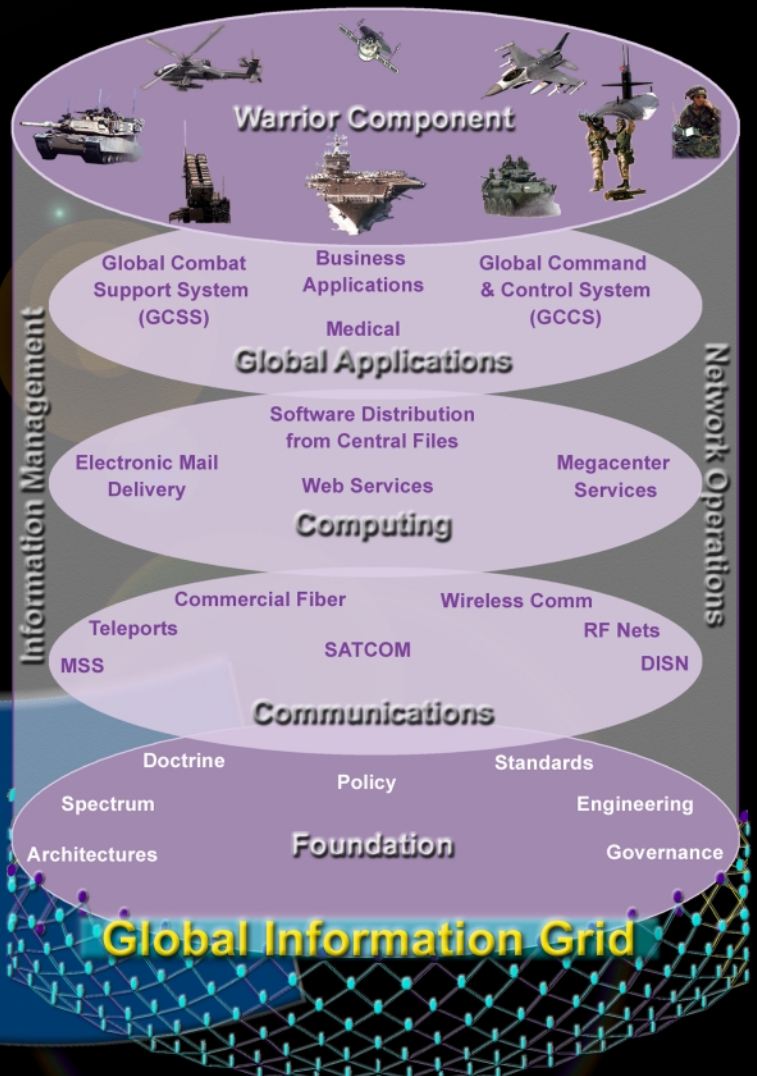


# Enabling the Joint Vision



Information Superiority





“An important aspect of future operations will be the development of a Global Information Grid, or GIG, to provide the network-centric environment required to achieve information superiority. The GIG is the globally interconnected, end-to-end set of information capabilities, associated processes, and personnel to manage and provide information on demand to warfighters, policy makers, and supporting personnel. It will enhance combat power through greatly increased battlespace awareness, improved ability to employ weapons beyond line-of-sight, employment of massed effects instead of massed forces, and reduced decision cycles. It will contribute to the success of non-combat military operations as well.”

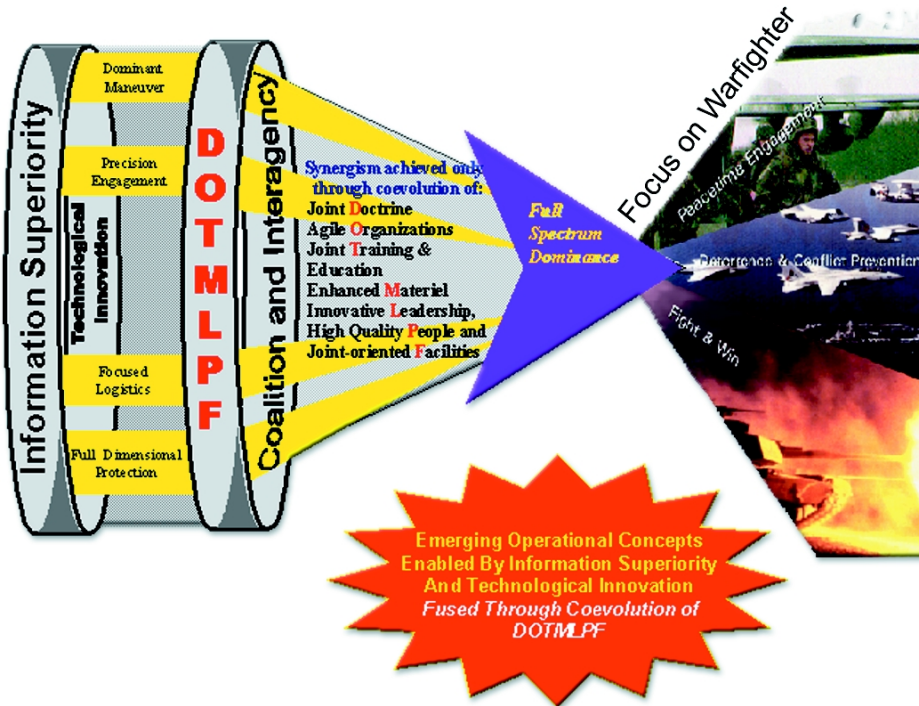
*-General Henry H. Shelton, Chairman of the Joint Chiefs of Staff  
Posture Statement, January 2000*

