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CHIEF OF NAVAL OPERATIONS  
STRATEGIC STUDIES GROUP  
XXVII



Way Ahead Plan

*Operating at the Convergence of  
Sea Power and Cyber Power*

9 January 2008

Submitted on behalf of SSG XXVII  
by

  
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*“The opening rounds of the next war will be in cyberspace – the Navy must be ready to prevent wars as well as win them; to do that, we must understand how we will live, operate, and win in cyberspace.”*

ADM Roughead, CNO, 19 October 2007

## **1. Introduction**

This plan outlines the Chief of Naval Operations’ (CNO) Strategic Studies Group (SSG) XXVII’s approach to addressing the challenges of operating at the convergence of Sea Power and Cyber Power as presented in the CNO’s Theme. In addition to providing a framework for the approach, this plan presents SSG XXVII’s initial overarching concept and Concept Team (CT) areas of focus.

SSG XXVII convened in Newport, Rhode Island on 1 October 2007. The ten CNO Fellows and eight Technology Fellows experienced in-depth exposure to various conceptual thinking techniques, analytical methods, science, technology, and approaches for successful innovation. This portion of the SSG process established a common knowledge base through a robust exploration of various topics presented by leading figures from industry, academia, government, and national laboratories. Complemented by 14 Associate Fellows from the Naval War College and Naval Postgraduate School in December, SSG XXVII will continue its work through the spring of 2008, generating revolutionary concepts for near- and far-term implementation. The Group will report out to the CNO in July 2008.

## **2. Background and Context**

In 2006, the CNO challenged SSG XXVI to explore “fighting in cyberspace in 2030” and to establish a means to tie together the broader dimensions of Interagency, United Nations, Non-governmental organizations, and local government with the Navy to achieve the full spectrum of influence in 2030. Envisioning the Navy operating at the “convergence of Sea Power and Cyber Power,” SSG XXVI foresaw a world where the speed and availability of information changed the employment of Maritime Forces and the calculus of power projection. SSG XXVI concluded the Navy would maintain its distinctive role as the nation’s persistent forward presence force in a world of pervasive networks and cyber-integrated battlefields, especially within “the last tactical mile.” Moreover, they found that in a “hyper-globalized” world of 2030, the Navy would metaphorically patrol the global commons of cyberspace while maintaining the strategic underpinnings of power projection, sea control, strategic deterrence, naval presence, and strategic lift.

SSG XXVI’s revolutionary concepts were Global Reach Forward, Virtually Enabled Operations, and necessary enabling concepts. Global Reach Forward focused on building awareness, capacity, and influence through a combination of virtual and physical presence to enhance

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coalition operations. Virtually Enabled Operations provided for real-time modeling of the battlespace by fusing information from sensors, weapons, and warriors in virtual environments. The enabling concepts included the use of ubiquitous distributed sensors across the battlespace, advanced decision aids for the commander and staff, establishment of cyber-warfare as a primary warfare area, and national level unity of effort regarding cyberspace across all agencies.

### **3. The CNO Theme and SSG Product**

Focusing through 2020 and beyond, the CNO directed SSG XXVII to generate revolutionary concepts to integrate “physical-world and cyber-world capabilities into a seamless continuum of Sea Power.” SSG XXVII will build upon the intellectual foundation of SSG XXVI and previous SSGs, identify successes and remaining challenges, and recommend how the Navy should close the gaps. The CNO’s Theme reflects that in the future all aspects of warfare, including the prevention of conflict, will be cyber-enabled. Future Maritime Forces will employ a full range of advanced information, communication, and computing technologies. Maritime Forces will shape the strategic environment to build and sustain peace while maintaining the ability to have a decisive impact on crises and conflicts.

SSG XXVII will produce actionable concepts; recommend broad and rapid experimentation to validate those concepts; and inform near-, mid-, and long-term program decisions supporting the concepts. The Group’s work will be delivered in an operational context grounded in the human element, with synergy across the physical, information, cognitive, and social domains. It will include recommendations on manpower and equipment requirements while addressing on how the Navy should develop its people to stay relevant and succeed in employing future maritime strategies. The Group will generate roadmaps for demonstrating, maturing, and capturing promising architectures, processes, and technologies supporting these revolutionary concepts.

