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VADM Mullen's first assignment was aboard USS *Collett*, followed by duty aboard USS *Blandy*. In 1973 he assumed command of USS *Noxubee* and later served as Chief Engineer aboard USS *Fox*. He was also Executive Officer aboard USS *Sterett* before taking over as Commanding Officer of USS *Goldsborough*. From 1992–1994, he served as Commanding Officer of USS *Yorktown*, and in August 1996, he served as Commander, Cruiser-Destroyer Group Two (George Washington Battle Group).

His duties ashore have included Executive Assistant to the Commandant, USNA (1975–1978); Director, Division Officer Course, Surface Warfare Officer's School (1987); Staff Assistant for Navy Programs, OSD (1989–1991); Director, Surface Officer Distribution Division/Surface Captain Detailer, Bureau of Naval Personnel (1994–1995); Head, Surface Warfare Plans/Programs/Requirements Division and later Deputy Director, Surface Warfare Division of the Office of the CNO (1995–1996); and Director, Surface Warfare Division (May 1998–Sep 2000).



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*VADM Mullen spoke at the Millennial Challenges Colloquium series on 14 April 2000. The text of "The Navy in the 21st Century, Part I: Surface Warfare" follows.*





## The Navy in the 21st Century, Part I: Surface Warfare

VADM Michael G. Mullen

I am delighted to see so many friendly and supportive faces here at APL. If you remember nothing else from this morning, please remember how appreciative I am of all you do. I have the good fortune in this job to travel widely, and one of the most important parts of my responsibilities is being able to interact (although not as much as I'd like) with the people who are in the trenches, who really make things happen. I first had the pleasure of working with APL in 1984 when I wound my way into the Air Defense Department here working on a thesis on the Aegis weapon system, which I knew little about. APL immediately brought me in and helped me a great deal on operations research. That was a very positive experience, and it remains one for which I am still grateful.

Some of you have been here for more than a couple of years, and some of you are relatively new. I want *you* to know how important this Laboratory is in our business. We would be in dire straits if we didn't have the kind of support across the board that we've gotten from APL for many years. Please don't underestimate the work that you do because it has made a huge difference, and I believe it will continue to make a huge difference for Surface Warfare, the Navy, and the nation for many years to come.

I'd like to cover where I see the Navy going in Surface Warfare from a broad perspective, as well as address specific systems and some challenges that we face. I will be followed by RADM Rempt (see the companion article, this issue), who will focus a bit more on the combat systems side, which is the heart of what we do for a living.

### THE SURFACE NAVY IN THE 21ST CENTURY

We developed a vision statement over the last several years (see insert). It's actually a significant course change for us. It emphasizes the offensive side and a balance among dominating in the littoral battlespace with ships, systems, and people and in two other emerging mission areas: Land Attack and Theater Ballistic Missile Defense (TBMD). The Laboratory has spent a great deal of time on the Air Defense side, and TBMD is really an extension of that. We also have a lot of interest from the Marine Corps and the Army in providing long-term, precision, fire-support land-attack weapons and artillery support, so developments in those areas are extremely important and a great challenge for us.

The Surface Navy will be an *offensive* maritime force. From a foundation of maritime dominance, we will ensure entry into the 21st century Joint battlespace through the twin missions of *land attack* and *theater air dominance*.

The Surface Navy will be interoperable with Joint forces in net-centric C<sup>4</sup>ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance) and provide maritime force protection, precision strike, and sea-based artillery, and Theater Air and Ballistic Missile Defense to the air, land, and sea elements of the Joint task force.

—Navy Surface Warfare Mission Statement

It is also very important to consider what Navy forces can do from a global perspective. This issue came into focus when I was fortunate enough to command the George Washington Battle Group (one of three) in the Gulf. As it got down to crunch time, what struck me was the nature of support from our allies in that region. Because of the political tensions that existed, I wondered if we would be able to use their bases to support a strike. That support seemed to grow more and more tenuous. This clearly is not an issue for naval forces.

As democracy continues to take root in some countries that we've tried to impact, I think we'll see more pressure to have U.S. forces on our own shore. But while other services retract, there will probably be more and more pressure for naval forces to be going in the other direction. If that doesn't happen, I worry about the naval forces that are the touchstones in many countries, and I worry that we will lose touch around the world. So maintaining a global perspective is important and fits right in to what the Navy—as well as the Marine

Corps—can do. I believe this will be a maritime century, at least for the next 30–50 years, even more so than the last, because of where we seem to be headed from a global perspective. So the developments to support our vision statement are vitally important.