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# Information Superiority



## INFORMATION SUPERIORITY:

*"...the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same."*

*- Joint Vision 2010*

The focus of Information Superiority (IS) is providing the future Joint Task Force (JTF) Commander with an understandable, multidimensional, real-time, fused view of the battlespace to support the full range of military operations: humanitarian assistance, peace operations, up to and including the highest intensity conflict. Information Superiority is the key enabler of the operational concepts of Precision Engagement, Dominant Maneuver, Focused Logistics, and Full Dimensional Protection.<sup>1</sup>

Information Superiority (IS) is not a static, predetermined, quantifiable capability. It is intricately tied to the specific situation and is determined by the mission, environment, and current need for information.

<sup>1</sup> Chairman, Joint Chiefs of Staff, *Joint Vision 2010*, July 1996, p. 25.



# Global Information Grid

Over the past 10 years the nature of the actions involving U.S. forces has been varied and the response times have been decreasing. If the U.S. and its Allies are given time, they will place an unbeatable force in the area of conflict. Consequently, our response times are being whittled down dramatically. Also, there are more short notice JTF requirements for natural disaster response forces needing interoperability with non-DoD agencies and host nations not on our standard list of Allied or Coalition partners.

## Global Information Grid

The Global Information Grid is the vision of the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD(C3I)) for achieving IS. The GIG is focused on the warfighters' needs for IS plus the critical concerns of frequency spectrum and improving the management of the information infrastructure investment along with the coevolution of Doctrine, Organization, Training and Education, Materiel, Leadership, Personnel, and Facilities (DOTMLPF).

The September 22, 1999, ASD (C3I) memorandum, Subject; Global Information Grid, defines the GIG as:

*“The globally interconnected, end-to-end set of information capabilities, associated processes and personnel for collecting, processing, storing, disseminating and managing information on demand to warfighters, policy makers, and support personnel. The GIG includes all owned and leased communications and computing systems and services, software (including applications), data, security services and other associated services necessary to achieve Information Superiority. It also includes National Security Systems as defined in section 5142 of the Clinger-Cohen Act of 1996. The GIG supports all Department of Defense, National Security, and related Intelli-*

## The Vision: Global Information Grid



- A single secure Grid providing seamless end-to-end capabilities to all warfighting, national security, and support users
- Supporting DoD and Intelligence Community requirements from peace time business support through all levels of conflict
- Joint, high capacity netted operations
- Fused with weapons systems
- Supporting strategic, operational, tactical, and base/post/camp/station
- Plug and Play interoperability
  - Guaranteed for US and Allied
  - Connectivity for Coalition users
- Tactical and functional fusion a reality
- Information/Bandwidth on demand
- Defense in Depth against all threats

Protected, Assured, Interoperable Information

Figure 1. Global Information Grid

*gence Community missions and functions (strategic, operational, tactical and business), in war and in peace. The GIG provides capabilities from all operating locations (bases, posts, camps, stations, facilities, mobile platforms and deployed sites). The GIG provides interfaces to coalition, allied, and non-DoD users and systems.”*



# Global Information Grid

Continued

The GIG's interoperability builds upon the existing Defense Information Infrastructure (DII) Common Operating Environment (DII COE). The building blocks of Joint Technical Architecture, Joint Operational Architecture, Joint Systems Architecture, a shared data environment, the migration of legacy systems, and adherence to commercial standards provide the necessary structure for the GIG.

The key to achieving Information Superiority lies in implementing a standards based, metric-oriented, end-to-end integrated GIG. The concept of IS may be situational but the GIG, which will implement IS, is quantifiable. Important initiatives to implement the GIG are described in the following sections.

## GIG Efforts For Achieving Information Superiority (IS)

To achieve IS through the GIG, various organizational, procedural, and doctrinal changes are occurring. They are inextricably linked to the vast advancements in information technology. The goal for these changes is to enable warfighters' concepts and more efficiently support the business functions of the Department of Defense.

In order to achieve this goal, the GIG must be dynamic and adaptable to changes in the operational environment, flexible and secure for adding and removing users, and support the JV2010 operational capabilities of Focused Logistics, Dominant Maneuver, Precision Engagement, and Full Dimension Protection. The GIG must provide end-to-end visibility, control, and support to manage and protect net-

works and the information they carry. To maintain the integral capabilities, the GIG must be scalable, resourced, and upgraded as required. Key to the warfighting environment, it must be Allied, Coalition, and non-DoD Agency friendly.

