

20 OCT 1994

Ref: 94-F-0721

Professor Trond Jacobsen
Department of Speech
University of Alaska-Anchorage
3211 Providence Drive
Anchorage, AK 99508

Dear Professor Jacobsen:

This responds to your March 11, 1994, Freedom of Information Act (FOIA) request pertaining to two publications. Our March 25 interim response refers.

The Joint Staff has provided the enclosed publication, *C4I for the Warrior*, as responsive to item one of your request. Since the processing costs for this portion of your request were under \$15.00, there are no charges, in this instance.

Item two of your request, *Management of DoD Interoperability Efforts for Tactical Command, Control, and Communications*, is under the cognizance of the Department of Defense Inspector General (IG). Since the DoD IG operates their own Freedom of Information office, your request was referred to the following address for additional processing and direct response to you:

OIG, DoD
Attn: Chief, FOIA/PA Office
400 Army Navy Drive, Room 405
Arlington, VA 22202-2884

Sincerely,

SIGNED

A. H. Passarella
Acting Director
Freedom of Information
and Security Review

Enclosure:
As stated

Prepared by Kahn:4F0721L1gr:10/19/94:DFOI:X71160:gr ✓ pk yl wh ✓

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C4I



for the

WAE

*Fused, Real Time,
Warrior's Battlespace
Coordinate Horizon
Warfighting Missions*

12 June 1992



The C4I for the Warrior concept will give the battlefield commander access to all information needed to win in war and will provide the information when, where, and how the commander wants it.

At the height of the Persian Gulf conflict, the automated message information network passed nearly 2 million packets of information per day through gateways in the Southwest Asia theater of operations. Efficient management of information increased the pace of combat operations, improved the decisionmaking process, and synchronized various combat capabilities. The technology developed to support these networks proved to be a vital margin that saved lives and helped achieve victory.

Many challenges still must be faced. The downsizing of military forces and the shrinking defense budget have resulted in increased reliance on C4I interoperability. The C4I for the Warrior concept starts with the Warrior's requirements and provides a roadmap to reach the objective of a seamless, secure, interoperable global C4I network for the Warrior.

The time is ripe to set a course to resolve our C4I interoperability issues. C4I for the Warrior provides the vision and the roadmap for present and future C4I support of our joint warfighting forces.

A handwritten signature in black ink, which appears to be "C. L. Powell". The signature is stylized and fluid.

COLIN L. POWELL
Chairman
of the
Joint Chiefs of Staff

C4I FOR THE WARRIOR

A Warrior's battlespace is the total, fluid, dynamic environment within which mission-derived operational objectives are pursued.

C4I for the Warrior sets forth a concept—a unifying theme—guiding principles and a roadmap for achieving global C4I joint interoperability that:

- *will allow any Warrior to perform any mission—any time, any place,*
- *is responsive, reliable, secure and*
- *is affordable.*

C4I for the Warrior realizes the concept of a global Command and Control, Communications, Computer and Intelligence system that directly links and supports the Warriors—combat troops of all Services—who engage in military operations in a rapidly changing world.

The C4I for the Warrior concept provides an interoperable, fully integrated C4I system for our Warriors to assess, respond, lead, and fight:

- *with maximum effectiveness,*
- *on arrival, and*
- *in unison with any other element.*

It will bring to the Warriors:

- *accurate and complete pictures of their battlespace,*
- *timely and detailed mission objectives, and*
- *the clearest view of their targets.*

A unifying C4I concept is essential to achieving the objective of a global C4I system that will support the requirements of the joint warfighter, consistent with national security

plans and Department of Defense (DOD) policy. Through a revolutionary approach and in an evolutionary manner, this concept addresses joint force operational C4I interoperability issues. It can improve the joint warfighter's ability to manage and execute crisis and contingency operations and provide a means for unifying the many heterogeneous Service C4I programs currently being pursued. The concept builds upon lessons learned from previous conflicts, operational requirements, the effects of rapidly changing technology, and the directions of a changing national security strategy.

The C4I for the Warrior vision is now being achieved. The roadmap to completion includes: (1) a Quick Fix Phase that will achieve interoperability between existing C4I systems by use of translators, adherence to a common set of joint standards, rigorous testing for conformance, and configuration management enforcement; (2) a Mid-Term Phase that achieves total interoperability for new C4I systems during development, testing, acquisition, and implementation and establishes a joint wide-area network based on digital commonality; and (3) an enduring Objective Phase during which evolving technologies and techniques are continuously identified and assimilated and a fully developed C4I network of fused information, updated automatically, is available from which the joint warfighter can pull information to provide the "picture" required on a single display, anyplace, anytime, in the performance of any mission.

A NEW CONCEPT: THE COMMON GLOBAL VISION

*"Where there is no vision the people perish"
Proverbs 29:18*

A Warrior is the man or woman who fights the war—whether from a foxhole or from a Commander-in-Chief's command post. The C4I for the Warrior concept provides a beacon that will guide all Services to a global C4I system that satisfies the total information requirements of Warriors when they fight as a team with a common mission. The common global vision of C4I for the Warrior is to create for these joint warfighters a single view of military C4I. This view is a widely distributed, user-driven network to which the Warrior "plugs in." This network:

- provides seamless, secure connectivity;
- through multiple, highly flexible nodes;
- to all other operational elements and data bases (which are automatically updated and from which desired information can be pulled);
- for any assigned mission.

What's new and different about C4I for the Warrior? The increasing complexity of multiple force operations in modern warfare is new as are the C4I tools and processes available and needed to plan, coordinate, and carry out these tasks. The concept of teamwork is *not* new. The fighting force that decimated Iraqi defenses validated again the long standing military axiom that victories are gained by close and effective integration of ground, sea, air and amphibious resources. The C4I for the Warrior concept facilitates teamwork, turning a vision of a fully integrated C4I support system into reality.

The need for interoperability among Services and nations is well known and is a

"We are doing a lot on a program we have just started, called C4I for the Warrior. Under my J6, Admiral Macke, we are taking a total look at the communications and intelligence systems that we are purchasing for the future to make sure that they are interoperable, to make sure that they have translation devices so every Service can talk to every other Service and so every unit on the battlefield can talk to every other unit on the battlefield."

*General Colin Powell,
Senate Armed Services
Committee Hearing,
March 10, 1992*

generally accepted premise. The term interoperability has little meaning unless specific parameters are described and specified. Interoperability encompasses doctrine, procedures and training as well as systems and equipments. In the C4I for the Warrior concept, interoperability is the capability of people, organizations, and equipment to operate effectively together so that "every unit on the battlefield can share information with every other unit on the battlefield."

