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Navy Network-Centric Warfare Concept: Key Programs and Issues for Congress

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Summary

Network-centric warfare (NCW) is the Navy's central concept for organizing its efforts to transform itself for military operations in the 21st Century. NCW focuses on using information technology (IT) to link together Navy ships, aircraft, and shore installations into highly integrated networks. It could significantly improve U.S. naval capabilities and lead to substantial changes in naval tactics, doctrine, and organization. Key programs for implementing NCW include the Cooperative Engagement Capability (CEC), the IT-21 program, and the Navy-Marine Corps Intranet (NMCI). Congress has closely followed and expressed concern for some of these programs. The Navy is working to resolve problems with the CEC system that were discovered in testing. The Navy recently awarded a multibillion-dollar NMCI contract and has begun to create the NMCI network. This report may be updated if developments warrant.

Network-Centric Warfare

The concept of network-centric warfare (NCW) emerged in 1997 and has become the Navy's central concept for organizing its efforts to change and transform itself for 21st Century military operations. NCW focuses on using advanced information technology (IT) – computers, high-speed data links, and networking software – to link together Navy ships, aircraft, and shore installations into highly integrated computer/telecommunications networks. Within these networks, ships, aircraft, and shore installations will share large amounts of critical information on a rapid and continuous basis. The Navy believes that NCW will dramatically improve Navy combat capability and efficiency by helping the fleet to achieve "speed of command" (an ability to generate and execute commands at much higher speeds), which will permit U.S. naval forces to outpace adversary decisionmaking and thereby "lock-out" (i.e., foreclose) potential adversary strategies:

> Reliance on NCW is at the heart of the current C4I [command, control, communications, computers, and intelligence] efforts in the Department of the Navy.... Network Centric Warfare increases the speed, precision, and effectiveness of Naval

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forces. NCW enables the Navy to attain information superiority, mass effects instead of forces, and disrupt the enemy's ability to carry out its strategy.[1]

Key NCW Programs

The Navy's effort to implement NCW involves several IT procurement efforts. Key among these are the Cooperative Engagement Capability (CEC) program, the IT-21 investment strategy, and the Navy-Marine Corps Intranet (NMCI). Each of these is discussed below.

CEC. The Cooperative Engagement Capability (CEC) system links U.S. Navy ships and aircraft operating in a particular area into a single, integrated air-defense network in which radar data collected by each platform is transmitted on a real-time (i.e., instantaneous) basis to the other units in the network.[2] Each unit in the CEC network fuses its own radar data with data received from the other units. As a result, units in the network share a common, composite, real-time air-defense picture. CEC will permit a ship to shoot air-defense missiles at incoming anti-ship missiles that the ship itself cannot see, using radar targeting data gathered by other ships and aircraft. It will also permit air-defense missiles fired by one ship to be guided by other ships or aircraft. The Navy has stated that CEC is a "central element" of NCW that "provides a revolutionary improvement in battle group air and missile defense capability.... CEC also has promising potential for Joint Service application with systems such as [the] Army Patriot [surface-to-air missile system] and the Air Force Airborne Warning and Control System (AWACS)."[3]

Then-Secretary of Defense William Perry strongly endorsed the system in 1994 and told the Navy to accelerate it. The system achieved further impressive results in early 1996 in a test known as Mountain Top and was granted certification for initial operational capability (IOC) at the end of FY1996. The Navy wants to install the system on its aircraft

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[1] Statement of The Honorable John W. Douglass, Assistant Secretary of the Navy (Research, Development and Acquisition), *et al*, Before the Military Procurement and Research and Development Subcommittees of The House National Security Committee on DoD Navy and Marine Corps Modernization Programs For FY1999, March 4, 1998, p. 19-20. For additional discussions of NCW, see Alberts, David S., *et al*. *Network Centric Warfare, Developing and Leveraging Information Superiority*. Washington, Department of Defense, 1999. 256 p.; Cipriano, Joseph R. A Fundamental Shift in the Business of Warfighting. *Sea Power*, March 1999: 39-42; Bender, Bryan. Buying Into Networked Warfare. *Jane's Defence Weekly*, May 13, 1998; West, Leslie. Network-Centric Warfare Realizes Its Promise. *Sea Power*, March 1998: 38-40; and Cebrowski, Arthur K., and John J. Garstka. Network-Centric Warfare: Its Origins and Future. *U.S. Naval Institute Proceedings*, January 1998: 28-35; Holzer, Robert. Navy Speeds Toward Centralized Information System. *Navy Times*, November 24, 1997: 35.

