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C4I2 INTEROPERABILITY:
Operational Art in a New Paradigm

by

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The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or Department of the Navy.

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Abstract of C4I2 INTEROPERABILITY: Operational Art in a New Paradigm

The United States Military has pursued interoperability of the services' C4I2 systems since the Korean and Viet Nam conflicts. Congressional inquiry and legislation led to numerous DoD and Joint Staff initiatives for achieving interoperability, to little or no avail. Today's National Military Strategy with its regional focus and current force reductions point to future conflicts being met with joint operations and more than likely combined. Given that these future joint operations must be planned to occur anywhere on the conflict continuum, the military's C4I2 infrastructure must be efficiently architected to deal with these conflicts, on short notice, any place on the Globe, and interoperate with all forces of all services immediately upon arrival in theater. During DESERT STORM the services required five months to lash a workable C4I2 architecture together. We may not have that luxury the next major regional conflict. Private industry has dealt with this problem for a long time, albeit on a smaller scale. The services could apply the techniques used in the private sector to develop the C4I2 architecture of the future.

PREFACE

A primary benefit of the Naval War College is the Joint education obtained by the students. Each of us has learned a great deal from our instructors, however, I believe I speak for my other classmates when I mention that we have gained the most from those members of our sister services during our seminars. Professionally, the time here has been enlightening and beneficial should we meet in joint future operations or as we plan and support them. It would be counter-productive if our efforts here were unable to come to its fruition simply due to the inability to communicate or coordinate our efforts. Interoperability of each services' command and control infrastructures is the single most initiative that once achieved will truly make us a joint force.

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CHAPTER I

INTRODUCTION

"Many challenges still must faced. The downsizing of military forces and the shrinking defense budget have resulted in the increased reliance on C4I interoperability"

General Colin L. Powell
Chairman of the
Joint Chiefs of Staff

Grenada to Kuwait. As the Atlantic Command's joint task force (JTF) moved to reclaim the spice island of Grenada, serious deficiencies in command and control between its commander and frontline units became more than apparent. "Numerous C2 problems included incompatible radios, lack of coordination and communication between ground forces, as well as numerous interservice and intraservice breakdowns."[1] Operation URGENT FURY's interoperability deficiencies between the services' command and control structures were reminiscent of the U.S. military's combat coordination problems experienced in Korea and Viet Nam. In response, "The Congress passed the Defense Reorganization Act of 1986 to help overcome many of the interservice rivalries and bureaucratic difficulties that have impeded the effective integration of

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[1] Theodore A. Duck, "An End to Ad Hocism in the Joint Warfare Arena: A Recommended Solution," Unpublished Research Paper, U.S. Naval War College, Newport RI: 1987, p.6.

combat resources."[2]

After five years of "jointness" the United States' and her coalition's decisive victory of DESERT STORM unquestionably validated the intent and vision of the Goldwater-Nichols initiative. However, dramatic images of smart bombs hitting targets with uncanny precision and mobile armored units executing classic maneuver warfare, overshadowed command and control shortfalls. While both operations were U.S. victories, DESERT STORM contrasts with URGENT FURY in scope and complexity, clearly demonstrating the benefits provided by the Joint Operations and Execution System continual deliberate planning process. However, when the characteristics of each theater of operations are compared and taken under consideration, there remains one alarming similarity, command and control infrastructure disconnects.

Grenada, led by one American JTF commander, was executed with five elements of the U.S. armed forces, Navy, Air Force, the Army's 82nd Airborne, the Marine Amphibious Unit and the Special Operations Forces. The U.S. achieved victory on a small island over out-numbered, out-gunned, members of the Caribbean's leading military power, despite short notice

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[2] U.S. General Accounting Office, Interoperability, DoD's Efforts to Achieve Interoperability among C3 Systems, Report to the Chairman, Legislation and National Security Subcommittee on Government Operations, House of Representatives (Washington: 1987), p.27.

contingency planning and uncoordinated tactical operations due to non-interoperable C4I2[3]. In comparison, Saddam Hussan's crushing defeat was made possible through a year of deliberate planning and war gaming, superior logistics and the ability to coordinate air, land and sea forces, over hundreds of miles. Ironically, even with the advantage of advanced, indepth planning, the DESERT STORM coalition's C4I2 architecture still required five months of "lashing" together vast numbers of incompatible C4I2 equipment. To achieve the necessary joint and combined interoperability, tactical units and commanders of the world's most advanced armed forces were compelled to initiate innovative technical modifications, often relying on drastic and always time consuming manual interventions.

DESERT SHIELD and DESERT STORM placed unprecedented demands on the command, control, communications, computers, intelligence and information C4I2 assets in serving a coalition of 36 nations and over 800,000 personnel. "In August 1990, there was little in the way of a communications infrastructure in Southwest Asia. The command, control, communications, and intelligence system built to support the coalition was largely introduced into the theater with

[3] The text of this paper will reflect the current acronym of C4I2. This evolving discipline has changed scope, functional areas, and technologies so quickly that elements of the information age are continually being added to its name. The use of other than C4I2 will occur in my direct quotes from references prior to 1993.

arriving forces and evolved in capability as the deployment progressed."[4] After five months, the C4I2 network (net) was in place and ready for the commencement of the air war. The robustness of this net, with its requirements for long haul logistics and dynamic intelligence connectivities, was severely tested as it changed significantly with troop movements and combat operations.

