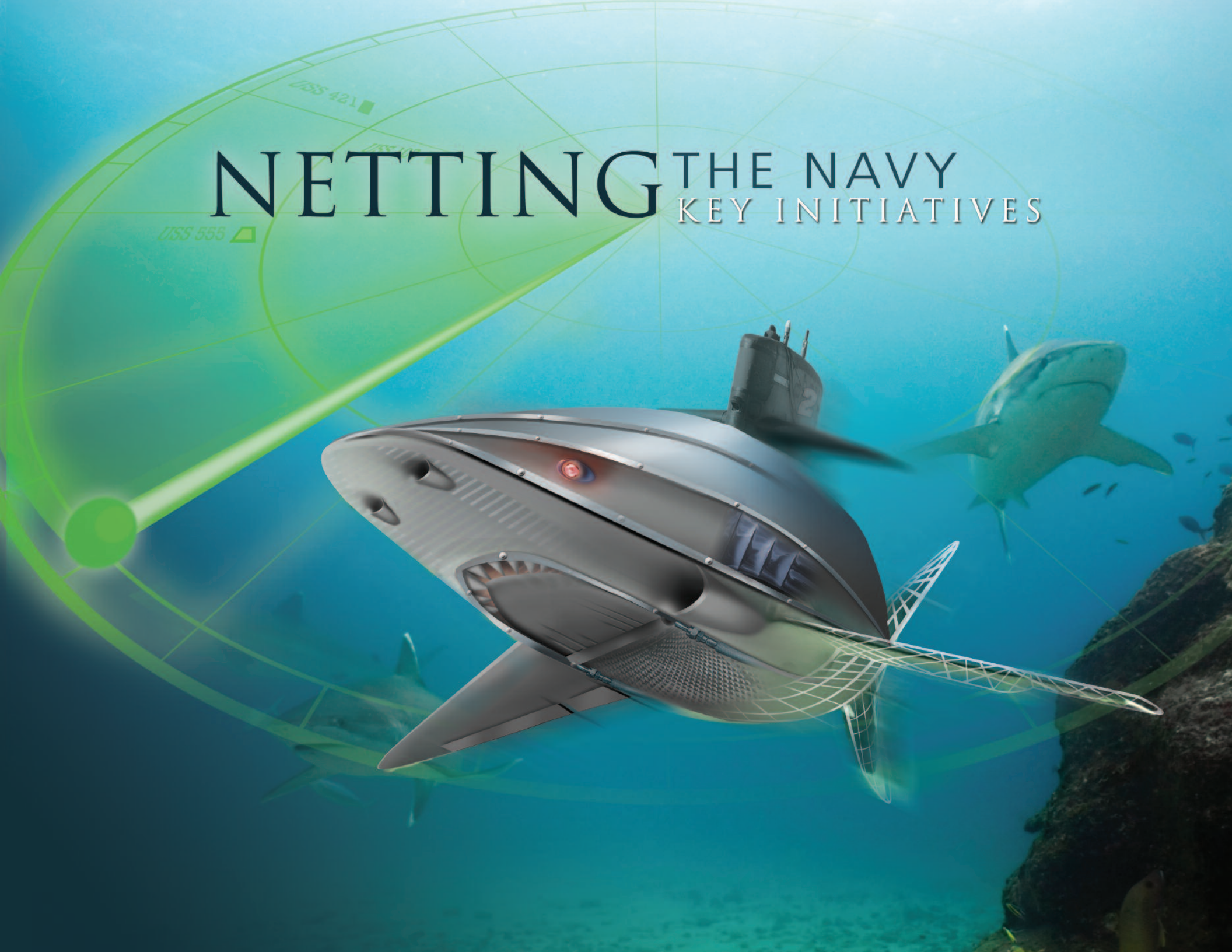
NETTING THE NAVY
KEY INITIATIVES



NETTING THE NAVY: KEY INITIATIVES

This report is the second in a series of studies that several colleagues and I are sponsoring to explain the importance of naval networking to a national audience. In the years since the cold war ended, global commerce and culture have been transformed by the internet. The internet got its name from the fact that technical protocols allow packets of information to be transmitted over thousands of loosely connected networks as if they were a single, unified web. The result is a communications tool of unprecedented reach and resilience. But although our defense department invented the internet, it has not benefited as fully as other users from the power the Worldwide Web unleashes.

The U.S. Navy is pursuing a concept called Forcenet that would enable the service to fully realize the potential of internet-protocol technology. If it succeeds, then our war-fighters scattered around the globe will enjoy continuous access to the complete resources of the joint force, even when they are in motion, under fire, or otherwise disadvantaged. Not only will they be able to communicate instantaneously with other friendly forces, but they will be able to tap into a wealth of life-saving information and analysis that is currently unavailable to sailors and marines on a timely basis.

Today's information revolution isn't just about new technology, it's about business models and cultural values. The Navy and other military services are shifting from a Balkanized "need-to-know" culture to a "need-to-share" environment in which war-fighters collaborate continuously to achieve national purposes. You still need security clearances to participate in this community of shared values and goals, but once your credentials are verified you gain access to more useful information than war-fighters of the past could possibly have hoped to obtain.