**Dominant Maneuver (DM)** depends upon IS to enable the multidimensional application of information, engagement, and mobility capabilities to position and employ widely dispersed joint air, land, sea, and space forces to accomplish operational tasks. IS will allow our forces to gain a decisive advantage by controlling the breadth, depth, and height of the battlespace through assured, real-time battlespace awareness. The GIG will ensure that warfighters can coordinate widely dispersed units, receive accurate and timely feedback, and execute more precision requirements.

**Precision Engagement (PE)** requires services and capabilities that enable forces to locate the objective or target, provide responsive command and control, generate the desired effect, assess the level of success, and retain the flexibility to re-engage with precision. PE will allow us to shape the battlespace and enhance force protection. IS will enable high fidelity target acquisition, prioritized requirements, command and control of joint forces within the battlespace, and minimizing collateral damage.

# Global Information Grid

Continued

**Full Dimensional Protection (FDP)** will enable the effective employment of our forces while degrading the enemy's abilities to do the same. "Full dimensional protection will be built upon IS which will provide multidimensional awareness and assessment, as well as identification of all forces in the battlespace."<sup>2</sup>

**Focused Logistics (FL)** will be achieved through a fusion of technological, organizational, and process innovations. Information Superiority is key to enabling the fusion to achieve FL objectives of total asset visibility, intransit visibility, right-sizing of the logistics footprint, and the merging of logistics information into the common operational picture to meet Commander in Chief (CINC) and JTF Commander priorities. IS goals are providing the interoperability, collaborative planning, and information processing capabilities essential to effective Joint Force logistics.

The GIG focuses on seven components to provide these capabilities:

- ◆ Warrior Component
- ◆ Global Applications
- ◆ Computing
- ◆ Communications
- ◆ Foundation
- ◆ Network Operations
- ◆ Information Management

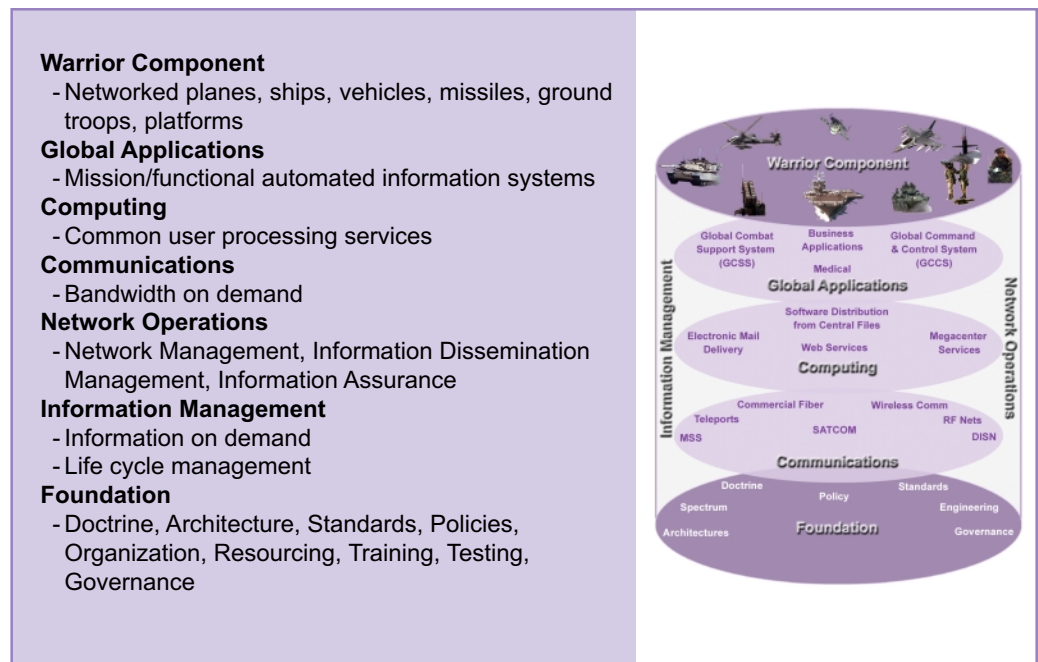


Figure 2. Global Information Grid Components

<sup>2</sup> Ibid., p. 23.



# Global Information Grid Warrior Component



Figure 3. Warrior Component

## Warrior Component

The GIG supports the sensor - decision maker - shooter - target structure critical to combat operations. During Allied Force, the entire spectrum of operations, including battle management, battlefield air interdiction, intelligence, surveillance, reconnaissance, and air campaign planning were required by NATO commanders to operate and maneuver their tanks within the adversary's decision cycle. The current C4ISR capabilities were enhanced when creative commanders on the ground developed new ways to use Unmanned Aerial Vehicles (UAV) and airborne forward air controllers to conduct flex targeting and filming of battle damage.<sup>3</sup>

Providing battlespace awareness to warfighters across the joint force with accuracy and timeliness requires that data and information from multiple sources be collected, processed (analyzed when necessary), transported, fused, placed in appropriate contexts, and presented in ways that facilitate rapid and accurate decision-making.<sup>4</sup>

<sup>3</sup> EUCOM Operation Allied Force briefing, *Kosovo Strike Assessment* (U), Aug 1999.