"A comprehensive C3I interoperable plan between Services and other defense agencies had to be constructed with many work arounds."[5] Exemplifying these "work arounds" were the radical measures Army corps and division level commanders applied to their mobile subscriber equipment (MSE) which allow them the capability to exercise command over great distances. Intensive management, translators, interfaces and a great deal of manual intervention were required to mix the Army's MSE with sister services' and coalition partners' communications equipment.

Additionally, incompatible transmission media between the Navy and the Air Force seriously jeopardized airstrike coordination. The now infamous tale of the Joint Force Air Component Commander's (JFACC) Air Tasking Order (ATO) points

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4 Conduct of the Persian Gulf Conflict, An Interim Report to Congress (Washington: 1991), p.15-1.

5 Ibid. p. 15-4.

to crucial interoperability issues.Currently, the lack of electronic interfaces and the Navy's inability to access the Air Force's SHF transmissions creates a communications barrier between flagships and the Air Force's Computer Aided Force Management System (CAFMS). During DESERT STORM the Navy relied upon a "Pigeon Post" solution. Two Navy aircraft flew nightly from Riyadh to respective carriers in the Persian Gulf and the Red Sea, delivering floppy disks containing the completed ATO. Once on board, the ATO was reformatted and then transmitted to the remainder of the fleet. This manual intervention induced hours of delay for all commanders, planners, schedulers and maintainers.[6]

In both URGENT FURY and DESERT STORM success at ad hoc C4I2 integration came at the price of some command and control flexibility and communications security. Should the luxury of time not have been available to coalition forces, and had Saddam maintained the initiativ^, DESERT STORM forces could have faced far greater risks due to ineffective combat coordination. Many of the interoperability issues that faced DESERT STORM's coalition were not unlike the command and control lessons learned from Grenada, which spurred the Goldwater-Nichols Act.

Twenty years and counting. Since Grenada, the services,

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[6] Ibid. p. 15-3.

as well as the JCS and Unified Staffs, have made marked progress in joint C4I2 interoperability with diverse technical architectures. Indeed, a direct comparison of command and control interoperability between URGENT FURY and DESERT SHIELD/STORM demonstrates that dramatic improvements have been accomplished in a relatively short time frame. However, DESERT STORM's intensive, innovative and frustrating C4I2 "work arounds" should have been avoidable in view of the Department of Defense's (DoD) twenty-six year pursuit of interoperable C4I2 systems.

DoD Directive 4630.5 was issued in 1967 establishing policy and procedures to ensure C4I2 equipment interoperability. Directive 4630.5 was deemed necessary following Congressional and DOD study of interoperability problems experienced between the Navy, Air Force and Army during the Vietnam War. "As a matter of policy, the military departments were to develop and procure equipment that was either compatible or common when fulfilling similar operational requirements. A further objective of the policy was to minimize the addition of buffering, translative or similar devices for the purposes of achieving workable connections."[7]

Implementation of DoD Directive 4360.5 came under the

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7 GAO, 1987. p. 21.

purview of the Joint Chiefs of Staff. JCS Memorandum of Policy NO. 160, originally signed out in 1967, last updated in 1985, designates the responsibilities and procedures necessary for C4I2 interoperability. The military services, Office of the Joint Chiefs of Staff (OJCS), Unified and Sub-unified commanders, Defense agencies and the former Joint Tactical Command, Control and Communications Agency are to provide policy guidance, operational demands, acquisition and oversight while developing a joint C4I2 architecture. In light of past congressional attention and the lessons of past armed conflicts, results from this twenty-six year joint effort have been disappointing.[8]

A 1987 U.S. General Accounting Office (GAO) report evaluated the DOD's C4I2 interoperability policy observing;

> The policy was not adequately implemented, however,nor was it revised in a timely manner to provide necessary authority. As a result, a C3 plan or architecture needed to guide system acquisitions is still in its infancy. Furthermore, three major programs established to foster interoperability fell short of their goals and the services continued to develop their own noncompatible communications equipment.[9]

The three programs cited by the GAO for their ineffectiveness are the Ground and Amphibious Operations

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[8] Joint Chiefs of Staff, Compatibility and Interoperability of Tactical Command, Control, Communications, and Intelligence Systems, Memorandum of Policy No.160 (Washington: 1986), pp. 20-26.