Ideally, all of the war-fighting systems in the joint force will one day be "born open," able to take full advantage of the flexibility and versatility internet-protocol technology provides. The Navy is pursuing a number of programs such as the Advanced Hawkeye radar plane and the Littoral Combat Ship that are fully open and adaptable to emerging information technologies. But war-fighters should not have to wait for the perfect solution to their information needs — there are faster ways of delivering most of the connectivity they require. This report offers insights into how we can deliver comprehensive global communications to our war-fighters as quickly and inexpensively as possible, so that the Navy of tomorrow can save both lives and money.

Representative Ander Crenshaw
House Appropriations Committee

THE WORLD TRANSFORMED

During the closing decades of the last century, a revolution in global communications began to unfold. It was driven by the internet, a system devised in the U.S. Department of Defense in the 1970s that allowed information to travel across thousands of public and private networks as if they were a single unified network. The key to the internet was a series of "protocols," that enabled messages to travel freely between diverse computers even though they were not linked by dedicated electrical circuits.

This was a very different approach to communication from the practices that had prevailed since the invention of the telegraph in the early nineteenth century. Until the 1970s, electronic communication between two points could not occur unless a connection was first established that served as the conduit for the information being sent. But the internet was devised by scientists trying to find a method of communicating in the midst of global war, when maintaining a direct connection between two points might be impossible. So they invented a system that chopped up messages into "packets" and transmitted them across whatever networks were available. The internet protocol enabled the packets to reach their destination despite the lack of a direct connection, and a second "transmission control" protocol assured the packets would be reassembled in the right order.

The flexibility afforded by this approach to communication was so promising that the internet protocol (IP) and transmission control protocol (TCP) became official standards for all U.S. military computers in 1982. It was not until a decade later that entrepreneurs began to realize the same flexibility could remake global commerce and culture. With the aid of additional innovations such as desktop computers and graphic-interface software that translated computer code into everyday text and images, the Worldwide Web was born. At that point, the internet ceased being a tool mainly of engineers and scientists, and rapidly became a global phenomenon. Today, it is transforming every facet of human interaction, empowering friends and foes alike.

The defense department has spent more money pursuing "netcentricity" than any other organization. However, it has not managed to keep up with the pace of progress in the commercial world. Unlike in the private telecommunications sector, where institutions such as the old Bell System were wiped out by the advance of technology, the military communications system remains a confusing patchwork of new and legacy systems that can be tied together only with great difficulty. There are big gaps in the ability of various services and agencies to communicate, especially under the stress of combat. Goals for carrying capacity, interoperability and speed that were satisfied long ago in the commercial world continue to elude military users. Thus, the organization that created the internet is not reaping its full benefits.

The Aegis combat system installed on Navy destroyers and cruisers will remain a linchpin of sea-based air and missile defense for decades to come. The Navy is funding networking and open architecture initiatives aimed at integrating Aegis capabilities more effectively with the other war-fighting competencies of the joint force.