What the Warrior Needs:

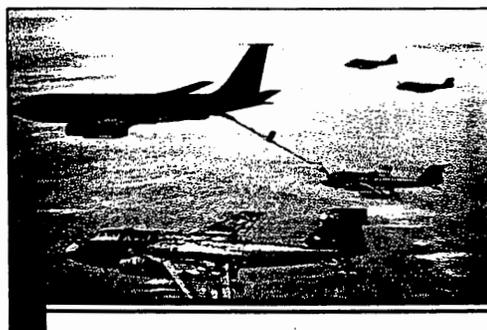
A fused, real time, true representation of the Warrior's battlespace—an ability to order, respond and coordinate horizontally and vertically to the degree necessary to prosecute his mission in that battlespace.

VADM Richard C. Macke, USN,
Director of Command, Control,
Communications and Computer Systems, (J6)
The Joint Staff

Computers, along with other high technology equipments, have changed warfare. Vital to most facets of modern, integrated operations, computers are used for applications ranging from missile tracking and guidance and control systems to streamlining routine staff and administrative functions. Command and control is exercised using linked, secure computer networks in addition to the more traditional voice and message procedures. Information is transmitted via satellite, fiber optic, microwave, cable, and radio links. The effectiveness as well as the efficiency of joint and combined operations can be adversely affected, or improved, by the flexibility and responsiveness of the total force's C4I support system.

FUSION In the C4I for the Warrior concept, fusion is the process of receiving and integrating all-source, multi-media and multi-format information to produce and make available an accurate, complete summary that is as timely, but more concise, less redundant, and more useful to the Warrior than if the same information were received directly from separate multiple sources.

According to current estimates, the total of all human knowledge doubles every 10 years. Thus, during the last decade (1980-1989) the body of human knowledge increased by an amount equal to everything learned from the dawn of history through 1979. The decade of 1990-1999 will likely produce *twice* that amount. Translated into military terms, the capacities of C4I communications and information processing capabilities might be severely saturated. The Warriors, however, neither want nor need the cumulative knowledge of the ages dumped into their battlespace information resource system when they are preparing to fight—and particularly not when they are busy fighting. They want only the specific information they need to win the fight. They want it when they need it, where they need it and in the form in which it will do them the most good.

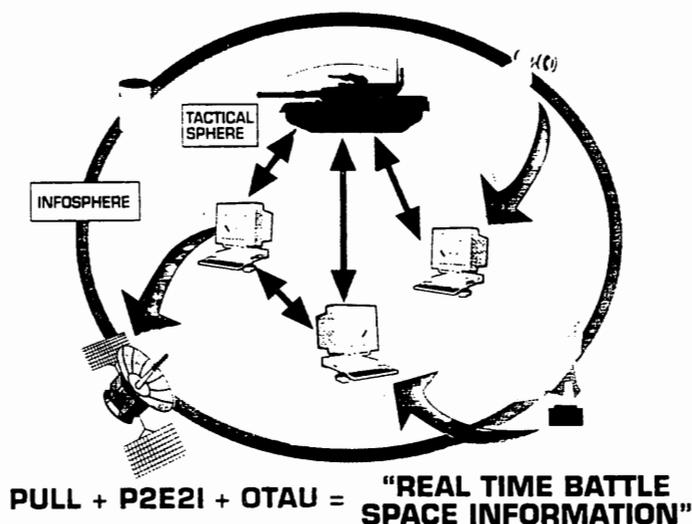


INFOSPHERE The infosphere contains the total combination of information sources, fusion centers, and distribution systems that represent the C4I resources a warfighter needs to pursue his operational objectives.



PREPLANNED ESSENTIAL ELEMENTS OF INFORMATION (P2E2I)

Preplanned essential elements of information (P2E2I) is all of the relevant information that the Warrior anticipates that will be needed to plan and carry out a future mission. This information will comprise the initial, static database. As the Warrior progresses toward and into combat, this data will be refreshed and supplemented automatically from decentralized elements of the infosphere.



"OTAU"

Over the Air Updating

"Over-the-Air Updating (OTAU) is the process by which the Warrior's databases are automatically updated by elements of the infosphere"

At the center of the C4I for the Warrior concept is the establishment of a global C4I capability that allows the Warrior to define his or her own battlespace and to "plug in" and "pull" timely, relevant information anytime, anyplace in the performance of any mission. The Warrior, by defining the battlespace, determines what information to pull from the infosphere. The Warrior would much rather "pull" information from the infosphere than have it "pushed" into the battlespace from all sources. Due to the need to be ready upon arrival, Warriors must have current, relevant information. This information must be resident either with the Warrior or automatically updated as frequently as required.

The warrior also connects with the infosphere to "provide" information as he reports to his higher headquarters, coordinates horizontally and vertically, and directs his own forces.

In the C4I for the Warrior concept, the Warrior is supported by a fully developed, transparent global C4I infrastructure that provides tailored, fused information via seamless strategic and tactical connectivity. Critical command and control grids are structured to meet functional needs and pertinent information will be provided automatically, when, and as needed. Transmissions will be minimized by adhering to the "compute before communicating" principle for information processing.

The rear-area C4I system components are capable of generating unit—and mission-directed information—securely and as needed. Future front line C4I systems will also continue to satisfy Service-oriented functions while being small, light, capable, and operable by the joint warfighter. Warriors will be linked together with efficient, robust, secure, multimedia networks and will depend upon ultra small and powerful computer systems containing preplanned essential elements of information that are integral to the Warrior's doctrine and plans.

A node is a C4I gateway and switching facility. In the C4I for the Warrior concept, nodes are connected in a synergistic, geodesic-like framework that provides interlocking connectivity among all national and theater communication links and fusion elements. These nodes not only serve to tie together all of the elements of the infosphere but also provide the Warriors with gateways from which they can "pull" information and automatically receive relevant, over-the-air updates to his information resource base.

The Warrior line addresses the concept that information will be provided by multiple systems, riding various communications paths. On the open side information is transmitted through numerous systems, whereas on the Warrior's side the information travels only on tactical command and control systems defined by the Warrior. The Warrior line mandates are:

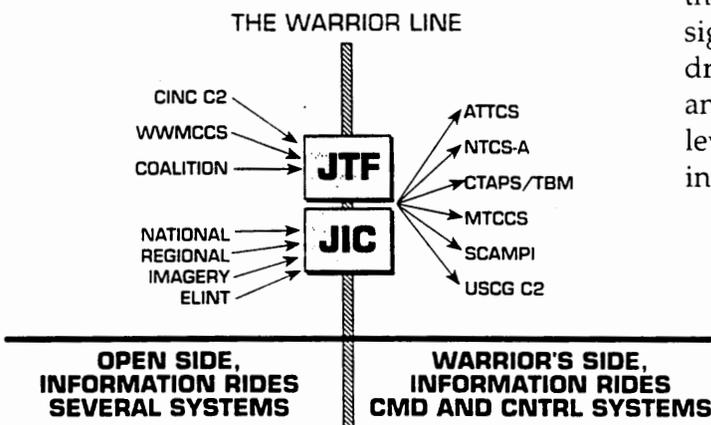
- New capabilities do not add weight or space (cube) requirements to the joint warfighter's C4I arsenal. Reductions in weight and cube are the goals.
- All information needed by the joint warfighter will be available on the JTF tactical C4I system. The JTF/JIC is the military organizational level at which information fusion takes place.