<sup>4</sup> David S. Alberts, John J. Garstka, and Frederick P. Stein, *Network Centric Warfare*, 2<sup>nd</sup> Edition Revised, August 1999, p 133.



# Global Information Grid

## Global Applications Component

### Global Applications Component

The Global Applications Component covers such diverse areas as medical, weather, electronic commerce, Global Combat Support System (GCSS), DoD Intelligence Information System, and Global Command and Control System (GCCS). GCSS and GCCS are two critical applications supporting joint command and control and operational concepts by providing for the information needs of the warfighters.

GCSS will provide the logistics, accounting and finance, personnel, and medical information needed to plan, deploy, sustain, and redeploy forces key to Focused Logistics. It will provide interoperability across combat support functions, as well as between combat support and command and control. GCCS will provide the joint warfighter access to all data and applications for total asset visibility.

GCCS is a comprehensive worldwide capability to provide end-to-end information processing and dissemination. It supports situational awareness, readiness assessments, course of action development, imagery exploitation, and planning. The development of a coherent set of Battlespace Awareness capabilities for IS will result from the continued enhancement of the GCCS Common Operational Picture.

### Global Applications Component



- Global Command and Control System (GCCS)
- Electronic Commerce
- Business Applications
- Global Combat Support System (GCSS)
- Allied/Coalition/Non-DoD Interfaces

... and many more; currently over 28K systems in DoD

Figure 4. Global Applications Component



# Global Information Grid

## Computing Component

### Computing Component

The GIG's Computing Component consists of hardware capabilities, software capabilities, and processes. It includes megacenter services, shared data warehouses for storage and access, software distribution from central locations, shared mapping services, licensing services, electronic mail delivery, web services, collaboration services to share information and ideas, common directories, and search services. These computing services will "...provide an uninterrupted distribution of information to U.S. forces, with the knowledge to use the information, while denying the enemy the ability to do the same."<sup>5</sup>

The Defense Information Systems Agency (DISA) is crafting a computing infrastructure to "...support all DoD missions, including command and control, combat support, and intelligence...,"<sup>6</sup> which is evolvable, interoperable, features reuse of data, and security to support IS. DISA's DII COE provides a set of integrated support services for mission area applications and the Shared Data Engineering (SHADE) provides for the interoperability of functional applications at

- Megacenter Services
- Common Directories
- Shared Data Warehouses for Storage/Access
- Search Services
- Data Services
- Software Distribution from Central Locations
- Shared Mapping Services
- Web Services
- Collaboration Services
  - Share information and ideas
- Electronic Mail Delivery
- Licensing Services
- End User Devices

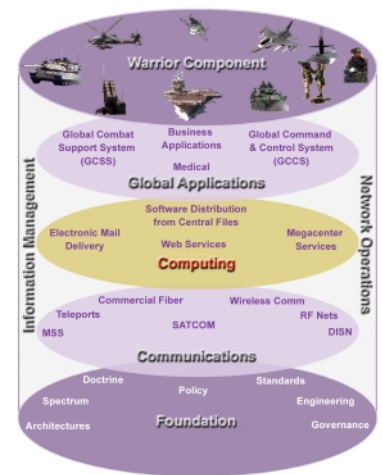


Figure 5. Computing Component

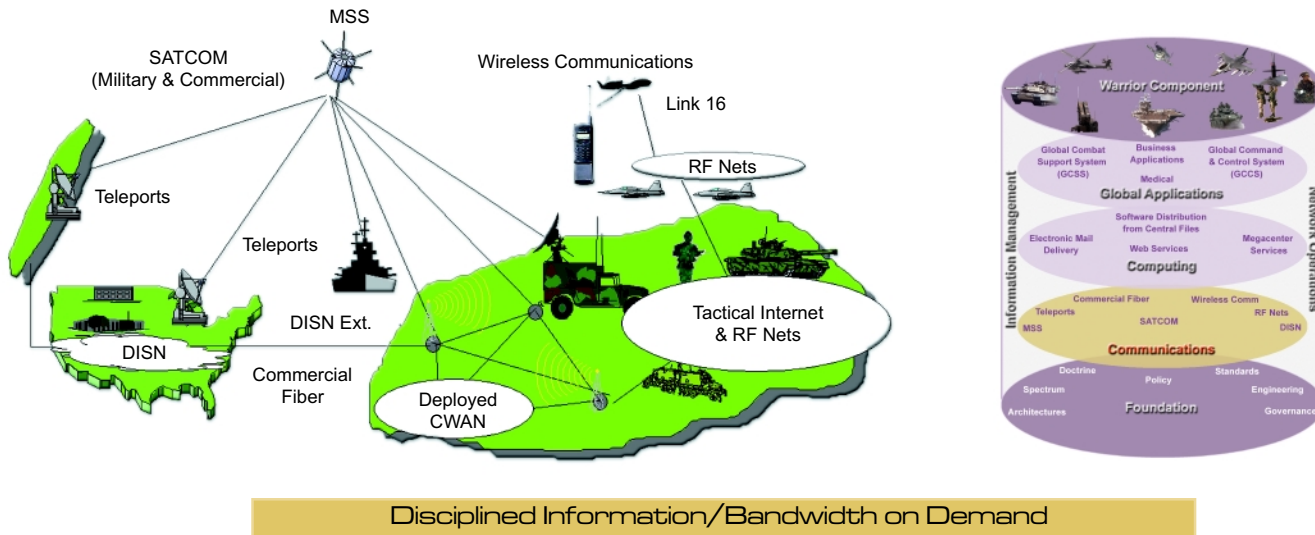
the data level among the functional areas needed to provide fused battlespace awareness. SHADE will ensure cross-functional integration of applications so data from one functional community can be used by applications belonging to another functional community.<sup>7</sup>