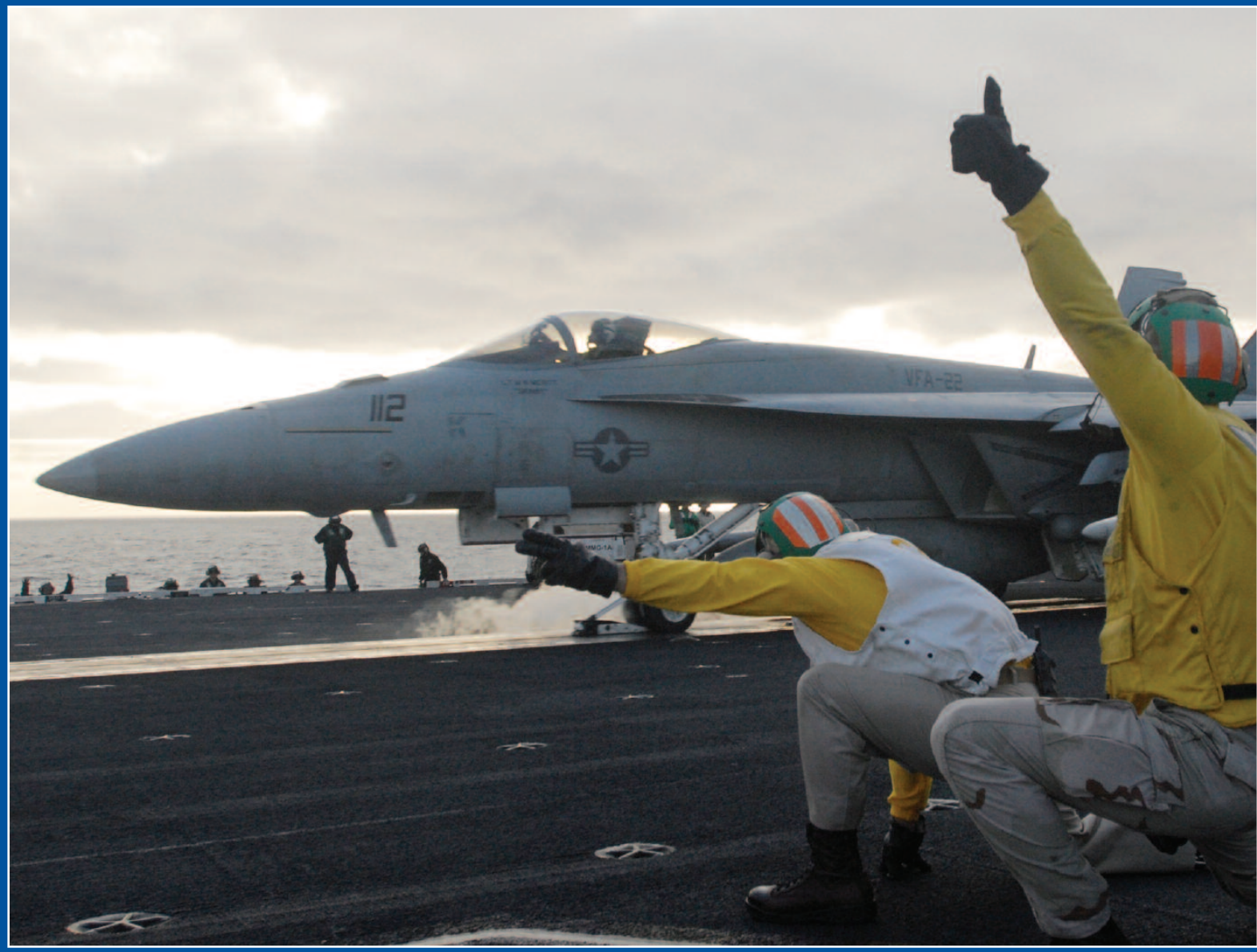
NAVAL NETWORKING GOALS

The U.S. Navy recognized the war-fighting potential of new information technologies before other military services did. It pioneered the concept of network-centric warfare during the 1990s, and today has the most complete vision of how internet-style communications can enable the operations of a joint force scattered around the globe. The centerpiece of this vision is Forcenet, the Navy's component of the Global Information Grid.

In the Navy's vision, the "need to know" culture of traditional military communications is giving way to a "need to share" ethos in which a premium is placed on the timely and complete availability of vital information to all members of a war-fighting community. Any barriers or incompatibilities that impede the generation of a common operating picture for the joint force are detrimental to war-fighting aims and national purposes. The information grid supporting comprehensive awareness and collaborative action is viewed not as a series of bilateral links, but as an environment for the sharing of whatever war-fighters need. In the spirit of the internet, all information is available to those with appropriate clearances, and individual users access the elements relevant to their circumstances.

A communications environment exhibiting these characteristics requires robust carrying capacity, open architectures, standard protocols for the transmission of information, uniform packaging of data, seamless interoperability, and flexible yet reliable security. Users must be able to access detailed information quickly and consistently, no matter where they are, secure in the knowledge that their information flows are not being monitored, manipulated or degraded. Furthermore, they must be able to continuously fuse, analyze and share information with other members of the joint force in a way that maximizes the capacity for cooperative action.

While it is not hard to identify the key features of a global communications network based on internet-protocol principles, the Navy faces a major challenge in transforming its current, Balkanized communications system. It will take too much time and money to build an all-new system, and the service has a huge investment in its existing gear. Forcenet has therefore been postured as a realignment of existing programs that introduces near-term improvements aimed at realizing the promise of internet-protocol communications as soon as possible. That will require affordable innovations that can close critical gaps in the current communications capabilities of war-fighters operating on the edge of the network — in other words, in forward tactical locations.



The carrier-based F/A-18 E/F Super Hornet is a multi-mission strike fighter that will soon be joined on aircraft carrier decks by the more stealthy F-35 Joint Strike Fighter. Both fighters will be equipped with tactical data links to the E-2D Advanced Hawkeye to enable agile and precise use of airborne assets.

