren't the best option, what is? The first thought of many when discussing an NSFS ship is a battleship, either a reactivated IOWA or a new class. However reactivating 70yr old ships with no training or maintenance pipeline and weapons that don't meet USMC requirements does not seem operational or economically feasible, especially in the short term. A solution is needed sooner, not later, to help enable the Littoral Operations in a Contested Environment (LOCE) concept and free multi-mission ships to perform their primary duties. The USN already has a modular high speed combat vessel designed to operate in the littorals, the Littoral Combat Ship (LCS). An NSFS support module could be developed for the LCS. The USMC High Mobility Artillery Rocket System (HIMARS) launcher weighs 12 tons, the same as a fully loaded MH-60 helicopter. Subtract the truck portions and perhaps two HIMARS modules could be placed on the LCS's flight deck, with reloads of shorter range rockets or longer range ATACMs stored in the mission area and reloaded as needed. The INDEPENDENCE variant might be particularly suited for this with its much larger flight deck. Another option might be to mount ATACMs VLS cells forward of the SeaRAM mount, keeping the flight deck free. The concept of the LCS as a rocket platform has already been discussed at CNO and Commandant level.⁵

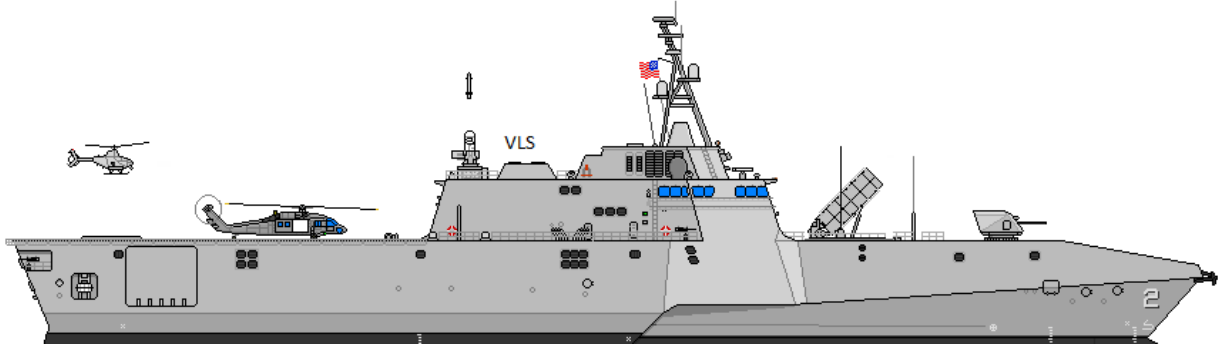


Figure 1: INDEPENDENCE Variant LCS reimaged with both deck and VLS launchers for rockets.

The NSFS module for LCS would capitalize on the LCS design for littoral missions, allow the ship to contribute to an additional mission set, and free up cruisers and destroyers while providing a relatively large number of hulls to perform the mission. The ATACMs anti-ship capability would also provide the LCS with a long-range punch for naval engagements. However, the LCS would not be able to carry many rockets and thus would suffer from the same fire sustainment issues as other options. The NSFS rocket modules on the flight deck would have to be limited to allow vertical replenishment of reloads, or the ship's sustainment would be further limited. Fuel is also a concern. While LCS is very fast for a surface vessel, using this capability is similar to flying a jet on after-burners. The speed is gained at great expense in fuel. This could impact its ability to remain on station. Finally, there is a survivability concern. LCS was designed to a much lower ship survivability requirement than cruisers and destroyers. The NSFS mission would result in a higher exposure to danger with reduced ability to cope with damage.

Another idea would be to take a large commercial hull and equip it with weapons needed to support forces ashore. Large ships are inherently resilient. In July of 1987, the USN escorts of SS Bridgeton had it assume the formation lead through a minefield, knowing the

Bridgeton was far more capable of surviving mine strikes than the much smaller warships. Bridgeton detonated a mine, had 4 of 31 compartments flooded, but kept on steaming with the escorting warships safely in its wake.⁶ Contrast this experience with that of the USS SAMUEL B. ROBERTS, which was crippled by a single mine strike and had to fight for its life with heroic damage control efforts. The sheer volume of Bridgeton, and other large vessels, allows them space to absorb damage. The Exxon Valdez grounding punctured every tank along the centerline of the ship, as well as most of the starboard side.⁷ When freed from grounding, she was towed to dry-dock despite this massive underwater damage. Nevertheless, the “Tanker War” between Iran and Iraq, provides sobering lessons in ship vulnerability as even the world’s largest oil tanker was burned out and written off as a total loss after being struck by Exocet missiles.⁸ Oil tankers hit by suicide boats and HSV-2 Swift off of Yemen also show the vulnerability of large, thinly crewed vessels transporting flammable material.