[9] GAO, 1987. p.21.

program (GAMO), the Tri-Service Tactical Communications (TRI-TAC) program and the Joint Interoperability of Tactical Command and Control Systems (JINTACCS). Additionally, the GAO made note of the "advocacy" role the Joint Tactical Command, Control and Communications Agency (JTC3A) had been assigned in addressing joint interoperability needs. The JTC3A had no real authority to alter or modify a service's C4I2 program or acquisitions regardless of the interoperability deficiencies it may have identified.[10]

Without listing the deficiencies of each program, the GAO found that all past studies, and numerous other initiatives had consistently identified three impediments to achieving interoperability between the services. They were: (1) DOD's decentralized management structure, (2) Lack of clearly defined joint requirements, and (3) The absence of an effective central enforcement authority.[11]

<u>New Strategies, New Paradigm</u>. The current National Military Strategy with its regional focus, relies on the CinC's adaptive planning and tailored force packages for crisis response. This strategy, coupled with inevitable declines in defense budgets and force structure, demands that the services constantly pursue enhancements of

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[10] <u>Ibid</u>. p.17.

[11] <u>Ibid</u>. p. 13.

interoperability. Standardized, flexible and interoperable C4I2 architectures are needed now more than ever.

The United States' is now applying its technological advantages toward a more efficient, world wide command and control architecture, one that is responsive immediately upon the arrival of joint forces in theater and allows for the swift assimilation of our friends' and allies' forces in multiple regional conflicts. This C4I2 architecture requires a "seamless", global reach from the National Command Authority to the commander in the field or embarked at sea, while providing logistics and readiness information vertically to service headquarters and coordinating capabilities horizontally with sister services and joint units.

The Chairman of the Joint Chiefs of staff recognizes these new realities and reflects his view in the National Military Strategy.

> "In peace, technological superiority is a key element of deterrence. In war, it enhances combat effectiveness and reduces loss of personnel and equipment. Our collective defeat of Iraq clearly demonstrates the need for superior intelligence and the world's best weapons and supporting systems."[12]

The services' new doctrines, budgets and force structures

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[12] Office of the Joint Chiefs of Staff, The National Military Strategy of the United States, (Washington: U.S. Govt. Print. Off., 1992),p.10.

no longer can support the development of separate command and control architectures that are "stove piped" up to respective headquarters. Continued reliance on translative devices, technical interfaces and manual intervention to solve interoperability between incompatible equipment is not reliable nor cost effective. Sole dependence on pure technical solutions serves only to exacerbate interoperability problems. On the other hand, the innovative application of today's information systems technologies to current C4I2 architectures have allowed each services to increase the accessibility to its own information.

However, if the services were allowed to pursue common problems with different technical solutions their interoperability will continue to diverge roughly proportionately to the complexity of the technologies applied. The more divergent the applied technical solutions are, the worse, almost exponentially, the services will be unable to exchange data, intelligence and exercise joint command and control. Accordingly, the Assistant Secretary of Defense for Command, Control Communications and Intelligence (ASD(C3I)) has provided his vision for the future in a recent Defense Management Report Decision (DMRD).

> A new paradigm is required to: (1) revolutionize information exchange, defense-wide (2) strengthen our ability to apply computing communications, and information management capabilities effectively to the accomplishment of the Department's mission and (3) significantly

reduce the information technology burdens on operational and functional staffs.[13]

However, it can only be through alignment of U.S. military strategies with joint C4I2 operational capabilities and new information technologies that the services will achieve an interoperability that leverages time, human resources and combat power. The services must begin now to develop C4I2 architectural models that not only "widen" their global information networks, but also to "deepen" their nets into joint strategic and operational imperatives.

GAO points the way. The GAO's 1987 report's findings serve as a strategic framework from which the JCS, the services and the intelligence agencies can realize the ASD(C3I) paradigm in a revitalized defense information infrastructure. Positive steps have been initiated to correct two of the impediments to C4I2 interoperability, lack of defined joint requirements and a central body to enforce these standards.

The Joint Staff's "C4I for the Warrior", published in 1992, provides " a concept-a unifying theme-guiding principles and a roadmap for achieving global C4I joint

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[13] Assistant Secretary of Defense for Command, Control, Communications and Intelligence, Defense Management Report Decision, Defense Information Infrastructure, (Washington: 1992), p.1.

interoperability..."[14] The DoD's DMRD referred to earlier, establishes the Defense Information Systems Agency (DISA) as the central manager of the defense information infrastructure. Centralizing the enforcement of information systems technical standards with DISA is meant to ensure an end-to-end information capability and transition to an open systems environment, in short, complete and seamless interoperability. The aim is to consolidate and integrate resources to achieve significantly greater economies and efficiencies.[15]

For obvious strategic and operational necessities the third finding, DoD's decentralized management structure must remain a compromise. The CinCs' and the services cannot abdicate the responsibility and initiative to tailor C4I2 architectures to their respective strategies and oplans. Just as important, they must remain wary of following a technology driven approach that merely perpetuates command and control stovepipes, ultimately undermining interoperability and thus blunting joint operational effectiveness.

Presented in the following chapters are approaches the CinCs and their respective J-6s' should take to meet the JCS concepts and DISA'S technical standards while planning the

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14 The Joint Staff, C4I for the Warrior, (Washington: 1992), p. 2.