The common vision of interoperable, fully integrated C4I is a widely distributed network which, through multiple nodes, provides connectivity to the other operational elements and information resources pertinent to the Warrior's mission.

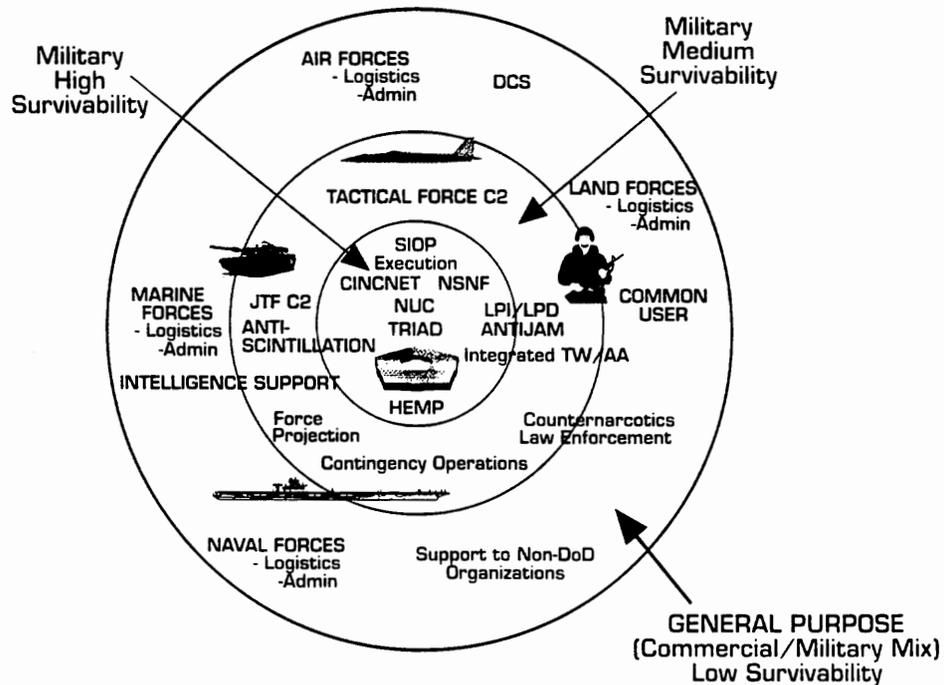
In essence, the Warrior's information inputs that make up the real time battlespace picture result from over-the-air updating plus the Warrior's capability to connect with and pull from the infosphere.

The Warrior also is capable of automatically redefining his or her battlespace to support changing missions. Computer-assisted decision-aiding artificial intelligence tools, derived from expert and knowledge-based computer system technologies, are part of the arsenal. Artificial intelligence will also yield more efficient fusion of information from multiple sources. Connectivity within the global C4I infrastructure may be provided by both military and commercial systems. Unique military survivability, reliability, and security requirements are met with features that are transparent to the users.

Intelligence and wide area surveillance support functions are provided by a global infrastructure of sensors and networks that are largely transparent to the Warrior. Intelligence system outputs are driven by the information element and need timelines of the Warrior's battlespace and mission assignments. They are provided through a user driven, user friendly information retrieval and display interface that can process all levels of classified as well as unclassified information.



MILSATCOM Requirements Survivability Hierarchy



The Services today lease commercial communications satellite channels when needed to supplement dedicated DOD and Service systems. Because of their flexible service features and competitive costs, future commercial systems, such as planned global cellular radio systems, are anticipated to be important elements in the future C4I for the Warrior global infrastructure.

Although the C4I for the Warrior concept may use commercial networks and systems extensively, feasibility issues such as interoperability, capacity, cost, security, and availability will be considered. The extent to which military-unique features, such as precedence and assured service, can be migrated to these systems and at what cost remains to be determined.

For example, significant growth in the availability of commercial long-haul telecommunications services is expected in the 1990's and beyond. Undersea fiber optic cables will be available to provide high capacity, transoceanic, leased services for DOD operations during peace, war, and in response to crises.

Domestic and international commercial satellite communications will offer leased circuits, transponders, and entire satellites in an increasing number of frequency ranges to meet a portion of the DOD satellite requirements.

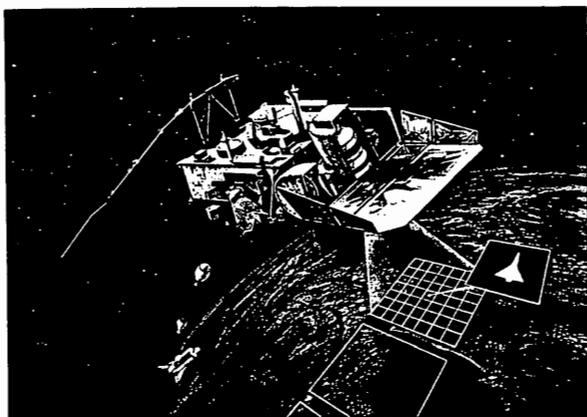
Military satellite communications (MILSATCOM) requirements are categorized into a three layer hierarchy based upon survivability and mission-essential information transfer requirements. Formal definitions of these layers and the C4I requirements each will support are written in CJCS Memorandum of Policy (MOP) 37. Studies are underway to further define the appropriate mix of military and commercial systems.

Due to unique requirements, not all military communications will use commercial systems. Combat net radios, survivable command and control systems, and systems requiring low probability of intercept (LPI) and low probability of detection (LPD), for example, will in all likelihood remain dedicated military systems.

“Information Systems Security which supports the warfighter’s requirements for real-time exchanges of information among many elements and across an array of functions, which facilitates joint interoperable communications between ourselves and our allies, is essential to the success of future military operations.”

VADM Richard C. Macke

Interoperability is a baseline component of the common global vision. It is manifested in a personalized battlefield C4I warfighter terminal from which the Warrior can access, select, display, manipulate, and manage all or any portion of the information related to the battlespace picture. The C4I station is the Warrior’s virtual connection to the combat force.