<sup>5</sup> Defense Information Systems Agency, *Defense Information Infrastructure Master Plan Version 8 Implementing the Global Information Grid*, 29 April 1999, p. A-23.

<sup>6</sup> Ibid.

<sup>7</sup> DoD Chief Information Officer Memorandum, Subject: Department of Defense (DoD) Chief Information Officer (CIO) Guidance and Policy Memorandum Concerning Effective Data Strategy, 7 February 2000.

# Global Information Grid Communications Component



Disciplined Information/Bandwidth on Demand

Figure 6. Communications Component

## Communications Component

To support the Joint Warfighter of today as well as 2010 and beyond, interoperable, assured, end-to-end networks for information and C2 transport and processing are vital. All information and data are required to be available end-to-end to support whatever mission requirements exist regardless of environment. Doctrine and policy will dictate access, but the information and data will be available for push or pull.

The Communications Component of the GIG extends from the post, base, camp, and station, through the strategic networks, to the “last tactical mile.” The last tactical mile extends to

the Service weapons and sensor platforms. The bridge between the strategic and tactical communications networks will be the DoD Teleport. Teleports will provide deployed communications networks access to strategic networks and the services, and data that those networks have to offer, e.g., secure and nonsecure telephone, data, and video teleconferencing networks. This will allow the deployed warfighter in a Navy ship, Army division, Air Force wing, or Marine task force access to data stored on these strategic networks, and provide a means to push information to strategic planners. As the more forward “networked sensors” need to move data and information in real-time, it makes the Communications Component more critical to operational success.



# Global Information Grid Network Operations (NETOPS)

## Network Operations (NETOPS)

NETOPS will provide collaborative, integrated, and seamless end-to-end management of networks, global applications, and services across the GIG by CINCs, Services, and Agencies.

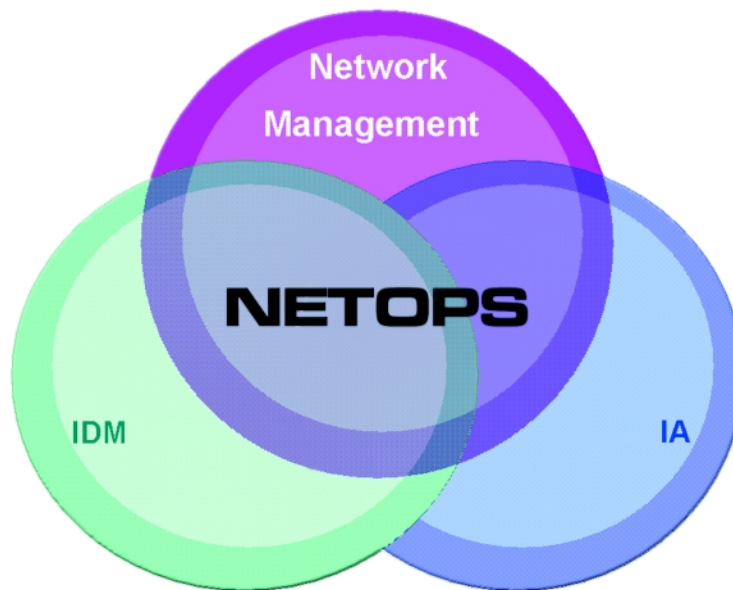


Figure 7. NETOPS Components

**Network Management** will provide visibility into the extent and intensity of activity, traffic load, and throughput potential. It will enable dynamic rerouting based on priority, system status, and capacity. The effects of disruptions and intrusions will be minimized through allocation of traffic to unaffected available network paths.

Network management, as one component of NETOPS, plays a key role in successful implementation of the GIG. Having end-to-end awareness of the networks comprising the GIG and then properly managing those networks from the strategic to the tactical level, whether

fixed station or deployed, is a critical part of synchronizing our forces in peacetime or war. Interoperability between these network management systems is crucial to provide true end-to-end service to the warfighter and DoD's crucial business functions.

Network management will provide commanders with the ability to view and manage their networks just like other resources. Commanders will be able to visualize the networks that support their on-going operations and adjust or reallocate capabilities as the situation changes.



### **Information Dissemination Management**

(IDM) will provide improved awareness, access, and delivery of information and will provide direction for information flows based on commanders' priorities that can then be executed by network management. IDM seeks to achieve the right information, arriving at the right place, at the right time, in a usable format through the processes, services, and applications to warfighters at all levels (Strategic, Operational, and Tactical) and other users of information. IDM will provide awareness of relevant, accurate information, automated access to newly discovered or recurring information, and timely, efficient delivery of that information.

