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Undersea Warfare (USW) in the Navy After Next (2015-2030)

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14. ABSTRACT

With the end of the Cold War, the U.S. armed forces faced a changed environment. Heretofore, the armed forces were prepared to fight two major regional contingencies at the same time. Now these forces must be prepared to fight a series of limited conflicts (e.g. the Gulf War, Kosovo,) and provide humanitarian support (e.g. Somalia) efforts. The armed forces must be transformed so that they are capable of projecting force, rapidly and potently to stop aggression by combining precision with speed. They must also be prepared to counter threats from terrorist organizations. Specifically the U.S. Navy and Marines must be prepared to operate jointly with other U.S. armed services and with coalition forces to project power ashore with the least risk to allied personnel and ships. In order to do this the U.S. Navy must operate in and transfer Marines through both blue water oceans and brown water littorals in order to assure access to all theaters of operation. This paper will address our vision of the role of surface platforms in Undersea Warfare (USW) in the Navy After Next (2015-2030).

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UNDERSEA WARFARE (USW) IN THE NAVY AFTER NEXT (2015-2030)

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INTRODUCTION

With the end of the Cold War, the U.S. armed forces faced a changed environment. Heretofore, the armed forces were prepared to fight two major regional contingencies at the same time. Now these forces must be prepared to fight a series of limited conflicts (e.g. the Gulf War, Kosovo,) and provide humanitarian support (e.g. Somalia) efforts. The armed forces must be transformed so that they are capable of projecting force, rapidly and potently to stop aggression by combining precision with speed. They must also be prepared to counter threats from terrorist organizations. Specifically the U.S. Navy and Marines must be prepared to operate jointly with other U.S. armed services and with coalition forces to project power ashore with the least risk to allied personnel and ships. In order to do this the U.S. Navy must operate in and transfer Marines through both blue water oceans and brown water littorals in order to assure access to all theaters of operation.

This paper will address our vision of the role of surface platforms in Undersea Warfare (USW) in the Navy After Next (2015-2030).

The USW Assets in the US Navy in 2015 – Budget Driven

The composition of the Navy After Next (NAN) will be determined as a result of current budget deliberations along with the Quadrennial Defense Review (QDR). Many budget/force studies have and are being done. An example of one is a report of October 2000. The Congressional Budget Office (CBO) assessed the ability of the Navy to maintain between today and 2020 its current force of 300 ships and 3500 aircraft at a funding level of $90 Billion (adjusted for inflation) per year. The CBO considered four options:

1. *Rely on aircraft carriers and focus on providing forward presence.*
2. *Use other ships for forward presence missions.*
3. *Build a submarine strike Navy.*
4. *Reorient the Navy to provide more support for the Marine Corps.*

The results of the study were:

	Navy's Current Plan	Option 1	Option 2	Option 3	Option 4
Aircraft Carriers	12	12	7	7	10
Surface Combatants*	117	83	118	58	93
Attack Submarines*	55	25	34	72	30
Strike Submarines	0	0	0	50	0
Ballistic Missile Submarines	14	10	10	10	10
Amphibious Ships	36	24	6	18	43
Combat Logistics Ships	31	26	26	26	26

	Navy's Current Plan	Option 1	Option 2	Option 3	Option 4
Mine Warfare Ships**	16	16	16	16	47
Fleet Auxiliaries	23	23	23	29	23
TOTAL SHIPS	**304**	**219**	**240**	**286**	**282**