The C4I warfighter terminal is the Warrior’s standardized, multi-functional, multi-media combat information terminal provided with the Service-oriented command and control system. Sensor information received via bit-oriented messages are displayed in graphics format and overlaid on maps or charts of the battlespace. Data bases are transmitted and updated automatically. Secure voice and data communications are integral to the terminal, which can receive, display, and manipulate video and imagery. It provides the Warrior with an accurate, dynamic depiction of the battlespace, access to the infosphere, as well as the tools to:

- conduct rapid, accurate situation assessments;
- plan and coordinate allocation of combat resources including logistics, medical, personnel, etc.; and
- command and control combat operations.

The concept of C4I for the Warrior is to build flexibility and integrated interoperability into C4I systems so that, in most cases, the fighting effectiveness of the Warrior and the Warrior’s weapons will be substantially increased by the inherent availability and effectiveness of his supporting C4I.

INTEROPERABILITY

“Interoperability is the ability of systems, units or forces to provide services to and to accept services from other systems, units or forces, and to use the exchanged services to operate effectively together.”

JOINT PUB 1-02

THE CHALLENGE: WHY C4I FOR THE WARRIOR?

Service initiatives are not unified because no common global vision has existed to guide the future direction of C4I in support of the Warrior during joint and combined operations.

COMMAND AND CONTROL

The exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of the mission.

JOINT PUB 1-02

C4I

COMMUNICATIONS

A method or means of conveying information of any kind from one person or place to another.

JOINT PUB 1-02

INTELLIGENCE

The product resulting from the collection, processing, integration, analysis, evaluation, and interpretation of available information concerning foreign countries or areas.

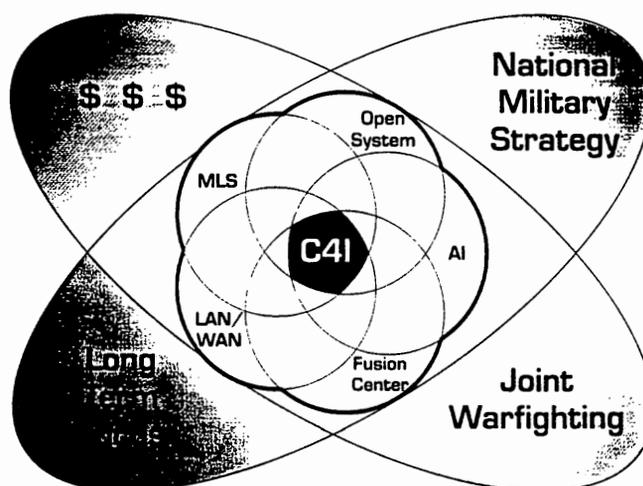
JOINT PUB 1-02

The definitions and descriptions of the components of C4I, and the functions they address, have not changed nor has the fact that computers compute and people communicate. Dramatic changes are occurring, however, in the technologies that drive the evolution of computing and communicating tools and techniques employed by a commander to plan, direct, and coordinate operations and to command and control battle forces. These changes have:

- expanded the procedural options available to the battle commander;
- changed the numbers and types of skills required of combat and support personnel; and
- increased the battle commander's opportunities for organizing and deploying available combat resources.

Changes have likewise occurred—seemingly overnight—in the methods and means of conveying information and in the collection, production, and availability of all-source intelligence.

PRESENT TRENDS



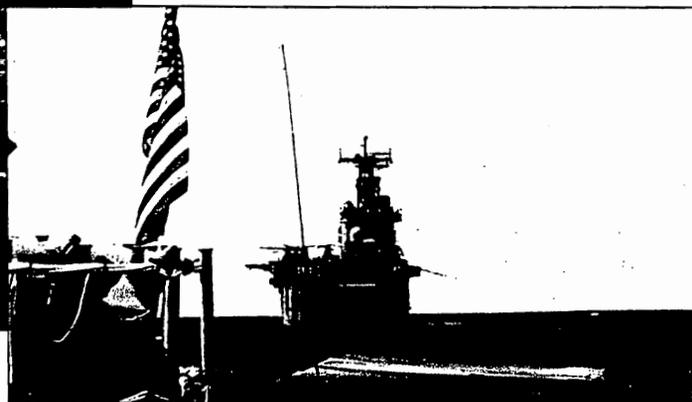
The national military strategy is also changing. The National Security Strategy of the United States and The National Military Strategy 1992 highlight factors that will influence the way in which future C4I systems are to be developed, acquired, implemented, and positioned to meet Warrior requirements. These considerations are:

- the defense budget will decline;
- active duty personnel levels will decline;
- a reduced Soviet threat is complicated by political uncertainty in the Commonwealth of Independent States;

- regional threats to the United States are increasingly complex and instability persists around the globe; and
- the rapid pace of advancing technology is revising the nature of modern warfare.

As a result of these changes:

- a new regional defense strategy will evolve;
- warfighting will be done as an integrated joint or combined force; and
- C4I capabilities must support the rapid deployment of joint or combined forces without competing for precious lift capabilities.



WHAT HAS REALLY CHANGED IN US MILITARY STRATEGY?

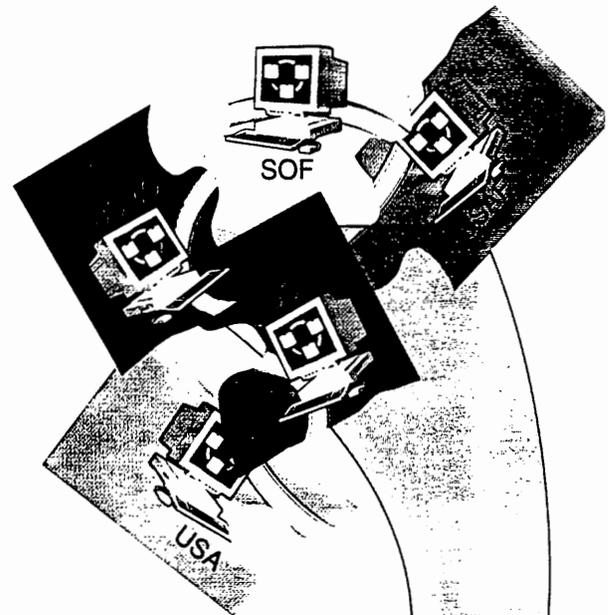
Regional Orientation
Threat of the Uncertain and Unknown
A Smaller Total Force—The Base Force
CINCs Drive the Planning Process
Adaptive Plans
Strategic Agility
Decisive Force

The National Military Strategy 1992

As articulated by the Chairman of the Joint Chiefs of Staff in The National Military Strategy 1992, the national defense strategy is based on four foundations: Strategic Deterrence, Forward Presence, Crisis Response, and Reconstitution. Because of the changes in the strategic environment, expected threats are regional rather than global.