[2] In very simplified form, a CEC installation on a ship or aircraft includes an antenna for receiving and transmitting radar data and a computer processor (with CEC software) for processing received radar data and fusing it with radar data collected by the ship's or aircraft's own radars. Procuring and installing a CEC system costs a few to several million dollars per ship or aircraft.

[3] Statement of The Honorable John W. Douglass, Assistant Secretary of the Navy (Research, Development and Acquisition), *et al*, op. cit., p. 20.

carriers, Aegis-equipped cruisers and destroyers, selected amphibious ships, and E-2C Hawkeye carrier-based airborne early warning aircraft over the next several years.[4]

Tests of CEC aboard Navy ships in 1998 revealed significant interoperability (i.e., compatibility) problems between the CEC system's software and the software of the air-defense systems on some ships, particularly surface combatants equipped with the Baseline 6 version (the most recent version) of the Navy's Aegis air defense system. In response to these problems, the Navy restructured its CEC testing and implementation schedule and undertook a major two-year effort, now completed, to identify, understand, and fix the problems. The CEC system, with the new fixes, passed its technical evaluation (TECHEVAL) testing in February and March 2001 and moved to final operational evaluation (OPEVAL) testing in April and May 2001.[5]

Navy officials have acknowledged that the CEC system (and NCW in general) will place strains on the limited data-transmission bandwidth capability[6] currently available to the Navy. One contractor has proposed modifying CEC with a capability called the Tactical Component Network (TCN). Advocates of TCN argue that incorporating it into CEC will reduce the bandwidth required by CEC without reducing CEC effectiveness.[7]

IT-21. IT-21, which stands for IT for the 21st Century, is the Navy's investment strategy for procuring the desktop computers, data links, and networking software needed to establish an intranet for transmitting tactical and administrative data within and between Navy ships. The IT-21 network will be built around commercial, off-the-shelf (COTS) desktop computers and networking software and will provide a multimedia (text, data,

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[4] For descriptions of CEC, see Busch, Daniel, and Conrad J. Grant. Changing The Face of War. *Seas Power*, March 2000, 37-39; O'Driscoll, M. [Michael] J., and J. [Jerry] A. Krill. Cooperative Engagement Capability. *Naval Engineers Journal*, March 1997: 43-57; Goodman, Glenn W., Jr. Extending The Horizon. *Armed Forces Journal International*, April 1996: 58, 60, 62; Co-operative Engagement. *Maritime Defence*, April 1995: 60-62; The Cooperative Engagement Capability. *Johns Hopkins APL Technical Digest*, no. 4, 1995: 377-396.

[5] Raytheon Navy Tareting System In Test For production. Bloomberg.com wire service story, May 9, 2001; Bohmfalk, Christian. CEC System Ready For OPEVALl; Missile Failures Anomolies, Navy Says. *Inside the Navy*, March 12, 2001; Cooperative Engagement Successfully Demonstrated At Sea. Department of Defense news Release No. 097-01, march 6, 2001; Bohmfalk, Christian. Navy Optimistic About CEC Technical Evaluation, Ready for OPEVAL. *Inside the Navy*, March 5, 2001.

[6] Bandwidth capability can be compared to the diameter of a water pipe or the number of lanes on a highway: The greater the bandwidth (i.e., the greater the pipe diameter of the larger the number of lanes), the larger the amount of data that can be transmitted.

[7] Bohmfalk, Christian. Lockheed Martin Pushing TCN As Cooperative Engagement Backbone. *Inside the Navy*, April 16, 2001; Holzer, Robert. U.S. Navy Sees CEC Boost From Tests of Tactical Network. *Defense News*, November 27, 2000: 4; Bohmfalk, Christian. TCN Test Money May Move Soon, After Report on Recent Evaluations. *Inside the Navy*, November 20, 2000; Holzer, Robert. U.S. Navy Halts Network Component Work Amid CEC Woes. *Defense News*, November 6, 2000: 4, 28; Bohmfalk, Christian. Navy Delaying Tests of Future CEC Component; Industry Bewildered. *Inside the Navy*, November 6, 2000; Bohmfalk, Christian. Raytheon, Lockheed Martin At Odds Over Proposeed CEC Changes. *Inside the Navy*, October 23, 2000; Holzer, Robert. Critics Dispute Findings of Tactical Study. *Defense News*, October 16, 2000: 14.

graphics, images, voice, and video) organizational intranet similar to the Capitol Hill intranet or corporate intranets. The Navy has testified that "This IT infrastructure is essential to realizing the Department's shift" to NCW.[8] The IT-21 concept originated in the Pacific Fleet in 1995-1996. The Navy plans to link most of the fleet into the IT-21 intranet within the next few years. The Navy believes IT-21 will significantly improve U.S. naval warfighting capability and achieve substantial cost reductions by significantly reducing the time and number of people required to carry out various tactical and administrative functions.[9]