However, these were ships loaded with flammable oil. Had this not been present, the tanks filled with water instead, the ships would have been far less vulnerable. A NPS thesis detailed an analysis of missile damage, and its projections showed that more than four Exocet equivalent missiles would be needed to cripple a 7,000 ton ship.⁹ It also concluded that it takes two to three times as many missiles to sink a ship as to put it out of action. While the study did not cover a 70,000 ton vessel, one can postulate how many missiles could be absorbed within its sheer volume, or that of a super-tanker sized. Thus, a vessel like this would be far more likely to survive in close to a hostile shoreline than existing warships, especially if it was not carrying vast amounts of oil but inert, nonflammable materials instead, and it was built to standards assuming it would take hits, unlike the standards for civilian vessels.

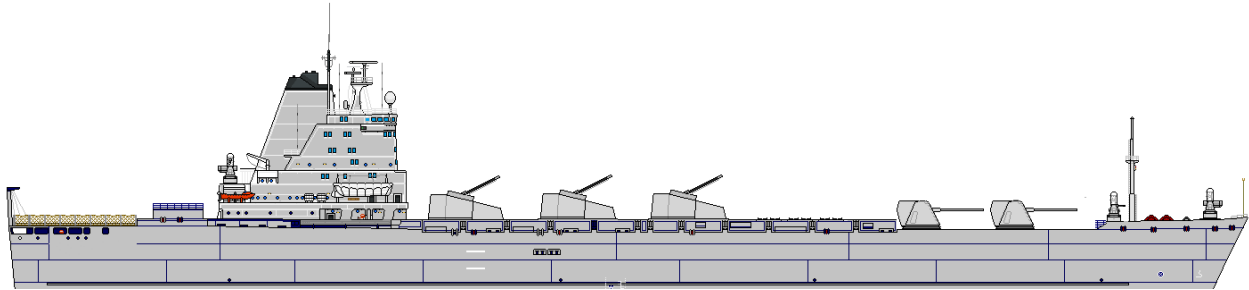


Figure 2: A 17,000ton 23kt Group III reimagined as a NSFS ship with 5 NSFS guns, 2 64-cell VLS modules for ATACMS / Tomahawk and CIWS self-defense weapons.

The Israeli's have already demonstrated firing the Long-Range Artillery (LORA) maneuvering ballistic missile from the deck of a cargo vessel.¹⁰ This standard-shipping containerized missile allows many ship platforms to be used. The shipboard variant has 16 launch tubes and 16 reloads, providing 32 total weapons able to strike targets over 250 miles away.

Now, let us imagine converting or building the ship to make it more effective. Take a standard large cargo ship or tanker design, perhaps a hull similar to what is used for the USNS LEWIS B PULLER (T-ESB-3), an existing 80,000 ton mobile landing platform. Instead of the larger, empty center section, put armored cylinders around NSFS weapons systems. Instead of the "all or nothing" armored citadel of historic US battleships, this vessel would have multiple barbette like armored cylinders, each enclosing an independent weapon system. Armor, taken from armored vehicle designs, would protect each cylinder. These cylinders would be well inside the skin of the ship, and separated from each other. Redundant and armored power, data and water connections would run between the cylinders, reducing the risk of a hit severing vital systems. The ship's large volume would act as spaced armor for these armored cylinders. In effect, the cylinders and vital spaces would be like independent armored vehicles, and the

rest of the ship's volume a honeycomb around it to absorb damage. If a weapon got past close in weapon system defenses, weight and space permitting, thin layers of armor or water-filled areas could be layered to defeat a missile's warhead before it reached the cylinders. If it penetrated to the cylinder, and the armored cylinder was breached, there could be blow-out panels similar to what is used on the Abrams tank to vent the explosion up and away from the ship. While one cylinder would be destroyed, the rest would remain operational. To keep costs down, defensive weapons would be minimal and off-the-shelf. An 80,000 ton vessel could fit multiple cylinders (based on dimensions needed), and a 200,000 ton super tanker sized one even more. Crew requirements for large civilian ships are relatively small, and most of the ship would be a honeycomb around the cylinders, so the accommodations question would be manning and maintenance of the weapons cylinders.

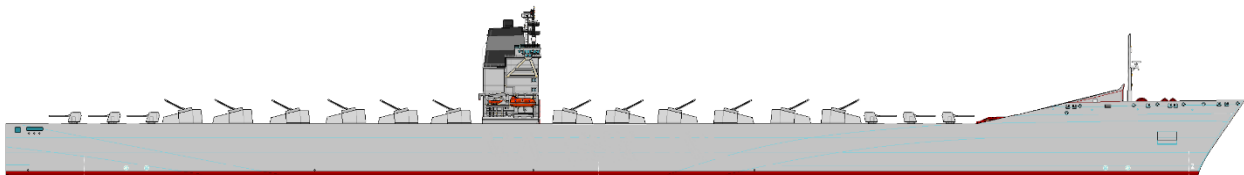


Figure 3: 170,000 ton 26kt Container Ship reimagined as a NSFS platform. VLS modules could be substituted for any of the 18 turrets.