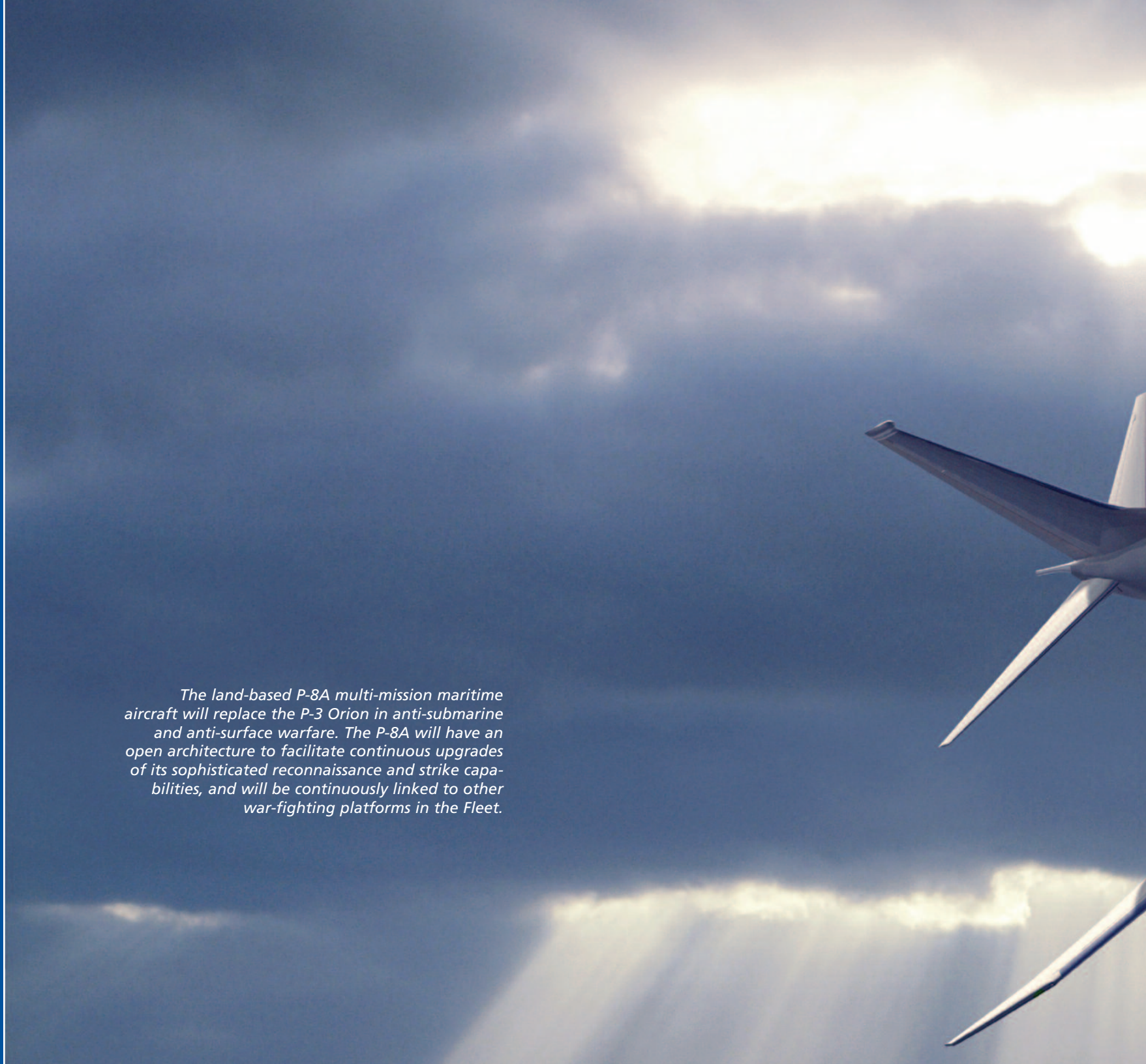
GAPS IN THE NET

In order to achieve the full potential of a net-centric fighting force, the Navy must create a global communications system that is completely seamless and accessible to all users satisfying security requirements. At present, there are four major obstacles to implementing that vision. First, the existing patchwork of communications systems is not truly interoperable, constraining interaction between different war-fighting commands, services and agencies. In order to become fully interoperable, the system design will need to stress "plug and play" principles and unlimited extensibility. In other words, diverse users must be able to enter the system easily, and the system itself must be able to grow effortlessly to accommodate whatever degree of data exchange is required.