NMCI. The Navy-Marine Corps Intranet (NMCI) is a corporate-style intranet that will link together Navy and Marine Corps shore installations in much the same way that the IT-21 effort will link together Navy ships. When completed in 2003, the NMCI will include a total of about 360,000 computer work stations, or "seats," at scores of Navy and Marine Corps installations in the continental United States, Hawaii, Guam, Puerto Rico, Guantanamo Bay (Cuba), and Iceland.[10] In October 2000, the Navy announced that it had awarded an industry team led by Electronic Data Systems (EDS) Corporation a $6.9 billion contract for installing , supporting, and periodically upgrading the NMCI over the next 8 years.[11] The first 42,000 NMCI seats at 29 sites are now being installed, and the system is scheduled to be fully implemented by October 2003.[12] Navy officials are considering whether to eventually merge the IT-21 and NMCI efforts.[13]

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[8] Statement of The Honorable John W. Douglass, Assistant Secretary of the Navy (Research, Development and Acquisition), *et al*, op. cit., p. 20.

[9] For more on IT-21 and the Navy-Marine Corps Intranet (NMCI), see Clemins, Archie. Standby for Big Reform – A Navy-Marine Corps Intranet. *Navy Times*, March 6, 2000: 58; Kreisher, Otto. Breaking Down the Barriers. *Sea Power*, March 2000: 34-36; Clemins, Archie. It's More Than E-Mail. *U.S. Naval Institute Proceedings*, February 2000: 56-58; Dawson, Cutler J., *et al*. The IT-21 Advantage. *U.S. Naval Institute Proceedings*, December 1999: 28-32; Peniston, Bradley. Navy-Wide Intranet To Be Online By 2001.

[10] For more on NMCI in general, see Murray, Bill. Joining Forces. *Government Executive*, December 2000; Cipriano, Joseph. Reinventing Maritime Power: The Navy-Marine Corps Intranet. *U.S. Naval Institute Proceedings*, September 2000: 72-74.

[11] Gilpin, Kenneth N. E.D.S. Wins Record $7 Billion Contract For Navy Computer Network. *New York Times*, October 7, 2000; Bohmfalk, Christian. EDS Team Wins $7 Billion, Eight-Year Navy-Marine Corps Intranet Deal. *Inside the Navy*, October 9, 2000; Ward, Leah Beth. Navy Links EDS Bonus To Satisfaction Of Users. *Dallas Morning News*. October 25, 2000; Donnelly, John M. Navy Says Network's Cost Could Double, But Payoff Huge. *Defense Week*, October 23, 2000: 2.

[12] Gunder, Joseph. Better Decisions Faster; Cipriano Explains What NMCI Is All About. Navy News service wire story, May 23, 2001; Bohmfalk, Christian. Pax River to Get NMCI Seats in Mid January, Later Than Planned. *Inside the Navy*, December 25, 2000; Bohmfalk, Christian. First NMCI Seats Should Come With Common-Access Cards, Readers. *Inside the Navy*, December 18, 2000.

[13] Woods, Randy. Navy May Merge IT-21 With Navy-Marine Corps Intranet. *Defense Information and Electronics Report*, January 19, 2001.

The 106th Congress expressed concern over the difficulty of identifying the total cost of the NMCI effort in Navy budget documents,[14] the Navy's ability to finance NMCI effort without disrupting other important Navy programs,[15] the pace at which the Navy planned to implement NMCI,[16] the Navy's ability to properly structure and manage the huge NMCI contract (the largest networking-services IT contract undertaken by a federal agency),[17] the potential impact of NMCI implementation on employees of current naval networking and telecommunications systems,[18] and whether the network should be extended to cover installations in the Marine Corps, which already has its own service-wide network.

In response, the Navy took actions to improve the visibility of NMCI costs in its budget, stated that the NMCI would be financed to a large degree using funds programmed for older IT procurement programs that the NMCI will supercede, stated that implementing NMCI would have only a small net employment impact, and argued that implementing NMCI in the Marine Corps as well as the Navy would result in greater efficiencies and lower overall costs for the two services. At Congress' direction, the plan for implementing NMCI was restructured to begin with a smaller number of initial installations, so that the success of the NMCI effort could be more carefully assessed before the program is expanded to cover larger parts of the Navy and the Marine Corps.

Issues for Congress

Potential issues for the 107th Congress pertaining to NCW include the following:

Resolving implementation issues with CEC. Issues include whether the interoperability problems have been fully resolved, whether the Navy's restructured installation schedule is appropriate,[19] and what, if anything, the problems in implementing CEC reveal about the challenges of incorporating advanced IT into complex weapon systems.