** USW (including organic mine avoidance) capable*

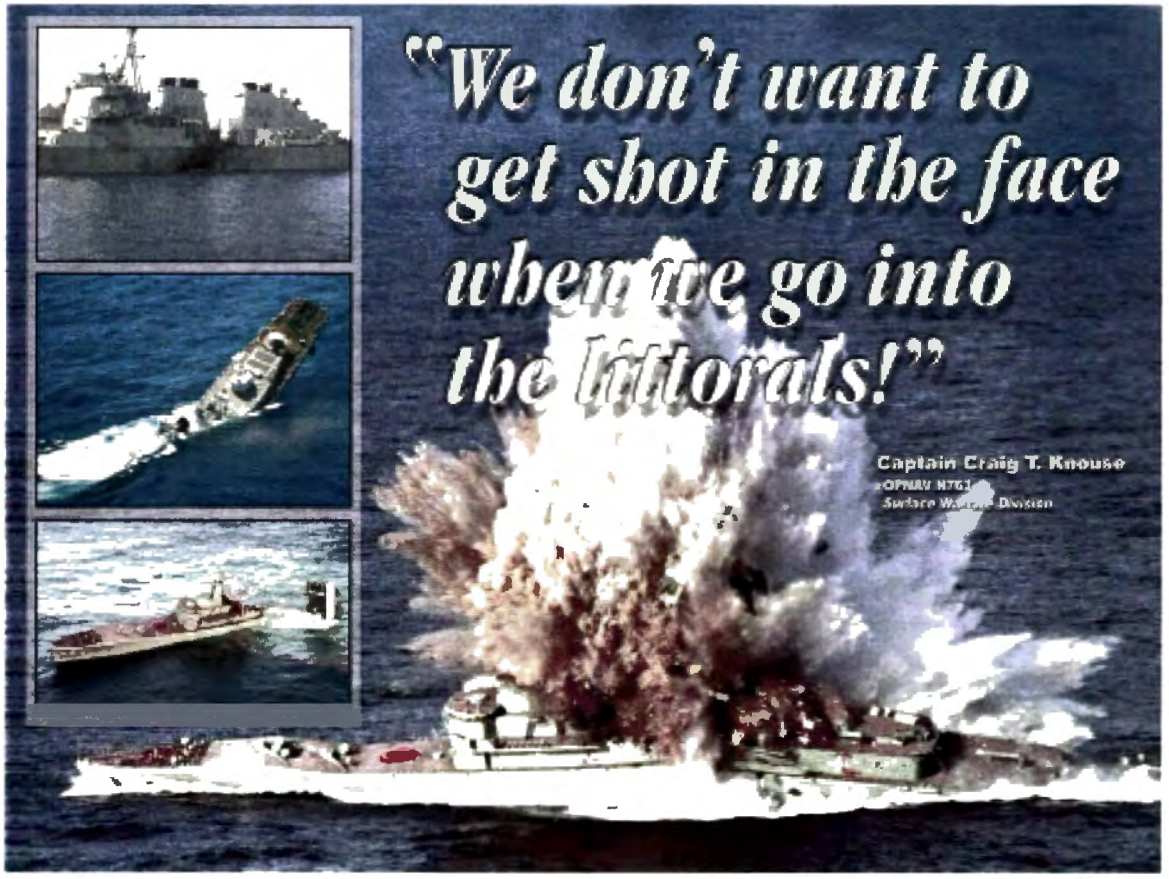
*** USW (Mine Warfare) capable*

It should also be noted that surface combatants (Cruisers, Destroyers, and Frigates) of afloat today will comprise 55% of the 2015 fleet. The only new class of surface combatant which may be in the 2015 fleet is the DD21. [At this date their future is uncertain.] The main surface ship ASW combat system of today is the AN/SQQ-89, which was originally designed for blue water operations against the Soviet nuclear submarine threat and is being redesigned for better performance in the littorals will be in the fleet until at least 2040.

Submarines afloat/submerged today will comprise nearly 70% of the 2015 fleet.

At this time no definitive answer is available. What is expected is that the fleet will not grow, and along with the number of personnel populating the fleet, may be reduced. The resulting fleet will have to be more efficient than the current fleet.

THE USW THREAT TO SURFACE SHIPS - TRENDS



Submarines

The conventional nuclear powered submarine will continue to be a threat, albeit at much reduced numbers. The major littoral submarine threat will be powered by either conventional Diesel engines or by a combination of Stirling cycle engines and fuel cells with conventional lead acid batteries. These latter submarines with air independent propulsion (AIP) may be capable of underwater speeds of 20-25 knots and be capable of remaining submerged for weeks at a time. They may be equipped up to 10 tubes capable of firing torpedoes or anti-ship cruise missiles. The submarines will be extensively sound dampened and will be extremely difficult to detect

using passive sonar and difficult to detect using active sonar. Submarines exhibiting some of these characteristics include the German Type 212, the Russian Kilo class Type 636 and the Franco-Spanish Scorpene design. If the countries developing this technology decide to provide export versions, proliferation will occur despite high cost.

Submarine Sensors

The rapid advance of signal processing technology and the availability of Commercial-Off-the-Shelf (COTS) high speed processing hardware will allow the proliferation of improved sensors. These sensors will allow improved acoustic and non-acoustic detection of surface ships. The sensors may be organic to the submarines or be pre-deployed in the littoral theater of operations. Non-organic pre-deployed sensors such as unmanned airborne vehicles (UAV) will provide the ability to search at ranges that will not compromise the submarine.