**4. SSG XXVII Overarching Concept: *Operating at the Convergence of Sea Power and Cyber Power***

Cyberspace is increasingly inseparable from the global commons. Figure 1 depicts cyberspace as being pervasive, encompassing a number of critical elements, such as energy, networks, foreign organizations, security, access and public support, that impact peace and war. These critical elements are shown encircling the globe to reflect how cyberspace transcends boundaries between elements formerly separated by time, distance, and space.

Building upon this notion, SSG XXVII will examine how the cyber-prevalent world drives changes in Maritime Force operations and supporting systems. In addressing today's maritime capabilities and how they must evolve for the future, SSG XXVII will research areas (listed on the left of the figure) critical for Maritime Forces to live, operate, and win in this complex environment. This research will support the generation of revolutionary concepts for *operating at the convergence of Sea Power and Cyber Power* through 2020 and beyond.

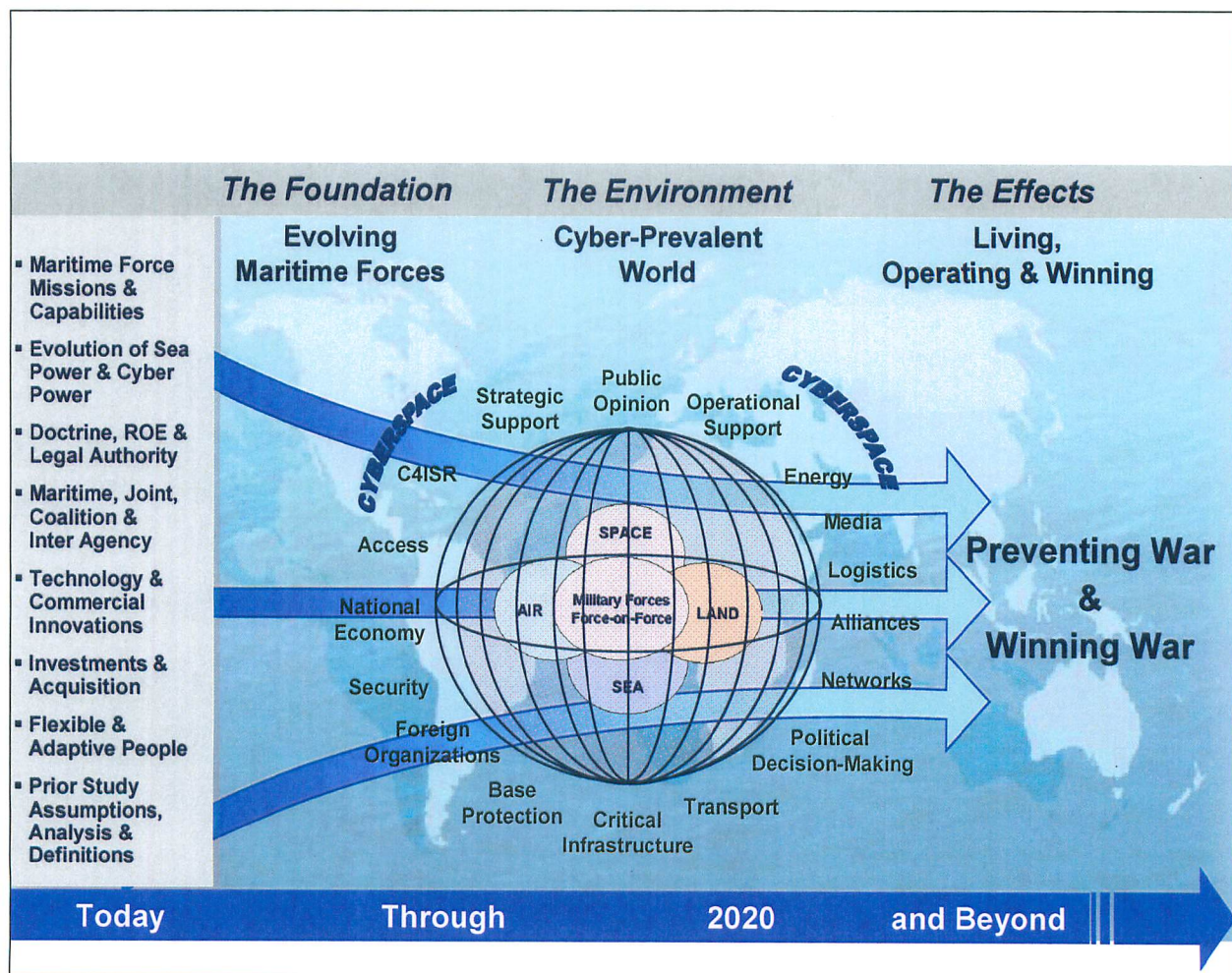


Figure 1: Operating at the Convergence of Sea Power and Cyber Power



**5. Approach**

SSG XXVII will generate revolutionary concepts for operating in a cyber-prevalent world, informed by an in-depth analysis and study of potential futures and assumptions related to Maritime Forces. The Group will identify and explore the driving forces which will likely influence the future and will consider the environment in which Maritime Forces must live, operate and win.