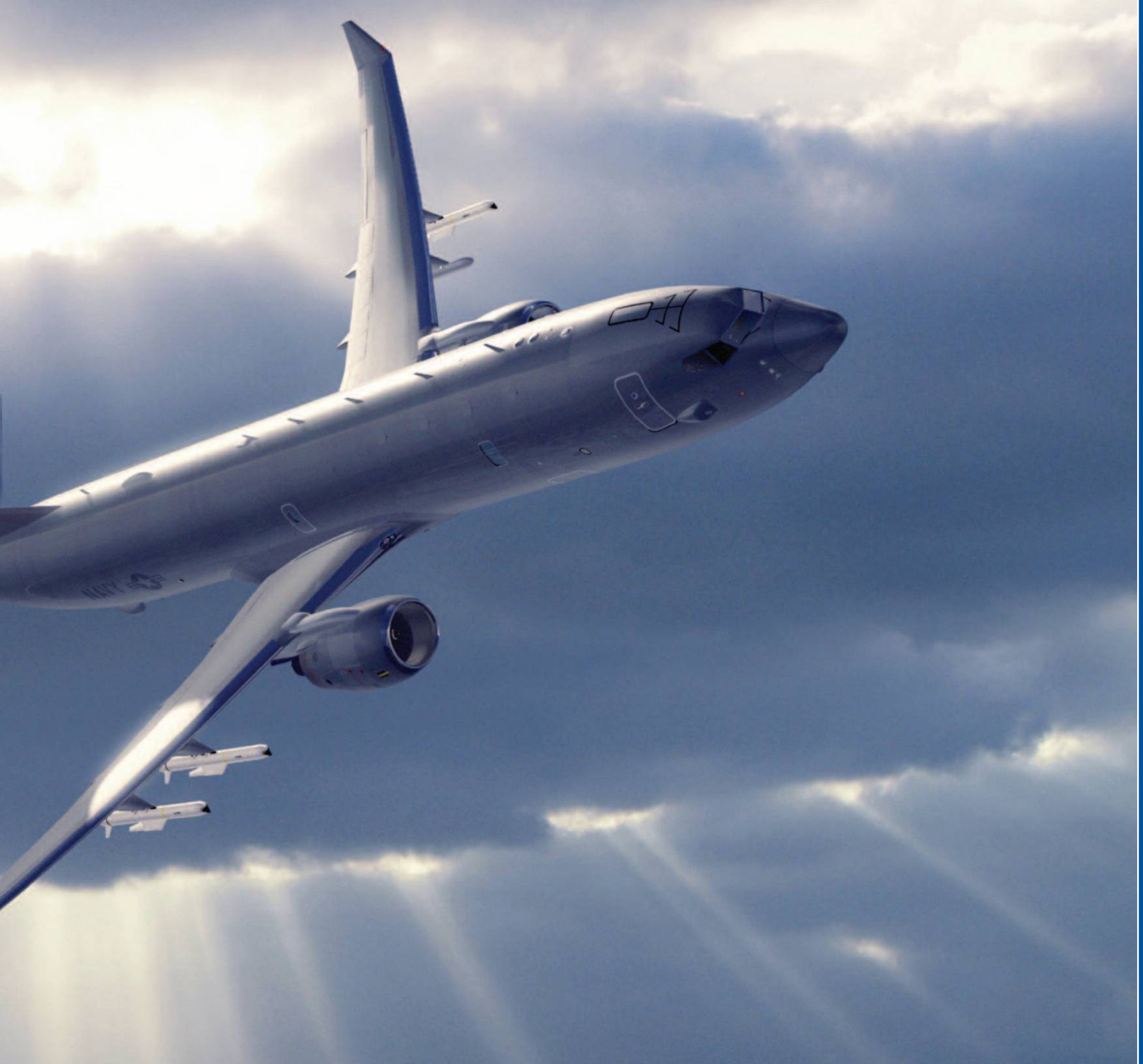
Second, the current communications system impedes information sharing by limiting the ability of authorized users to access and/or post information relevant to their missions. The Navy must fashion a communications environment conducive to the sharing of information across multiple commands, services, agencies and coalition partners. That environment must also be able to support sharing and collaboration across multiple levels of security (secret, top secret, etc.). In the absence of such an environment, the various members of a joint or international force will be unable to generate the timely, textured common operating picture essential to maximizing their prospects of success.

Third, the existing communications system discourages the fusion of information from diverse sources by channeling collections and analysis through incompatible, compartmented systems. As a result, information germane to war-fighting objectives generated by one agency or network does not get combined in a timely fashion with other information to form a comprehensive mosaic of what the joint force knows. The inability to combine and consider all relevant information as a military operation unfolds compromises war-fighting objectives and exposes friendly forces to unnecessary risk.

Fourth, the present communications system allows only limited transport of information across the operational environment, and is especially weak in bridging the "last mile" between tactical users and the rest of the network. Not only does available bandwidth diminish markedly at the outer edge of the network, but contact is sometimes lost completely when war-fighters are operating on the move or beyond the line of sight needed for point-to-point communications. A seamless, highly responsive network must be able to deliver robust carrying capacity and access to tactical-edge users regardless of where they are and what war-fighting challenges they are facing.