## THE JOINT BATTLE FORCE

The Navy contributes many assets to the 21st century Joint battlespace (Fig. 1): maritime dominance; theater air dominance; land attack; assured access (not just getting there, but staying there); and the ability to take the Air Defense “bubble,” which has historically existed over our ships at sea, and project it out over the forces at shore, whether they're Marines or Army forces or our allies. I also don't believe that in the future we will participate in many operations that are not Joint or combined with our allies. When the UK showed up in the Gulf with their carrier and support forces, it wasn't a matter of matching up how much one carrier could do versus another,

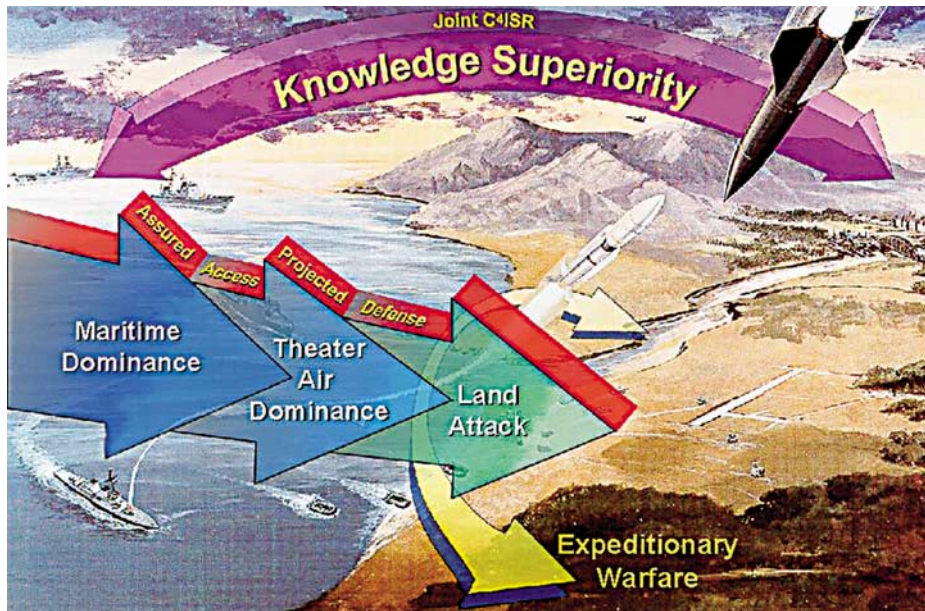


Figure 1. The 21st century Joint battlespace.

it was a matter of having the political support of an ally that was physically there that lifted our spirits much more than I realized it would. Until then, I felt like we were very much alone. We will be evolving more toward coalition types of operations.

Our allies often ask me how they are going to operate with us and how they're going to stay up with us. I respond by telling them that we won't be slowing down so that they can catch up. It is a real challenge, given their budgets to develop systems. So how are we going to be interoperative with those forces, i.e., connect systems and do it from a systems engineering standpoint? This is a real challenge for the Navy as we move out smartly and other countries don't follow. Being in touch with what other navies are developing is also very important, and I give RADM Rempt a lot of credit for the bases he has touched around the world. His efforts have created interest in the types of systems we're evolving, which we will be able to operate together and under budget constraints. Our allies will also be able to help us pay for some of these systems as they are developed jointly.

We are currently focused on expeditionary warfare, which is not new. We do that for a living. You will see the Army and Air Force moving in that direction, but we've been doing it all our lives. Our rotational force concept of operations has been in place almost as long as we've been around, and that will continue.

Joint C<sup>4</sup>ISR and knowledge superiority involve getting relevant information where and when we need it. When I visited the British aircraft carrier's command center, I saw a little scope that was not as technologically advanced as some of the things we had on our ships. On it, handwritten in grease pencil, was, "This is knowledge, not information." That really hit me because we have a tendency to examine as much information as we possibly can, but it's hard sometimes to figure out what the *relevant* information is. Knowledge superiority means we've got to have the information we need *when* we need it. We're not going to have the time to sort through it. There is a time factor in everything we do, and APL is very poised in that regard. In Air Defense, time is the *most* critical factor. Time is becoming more critical in just about every single warfare area, and it's going to be more and more compressed.

## THE ENDURING NEED FOR NAVAL POWER

The need for naval power today is as great or greater than it ever was. You may have heard or read that 75 to 80% of people in the world live around water. I have been in many countries, and I have concluded that the Navy brings stability wherever it goes. I've seen it in the Gulf, in the Western and South Pacific, and in the North and South Atlantic. It's roundly welcomed

wherever we are. It's sometimes very difficult to describe and characterize, but a navy and its forces can bring a wonderfully stabilizing influence.

Naval power is also essential since most nations' economies depend on the sea for trade. And the increasing world instability dictates a need for forward deployment and engagement. It also foreshadows declining access to overseas bases. Typically I don't have to ask anybody's permission to go anywhere. I can go because of the freedom of the seas, and that's understood. This *clearly* is a warfighting capability. It's not one I want to use, but I have got to have it as a deterrent and be able to handle a crisis if one occurs. That is a very big challenge, given the numbers of ships that we have and the requirements that exist. We call it a "Vietnam pace" right now. We built a lot of ships in the 1980s and we're still building them, but we are wearing them out at an incredible pace because we're pushing them so hard. Write your congressmen. Tell them we don't have enough ships. We need more in order to do what is required, and I don't see those requirements going away anytime in the near future.

## THE NAVY'S UNIQUE ABILITIES

Table 1 delineates the Navy's unique, powerful attributes. These are not listed to denigrate the contributions of any other service, because it takes all of us. These characteristics identify what we do exceptionally well.