15 Defense Information Infrastructure DMRD, 1992, p. 3.

command and control support for future JTF commanders. Additionally, business systems planning methodologies, used in the private sector, can be adopted to identify C4I2 needs, prioritize systems acquisition/developments and prevent duplication of effort.

CHAPTER II

IMPLEMENTING INTEROPERABILITY

C' Cs drive the problem. Joint Pub 6.0 requires the CinCs to review the C4I2 requirements, projects and resources of their supporting commands. The JCS places this review responsibility in C4I2 development on the CinC's with the aim of "top down" guidance and "bottom up" implementation. "The review will ensure essential performance of missions, establishment of selective implementation priorities, and agreement with approved plans and programs, including employment plans.[16]

Today's need for diverse and flexible adaptive planning make it imperative that unified and specified commanders drive the problem in the design of future C4I2 architectures. CinCs and service component commanders are shaping the forces today for future operations throughout the conflict continuum. Accordingly, national strategy and total force size undoubtedly dictate that these future operations will be joint, therefore command and control architecture must remain dynamic, flexible and responsive to on-scene JTF commanders, and not oriented solely to a centralized chain of command. The operator, in his own theater, is always in the best

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[16] Joint Chiefs of Staff, Test Pub 6-0, Doctrine for Command, Control and Communications Systems Support to Joint Operations,(Washington: Joint Staff, 1990). p.III-1

position to judge his needs and translate them to respective service commanders. Without proactive and knowledgeable involvement by the CinCs and their staffs in the acquisition and planned employment of C4I2 systems, they run the risk of mismatching operational plans with incompatible command and control assets.

"C4I for the Warrior": Defining the CinCs Needs. The JCS outlines its concept for an ideal joint C4I2 infrastructure in its C4I for the Warrior publication. Taking lessons directly from the Gulf War, this concept ambitiously seeks to improve C4I2 capabilities and present a clearer, more timely, picture of the battlefield for the JTF commander. Improvements identified by the Joint Staff include the use of electronic cryptographic key generation, distribution and management, eliminating mass code changing and potential delays caused by human error, the dreaded dead spots caused by "changing HJ's". A majority of the improvements identified specifically enhance interoperability. Establishing standardized software configurations, testing and validating the integration capabilities of C4I2 systems, and implementing technical interface standards are positive steps toward the interoperability of voice, data, message, video and imagery systems. "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"[17]

A key goal for the C4I for the Warrior concept is ensuring that the control and management of command and control infrastructures remain in the hands of the "warrior", the commander in the field. Indicative of this commitment is the pursuit of an implementation strategy that "puts a premium on finding solutions to interoperability problems and getting these solutions into the hands of the warrior".[18] With the first phase of an eighteen year, three phase approach on the verge of completion, now is the time for CinC's to ensure that the future joint interoperable architecture will be configured to support their strategies and their JTF commanders regardless of the theater of operations.[19]

The C4I for the Warrior architecture comprises of ten characteristics which should drive C4I2 development and acquisition. Specifically, the ultimate goal is to avail the operational commander a system that is seamless or transparent to the user; 100% interoperable; resides in a common operating environment; flexible due to modular equipment; not only

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17 C4I for the Warrior. p.10.

18 Ibid. p.12.

19 Interview with Cdr. Larry Jahnke, Architecture and Implementation Division (J6I), The Joint Staff, Washington, D.C.: 26 April 1993.

functions vertically but also horizontally between all services; comprises of over-arching data bases that are permanently in residence and are continually updated "over the air"; allows the forces in the field to "pull" applicable current information rather than be inundated by all, mostly irrelevant, information "pushed" down upon them; allows for real-time decisionmaking; allows for global logistics management and control; and ensures reliability through adaptive safeguards ranging from electronic transmission security to survivability of the C4I2 infrastructure itself.[20]

A concept for any information system lacks utility if not developed in the context of users' needs. While the JCS concept objectives provide the direction or theme for systems development, the service component commanders are actually driving the aquisition process to address their CinCs operational needs. The salient question that a CinC's J-6 must ask is "does the JCS concept support the operational commander's needs once it is achieved"?

The CinC's C4I2 generic support requirements have expanded in today's strategic environment. They include; the ability to manage risk throughout the anticipated conflict spectrum, requiring C4I2 that is robust and adaptable; support

[20] The Joint Staff, C4I for the Warrior, Objective Concept Coordination Draft, (Washington: 1992), p.26.

for adaptive planning and training; timely fused information; accurate battlespace representation; security; integrated logistics support functions; the ability to control the C4I2 resources depending on the situation, enabling the commander to shape the battlefield; and must be environment independent allowing joint forces to "plug in" upon arrival. While these support requirements are rather conceptual at the CinC level, they become specific further down the chain of command.[21]

Therefore, today's implementation challenge lays not in merely applying C4I2 technologies to distinct regional imperatives and service component requirements. Rather, current strategies oblige the CinCs, services, and DoD agencies to orchestrate their efforts and thereby ensure joint, intraservice and interagency interoperability. The attainment of the JCS vision is driven by the operational commander's needs in diverse conflicts, supported by current and future technology, and tempered by fiscal realities.[22]

DISA: Ensuring the CinCs Interoperability. The post Cold War strategy demands unprecedented interoperability between services. The Defense Management Report Decision establishing the Defense Information Systems Agency, signed out by the ASD(C3I) in September of 1992, is an ambitious initiative to

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[21] Ibid. pp. 10-22.