Submarine Launched Weapons

Torpedoes: The expected torpedo threats will be a mix of acoustic homers, either passively homing on surface ship radiated noise or wake homers actively homing on ships wake. One interesting development, a compromise between an underwater launched missile and a torpedo, is the Russian manufactured Shival "rocket torpedo." This torpedo with a maximum range of six miles localizes the target at 50 knots and attacks at 200 knots.

Anti-Ship Cruise Missiles (ASCM): It is expected that ASCM's will proliferate. Modern submarine launched ASCM's have ranges over 100 miles, supersonic speed, and can maneuver to avoid ship self defense weapons. Some ASCM's will be built with stealth characteristics and able to attack multiple targets. The surface ships can be targeted via autonomous airborne vehicles or other third party methods with the resulting data transmitted to the submarine.

Mines

Mines may be the weapon of choice for those countries that either do not have the technology or resources to support submarines or wish to supplement their submarines. This can be an especially effective tool for navies that wish to deny a limited area to an enemy. Mines are relatively inexpensive and can be built in size and materials that reduces the ability of their being detected. The addition of underwater communications to mine sensors can allow a limited interrogate friend or foe (IFF) capability in a smart mine. Low cost microprocessors can be installed along with sensors can be incorporated in the mine to allow it to be activated by predetermined vessel classes (e.g., submarine or surface ship).

TECHNOLOGY TRENDS

Proliferation of advanced technology cannot, and probably should not, be constrained. Well qualified students from potentially hostile countries and entities (e.g., terrorist groups) attend universities in other countries, such as the United States and the United Kingdom without restraint. They then return home with state-of-the-art technical knowledge. Commercial firms sell state-of-the-art components on the open market with few constraints. The technological lead enjoyed by the United States and its allies over potential hostile countries and (terrorist) groups is getting smaller. Some relevant technological items are:

Knowledge Management: The amount of information needed and being supplied to the warfighter is continually increasing. This information must be sorted, mined, understood and converted to information to aid the warfighter in acting on that knowledge. The next generation of software called "Software Agents" are being developed to accomplish this by automatically accepting abstract tasking, getting needed information, deciding how to solve simple problems, helping the user solve difficult problems, and by taking action on the user's behalf.

Reduced Manning: Commercial ships operate with minimal crews through automation. The US Navy is applying this technology to its ships. The "Smart Ship" experiment on the USS Yorktown accomplished reduced manning by automating the engineering plant, by providing on board "cell phone" technology in all compartments and by placing damage control gear throughout the ship. This type of technology is planned to be applied to DDG51 class ships within the next several years. In addition the DD21 class ships will reduce personnel requirements to less than 100 personnel from the more than 300 personnel on current surface combatants.

Electric Drive: Electric drive for ship propulsion is being developed for the DD21 class ship and is also being developed for similar uses in the United Kingdom and France. The use of electric drive will reduce ships acoustic signatures and will allow for reduced manning.

Nanotechnology: The science of nanotechnology continues to grow. It may allow the development of:

- *Products designed at the molecular level*
- *Stronger and lighter materials, for example, nanotubes one atom thick of carbon can be created that are 100 times stronger than steel.*

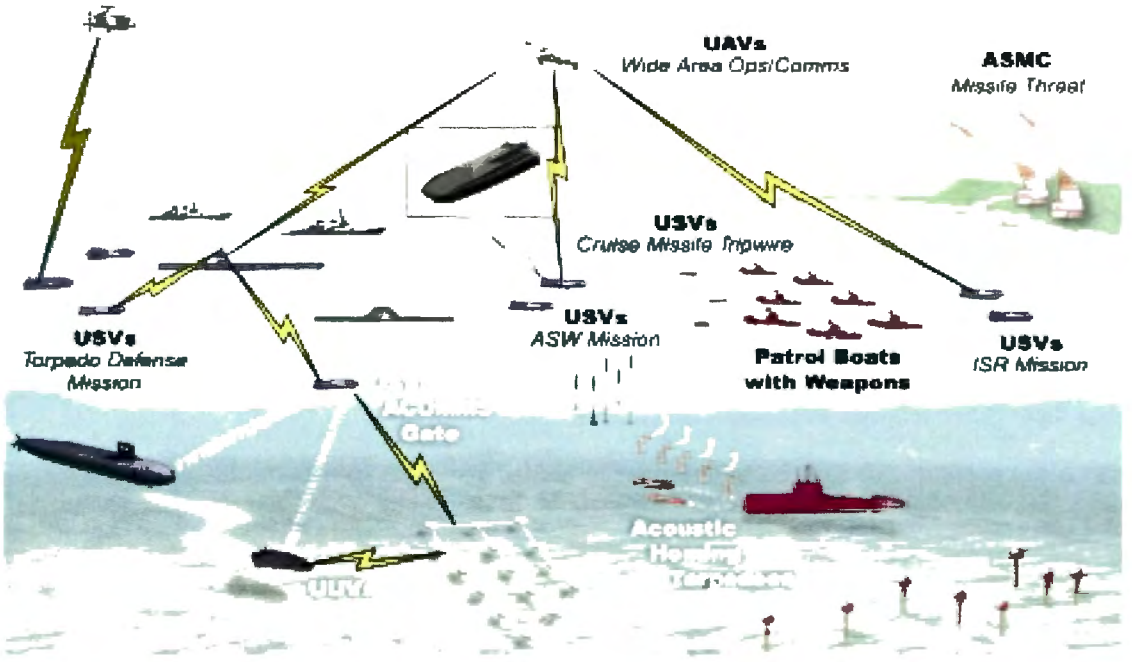
Micro-Electronic Mechanical System (MEMS) technology is being developed that may produce devices that can, among other things, adaptively reduce drag thus increasing the endurance of ships and torpedoes.