The land-based P-8A multi-mission maritime aircraft will replace the P-3 Orion in anti-submarine and anti-surface warfare. The P-8A will have an open architecture to facilitate continuous upgrades of its sophisticated reconnaissance and strike capabilities, and will be continuously linked to other war-fighting platforms in the Fleet.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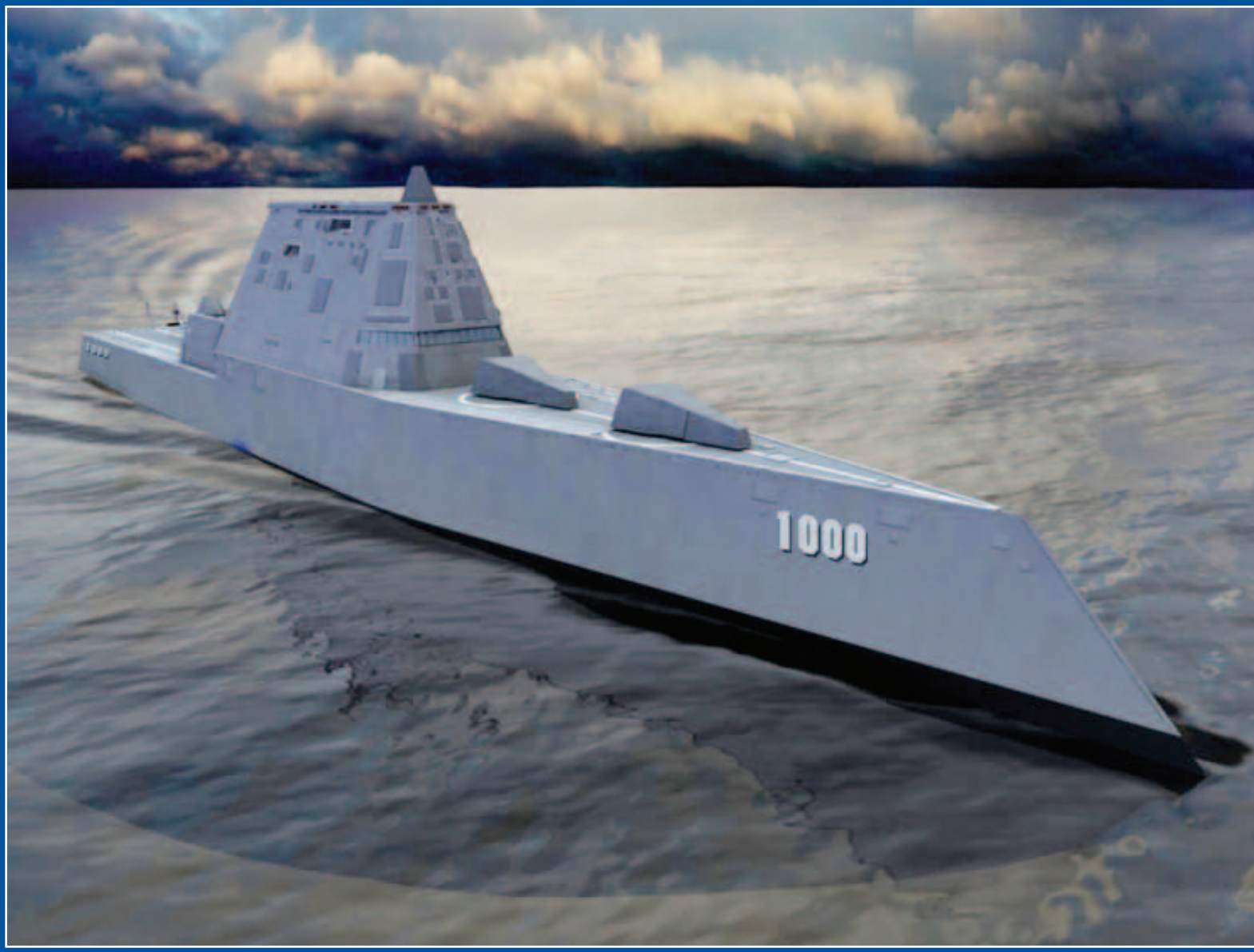


The DDG-1000 destroyer is fundamentally different from earlier surface combatants in its focus on net-centric warfare, multi-mission versatility and support of the joint force. The connectivity and situational awareness of the DDG-1000 will far surpass that of any other warship in the world.

KEY INITIATIVES

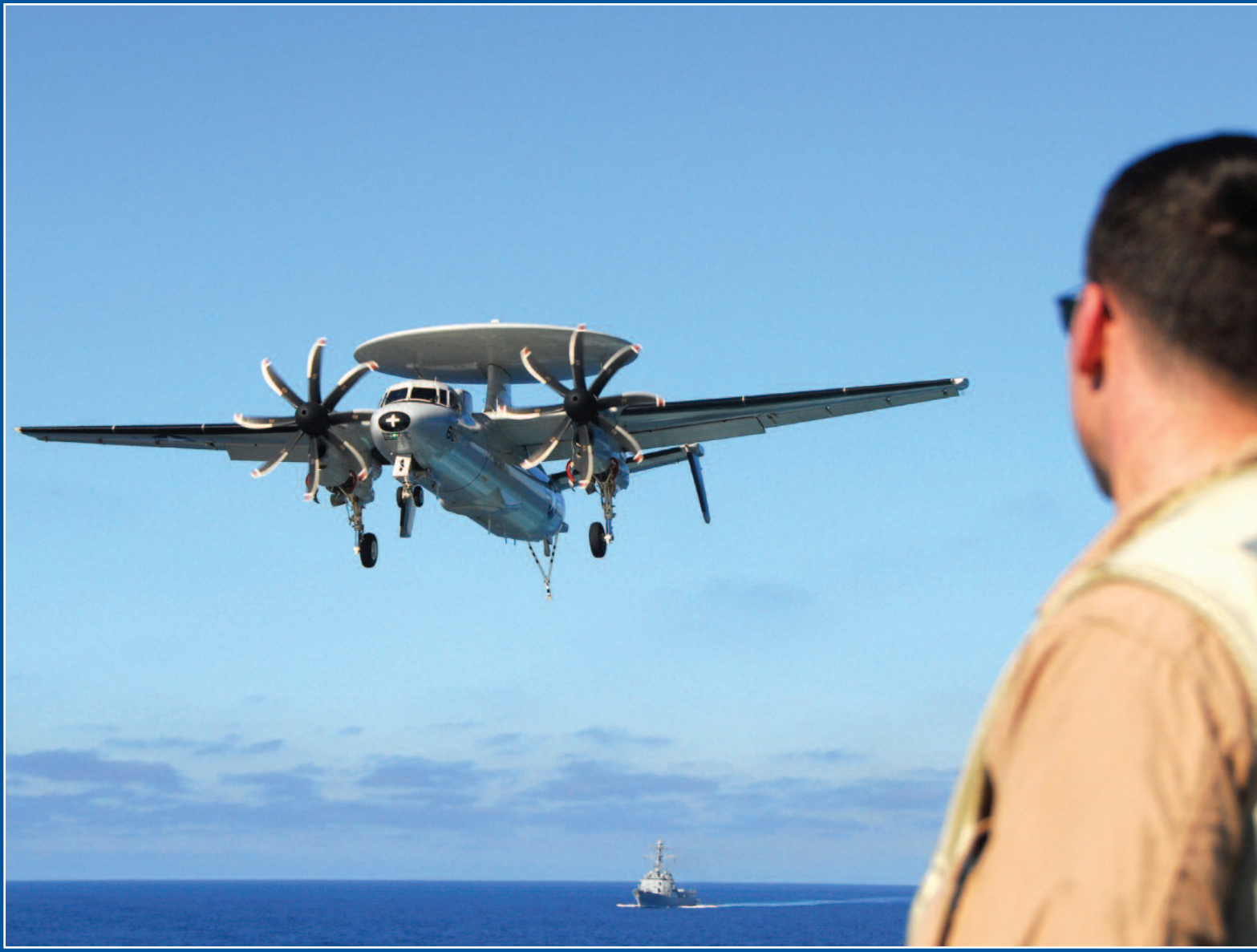
The Navy and other services are pursuing a handful of technology initiatives that have the potential to close gaps in the war-fighting network quickly and inexpensively. They include novel waveforms for fast sharing of data among diverse users, gateways for entering the Global Information Grid, routers for fashioning a more flexible networking environment, translators for enabling exchanges among previously incompatible data links, and various network management tools. What all of these initiatives have in common is an internet-protocol approach to communication that can be fielded much sooner than the big systems-of-systems architectures being pursued by the military services. The most important initiatives include:

— A version of the Multifunctional Information Distribution System (MIDS) compatible with the planned Joint Tactical Radio Systems (JTRS, or "Jitters"). MIDS gathers data from many sources to provide tactical users with a digital view of the battlefield, while JTRS is a multi-channel, "software-reconfigurable" system capable of performing numerous functions that previously could be accomplished only by using several different radios and communications devices. Begun in 2001, the JTRS-compliant version of MIDS will be installed on Navy aircraft to create an internet-protocol, plug-and-play environment for sharing essential war-fighting information.

— A program called Tactical Targeting Network Technology (TTNT) that exploits internet-protocol software to share information relevant to the destruction of moving and/or time-sensitive targets. TTNT quickly correlates information from multiple sources and then transmits it to users at the rate of one million bits per millisecond over distances in excess of a hundred nautical miles. It can accommodate virtually any kind of information expressible in internet-protocol format, including voice, text chat, streaming video and still imagery. Rapid transmission of such collaboratively exchanged information, as TTNT would allow, is vital to dealing successfully with fleeting, elusive targets.

— An airborne Automated Digital Network System (ADNS) that uses off-the-shelf protocols, processors and routers to fashion a robust, flexible networking environment. ADNS can be employed with virtually any radio-frequency signal relevant to tactical users, providing Navy personnel at sea and on shore with assured access to a secure, high-capacity local or wide-area network. The Navy plans to merge ADNS with a similar airborne communications system for the Air Force's Joint Surveillance and Target Attack Radar System called the Interim Capability for Airborne Networking (ICAN) in a program called the Joint Capability for Airborne Networking.

Other critical initiatives include the Common Link Integration Processing (CLIP) translator, a suite of software for merging tactical data links on aircraft, ships and surface vehicles, and the Battlefield Airborne Communications Node (BACN) gateway that enables communication across diverse and previously incompatible tactical networks. While the technical details of such initiatives are sometimes difficult to grasp, they all facilitate the fast sharing of vital information among previously fragmented war-fighting organizations through the exploitation of internet-protocol technology.



The E-2D Advanced Hawkeye successor to the carrier-based E-2C radar plane will be a key player in the Navy's future war-fighting doctrine. Comprehensively networked and hosting an extremely sensitive, long-range radar, the Advanced Hawkeye is designed to speed the Navy's transition from a legacy "need-to-know" mindset to the "need-to-share" war-fighting culture of tomorrow.