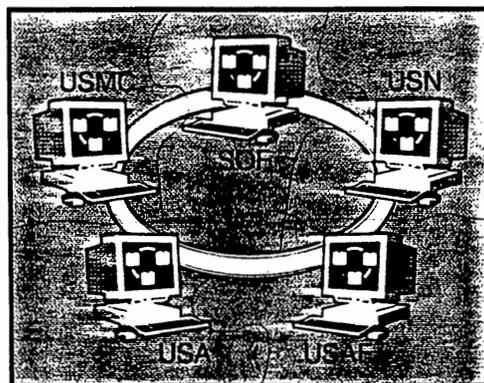
Adaptive planning, as a component of the regional focus of national military strategy, provides a diverse spectrum of military options, requiring flexibility in planning, training and employment. Flexible, modular and interoperable C4I is an essential element of nearly every option in the adaptive planning process.

C4I interoperability is the condition achieved when information or services can be exchanged directly and satisfactorily. This "condition" is defined on a case basis; as a result, the term "interoperability" is open to wide interpretation by both the technical and operational communities. Accordingly, a variety of approaches are available, ranging from Service-unique interoperability architectures to total redesign of major DOD-wide C4I system components. In the long term, any of these roadmaps potentially could succeed. None however appear to have the capacity to provide full interoperability in the near-term, or at a cost consistent with projected budget constraints.



UNITY OF EFFORT

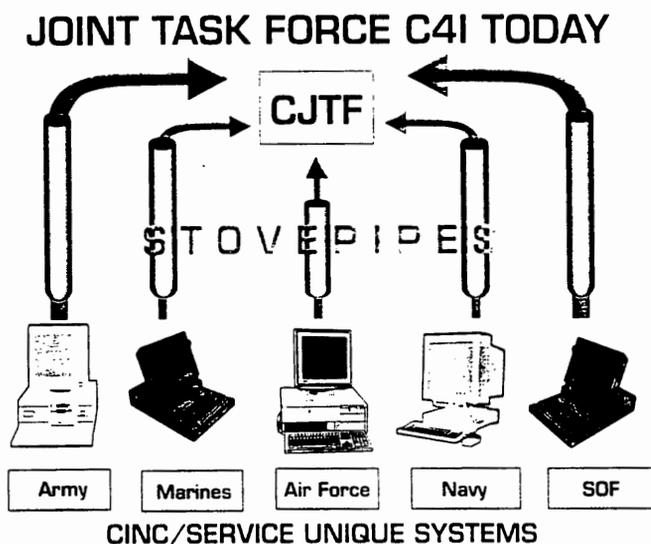
Interoperability



At the joint or combined force planning level, the commander must be able to integrate fully the component combat resources. The commander cannot today because existing C4I resources are not interoperable. Although many commonalities do exist, current C4I systems were designed and developed to meet individual CINC and Service organizational structures and mission needs. These systems support effectively the "stovepipe", hierarchical, vertical military chain of command structure. However, they were not designed to support a fully integrated joint or combined force operation and are therefore limited when information requirements are based on horizontal or functional sources.

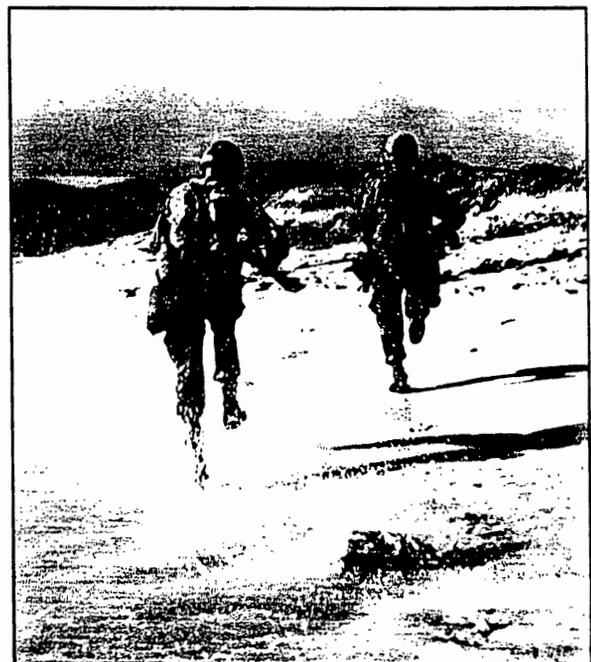
Differences, however, that may lead to interoperability problems have been identified:

- the existing inventory of military C4I is inadequate to support joint or combined operations with large and diverse assigned components;
- although both newer technology satellite communications and computer and radio system applications have proved their worth, they are not totally modular or interoperable; and
- military C4I has not been able to take full advantage of commercial technology.



Some of the existing C4I systems use the concept of a shared database very effectively. Unfortunately, many can share their database information only with elements of the same system. None can provide the total flexibility envisioned by the C4I for the Warrior concept.

C4I planning shares such commonalities among the CINCs and Services as the migration to open systems, the development of information fusion centers, and the use of experience-based decision support applications. In the selection of equipment and software to satisfy C4I requirements, each architecture emphasizes use of commercial off-the-shelf and nondevelopmental items.



The C4I capabilities available to the Warrior during Operation DESERT STORM provided a far clearer picture of the battlefield than ever before. Nonetheless, needs for C4I improvements were identified and either have been or are being corrected. These needs included:

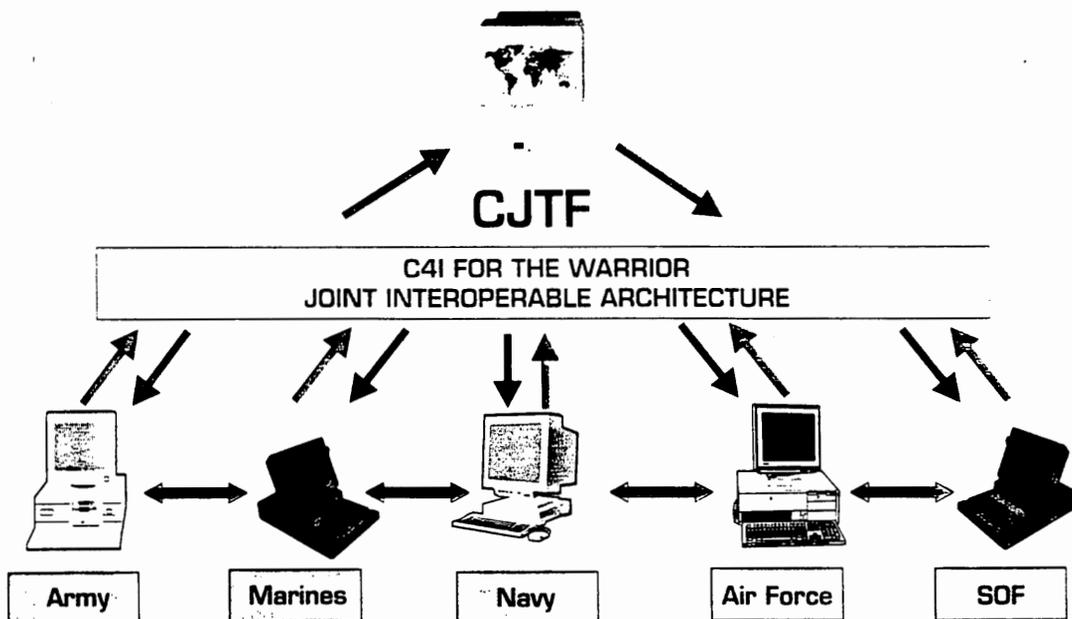
- replacing manually distributed, highly vulnerable, and logistically cumbersome paper codes and cryptographic keying materials with electronic key generation, as well as distribution and management technologies;
- seeking interoperability for all media transmission systems—voice, data, message, and video, as well as imagery;
- establishing software configuration management and standardization;
- testing and validating the integration capabilities of C4I systems;
- implementing technical interface standards to help achieve



- interoperability among military communications systems; and
- placing management and control of C4I functions in the hands of the Warrior during combat.

As with components of the fighting force, all parts of the C4I systems supporting the Warrior must not only work but also must work in unison if they are to be operationally effective.

JOINT TASK FORCE C4I TOMORROW



“If C4I fails, it has not satisfied operational system performance requirements. A failure of C4I in combat may result in overall mission failure; mission failure is totally unacceptable!”

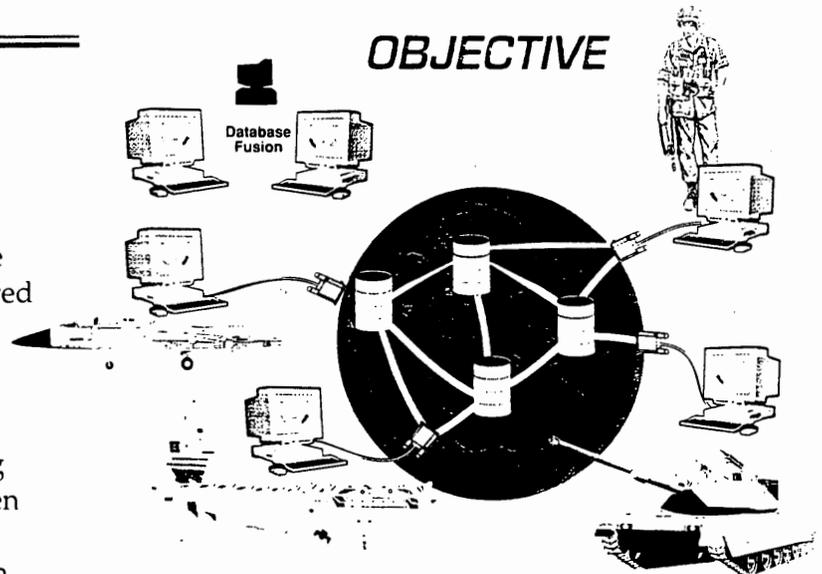
MAJ GEN Albert J. Edmonds, USAF
Vice Director for
Defense-Wide C3 Support, (J61)
The Joint Staff



Innovative Warriors and their aggressive support components have independently developed and acquired equipments that are largely stand-alone. The net result is that:

- many worthwhile, but stand-alone, information processing and transfer devices have been introduced;
- the Warrior is inundated with more information, in more formats, on more diverse displays, and in more locations than he or she can absorb effectively.

The C4I for the Warrior concept builds on lessons learned from the Gulf War, the Warrior's operational requirements, the effects of rapidly changing technology, budget constraints, and the dictates of a changing national military strategy.



A unifying C4I concept is essential to ensure that C4I supports the requirements of joint or combined operations and is consistent with DOD policy and national security objectives. C4I for the Warrior is the concept to meet these requirements.

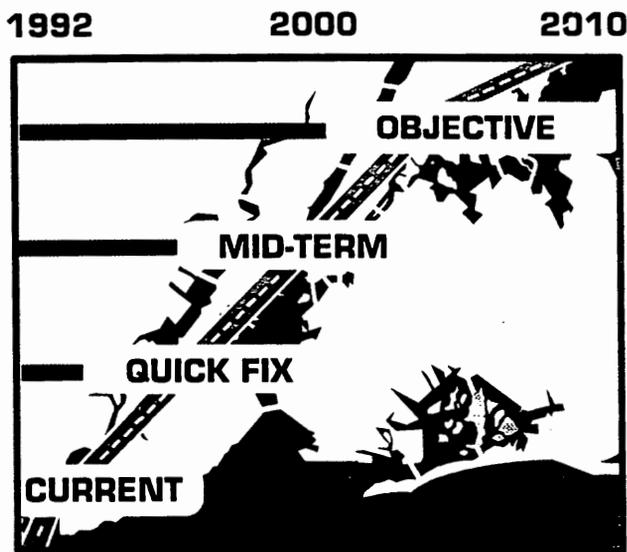
The objective is feasible, achievable, affordable, and needed. Achievement of the total set of required capabilities can occur only during the Objective Phase.

THE TARGET: HOW TO REACH THE OBJECTIVE C4I FOR THE WARRIOR SYSTEM

"Paper won't do it—you have to put a product in the hands of the Warrior."

VADM R. C. Macke

The C4I for the Warrior concept contains both a vision and a roadmap.



The Joint Staff has developed a roadmap to provide the positive direction necessary to achieve a common focus in C4I. The Plan is built on four basic guidelines:

- produce results through teamwork that are driven by the C4I requirements of the Warrior;
- establish a roadmap to show clearly how to achieve progress through the use of a coordinated approach and common standards;
- assimilate new and affordable technology when it will improve the

Warrior's operational effectiveness; and

- pursue an implementation strategy that puts a premium on finding solutions to interoperability problems and getting these solutions into the hands of the Warrior.