SSG XXVII has divided into five Concept Teams (CTs):

**Futures,  
Maritime Influence Through Cyber-Enabled Networks,  
Operational Art in the 21<sup>st</sup> Century,  
The Human Element, and  
Technology & Integration.**

These CTs will research topics that will collectively generate revolutionary concepts and actionable recommendations. Each CT will develop individual research plans. In developing these plans, the CTs will review past SSG work, draw upon literature reviews, integrate futures forecasting, and outline methods to collect the best ideas from academia, industry, and government.

Throughout the research period, CTs will collaborate extensively. Concepts will be individually and collectively challenged and critiqued within the SSG and by outside experts. Concepts will be refined continuously, analyzed for gaps and ultimately integrated into a common operational context.

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### **6. Concept Teams:**

#### **Futures Concept Team**

##### **Overview:**

The world is in a state of rapid transition. The pace of change is accelerating—socially, economically, technologically, and politically. The Navy must be capable of operations supporting war and peace within any environment, be it the physical world or the cyber world. Maritime Forces must develop along lines that will achieve a preferred posture while remaining relevant and adaptable to any possible environment. Global cultural perspectives, outlooks, and philosophies (referred to as worldviews) may influence the future of Sea Power, Cyber Power, and their convergence. Understanding these diverse perspectives can aid in future-casting.

This CT will identify and explore influential forces to future-cast environments in which Maritime Forces must live, operate, and win. Part of this CT's approach will require an iterative process of evaluating trends toward the futures and the capabilities of Maritime Forces in both physical and cyber environments. This CT's work will be used internally to the SSG to define coherent future environments, identify assumptions, and highlight critical uncertainties all of which will enable other CTs to build robust and relevant concepts.

##### **Pursuits:**

- Examine current policies, directives, and strategies that govern and focus on cyberspace.
- Bound the future estimate of the environment facing the Navy using conservative and aggressive interpretations of the driving forces, with special emphasis on the interrelationship with cyberspace. Methods employed will include but are not limited to retrospective analyses, scenario development, and expert consultation.
- Identify and study other enterprises that have recently faced the challenge of rapid immersion in a changing technological environment.
- Explore and characterize the ways by which future human-physical-cyber interactions can yield real-world effects.
- Explore how the new branch of cyber philosophy can affect worldviews and shape potential futures.

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### **Maritime Influence Through Cyber-Enabled Networks Concept Team**

#### **Overview:**

Globalization and the ubiquitous growth of cyber-enabled physical and social networks are increasingly pervasive and have the potential to revolutionize maritime influence and operations. This CT will examine the nature of the evolving information-age environment and its effects upon physical, information, cognitive, and social systems. Areas of research will include the impact of enhanced human cognition, building of trust, and secure transfer of knowledge. This CT will generate concepts to further harness the collective capacity of networks and systems to allow Maritime Forces to exploit the full spectrum of influence (from peace to war) and lead the nation beyond the information age.

#### **Pursuits:**

- Study physical, information, cognitive, and social networks to develop an understanding of their inherent dynamic and adaptive natures.
- Evaluate the evolution of cultural trends to recognize how behavioral patterns are affected by cyber-enabled networks.
- Explore the impact of cyberspace on human cognition through human-systems interfaces, artificial intelligence, and biological augmentation.
- Explore the ability of physical, information, cognitive, and social systems to revolutionize command, control, coordination and collaboration architectures, and provide the best utility and unity of command across Joint, Interagency, Non-government organizations, Allied and Coalition partners.
- Explore the complexities of influencing people, building relationships, developing trust, managing knowledge, and making decisions in cyber-prevalent environments.
- Investigate the synergy between cyberspace and physical networks through the study of network science.
- Explore the implications of cyber-prevalent convergence of the warfighter and the enterprise.
- Explore the means required to successfully fight and win against a sophisticated network-enabled force.

