Success Story

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—Vice Admiral Michael G.Mullen, Commander of the Second Fleet, U.S. Navy

Creating a New Air Defense System for the 21st Century

In the world of the 21st century, knowledge will triumph. To defeat the enemy, not only must the U.S. armed services excel at gathering information, they must also be able to rapidly analyze it, understand it, and use it dynamically. Quickness of action will be key to gaining a strategic advantage against a growing number of potential foes and rapidly changing world situations.

The problem, in short, is not getting information so much as managing it, a fact that was clearly brought home by the tragic events of September 11, 2001. The sudden nature of the attacks and the continually changing events in their wake substantiated the need to rapidly deploy an air defense system that not only can respond to changing conditions but also quickly anticipate possible scenarios and develop plans of action.

"The grave threat from nuclear, biological, and chemical weapons has not gone away with the Cold War," President George W. Bush presciently noted in February 2001. "It has evolved into many separate threats, some of them harder to see and harder to answer. And the adversaries seeking these tools of terror are less predictable, more diverse."

In 1998, in conjunction with the Johns Hopkins Applied Physics Laboratory, the U.S. Navy began to develop a prototype Area Air Defense Commander (AADC) Capability program to address existing and emerging ballistic and air-breathing threats.

The Area Air Defense Commander is responsible for planning, executing, and coordinating air and missile defense operations in an integrated air-defense environment, theater-wide. The AADC Capability is a battlespace management system designed to improve the AADC's battlefield readiness by rapidly analyzing the capabilities and intentions of enemy ballistic missile and air forces, comparing them with allied assets in the theater, and simultaneously creating "what-if" scenarios to facilitate the rapid development of robust air defense plans.

The system is designed to display a three-dimensional, graphically rich battlespace, with clearly discernable friendly air defense assets and enemy ballistic missiles, land attack weapons, and air fighters. Commanders can use the AADC system to visualize the theater and develop a dynamic set of integrated air defense plans in support of the goals of the Joint Force Commander.

The objective is to radically improve battlefield response times. Before the development of the AADC program, Navy analysts digested incoming intelligence data and created attack scenarios using little more than "a stack of publications the size of a pickup truck, a bunch of acetate, and some pencils," noted Captain Ken Hamilton, U.S. Navy Reserve. "They'd be wading through this data for days or possibly weeks to come up with a plan."

With the AADC system, "we can create more air defense plans and evaluate how effective they are in a

substantially faster time frame," added Mike Tweed-Kent, Vice President and General Manager of General Dynamics Command and Control System Business. Plans can be created in minutes and then distributed to the combined units that are charged with carrying out the mission of theater air and missile defense.

In July 2000, the Navy awarded GDAIS a contract to produce an AADC Capability Engineering Development Model. However, positive fleet input and the immediate requirement to address threats to U.S. forces and homeland defense led the Navy to decide to rapidly field the AADC prototype system already developed by JHU Applied Physics Lab. As a result, General Dynamics had to rapidly make a transition from a prototype to a production system and deploy it on an accelerated basis.

With the AADC Capability system, information regarding the enemy's assets, the constraints of its weaponry, and likely courses of action are continuously analyzed and paired against the capabilities of friendly forces. This ability to rapidly assess the operational situation at the theater level allows the AADC to quickly develop and direct the execution of effective air defense plans. Developing only one attack plan would not be enough. Instead, the system must be dynamic and predictive, ready to alter scenarios at any time to respond to new and changing enemy courses of action. The AADC Capability system allows commanders to monitor the action in real time, using wide-screen, high-definition displays—supplied by SGI—that show the battlespace three-dimensionally. Personnel can quickly engage in real-time fly-throughs over and around battlefield assets to examine the space from any angle. Both the planning and the current operations displays can be viewed simultaneously, giving commanders the ability to alter a friendly force air defense laydown and then quickly assess the operational effect of that change.