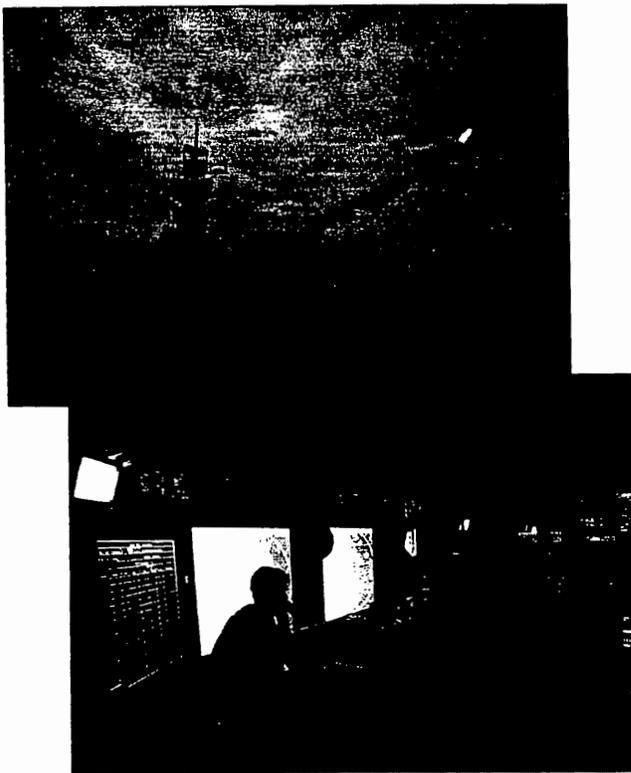
The Chairman of the Joint Chiefs of Staff is assigned the responsibility for achieving interoperability among the Services. Through the Military Communications and Electronics Board (MCEB), and in accordance with the policies of the ASD(C3I), that responsibility will be focused on identifying and resolving interoperability and standardization issues relevant to joint and combined operations.

"Meeting the needs of C4I for the Warrior depends upon commitments from the CINCs, Services and Defense Agencies to accept, coordinate, cooperate and comply."

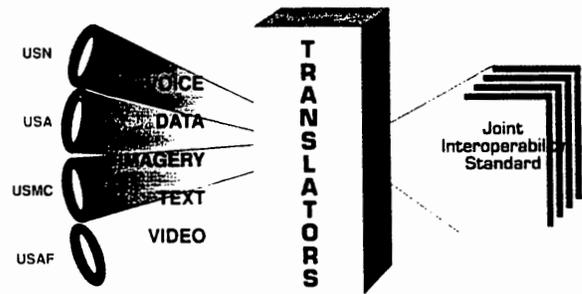
BG Douglas Buchholz, USA
Deputy Director for Unified and
Specified Command C3 Support, (J62)
The Joint Staff

The Joint Staff will coordinate with the CINCs, Services, and Agencies in a phased, team approach, which will provide the flexibility to absorb the dramatic changes that technology, budgets, and politics may impose. The approach:

- capitalizes on the current investment in C4I systems;
- provides for the capture of new technology—commercial as well as Government;
- minimizes disruption to ongoing programs;
- focuses from the start on the adoption and use of common information exchange standards to achieve interoperability among existing as well as future systems; and
- demonstrates full compliance with ASD(C3I) policy guidance and direction.



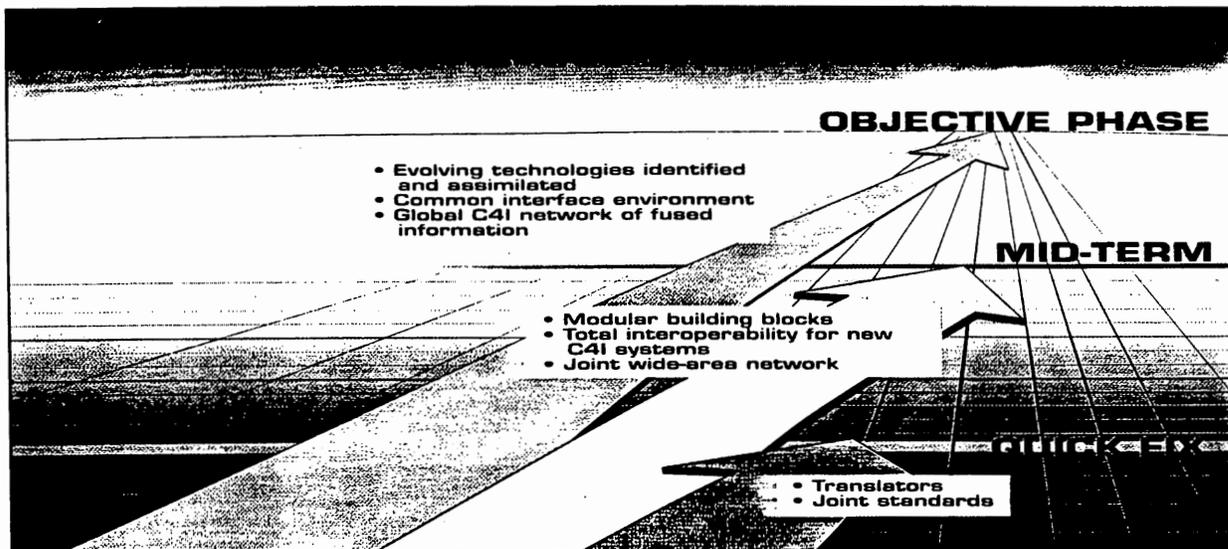
QUICK FIX



The three phases of the plan are:

- Quick Fix Phase (POM Years);
- Mid-Term Phase (POM Plus 10 Years); and
- Objective Phase (Beyond the Mid-Term Period).

The initial phase addresses “quick fixes” to Service and Agency independent stovepipe and manual systems. The objective of the Quick Fix Phase is to take actions now that will result in near-term interoperability improvements. **Quick fixes include the installation of translation devices that interpret nonstandard message and data formats and protocols and produce common outputs that can be readily exchanged via standard transmission paths.** All unique systems that require manual interfaces or elaborate buffer-translator processes to establish interoperability are identified and modified. Eventually they will be eliminated as the unique systems evolve. CINC, Service, and Agency architectures are analyzed for interoperability and commonality resolutions. Responsive, expert technical Tiger Teams are used to evaluate and resolve interoperability issues as soon as they are identified. Joint and combined C4I policy, doctrine, procedures, and programs coalesce into one coordinated approach. The Joint Staff coordinates efforts to achieve Quick-Fix Phase results. This phase has already started and extends through the POM years.