In the last 84 months we've had 84 contingencies. From 1969 to 1989 we had on the order of maybe 40. From 1989 to 2000 we've had almost 100, so the pace continues to increase. We can debate whether that is good or bad. I have got to be able to deliver the capability and ships and meet the threat. I have to keep my own sailors and Marines out of harm's way when I do it—whether it's in Africa, the eastern Mediterranean, Bosnia, Russia, or Iraq, whether we're countering weapons of mass destruction, delivering humanitarian support, carrying out counterdrug operations, or participating in Partnership for Peace with NATO. Every indication is that this will continue and expand in ways that are difficult to predict. So shaping and responding are what we do, and we've got to have the kinds of ships and support structure that are going to allow us to do that in the future.

## PEACETIME ENGAGEMENT REQUIREMENTS

Right now, peacetime engagement requirements (Fig. 2) are going up. I am limited to 116 service combatants by the QDR (Quadrennial Defense Review). The next 12 to 24 months hold a lot of uncertainty for us. With an election this year, and a new administration, many

**Table 1. Attributes of naval forces.**

Appear without notice	Influence without commitments	Engage without delay	Enable counter-offensive	Withdraw without signal
Strategic mobility	Deterrence	Dominate early fire power	Approach indirectly	Cover the withdrawal
Presence	Gun boat diplomacy	Halt invasions	Enable buildup	Provide postwar stability
Engagement and enlargement	Crisis response	Knock down doors	Shape battlespace	
	Noncombatant evacuation order	Suppress defenses	Cover maneuver elements	
	Independent operations	Hold objectives		
	Flexible deterrent option			

of the key players will change. This means a lot of turmoil for us. It usually takes 18 to 24 months before a new administration gets settled with its leadership. In the meantime, I still have five major warfighting Commanders-in-Chief who have an incredible thirst for requirements, and they depend on what the Navy brings.

The forward presence, i.e., the Navy Theater-Wide (NTW) TBMD strike deterrence, is very high on the Navy's priority list. We need somewhere between 134 to 138 surface combatants. We're also approaching the QDR in 2001 (the last one was in 1997). This is the time we will have to evaluate what our force structure is going to do in the future.

I do encourage you to write to your congressmen and senators. There is incredible pressure on the Navy, and we need to have more forces to do well what we are being asked to do. With these surface combatants, we've got to be able to win, to handle TBMD, to strike, and to stay engaged. You may have heard the phrase,

"Virtual presence is equal to absolute absence," i.e., you need to be there and you need the numbers to do that.

Affordability is a very tough issue. Since I've been on this job for the last couple of years, the budget has been going down constantly. And we continue to expand defense funding, to some degree, I believe, to the detriment of where it really matters, which includes the systems we need.

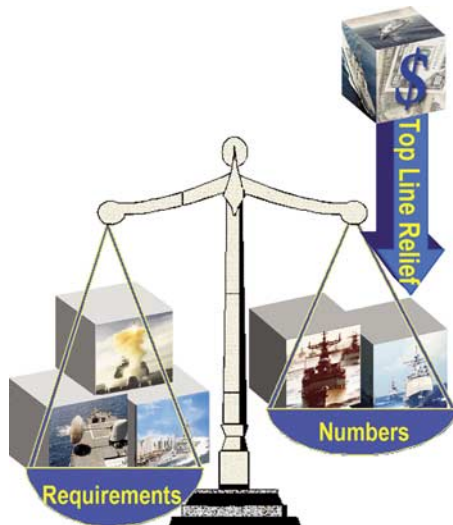
**FORCE STRUCTURE DRIVERS**

I cannot overstate the Navy's deterrence aspect, which has been a powerful force for peacetime and wartime engagements for many years. New peacetime missions in particular bring significant deterrence value. We see it in the warfighting capability that we're bringing online, the NTW TBMD buildup, Tomahawk Land Attack Missile, and DD 21, etc.

**DD 21: Providing Substantial Capability**

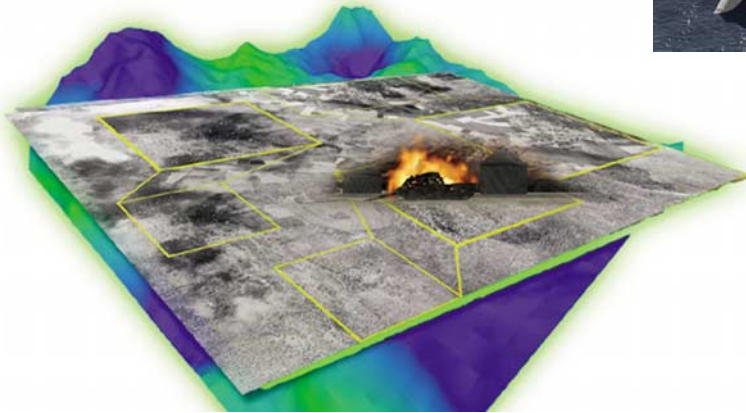
DD 21 will provide fire support and strike capabilities that have been needed for four or five decades (Fig. 3). Conventional battleships are not coming back. We need to get over that. That does not mean that we don't need to develop the kind of fire support that the Army and Marine Corps require. DD 21 is the answer to those needs. There are no single-mission ships; they must be multimission. Tomahawk paved the way for this type of multimission capability. Aegis and Tomahawk were developed for one threat, yet each has evolved to "the threat after."