Key to this uninterrupted flow and making the most efficient use of the networks is providing awareness of information within a commander's Area of Responsibility (AOR) and providing the capability to dynamically adjust the priority of information flow based on the current operational environment. IDM must work hand-in-hand with network management allowing the commander's dissemination policies to be executed while maintaining priority schemes established within specific AORs. These capabilities will become an integrated part of the DII COE and will be applied to the entire GIG with a goal of making all information on the GIG available to those who are "plugged in."

**Information Assurance** (IA) will provide the vital element of NETOPS that minimizes our systems and information vulnerabilities. Through a *DEFENSE IN DEPTH* approach of tactics, techniques, and procedures, IA will pro-

tect and defend the information, data, systems, and networks.

Our armed forces increasingly rely on critical digital electronic information capabilities to store, process, and move essential data in planning, directing, coordinating, and executing operations of all types. However, many of these systems have security weaknesses that can be exploited by powerful and sophisticated deep-attack threats—events or circumstances that can cause unauthorized access, destruction, disclosure, modification of data, or denial of service—and increasing interoperability and network integration increase vulnerabilities. With deep, layered defenses we can eliminate vulnerabilities and deter, defeat, and recover from sustained, skillful, and penetrating assaults. The integrated, network-centric nature of the GIG requires that assurance measures be applied throughout because the assurance of the entire GIG is dependent upon the assurance of all its individual elements.<sup>8</sup>

"With one's adversaries having potentially increased visibility into our deliberation, decision-making processes, preparations, and operations, there is an increased risk of being outflanked or disrupted. In one sense the situation actually becomes more like chess, where everyone gets the same pieces and sees the same battlespace. The winner, of course, is the one who can make the best use of the pieces."<sup>9</sup> A solid investment in IA and its training, doctrine, and policy are required now in order to be prepared for the GIG environment.

<sup>8</sup> Joint Staff, C4 Systems Directorate brochure, *Defense in Depth*, September 1999.

<sup>9</sup> David S. Alberts, John J. Garstka, and Frederick P. Stein, *Network Centric Warfare*, 2<sup>nd</sup> Edition Revised, August 1999, p. 64.



# Global Information Grid

## Information Management

### Information Management

Information Management is defined as “the planning, budgeting, manipulating, and controlling of information throughout its life cycle (e.g., creation or collection, processing, dissemination, use, storage, and disposition).”<sup>10</sup>

The Information Management Component will enable the warfighter to access needed databases with appropriate permissions, anywhere in the world. It is essential for real-time decision support and knowledge management necessary to decrease response time, enable a more rapid transition from deployment to full operational capability and support flexible organizations essential to dynamic future joint operations.

Information Management provides Joint Warfighters with the critical ability to dynamically tailor and prioritize their information requirements to support the mission and environment. This flexibility will ensure real-time, relevant information and Battlespace Awareness.

Greater networking can quickly lead to information overload - we must ensure our data works for us. Information Management is a means of prioritizing information through electronic labeling to ensure that highly critical mission information proceeds across the networks prior to less important planning or administrative information.

### Information Management



The management of data, information, and knowledge to enable decisions consists of:

- Information Needs
- Data and Information Acquisition
- Data and Information Processing
- Data and Information Access and Availability
- Knowledge Management
- Decision Support
- Feedback

Information Management: Enabling Timely Decisions

Figure 8. Information Management

<sup>10</sup> DoD Chief Information Officer, Memorandum, SUBJECT: DoD Chief Information Officer (CIO) Guidance and Policy Memorandum No. 7-8170 Information Management, 1999.