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[14] See, for example, Holzer, Robert. U.S. Navy's Intranet Meets Congressional Resistance. *Defense News*, May 29, 2000: 10, 14; Bohmfalk, Christian. Navy Estimates Intranet To Cost $5.75 Billion Over First Five Years. *Inside the Navy*, July 10, 2000; Text: Navy Marine Corps Intranet Report to Congress. *Inside the Navy*, July 10, 2000; Brown, David. Congress Clogs Navy-Marine Intranet Plan. *Navy Times*, May 15, 2000: 15; Bohmfalk, Christian. Congress Demands More Information on Navy Intranet Plan. *Inside the Navy*, May 15, 2000.

[15] See, for example, Robinson, John. Incoming CNO Warns Navy Intranet Effort Can't Bankrupt Readiness. *Defense Daily*, June 29, 2000: 2; Verton, Dan. Lost At Sea. *Federal Computer Week*, May 8, 2000: 26-28; Cahlink, George. U.S. Congress Questions Navy's Ability To Fund Service Intranet. *Defense News*, April 24, 2000: 8.

[16] See, for example, Bohmfalk. Navy Still Working Through Intranet Issues With OSD, Congress. *Inside the Navy*, August 14, 2000.

[17] See, for example, Bohmfalk, Christian. GAO Evaluating Early Navy Work on Intranet, Associated Risks. *Inside the Navy*, November 6, 2000; Bohmfalk, Christian. Congress Requires More Oversight of Multiyear Service Contracts. *Inside the navy*, October 23, 2000.

[18] See, for example, Bohmfalk, Christian. Hundreds of Naval Employees Change Jobs Because of NMCI. *Inside the Navy*, May 14, 2001.

[19] Keeter, Hunter. New Numbers Show Reduced Buy For Navy CEC Program, $3.7 Billion Total Cost. *Defense Daily*, December 21, 2000: 5.

Adequacy of transmission bandwidth for CEC. Another issue is whether TCN should be incorporated into CEC as part of the effort to manage limits on available bandwidth, and what implications TCN would have for the evolution of the CEC system.

Tracking implementation of NMCI. Potential NMCI issues concern the success of the initial NMCI installation efforts,[20] whether funding requirements for the program are displacing other high-priority Navy or Marine Corps efforts,[21] and whether installations using NMCI are achieving the kinds of improvements in operational efficiency that NMCI advocates have projected.

Questions concerning NCW in general.[22] Congress may consider other potential issues relating to NCW in general, including the following:

- *Tactics, doctrine and organization:* The Navy recognizes that it needs to develop new tactics, doctrine, and organizations to take full advantage of NCW; this could significantly alter current practices, if not the leadership culture itself, and pose challenges for retraining Navy personnel.
- *Overall fleet design:* The Navy is currently adding NCW to an overall fleet architecture that has evolved in a gradual fashion over the last several decades. The issue is whether the Navy has taken the relatively new concept of NCW adequately into account in its thinking and planning for future ship and aircraft designs and the future overall architecture of the fleet.
- *Allied interoperability:* If NATO and other allied navies invest in NCW-enabling technologies, U.S.-allied naval interoperability (the ability to operate together effectively in multinational efforts) could be significantly increased; if they do not, maintaining naval interoperability could become increasingly difficult.
- *Information security*: The Navy acknowledges that it needs to work on measures for preventing, detecting, and responding to attempts by outsiders to illegally enter the computer networks being created to implement NCW.[23]

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[20] Bohmfalk, Christian. Naval Intranet Report To Reach Capitol Hill By End of October. *Inside the Navy*, June 4, 2001; Bohmfalk, Christian. Atlantic Fleet Headquarters Pleased With Early Intranet Seats. *Inside the Navy*, May 28, 2001.

[21] See, for example, Bohmfalk, Christian. Service Official: Naval Intranet Fully Funded In FY-02 Budget Plans. *Inside the Navy*, May 14, 2001.

[22] For a survey of potential issues relating to NCW, see Jenik, Douglas A. Beyond the Rose-Colored Glasses. *U.S. Naval Institute Proceedings*, February 2000: 60-63; Barnett, Thomas P. M. The Seven Deadly Sins of Network-Centric Warfare. *U.S. Naval Institute Proceedings*, January 1999: 36-39.

[23] See, for example, McCarter, Mickey. Navy Marine Corps Intranet On Schedule TO Fend Off Cyber-Attacks. *Stars and Stripe Omnimedia*, May 18, 2001.