[22] Ibid. p.26.

provide an end-to-end defense C4I2 infrastructure encompassing collection, generation, storage, display and dissemination of information, Department-wide. "The anticipated magnitude of change involved in creating this new paradigm will require intensive, coordinated efforts by the ASD(C3I); the Secretaries of Military Departments; the Chairman of the Joint Chiefs of Staff in consultation with the Commanders of the Unified and Specified Commands, including US Element, NORAD; and departmental officials."[23]

Citing the current heterogeneous mixture of computing and communications systems operated by the different military services and civilian agencies, DoD justifies its need to centralize its policies for C4I2 security, standards, methodologies and technology. Past attempts to retrofit security measures and integrate information have proven expensive, constraining and ineffective. "Nevertheless, the need for capabilities to obtain, process, and communicate information among defense Components, while simultaneously denying such access to opposing forces, has never been more apparent."[24]

DISA's mission is to provide department-wide information technology support with purview over security, hardware and

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[23] DISA DMRD P.10.

[24] Ibid. p.3.

software standards, communications, computing, central design activities for improving architectures, acquisition and most importantly, education. The intent of this centralized managed approach is to significantly reduce the information technology burdens on these staffs and enable access and exchange information worldwide with minimal knowledge of communications and computing technologies. To ensure ultimate C4I2 architectures are responsive to the CinCs needs decentralized execution is essential. To that end the operational and functional staffs will be supported through a single point of contact to resolve complex computing and communication problems.

The CinC staffs needs to proactively engage in the DISA implementation process early on. Not only to nurture a congenial "customer service" relationship but to ensure DISA's vast resources[25], remain responsive to the evolving operational needs of Unified and Specified Commanders in ever changing conflict scenarios. The CinCs' J-6s now face a dynamic and complex adaptive planning process. The efficient application of current doctrines and technologies to current oplans is required, as well as enhancing the services' interoperability in future operations through active involvement in developing the next generations of C4I2 architectures.

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[25] Once fully established, 100,000 personnel from six major military staffs and five agencies will provide these centralized technical services.

CHAPTER III

INTEROPERABILITY; DEFINING INFORMATION NEEDS

Business Systems Planning. The "New World Order" has had its effect on the private sector as well as on the National Military Strategy. Just as the military adjusts to the demands of preparing for and executing contingency operations in an uncertain world, businesses today find it necessary to respond quickly to a rapidly changing economic environment. Therefore, senior executives require up-to-date information available at all times. "With organization-wide availability of information, strategies can be improved, decisions made more soundly, and operations performed more efficiently."[26]

In a now familiar theme, large corporations have also felt the "dragging" effects of unchecked and uncoordinated technology applications on strategically vital information systems. "Traditionally, management information systems have not really been designed at all. They have been spun off as by-products while improving existing systems within a company. No tool has proved so disappointing in use...-an effective system, under normal conditions, can only be born of carefully planned, rational design that looks down from the top, the

[26] International Business Machines Corporation, Business Systems Planning, Information Systems Planning Guide, GE20-0527-3 (Atlanta, Ga.:1984),p.1.

natural vantage point of the managers who will use it."[27] The IBM corporation developed Business Systems Planning (BSP) as a structured approach to assist a business in establishing an information systems plan to satisfy its near and long term information needs. Information systems, the private sector's C4I2 structure, are critical to a company's overall effectiveness. The BSP process is a vehicle that translates business strategies into information systems strategies and provides the foundation for current and future interoperability.

Like the Unified Commander operating in a contingency environment, the business leader has found that their current data and information systems are performing adequately, meeting their specific intents. However, it is the numerous and varied interfaces and maintenance requirements that have made these systems unmanageable. Similar to the CJCS' "Warrior" and the Navy's Copernicus approach to guiding C4I2 architectures, BSP highly recommends a modular approach to implementation. Modularity provides the confidence that new phases being developed will fit and function properly, forming an integrated system that will interoperate with present command and control systems. "The plan should also allow for better decisions concerning the efficient and effective

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[27] Dr. William Zani, "Blueprint for MIS", Harvard Business Review, November/December, 1970.

commitment of information development resources. With such a plan, the required information can be more readily obtained."[28]

In addition to providing an information systems plan that supports a business' short- and long-term information needs, BSP has other objectives that clarify and justify its utility once applied to the command and control needs of regional strategies. BSP provides; (1) Formal, objective method to establish information systems priorities without regard to provincial interests[29]; (2) Efficient and effective management for data processing resources in support of business' goals; (3) Increased confidence that high-return, major information systems will be produced; (4) Systems that are responsive to user requirements and priorities; (5) Identification of data as a corporate resource that should be planned, managed, and controlled in order to be used effectively by everyone.[30]

Any operational commander can see how the above broad objectives easily translate into the command and control infrastructure development. The military has a big advantage in employing a BSP-like approach. The first step in defining a BSP information system strategy is commitment from the top. As seen in the previous chapter there is no lack of guidance

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[28] IBM BSP Guide. p.4.