I hope that the new systems will be robust enough to handle whatever comes next and will not be limited. New systems should be ready for any new threat because there won't be time to develop something new. That's what I need in DD 21. It will provide not only strategic attack and interdiction, but a weapon system (gun support) that is affordable and that I can sustain over a long



**Figure 2.** Pacing the threat in an uncertain (peacetime) world means balancing requirements with an affordable force structure.

- Land Attack in theater
  - Strategic attack
  - Interdiction
  - Ground forces support
- Compatibility with Army's "effects-based fires" concept
- USMC fire support
- Anti-Submarine Warfare protection and escort role



Decisively Influencing  
Events Ashore

Figure 3. DD 21 capabilities.

period. DD 21 will satisfy Marine Corps fire requirements and provide multimission capability. I have talked to Marines and Army officers who said they would have loved to have the DD 21 100-mile gun system in Kosovo. It would have given them the range and precision to take out the targets they couldn't reach.

Some people are critical of DD 21 contracting. They ask if we can do it with 95 people. I think that number is about right. We are developing DD 21 without the constraints of the current system. Some people are concerned about giving this over to contractors to build. The contractors have many years of experience in Navy shipbuilding. Their work is exciting, competitive, and innovative, and they have some great new ideas, which I believe will impact all types of shipbuilding for many years to come.

### CG Conversion and Modernization

How do we modernize our cruisers? I need a lot of support in this area. If we don't modernize, we're not going to have TBMD. We don't have a great track record for getting this right, particularly in a constrained environment. At budget time, modernization accounts are the first to get hit. This conversion

program for CGs 52–73 as part of the NTW TBMD capability is critical for their long-term survival.

- CG 52–73 conversion is required to satisfy forward-engagement NTW deployments (e.g., NTW with SM-3 Blk 2)
- CG 47–51 modernization reduces NTW maritime protection shortfalls and includes
  - Vertical Launch System, Evolved Sea Sparrow Missile (ESSM), Extended Range Guided Munitions (ERGM), and Navy Fire Control System
  - Baseline 1 returns to worldwide deployment
  - Multimission and command and control capability (air area, surface, and undersea dominance)

The first five CGs are not in the program. If a combat system on a surface ship is not upgraded, the ship is typically decommissioned after 14 to 17 years. USS *Ticonderoga* (CG 47), commissioned in 1983, is almost at the decommission point. With increased pressure on the budget, it won't be too long before we have to give these ships up because their combat systems are obsolete. I have not found the money or the support to upgrade CGs 47–51 yet. It will take about \$1 billion to convert them in order to give them 20–25 more years of warfighting capability and to make them prime players in the battle group.

## DDG 51 Upgrade

DDG 51 is being upgraded with many new technologies. This is going to be the “workhorse of the Fleet.” Right now we have about 58 of them. We’re going to have to decommission the older ships and then think about how to develop the Aegis destroyers, the DD 21s, and then the follow-on cruisers.

## TECHNOLOGICAL CHALLENGES

The Navy faces significant technological challenges in the coming decades, some of which I will touch upon next.

### Time-Critical Targeting

Having been off the coast of Iraq and having watched what’s going on in Korea, the Mediterranean, the Adriatic, and the Balkans, I can tell you that our adversaries are very good at figuring out where our weaknesses are and attacking them or taking steps that make it very hard for us to execute with our weapons. So how I reduce the time between locating a target and getting a bomb on it is a major issue for me. This issue is particularly critical from a surface community standpoint as we move into the strike arena, which heretofore has really been handled on the aviation side. Aviation is now very supportive of Tomahawk. They’re very supportive of that kind of autonomous attack before they run their strikers in. I have not been in a theater yet where there weren’t numerous targets, typically more than we can service. So the Air Force and the Navy are moving forward together on this kind of time-critical strike arena.

Time-critical targeting involves not only locating and hitting a target, but knowing the availability of every sensor in the theater so that an immediate decision can be made (Fig. 4). There are some good technologies out there that will help us in that regard. I need to know how long it will take to process the sensor information, what kind of network is supporting us, and what sensors are needed.

I also need to know how I get my requirements on a satellite. I haven’t spent much time doing that. Every time I become involved, the satellite’s requirements piece is full. I don’t fund the satellite program (97% of it comes from outside the Navy), so when one is launched, I get what I get. I need to be more connected to the satellite world, and typically line officers like me haven’t rewarded that. We haven’t rewarded success in space or the C<sup>4</sup>ISR world.