Unmanned Aerial Vehicles (UAVs) have been developed by various countries, including the United States. This technology is being applied to undersea (UUVs) and surface (USVs) vehicles. These vehicles will have the capability to deploy acoustic and non-acoustic sensors and/or weapons with a combination of fully autonomously or semi-autonomously operation with or without human interaction. The technology for semi-autonomous/remote control is available on the open market, so it can be expected that these vehicles will potentially comprise a large part of hostile forces confronting U.S. and Coalition forces.

Cyber-Warfare: The increased reliance on cyber communications by warfighters and the world's economy creates the opportunity for hostile forces to use asymmetric cyber warfare to create chaos. The insertion of Trojan Horses, worms, and other computer viruses into computer networks is an ongoing threat.

High Speed Computing: Moore's law appears to be still in effect. Computational power is doubling about every 18 months.

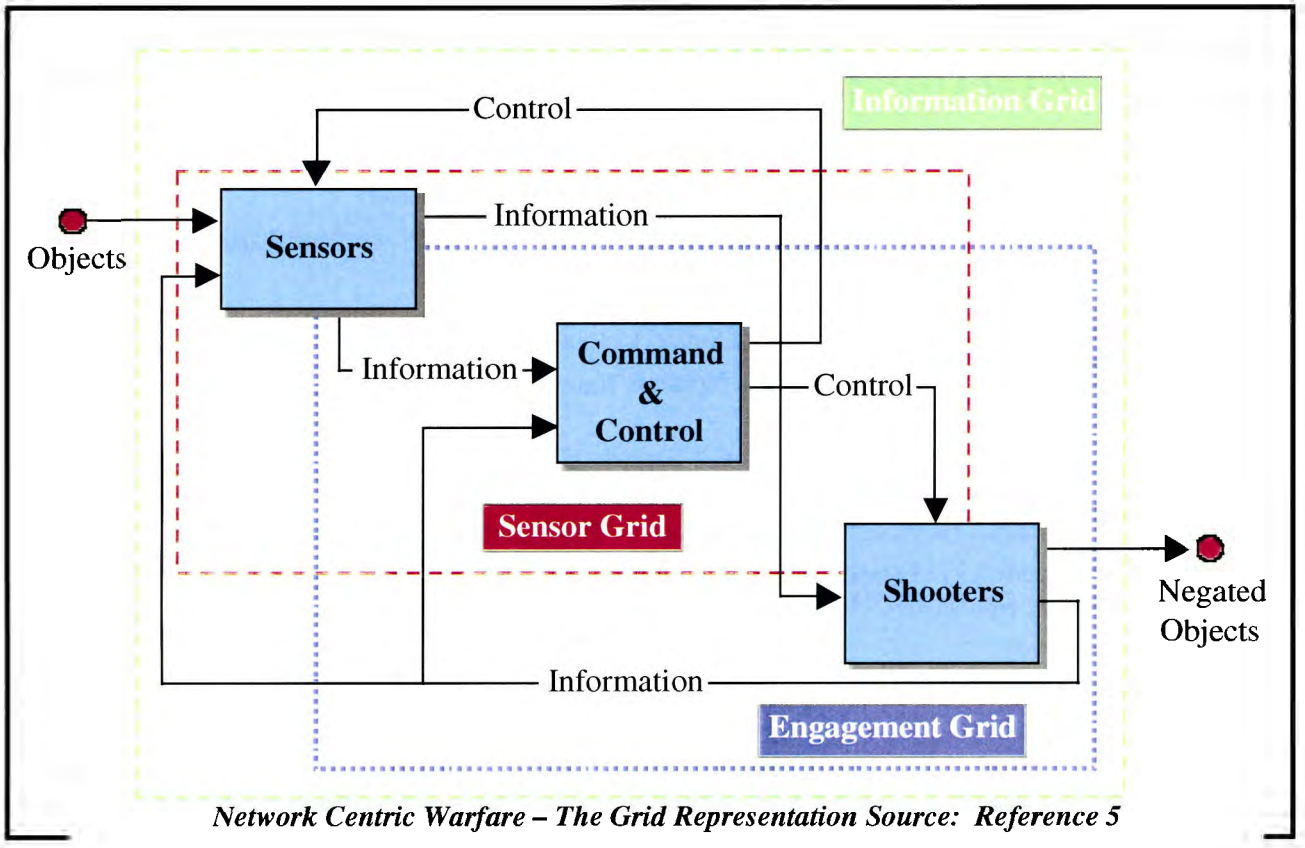
THE NAVY AFTER NEXT (NAN)