The Mid-term Phase produces a global C4I system capable of generating and delivering the fused information needed for tactical command decisions. The Mid-term Phase is concurrent with the Quick Fix Phase and encompasses the POM period plus the following 10 years. During this period:

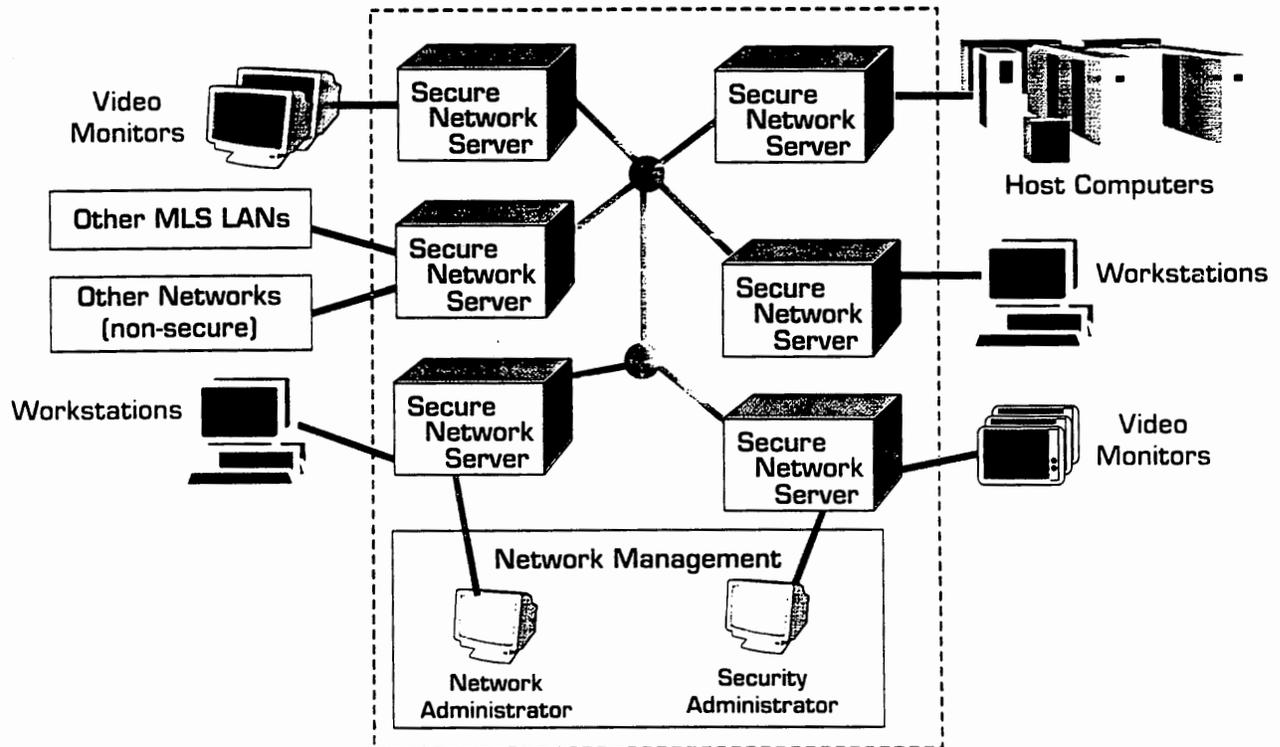
- interoperability becomes fully integrated into the policy, doctrine, and system acquisition processes for all **new** C4I systems and modernization programs;
- modular building blocks are described in technical detail;
- a common network operating environment cements the modular building blocks into a joint network of networks;
- applications interoperability and standardization produce fixed, transportable, and tactical communications and information nodes that are interconnected in support of joint or combined operations irrespective of time, place, or Service/Agency sponsorship;
- the joint global C4I infrastructure evolves toward a single common, unified, interoperable system; and,
- migration from unique military standards to commercial national and international standards.

The Objective Phase extends beyond the year 2000 and is very dependent upon advanced technology drivers. The concept description itself should provide the focus needed by the research, development, and acquisition communities to generate solutions. It is unconstrained by nostalgia and free of the design predictability that prematurely dismisses relevant options. Necessary progress is expected in at least the following areas:

- artificial intelligence (AI) applications;
- multilevel security;
- data compression and data fusion; and
- common operating and interface environments.



Multilevel Secure (MLS) Local Area Network (LAN)



Artificial intelligence (AI) techniques will support more efficient fusion and fully integrated multi-media, multi-functional workstations capable of near-real-time decision aiding. Improved routers and switches for seamless network management will also be enabled.

Multilevel security (MLS) solutions include using a multiple layer concept for encryption, combined with electronic, benign, transparent cryptographic key distribution and automated key management approaches.

Data compression and transmission technologies will improve the speed and efficiency and reduce the cost of processing

and transferring digital information, including voice, data, imagery, and video signals.

Common display unit technology is capable of producing a common integrated, multi-media, multi-functional display terminal. The terminal provides a color graphics display battle element and geographic icons, overlaid on all or selected portions of the Warrior's battlespace display. Embedded features include data link encryption, secure voice and video transmission, and decision aiding/targeting support applications.

C4I FOR THE WARRIOR

"What was once a dream is now doable"

COL J. David Bryan, USA
Chief, Architecture and
Integration Division (J6I)
The Joint Staff

CONCLUSION

C4I for the Warrior is a concept that provides the common global vision necessary to focus independent efforts toward a series of common objectives. The basic tenets of the approach are:

The Concept Supports The Warrior. Its implementation will provide a global C4I infrastructure that is reliable, secure, responsive, and survivable. It furnishes and presents essential information to the Warrior in standard formats whenever and wherever the Warrior directs. Interoperability is ensured through the adherence to a common set of standards, a common operating environment, and rigorous testing for conformance and interoperability. Additionally, once interoperability has been achieved, it will be maintained through configuration management.

The Objective Concept Is Achievable. It offers revolutionary ideas and capabilities based upon proven and evolving technologies. These capabilities can be implemented in an evolutionary manner. Technology advancements are incorporated as they mature in the areas of:

- multilevel information system security applications;
- international standards and common database structures;
- standard data elements; and
- standard interface protocols.

The Objective Concept Is Affordable and Is Not Technologically Limited. It calls for the continuation of the current investment strategy for systems under procurement, with maximum use of commercial-off-the-shelf and nondevelopmental items. The immediate advantage of this strategy is the leveraging and sharing of research and development investments. It also promotes the opportunity for unity of effort in the development and acquisition of C4I systems and equipments. The concept encourages wider use of commercial communications facilities and transmission systems in support of military tactical operations.

TEAMWORK is the KEY to achieving the vision. No one organization alone can make it all happen; only through close teamwork can this concept come to fruition. The defining moment to address the challenges and seek creative solutions to the C4I needs of the future has arrived.

C4I

FOR THE WARRIOR

For further information, please contact the appropriate DSN listed below. For more information, please contact the appropriate DSN listed below.

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