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## **Operational Art in the 21<sup>st</sup> Century Concept Team**

### **Overview:**

Cyberspace is revolutionizing life and the world. Maritime Forces must fully develop and merge the physical, information, cognitive and social dimensions of a cyber-prevalent world. This team will generate concepts in maritime operations that will seize the advantage by integrating emerging cyber capabilities with related elements of national and multi-national power to optimize the art and science of both peace and war.

### **Pursuits:**

- Examine the significance of Maritime Forces in the cyber-prevalent world through 2020 and beyond.
- Determine how the advent of cyberspace has fundamentally changed maritime aspects of operational art for the 21<sup>st</sup> Century.
  - Explore how cyberspace affects the principles of war, phases of operations, operational functions, and factors across the spectrum of adversarial capabilities.
  - Determine whether cyberspace operations are force multipliers or whether conflict in cyberspace is unique unto itself.
  - Determine the conditions in which cyberspace is a Maritime Force's center of gravity.
- Revolutionize maritime operational structures, organizations, and processes to be efficient and effective in all dimensions of the cyber-prevalent world.
  - Determine the composition and core capabilities of a globally distributed, mission-tailored, cyber-maritime force.
  - Determine how maritime command, control, coordination and collaboration should evolve, given the opportunities and challenges cyberspace presents, to ensure desired operational outcomes. Identify means to facilitate unity of effort among Maritime Forces engaged in interagency and multinational operations.
  - Ascertain ways to exploit advantages and mitigate adverse effects of the expanding communication and information flow to achieve decision superiority.
  - Investigate the approach taken by international partners, competitors, adversaries, and industry at the convergence of Sea Power and Cyber Power. Identify measures necessary to enhance common security in a cyber-prevalent global commons while ensuring interoperability.
  - Identify changes necessary to existing domestic and international legal authorities to support the development of rules of engagement that will provide the commander the agility and flexibility necessary to reach operational objectives.



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### **The Human Element Concept Team**

#### **Overview:**

U.S. Maritime Forces will remain dominant and influential only with a bold shift in their commitment to understand and pursue the technological and human elements where Sea Power and Cyber Power converge. This CT will generate concepts to establish how the future Maritime Force will live, operate, and win within this convergence. This team will evaluate and expand upon previously identified concepts to develop and integrate the future Maritime Force with the cyber-prevalent environment.

#### **Pursuits:**

- Perform a needs analysis of human functions that can be assisted or supplanted by Cyber Power.
- Examine the evolution of human resource policy as it pertains to recruitment, selection, education, training, and retention in a cyber-prevalent world.
- Examine the effect of Cyber Power on processes that involve the human element.
- Explore human/system interface considerations.
- Determine how to bridge the cognitive-technological divide to ensure decision and information superiority.
- Identify Navy cultural impediments that will stall progress in the convergence area.

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### **Technology & Integration Concept Team**

#### **Overview:**

The convergence of Sea Power and Cyber Power is enhanced by advancing technology and requires new ethical and legal considerations. This CT will explore science and technology postures, program acquisition plans, investment priorities, and acquisition approaches for preventing and winning wars through 2020 and beyond. Additionally, this CT will consider the associated legal and ethical implications for operating in this cyber-prevalent environment. By partnering with other CTs, this team will identify potential operational shortcomings and vulnerabilities in the evolving Maritime Force cyber infrastructure—realizing this infrastructure includes assets under the cognizance of other U.S. Government organizations and agencies, and industry. Operational shortcomings may include bandwidth, range, and platform connectivity; vulnerabilities might be total cyber denial, spoofing, and interception by adversaries ranging from nation states to super empowered individuals. As shortcomings and vulnerabilities are identified, this CT will assess the effectiveness of existing acquisition programs in filling these gaps.

#### **Pursuits:**

- Research science and technology efforts based on future forecasting and anticipated requirements for operating through 2020 and beyond.
- Examine technologies for potential breakthrough capabilities to support the Nation's interest in fostering a peaceful global community while allowing for a competitive advantage in winning wars.
- Address legal and ethical implications related to the development, testing, and deployment of cyber-enabled capabilities.
- Evaluate existing investment priorities and the extent to which the acquisition process is responsive to the needs of Maritime Forces and recommend changes or new approaches.

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