[29] An end to parochialism!!! this I gotta see

[30] IBM BSP Guide p.3.

coming from the highest levels of the chain of command in regards to future C4I2 architecture. The potential quandary a CinC's J-6 may find him or herself[31] is <u>how</u> to go about identifying and prioritizing future C4I2 needs efficiently, during "bottom up" implementation.

The BSP approach has been successful in the public as well as the private sectors. It has been found that the required steps for developing information systems are similar regardless of the institution who employs BSP or the product or services produced. The success of this or a similar "topdown" approach in aiding businesses avoid or "back out" of technological cul-de-sacs has direct applicability to the challenges now facing a Unified Commander's J-6 in planning the C4I2 support for JTF commanders of contingency operations.[32]

<u>BSP Application in OCEAN VENTURE 93</u>. Commander in Chief Atlantic planned and, as of this writing, is conducting OCEAN VENTURE 93. A major objective of this joint exercise is to validate the C4I2 support infrastructure for a JTF commander located aboard a ship. The CinC considers OCEAN VENTURE 93 as a "first step" in realizing the vision of CJCS' "C4I for the Warrior" interoperability concept. The hardware needed to be

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31 Political correctness, worth extra points!

32 IBM BSP Guide pp. 6-7.

retrofitted or expanded for the test ships, Mount Whitney, America, and Guadalcanal, includes the expansion of super high frequency (SHF), design of multi-media networks, and use of commercial communications systems to provide video teleconferencing. The cost of developing and demonstrating this capability during this exercise is estimated at between $14 to $20 million dollars.[33]

Appendix A is the Joint Information Requirements Matrix used by CINCLANT's J-6 to begin the process of assessing command and control needs for the conduct of OCEAN VENTURE 93. This first step enabled the CINCLANT staff to evaluate the command and control of an embarked joint task force commander. It compares the staff directorates' data and information requirements and the current C4I2 system available for their transmission. While this is only the starting point of a very complex process, it is interesting to compare the examples of Appendix B, BSP's Current Systems Support Analysis, with the obvious similarities with the matrix employed by CINCLANT. This structured approach allowed them to logically target specific interoperability shortfalls identified in the Gulf War. The CINCLANT staff aggressively took on this critical challenge by matching command and control capability with the appropriate technology presently available. The technical

[33] The MITRE Corporation, Center for Integration Intelligence Systems, Risk Assessment for Exercise OCEAN VENTURE 93, Report to CINCLANT J-6, (Norfolk, Va.: 1992)vp.

solution of "wiring" the Contingency Tactical Air Control Automated Planning System (CTAPS), the Air Forces system that produces a JTF commander's ATO, to a maritime platform was entirely feasible with today's technological advances. As always there are risks to success in applying the technologies of sister services to the maritime environment. Significantly, while CINCLANT has wasted no time to proactively identify the paths to realize the first phase of CJCS' "Warrior" concept, it has also achieved the first two objectives of BSP.[34]

OCEAN VENTURE 93 will be a tribute to the congenial, team efforts of various military staffs, government technical laboratories and agencies. However, the application of existing technologies to solve specific command and control shortfalls may not lend itself to addressing the total interoperability vision of the future. Does a Current Systems Support Analysis lead the services to merely exchange stovepipes? What will be the future requirements and the priorities for developing new C4I2 technologies?

BSP offers another methodology that does not tie itself to existing technologies or traditional processes and enables C4I2 architects to envision the information flow about an organization. BSP's techniques in defining information

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[34] IBM BSP P.46.

architecture identify the processes of departments/ directorates of an organization and the data that each produces. This technique will reveal who creates data and in what form, as well as what other departments use the data produced to properly conduct operations. Appendix C provides examples of the various stages in creating an information flow architectural diagram. These diagrams, illustrating which organization "creates data" (the C's) and which ones "use data created" (the U's), aid those developing C4I2 systems to visualize the data sharing needs throughout an organization.

While some training is required to effectively utilize a BSP-like approach, the return on investment or payback should be prompt. Users, staff and technicians alike will have an increased understanding and appreciation of how information flows throughout a joint command or operation. This will help the CinC adapt contingency plans to changing threats, evolving force structures and emerging C4I2 technologies. Unnecessary delays and inefficiencies, such as duplications of data and critical disconnects, must be identified now, in lieu of surprising a JTF commander with C4I2 bottlenecks in the midst of a conflict. Additionally, we cannot afford to wait for another long-lead time, major regional conflict to compel the military to solve long seeded interoperability problems.