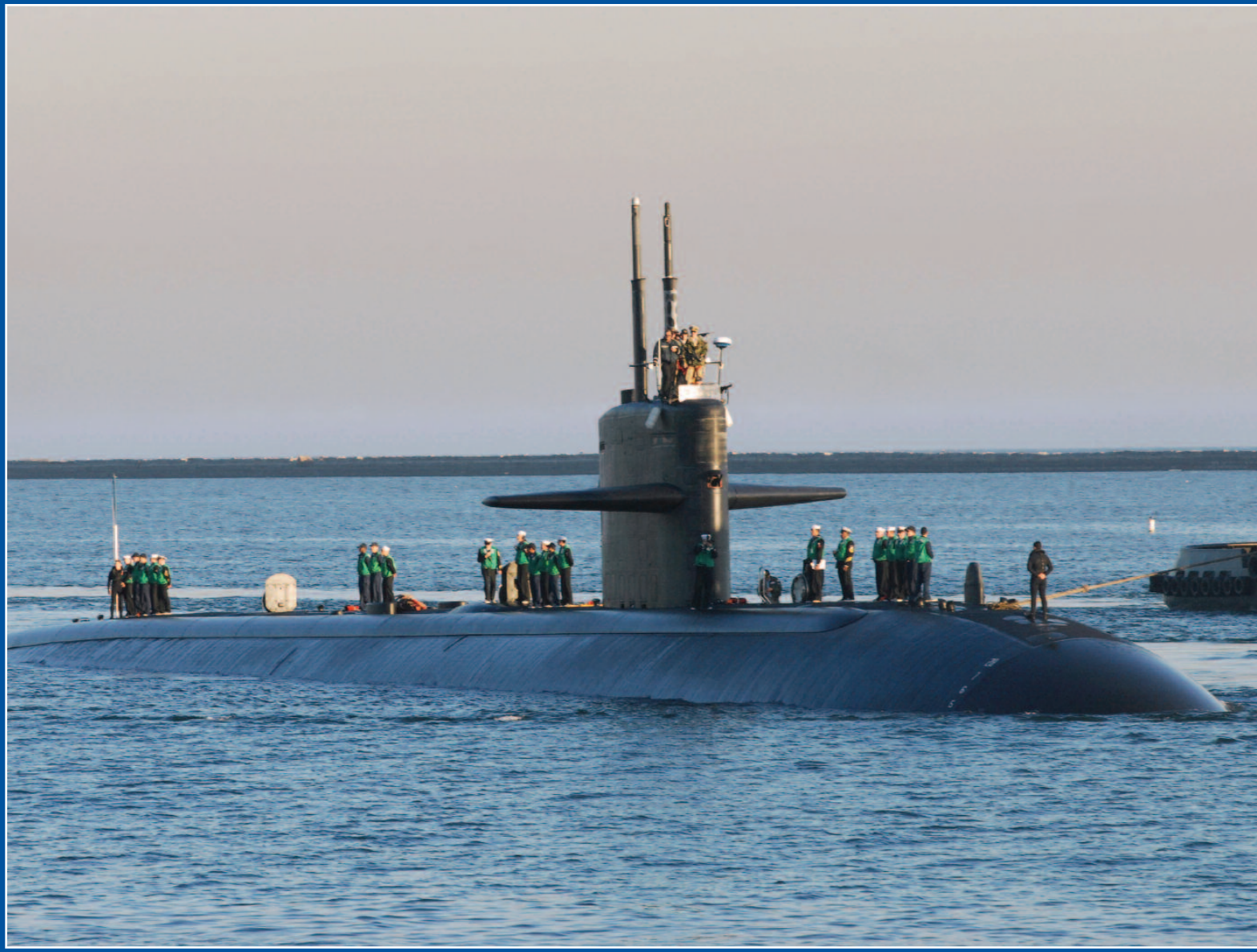
ADVANCED HAWKEYE: A MODEL PROGRAM

Initiatives such as TTNT and airborne ADNS are designed to foster an environment of effortless sharing and collaboration among war-fighters — an environment that is network-centric and information-rich rather than weapon-centric or organization-centric. But the key initiatives are not stand-alone systems. They must be installed on war-fighting platforms in order to accomplish useful purposes. In some cases, they will be integrated into pre-existing platforms such as the carrier-based F/A-18 Super Hornet strike fighter. Ideally, though, the new systems could be embedded in next-generation platforms that were "born open," meaning developed from their inception to accommodate continuous improvements exploiting internet-protocol principles.

A handful of these next-generation platforms already are in development, most notably the E-2D Advanced Hawkeye radar plane, the P-8A maritime surveillance aircraft, and the DDG-1000 land-attack destroyer. Advanced Hawkeye is an especially significant example of the trend toward net-centricity in warfare, because it illustrates how an airframe that superficially looks similar to its predecessors can nonetheless become a revolutionary war-fighting tool through the introduction of cutting-edge technology.

Like previous versions of the Hawkeye, the E-2D is a carrier-based turboprop aircraft hosting a large radar that enables battle group commanders to conduct surveillance of nearby air space and surface traffic. But the Advanced Hawkeye variant of the plane is almost entirely new, incorporating a vastly enhanced radar that delivers greater range, sensitivity and versatility than any other sensor of its type, current or planned. When combined with the communications initiatives described in the preceding section and the open network architecture of the E-2D, the new radar will enable operators to be key players in airborne situational awareness, battle management, theater air and missile defense, and even search-and-rescue missions.

The E-2D will have a greatly improved ability to discriminate fine details in the targets it tracks, including quick determination of whether a distant airframe is friend or foe. And, employing the openly-architected Tactical Information Services (TIS) capability, the E-2D will support internet-protocol-based information flows — giving it the capacity for managing the engagement of hostile targets by the combined assets of the joint force. But most fundamentally, it will be an essential node in net-centric warfare that can instantaneously receive, fuse, analyze and resend information from a wide array of friendly forces. Because Advanced Hawkeye was conceived to match the demands of future warfare reflected in the Navy's Forcenet vision, it will be an indispensable contributor to military success in the information age, a model of how modern technology can support the war-fighter.



Submarines will remain the most survivable intelligence-gathering and war-fighting systems in the joint force for the foreseeable future. A variety of networking initiatives will tie the undersea warfare community more closely to the rest of the force, so that its unique capabilities can be more effectively integrated into joint war-fighting concepts.

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