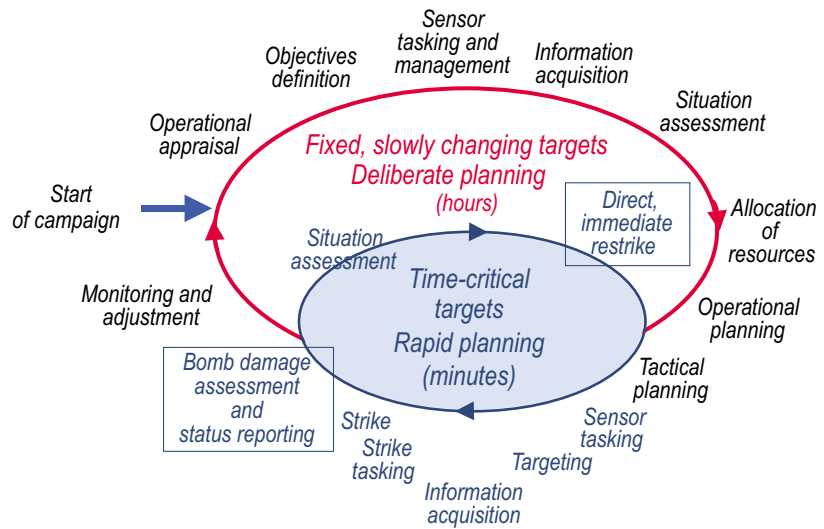


Figure 4. Time-critical targeting challenges.

So how do I make sure that what goes up in space is going to help me? I need sensor-to-shooter capability—right now. That’s an important development for me, and DD 21 will have that requirement and capability. Sensor-to-shooter is really sensor-to-target. I need to know not just that a target landed somewhere, but what happened after it hit or missed, and how fast I can get that information back and how quickly I can reload and restrike. Sensor-to-shooter is important, but I need to know what I have to do to take that target out.

Our bomb damage assessment needs improvement. It’s very organic, and it doesn’t come back to me in any timely fashion. We assume that when we pull the trigger all these wonderful systems will work. They do for the most part, but they aren’t 100%. In their early use, we would shoot many Tomahawks at a single point to make sure we hit the target. We don’t have to do that anymore. And we can’t afford to do it because the weapons are too expensive.

Tomahawk employment is done exceptionally well. Our confidence in Tomahawk has evolved, and I give VADM Dan Murphy a lot of credit for being a resource sponsor, for using the right number of weapons in the right situations, and for really advancing us in the use of Tomahawk. It has become the weapon of choice for hitting relocatable targets. The tactical Tomahawk will be able to fly for 2 or 3 hours, giving me time to retarget from my ship and replan a mission. VADM Murphy validated that concept in Kosovo.

### The Joint Challenge

The Joint challenge is how we share technology. We have to be very careful about what we share and what we don’t. We have a wonderful system called Foreign



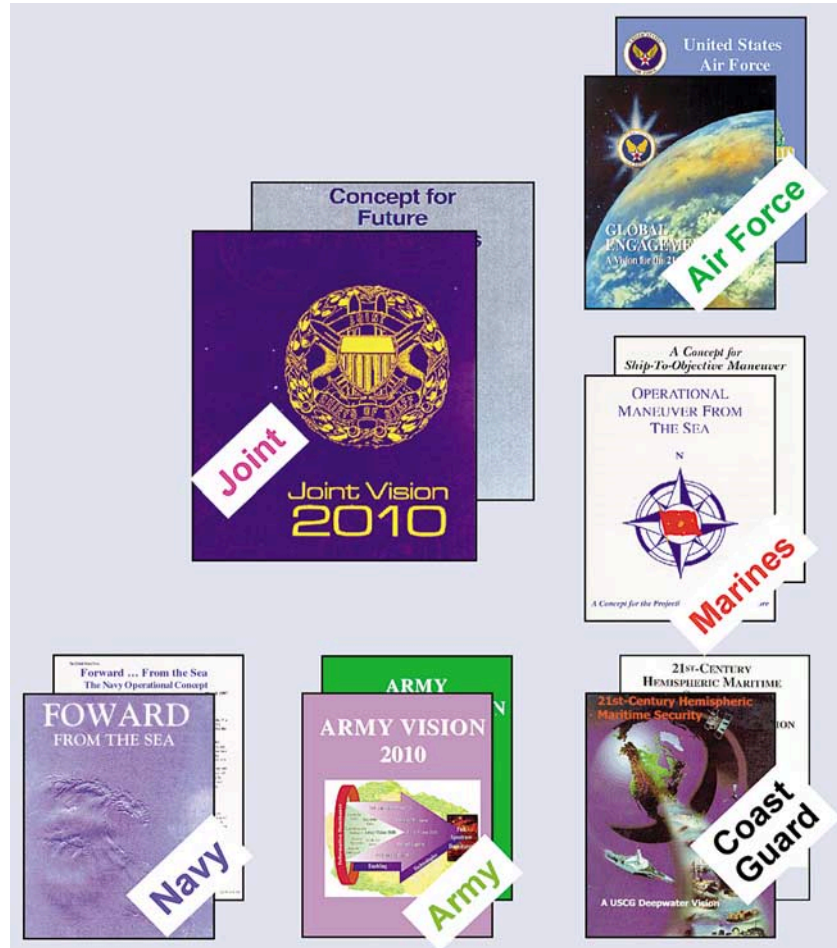
Military Sales, which was built in the Cold War era. Any involvement that we have with other countries must go through this system, which strangles much of the technology sharing automatically. We have to figure out different ways to open up the system. It was good in its time, but it needs to be more flexible than it is now. If we don't get technology sharing right, we won't be able to operate with the other services or with other countries.