# Global Information Grid

## Foundation Component

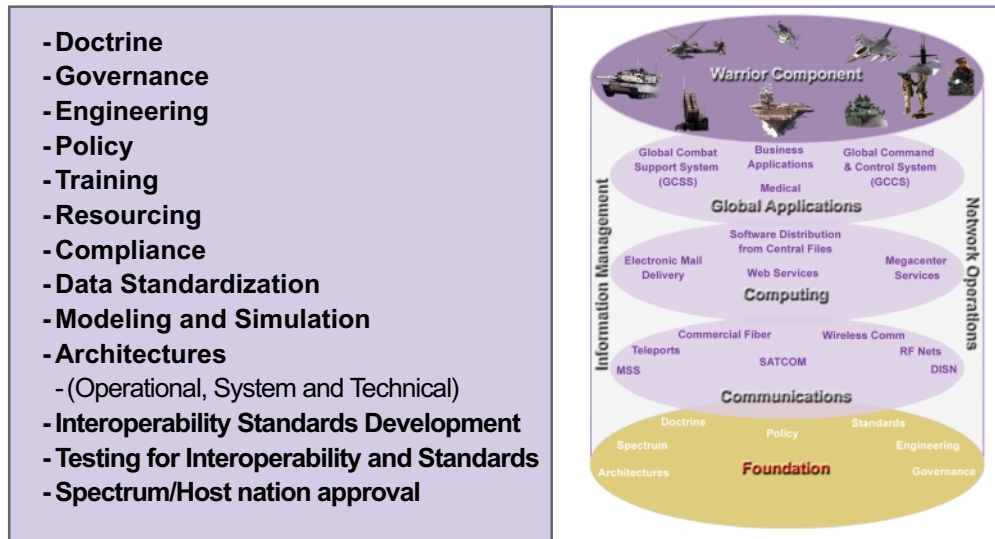


Figure 9. Foundation Component

### Foundation

The Foundation of the GIG is solidly grounded in doctrine, policy, governance, training, engineering, resourcing, compliance, standards, architectures, and testing. These elements have been proven over time to be the strength of every successful endeavor and the downfall if they are not properly addressed.

The Foundation is all those “transforming” activities that must happen involving people and organizations in order to make the GIG a reality. It involves changing from the way we think today—more than individual networks and systems to being able to access information, at any time, in any location by tapping into the Global Information Grid.

The ability to provide assured awareness across the joint force with accuracy and timeliness requires that data and information from multiple sources be collected, processed, transported, fused, placed in appropriate contexts, and presented in ways that ensure rapid and accurate understanding. It also requires that modeling and simulation (M&S) and decision support systems become integral parts of the decision making process.<sup>11</sup> M&S will be critical to synchronized, integrated employment and implementation of the GIG.

<sup>11</sup> David S. Alberts, John J. Garstka, and Frederick P. Stein, *Network Centric Warfare*, 2<sup>nd</sup> Edition Revised, August 1999, p 133.



# Global Information Grid

## Network Warfare Simulation (NETWARS)

### Network Warfare Simulation (NETWARS)

NETWARS is a modeling and simulation capability to analyze joint communications systems' capacity and performance. It assures the JTF Commander and the CINC that they have the right network resources to support the fight, or if these resources must be prioritized, adjust other warfighting resources during certain phases of the operation. The NETWARS communications model is being developed to satisfy compelling needs to: (1) conduct C4 contingency planning; (2) conduct communications burden analysis of new and existing networks; (3) evaluate emerging technologies; and (4) justify joint C4 investments.

NETWARS will provide results such as network and circuit utilization rates, speed of service, and message perishability with enough technical accuracy and precision to quantify the network loading delays and bottlenecks. The NETWARS model and simulation tool will help the C4 planner predict network problems and solve them during the planning phase, before they have a negative operational impact. In addition, NETWARS will justify investment strategies to help evolve the GIG.

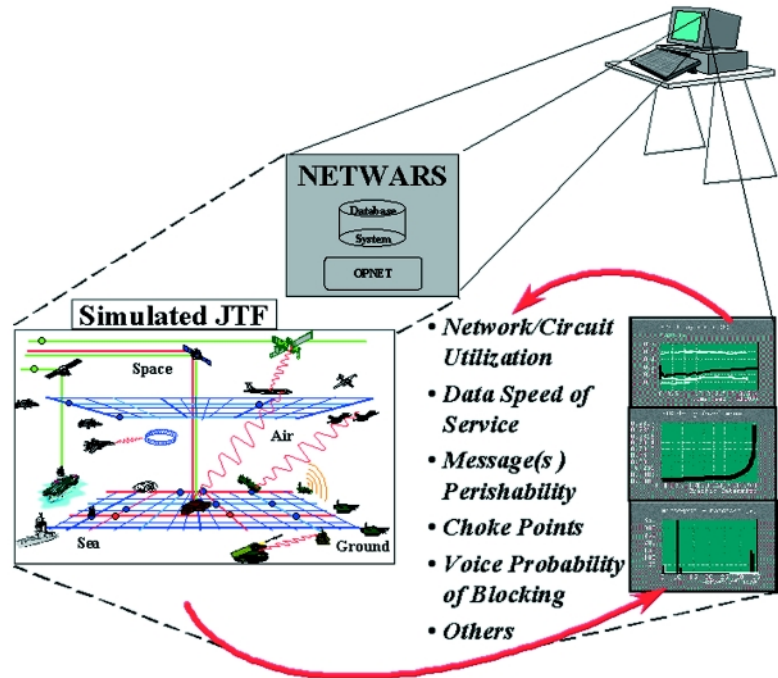


Figure 10. NETWARS Process

NETWARS is being developed in a modular way with each Service to facilitate and reduce the time required to perform these studies. This process will take advantage of economies of scale by sharing data and models among all Services and Agencies, provide a Joint modeling environment, and be the primary network-modeling tool for the Services in the future.



# Spectrum Management

Solving spectrum management issues is key to the ability to implement a real-time, assured, integrated GIG for enabling Dominant Maneuver, Precision Engagement, Focused Logistics and Full Dimensional Protection. Conflicting commercial spectrum needs domestically and internationally pose serious threats to military communications access.