The AADC system is powered by a wide range of SGI® computing and visualization products. Each installation includes a 32-processor SGI® Origin® 3400 server, four SGI® Onyx® 3200 visualization systems (including one for system redundancy), eight Silicon Graphics® Octane2™ visualization workstations, and one Silicon Graphics® O2+™ graphics workstation. In addition to the display technology, built-in videoconferencing and e-mail capabilities mean that other commanders can quickly be brought into the operation. "The key is collaborative planning," noted Rear Admiral Philip M. Balisle, then commander of Cruiser-Destroyer Group Three. With AADC, "the land, air, and maritime component commanders can all be collaboratively working to develop plans and execute an air war in real time."

Unlike other systems, SGI AADC technology displays objects in the theater as they really are. The use of visual representations greatly enhances situational awareness, an especially critical factor during an engagement, when participants are under extraordinary stress and time constraints. Realistic, color-coded icons are universally recognizable, allowing for rapid grasp of the operational situation.

Using SGI displays and large 30x30-foot "reality screens," planes look like planes, and friendly aircraft can easily be distinguished from the enemy. "I see an F-14 as an F-14," noted Captain Hamilton. "With AADC, I see the engagements occurring. The system presents me with a schedule of engagements that I can execute or not in a complex battlespace. AADC helps me zone in on critical contacts to understand what our force is doing to combat that threat."

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The AADC technology was initially tested in 1998 during Fleet Battle Experiment Charlie and in the Theater Missile Defense Initiative. Thanks to the new system, participants had more time to spend developing battlefield analysis and needed less time to organize and assemble incoming data, according to Commander Michael Delaney, former fleet liaison and evaluation officer in the AADC Capability Program Office.

The system was used as part of a full-scale, multinational fleet exercise during RIMPAC 2000. Conducted off the Hawaiian coast, the AADC Capability was installed in USS Shiloh, which was acting as the anti-air warfare commander for the USS Abraham Lincoln carrier battle group. According to Rear Admiral Balisle, the AADC system "showed outstanding value as a force enabler that will allow a ... battle group commander to enter a troubled area and gain control of it quickly." As one reservist participating in the exercise noted, "The AADC capability prototype is a dream. Situational awareness was significantly enhanced by [its three-dimensional graphics and screen icons]."

The program has been well received by Navy personnel. "AADC provides an accurate, three-dimensional air picture and a revolutionary campaign-planning capability that reduces planning time from days to hours or minutes," noted Vice Admiral Michael G. Mullen, then commander of the Second Fleet, in a February 2001 demonstration to President Bush. "It is, quite simply, the most advanced air-defense planning and display system of its kind anywhere in the world."

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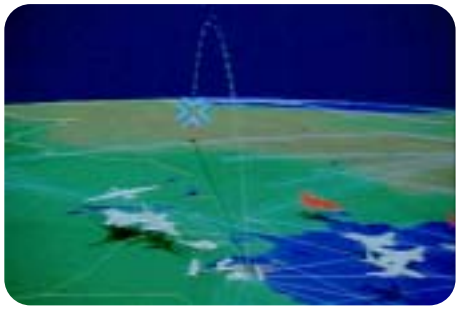
"The AADC module is exceptionally well conceived, designed and built," agreed the Commander of the Sixth Fleet. "It offers a revolutionary capability to air-defense commanders challenged with command and control of increasingly advanced and interoperable forces."



Rodney Sams, of General Dynamics Advanced Information Systems, noted "To use all the new capabilities on the next battlefield that have been bought and paid for, our warriors must have a coherent, believable depiction of the battlespace. All of us, including our allies, will need to use the same game book. Collaborative, near-real-time planning and tactical operations will be essential."

It is a viewpoint with which the President of the United States would agree. After seeing a demonstration of the AADC project, President Bush pointed out that "We're witnessing a revolution in the technology of war. Power is increasingly defined not by size, but by mobility and swiftness. Advantage increasingly comes from information such as the three-dimensional images of simulated battle that I have just seen. Safety is gained in stealth and forces projected on the long arc of precision-guided weapons. The best way to keep the peace is to redefine war on our terms." With AADC, the U.S. Navy and its commercial partners have taken one large step toward that goal.

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3404 (11/01/2002)

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