With the development of the Cooperative Engagement Capability (CEC), the other services are starting to realize the benefits of Joint warfare. Every warfighter out there, after seeing a CEC picture, says, "I don't care what it takes. Give me that picture because I can't get that anywhere else." Each of the services (Fig. 5) has evolved in its own stovepipe way, and the Navy is just as guilty. And we all have a difficult time looking to another service to consider what may be a better technology. CEC leads the way in creating opportunities to see where the holes are in a single integrated picture by

- Providing a weapon control net that enables sensor netting
- Engaging on a remote weapon control system that allows Joint units to fight as a team
- Increasing the battlespace and improving reaction time
- Enhancing capability to intercept at longer ranges
- Improving depth of fire

A single integrated picture is a large part of the Joint Planning Network, Joint Data Network, and Joint Composite Tracking Network (which includes CEC).

We have other issues to face in terms of Joint operations. For example, the Coast Guard is not the Navy. They perform a very important mission. They are developing a new, expensive ship. We support them from a combat systems standpoint. We recently deployed both a Coast Guard cutter and a Canadian ship with a battle group. We have to be very careful about how much of this we do in terms of numbers of ships, which can give the illusion that there are non-Navy ships that are equal to us. When it comes to pulling the trigger, it's different having the Canadian ship do it. We don't control it, the head of the Canadian government does. You have to



**Figure 5.** The Joint challenge impacts connectivity, interoperability, technology sharing, etc.

look at the kind of capabilities that a Coast Guard ship has before you put it into that kind of environment. They have some terrific forward engagement, and they're the right size for many smaller countries that are trying to develop capability for inland operations.

### Deconfliction and Doctrine

There are many deconfliction challenges: Joint command, Joint doctrine, fire concepts, fire coordination, time-critical targets, safety, and tactics, techniques, and procedures. Some of you at APL have worked on a wonderful support system, the AADC (Area Air Defense Commander), and I applaud that effort. It leads the way, as do many of the things that you work on. It's important to understand where the Navy is, i.e., how we get things in place. We build the mousetrap early, put it out there, and then convince everybody that it's a good thing and they ought to embrace it. This is the way it was done with CEC, it is where we are with AADC, it's how we do business. I don't see us changing it as we continue to evolve.

Deconfliction is a huge problem for me. If you compare the link architecture in the Gulf War with the one in Kosovo, you could almost say that nothing has changed in 10 years. Essentially everyone has their own discrete area. That's not going to work because of that time problem. We need to be able to engage targets when we see them, using the best weapon and at the right time. We can't just say, "You get area A, you get area B, and you get area C." When you're shooting ballistic rounds, you're going to have that requirement as well. How I deconflict on the Air Defense side and on the Strike side is a huge challenge.

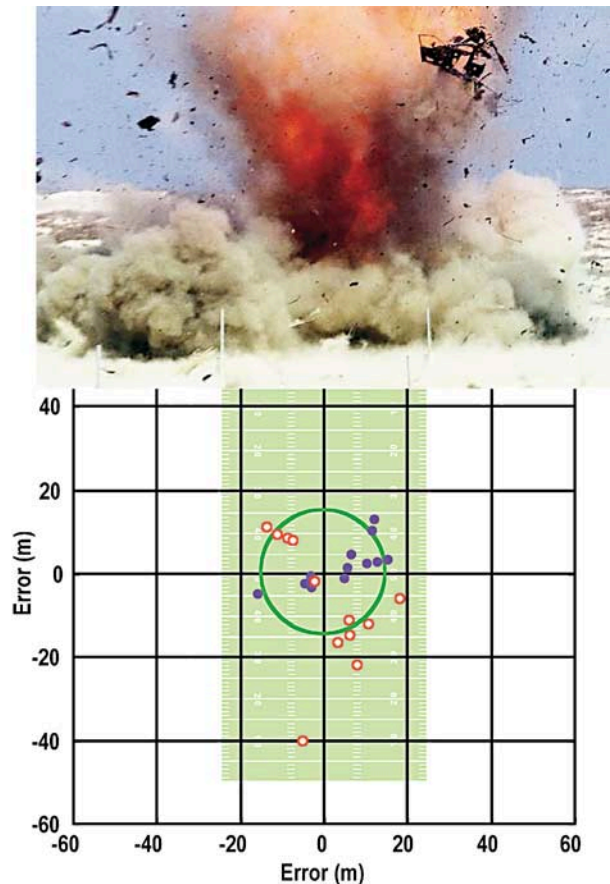
The Navy does not do doctrine very well. We like to develop the Aegis weapon system, put it out there, and have the world fall in on it, and then figure out how it impacts changing doctrine. We are not doctrine people. Naval forces are much more reactive, and we don't like rules. We like to figure it out when we get there. We do that very well. That's not what the Army or Air Force does. They like rules. And there's some benefit to that. We have to come to some middle ground, particularly in the Joint arena. We can't just show up and run everything.