What weapons could be put in these cylinders? Anything in current inventory. AGS could fire HVP, Excalibur or LRLAP rounds. With many more AGS fielded, the LRLAP could become affordable again via economy of scale. Standard 5" 62 caliber would ease logistics (common systems). The large cylinders could contain more ammo stowage than what is available for each turret on a conventional warship. Railguns would be useful if they come online with sufficient power production. MLRS or ATACMS could be housed in vertical launch cells or simple launch turrets bolted to a ship's deck and, perhaps most importantly, are

reloadable at sea. The deck space and stability of a large ship could support reloads that cannot currently occur on cruiser or destroyer sized vessels.¹¹ The idea is that the ship itself is a rather resilient and large bus, with existing program of record weapons mounted in as stand-alone fashion as possible, similar to how armored fighting vehicles on shore are independent weapon systems. Destroying one Paladin mobile artillery piece does not disable the battery. The only new concept being applied is including tank-like armor on the cylinders housing the weapons and support systems, and ship's vitals as required. Such armor is already produced for Army and Marine vehicle applications. If space and affordability allow, cargo areas accessible to sea-land-connectors could be provided, as well as rudimentary flight facilities to support helicopters. The SS ATLANTIC CONVEYOR, which transported supplies, Harriers and helicopters for the British military in the Falkland Islands War, is an example. Although some may consider it a cautionary tale since she was sunk by two Exocet missiles, she had no defenses, no armor as suggested in this article, and was a fraction of the size of the vessel proposed here.

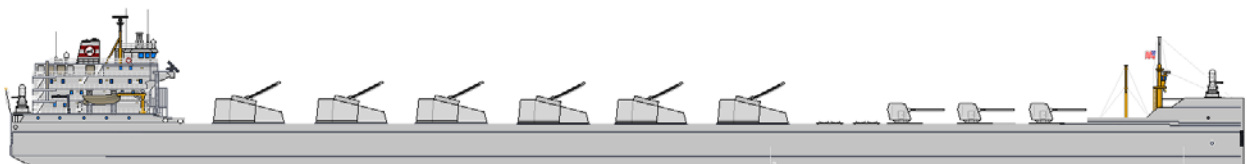


Figure 4: 30,000ton 12kt Bulk Carrier reimagined as a NSFS vessel with 9 guns and 2 64-cell VLS modules

A ship similar to this would be relatively expendable compared to a modern CG or DDG. She is not a multi-role vessel torn between competing missions and required ordnance for each. She would also be less expensive since she would not require all the electronics and systems to support multiple missions. She could remain on the gun line far longer than any

existing warship, and provide NSFS fire power at a rate much higher than any individual warship. She is not an arsenal ship, because she is not packed with high-end weapons. This also makes her more affordable and more expendable, since the loss of one is not the loss of hundreds of expensive missiles as on the arsenal ship. All the eggs are not in one basket. Instead, it is a basket with a few eggs and lots of padding.

Such a vessel could be assigned to each MPS or APS squadron, or perhaps even Expeditionary Strike Group (ESG), to provide NSFS when required. Additionally, the concept is scalable. It could be a smaller cargo ship, or a massive tanker, depending on the best efficiencies as determined by actual architects compared to this author's musings. The vessel uses existing hulls, tech, and weapons to allow rapid fielding compared to a new warship design. Perhaps this can be the seed of an idea that allows the USN to break the NSFS drought.

¹ <https://www.gao.gov/new.items/d01493.pdf> page 21

² <https://www.acq.osd.mil/dsb/reports/2000s/ADA428791.pdf>

³ <http://www.gao.gov/new.items/d01493.pdf>

⁴ <http://www.navy.gov.au/spc/publications/semaphore/semaphore-2003-issue-6>

⁵ <http://www.govexec.com/defense/2009/05/commandant-says-marines-will-field-their-own-gunships/29179/>

⁶ https://csis-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/media/csis/pubs/9005lessonsiraniraqii-chap09.pdf

⁷ <https://www.nts.gov/investigations/AccidentReports/Reports/MAR9004.pdf>

⁸ <http://mentalfloss.com/article/27877/seawise-giant-you-cant-keep-good-ship-down>

⁹ <http://www.dtic.mil/dtic/tr/fulltext/u2/b192139.pdf>

¹⁰ <http://www.thedrive.com/the-war-zone/11723/israel-just-launched-a-containerized-ballistic-missile-from-the-deck-of-a-ship>

¹¹ <http://www.popularmechanics.com/military/navy-ships/a27205/navy-reload-missile-silos-at-sea/>