CHAPTER IV

CONCLUSION

The victory in the Gulf War points the United States military in the direction of increased interoperability. If recent history is correct, operation RESTORE HOPE and the potential conflict in Bosnia certainly indicate that future conflicts will be varied, short notice, definitely joint and more than likely combined. The challenge facing the CinC and his J-6 today is concerted planning to take advantage of all available C4I2 technologies. Current contingency planning must be thorough and proactive and involve the J-6 early in the process. Creative use of technology to resolve interface barriers and eliminate unnecessary manual interventions should be explored without regard to parochial interests. Discipline and a structured business approach to technical applications is a must to prevent an organization from having to "wade" through duplicative systems and data.

With an eye to the future, operational staffs should think in terms of how information and data flows throughout an organization instead of figuring out how to "pipe" information in and then deal with its distribution. Exploring a BSP approach to designing C4I2 architectures will identify a CinC's needs and help crystalize concepts into technical requirements within the context of operational contingency plans.

As the size of a conflict increases the more complex a joint C4I2 architecture becomes. Concomitantly, the larger the conflict, the greater the consequences should there be a command and control failure. Only through an orchestrated effort of the JCS' guidance, DISA's timely service and the CinCs' commitment will the "warriors" in the field and embarked at sea interoperate in a true joint environment.

Legislation, DoD directives and Joint Staff instructions alone have not produced the requisite interoperability to date. The CinC and his staff will need concrete knowledge about information systems and technologies while DISA's main imperative is to know the array of operations it supports. Through strengthened cooperation between the joint operators and the DISA technicians, the enormous potential of the future joint C4I2 architecture can be effectively tapped. The new paradigm of joint interoperability includes not only formulating a CinC's regional strategy but also flexibly implementing it. This is the joint military discipline of the future.

APPENDIX A

OV93 JOINT INFO RQMTS MATRIX

INFO RQMTS/SYSTEMS	AUTODIN MSG	CTAPS	JOTS/JVIDS	OSS	WWMCCS	SECURE FAX	RTSS/STU-III	VOICE NETS	JDISS SOCRATES ET AL	HF DATA	LIMS
J1											
UNIT PERS STRENGTHS	XX										
UNIT PERS SHORTFALLS	XX										
RESERVISTS PARTICIPATION	XX										
STAFF AUGMENT RQMTS	XX										
CASUALTIES/LOSSES	XX										
TABLE OF ORGANIZATION CHANGES	XX										
PRISONER INFO	XX										
REPATRIATION	XX										
MORALE ISSUES	XX										
MEDICAL											
LEGAL											
PAO											
J2											
IMINT											
IMAGERY									XX		
DATA											
VOICE							XX				
ELINT											
EOB									XX		
DATA									XX		
VOICE							XX				
DIRECT SCREEN TRANSFER											

APPENDIX A

CVSO JOINT INFO RQMTS MATRIX

INFO RQMTS/SYSTEMS	AUTODIN MSG	CTAPS	JOTS/JMDS	OSS	WWMCCS	SECURE FAX	RTSS/STU-III	VOICE NETS	JOISS	HF DATA	LIMS
I2 (CONT)											
COMINT											
OOB											
DATA									XX		
VOICE							XX				
DIRECT SCREEN TRANSFER											
HUMINT											
DATA									XX		
VOICE							XX				
TARGETING											
IMAGERY									XX		
DATA		XX							XX		
VOICE							XX				
REQUEST FOR INFORMATION											
DATA									XX		
VOICE							XX				
NOTIONAL											
DATA									XX		
VOICE							XX				
IMAGERY									XX		
PRODUCTS											
DATA									XX		
J3/J3A											
BLUE OPCON ASMNT											
AIR (SQDN)	XX				XX		XX				
GROUND (BRIGADE)	XX				XX		XX				
MARITIME (SHIPS)	XX		XX		XX		XX				
BLUE ATO/SPINS	XX	XX			XX						
BLUE TARGET LISTS	XX	XX			XX						
BLUE APPORTIONMENT SMRY	XX										

APPENDIX A

CV'93 JOINT INFO RQMTS MATRIX

INFO RQMTS/SYSTEMS	AUTODIN MSG	CTAPS	JOTS/JMIDS	OSS	WWMCCS	SECURE FAX	RTSS/STU-III	VOICE NETS	JDISS	HF DATA	LIMS
J3/J3A (CON'T)											
RED FORCE DPSTN											
AIR (SQDN)	XX		XX						XX		
GROUND (BRIGADE)	XX								XX		
MARITIME (SHIPS/FPB/	XX		XX						XX		
SUBS/MINEFIELDS/MPA											
COASTAL DEFENSE/											
UNCONVENTIONAL THREATS											
SOF (SQDN)	XX								XX		
NET ASSESSMENT											
AIR	XX										
GROUND	XX										
MARITIME	XX										
SOF	XX										
BLUE INTENDED MOVEMENT	XX										
BLUE KEY OBJ SUMMARY											
GROUND	XX										
MARITIME	XX										
SOF	XX										
SPEC INTEREST CIV/HOSTAGE	XX								XX		
BLUE FORCE DISPOSITION											
GROUND (BRIGADE)	XX	PRIMARY METHOD—COMPUTER DIRECT ACCESS—SYSTEM UNKNOWN ATT									
MARITIME (SHIPS/SUBS)	XX		XX	XX	XX						
SOF (SQDN)	XX	PRIMARY METHOD—COMPUTER DIRECT ACCESS—SYSTEM UNKNOWN ATT									
WHITE SHIPPING DPSTN			XX	XX	XX						
JOCG											
SAR INCIDENT REPORT	XX										
SAR SITREP	XX										
SAR REQUEST/SEARCH	XX										
ACTION PLAN MSG											