Like doctrine, we're not great on tactics, techniques, and procedures either. The Army and Air Force wonder how we even function without them. Sometimes it's hard to make up the right answer when they ask that question.

### Precision Targeting

We like weapons that actually hit the target the first time (Fig. 6), and now we have them. They are expensive, and we need to reach a point where they are actually low-cost. That is the direction for ERGM development, this rocket-guided gun projectile. We also like weapons that only kill those that we want killed. We like wars where none of our people die, but war is tough business and people do die. We can now fly unmanned Tomahawks in, hit the target, and come out with no casualties or POWs. We need to be careful with this capability in the long term in terms of our ability to carry out sustained operations. We also have to be careful because of the high expectations that this capability has given us.

I had the privilege last June, right after Kosovo, of sitting down with the No. 2 man at Oracle, and I asked, "So what do you think about defense?" He said, "Looks about right to me. I watch CNN. We're hitting the targets, none of our people are dying, we seem to be 'winning.'" In addition to writing to your congressman, talk to your families and those back home, because the relationship we have with the American people continues to drift. Why? Because everything is going pretty well. The average American is not concerned about defense right now, and that's the challenge that we are up against. Many people still think that President



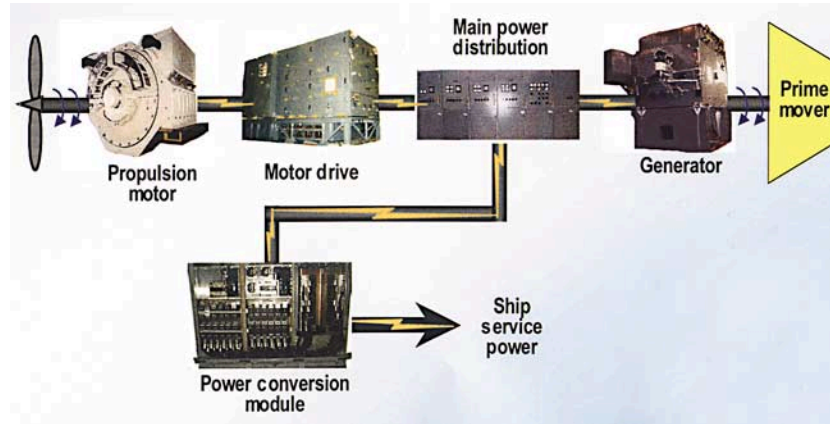
**Figure 6.** Precision targeting challenges include the technology to reduce target location error and increase target location ranges. Volume of fire effects, all-weather and day/night operations, and other factors impacting both the Navy and the Marine Corps are also involved.

Reagan gave us a shield with the Strategic Defense Initiative, but SDI is not here yet. It's that kind of threat that will eventually wake us up—I hope short of disaster.

### Bandwidth

Bandwidth is like memory. Remember when 2 or 4 MB of RAM was considered a lot? Now 64 MB isn't considered very much. It's the same with bandwidth. I've had people tell me that we won't fill up 23 GB. I just don't believe them. We will put something in that 23 GB whether it's useful or not. It will certainly be information. Technological breakthroughs that manage bandwidth are absolutely vital because we're filling it up but we can't sort the data. So systems that sort data, particularly combat systems that sort data automatically, are vital.

I have to have good antennas, even though space on ships is limited. My radar signature has to come down dramatically or I become a target. And how do I get that aboard a ship? I've got to have lots of bandwidth. People think I've asked for a lot of bandwidth because the requirement on a DDG is 256 K and the requirement on a cruiser is 0.5 MB. That's high compared to what



**Figure 7.** The Integrated Propulsion System/electric drive challenge includes propulsion motor controller topologies, high-energy distribution and protection, and solid-state power conversion.

we have right now, which is 32 or 64 K, but it's not enough for the future. We need to figure out how to get more than that aboard our ships.

We also have a debate going about X-band versus S-band radar. We need them both in the long term.