CINCs desire assured spectrum access for the warfighter for domestic defense and international operations, without today's diverging allocation tables. We need to achieve "stable allocation tables" in order to:

- ◆ Procure/acquire future weapons systems
- ◆ Train with current warfighting equipment capabilities
- ◆ Minimize modifications and thereby costs

DoD faces increased "competition" for access to frequencies because of the 1980s significant increases of technology and 1990s considerable commercially driven interests. The 2000s will see an expansion of the dependence on wireless requirements for civilian and military needs.

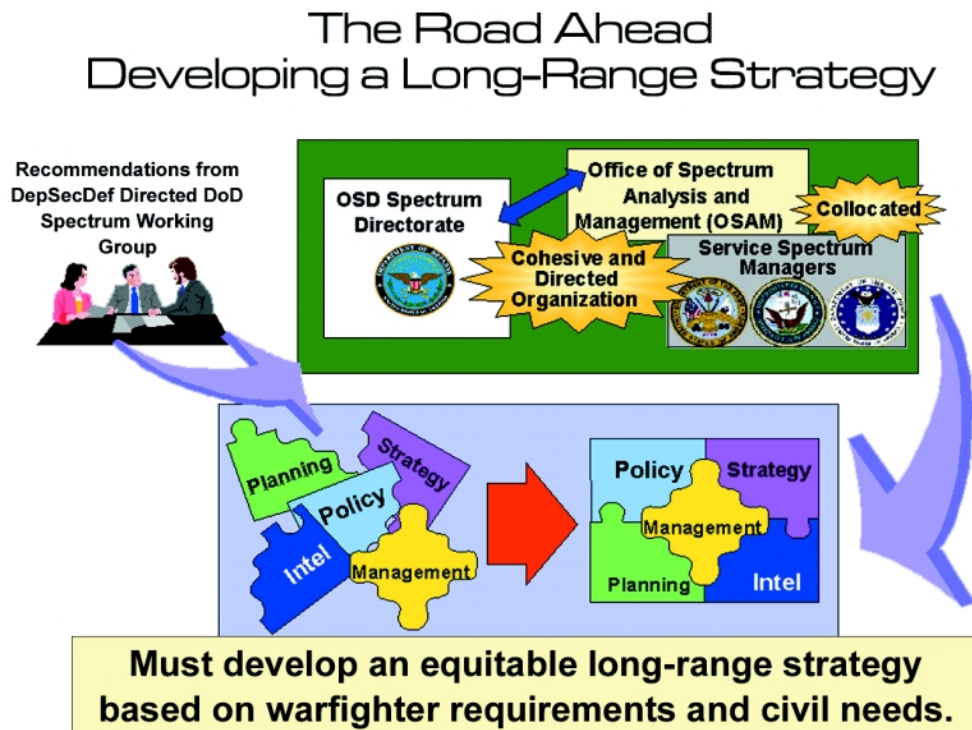


Figure 11. Spectrum Management Strategy



## Allied and Coalition Interoperability

Operations Allied Force and Noble Anvil have provided a real world laboratory for Command, Control, Communications, and Computers (C4) interoperability and its effects on the joint warfighting environment. “NATO commanders used video teleconferencing for the first time as a major instrument for exercising command and control...these commanders’ video teleconferences spanned the strategic, operational, and tactical levels of command, thus greatly compressing normal command and control processes.”<sup>12</sup> However, problems in communications interoperability, “...persisted throughout the campaign.”<sup>13</sup>

International standards, policies, doctrines, and procedures affect the critical need for C4 interoperability along with hardware and software inequities.<sup>14</sup> The capabilities envisioned by the GIG will ensure applicable standards, hardware, and software compatibilities while providing the flexibility to support evolving policies, doctrines, and procedures.

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<sup>12</sup> Report to Congress, Kosovo/Allied Force Final Report to Congress (U), 31 Jan 2000, p. 28.

<sup>13</sup> Ibid., p.25.

<sup>14</sup> Ibid., p. 26.

# Coevolution

Doctrine, policy, and organizations will need to coevolve to take full advantage of the enhanced capabilities provided by the GIG. Coevolution of the elements of the GIG's Foundation Component will provide increased connectivity and interoperability. With the GIG capabilities and JV2010 operational capabilities, warfighters and their staffs are likely to coevolve innovative ways of fighting not yet invented or observed.

As networks, applications, software, systems, and transmission mediums become more interoperable and assured, they provide the warfighter, as well as the business process owners of the DoD, an opportunity to take full advantage of capabilities at all levels to visualize their current situation. They can then use this fused data to plan their specific mission, within the context of the global situation. Increased battlespace visualization will provide the joint warfighter with real-time resources available, allowing optimization based on operational constraints.



## Summary

The Global Information Grid is the unifying theme that will enable the Department of Defense to develop, acquire, field, and operate the applications, communications and computing capability necessary to assure mission success in an integrated, synchronized fashion. The GIG will permit:

- ◆ battlespace awareness through a common operational picture
- ◆ collaborative planning of dispersed, multi-functional operational teams
- ◆ employment of massed effects rather than massed forces
- ◆ in-flight retargeting of precision-guided munitions
- ◆ fused sensor-to-decision maker-to-shooter capability

**Information Superiority**

***EQUALS***

**Increased Combat Power**



# Notes



# Notes





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