The post Cold War environment and the threats facing the Navy After Next are causing a major transformation of the Navy. The ships that exist today and those to be built in the next ten years will be the major components of the NAN. Future USW operations will not differ fundamentally from the past. The need will still exist to:

- *Conduct cover/overt tracking prior to hostilities*
- *Control choke points*
- *Perform large area surveillance and clearance*
- *Provide moving screen protection for transiting forces (escort)*
- *Protect havens/staging areas/ports*
- *Defend fleet operating areas*
- *Monitor adversary ports/OPAREAS*

What will change is the type of USW assets used to perform these operations and the organization utilizing them. Manned warships, such as submarines and surface combatants, may likely be considered too valuable to be used in protracted USW operations. In addition, these warships will be likely assigned to missions other than USW such as theater ballistic missile defense and strike warfare. Rather than relying completely on these platforms, remote networked sensor grids are envisioned to be deployed either by air or by submarine.



Network Centric Warfare – The Grid Representation Source: Reference 5

Unmanned undersea, air, and surface vehicles (UUV, UAV, USV) will be also be deployed. These vehicles and the sensor grid will be networked together to provide data to the manned platforms. [It should be noted that this automated platform and sensor technology can also be employed by forces hostile to the US Navy.] UUV's and USV's will operate in advance of our manned ships, carrying sensors and/or weapons and will covertly or clandestinely map the expected undersea battle space, determining safe routes for our ships and neutralizing as many mines and submarines as possible. This concept is based on Network Centric Warfare. Network Centric Warfare strives to achieve information superiority by erecting a cohesive network of sensors, command-and-control directions, and shooters. This network is often depicted as an interlocking set of grids for information exchange, sensors and engagement capacity. Within these grids the combat events unfold. The information grid includes cooperative engagement capabilities and common information exchange such as integrated tactical and operational pictures. It provides the ability to exchange, process, manage and protect information for the forces. The sensor grid can include air, sea, ground, and space sensors. These produce information to improve the force's awareness of the battle-space. The engagement or shooter grid enables operations to be executed in a precise manner.

This vision of the grids as an information network describes an infrastructure in which the sensors and the shooters are tied more closely together. The emerging operational architectures that are a result of this vision are characterized by some important operational concepts. Some of these are:

- **Self-Synchronization:** *Forces can organize and coordinate warfare activities from the bottom up.*
- **Improved Speed of Command:** *The command structure can use superior information to rapidly lock out enemy alternatives. This may cause basic changes in the command structure.*
- **Improved Firing Doctrine:** *The forces can use superior information to engage more enemy units with fewer weapons.*

CONCLUSION

The proliferation of advanced technology to potentially hostile countries and other entities combined with increased importance of each manned ship in the US Navy due to their reduced numbers has caused the US Navy to begin to transform itself into the Navy After Next. Although current ship designs will comprise the bulk of naval forces in this time frame, their tactical employment will not be the same. The result will be that our ships, with reduced numbers of personnel aboard, will still go in "Harms Way," with greater visibility into the actual tactical situation and with hostile capabilities having been minimized by autonomous platforms/weapons. The plans are being put into place, the technology is being developed, and with an adequate budget it will happen.

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