### Commercial Off-the-Shelf (COTS) Components

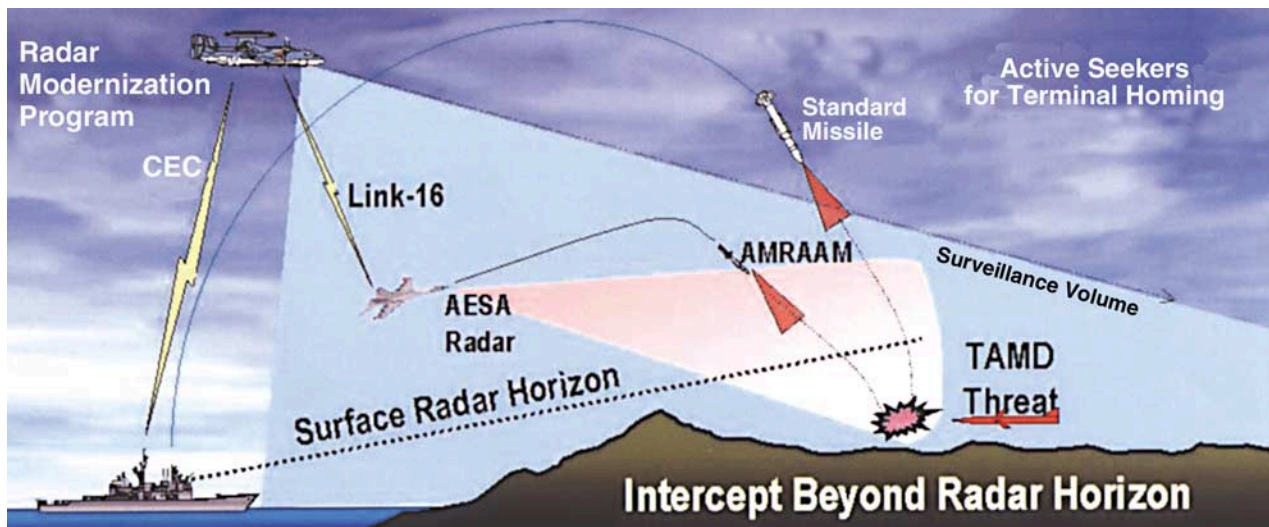
Three years ago COTS was a wonderful thing. Not anymore. I built systems and bought COTS because I didn't have a choice. What is happening now is that the brand new DDG 51 Aegis combat systems are out of date upon arrival. The people who made the boards are long gone when it comes time to upgrade or replace them. So it will be extremely expensive to update all the complex Aegis software systems for the next 10 years. Every defense program has this COTS challenge.

### Integrated Propulsion System

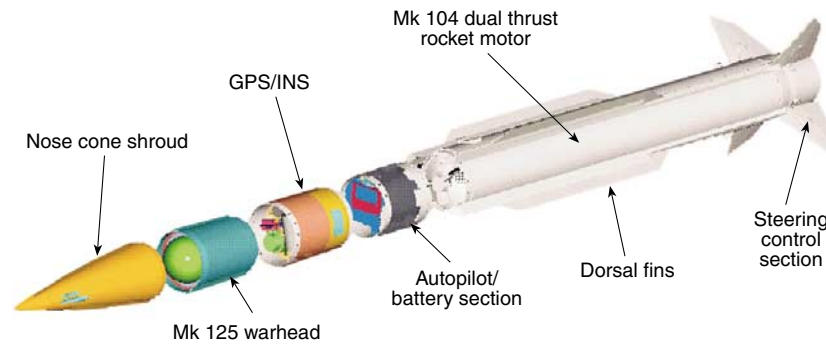
We have been trying to get integrated propulsion technology onboard for 20 years (Fig. 7). We have it on DD 21, and that's a very important development. I'm excited about its conversion capability, i.e., the instantaneous reconfiguration of combat systems. If a bomb goes off next to a ship, the propulsion plant will survive. If I am being shot at, I need either speed or weapons, depending on the scenario. I need to be able to sense and react from a damage control and survivability standpoint.

### Other Challenges

Overland Cruise Missile Defense will give me the capability to fly a missile out farther than my radar (Fig. 8). I need to have the air support. In the Air



**Figure 8.** Overland Cruise Missile Defense uses CEC to pass radar track data between airborne and surface units, extends engagement range out to the kinematic range of interceptor missiles, and increases battlespace reaction time, visibility, and engagement. (AESA = active electronic scanned array, AMRAAM = Advanced Medium-Range Air-to-Air Missile, TAMD = Theater Air and Missile Defense.)



**Figure 9.** The Land Attack Standard Missile (initial operating capability, 2003) will provide Global Positioning System/Inertial Navigation System (GPS/INS) coupled guidance, a 150-nmi range, time of flight of 10 min, and a 10- to 20-m circular error probability.

Defense world, I can't function without E-2C support. It's the enabler for me. If I have this capability with the right technology, I can create the fire control loop that shoots down a cruise missile, whether it is coming at me or at a city. So the challenge is to figure out how I take that, particularly on the radar side, and match it with the kinematic capability of my missile.

Navy Area and Theater-Wide Defense is a challenge that RADM Rempt will talk more about. We call this the "catcher's mitt." It's a point defense system that will be operational in a couple of years. We are poised in the next 24 to 36 months to have over 30 events and 50 missile shots in both the Navy and theater-wide programs. We are "at the plate." We are now included in TBMD where no one wanted us before. RADM Rempt has led the way in this regard. USS *Lake Erie* has been dedicated as the test ship for this program, and DDG 85 will be the first Navy area platform. It will be delivered in the next 2–3 years. NTW Defense includes the exoatmospheric hit-to-kill technology intercept.

This is designed to hit the target in midcourse, causing it to maybe land on its own territory. That would seem to be a very powerful deterrent.

Land Attack capabilities represent another challenge. We're taking affordable weapons (Standard Missile shells) and converting them to Land Attack Standard Missiles (Fig. 9) and Advanced Land Attack Missiles. The latter will be longer-range missiles with a 300-nmi objective/200-nmi threshold.

## CONCLUSION

We need the best technology and APL's continued support for the challenges that lie ahead. We need to be able to instantly fight a war if we have to, and that depends on our ability to sustain a show of force, conduct peacetime operations, and provide a forward presence. That is a huge challenge. I'm grateful for all the support you have given us, and I look forward to continuing that relationship long into the 21st century.