APPENDIX A

OV93 JOINT INFO RQMTS MATRIX

INFO RQMTS/SYSTEMS	AUTODIN MSG	CTAPS	JOTS/JMIDS	OSS	WWMCCS	SECURE FAX	RTSS/STU-III	VOICE NETS	JDISS	HF DATA	LIMS
J3CG (CON'T)											
SAR FORCES EMPLOYMENT	XX										
PLANNING MSG											
DAILY SAR SUMMARY	XX										
J35											
ENEMY PSYOP	XX										
ALL PSYOP/CA ASSESSMENT	XX										
SOF BASIC MSN DATA	XX										
(LAUNCH/TGT HIT/											
RECOVERY TIME)											
J37											
GOLD WING COMMS										XX	
HF WEATHER DATA (15,000 FT)										XX	
WEATHER UPDATES							XX				
J4											
LOGSTAT	XX				XX						
REPOL	XX				XX						
CHANGE REPORTS	XX				XX						
DEPLOYMENT/MOVEMENT											
INFO EXCHANGE											XX
SITUATION UPDATES											
TASKERS							XX				
RQMTS							XX				
J6											
COMM OUTAGES	XX							XX			
[illegible]	XX				XX	XX	XX	XX	XX		

APPENDIX B

Process / System	Management				Marketing			Sales Operations				Engineering			Production				Materials Management				Facilities Management			Administration			Finance			Human Resources		
	Develop Business Plan	Establish Organization Criteria	Review and Control Finances	Manage Risk	Plan Market Support	Conduct Market Research	Forecast Product	Manage Territory	Establish Sales Objectives	Administer Sales Plan	Service Orders	Design and Develop Product	Maintain Product Specifications	Control Information	Schedule Production	Plan Capacity	Specify Material Requirements	Control Operations	Purchase Materials	Receive/Inspect Materials	Control Inventory	Ship Stock to Customer	Plan Facilities	Maintain Facilities	Measure Equipment Performance	Manage General Accounts	Plan Costs	Establish Budget	Plan Financial Performance	Acquire Capital	Manage Funds	Plan for Personnel	Recruit/Develop Personnel	Pay Personnel
Customer Order Entry	C/P							C/P			C/P				C/P	C/P	C/P																	
Customer Order Control											C			C	C		C		C															
Invoicing																										C			C					
Engineering Control														P																				
Finished Goods Inventory																			C	C	C					C	C							
Bills of Material													C	C	C				C								C							
Parts Inventory											C								C		C													
Purchase Order Control															C/P	C/P	C/P		C/P															
Routings														C		C		C																
Shop Floor Control														C		C		C			C													
Capacity Planning																P		P																
General Ledger																										P					P			
Expense								C																		C								
Product Costing														C/P				C/P			C/P						C/P							
Operating Statements	C	C		C																						C								
Accounts Receivable				C																						C								
Accounts Payable	C			C																						C								
Asset Accounting				C																								C		C				
Marketing Analysis			C					C	C		C																							
Payroll																										C		C						C

C Current P Planned C/P Current and Planned

Figure 23. System/process matrix

APPENDIX C

Processes \ Data Classes	Objectives	Policies & Procedures	Organization Unit Desc	Product Forecasts	Bldg & Real Estate Reqt	Equipment Requirements	Organization Unit Budget	G/L Accounts Desc & Budget	Long Term Debt	Employee Requirements	Legal Requirements	Competitor	Marketplace	Product Description	Raw Material Description	Vendor Description	Buy Order	Product Warehouse Inventory	Shipment	Promotion	Customer Description	Customer Order	Seasonal Production Plan	Supplier Description	Purchase Order	Raw Material Inventory	Production Order	Equipment Description	Bldg & Real Estate Desc	Equipment Status	Accounts Receivable	Product Profitability	G/L Accounts Status	Accounts Payable	Employee Description	Employee Status
Establish Business Direction	C	C	C								U	U	U																			U	U			
Forecast Product Requirements	U			C															U			U														
Determine Facility & Eqt Reqts	U		U		C	C		U																				U	U	U						
Determine & Control Fin Reqts	U		U				C	C	C																								U			
Determine Personnel Reqts		U	U		U	U	U	U		C	U																									U
Comply With Legal Reqts		U						U			C			U																					U	U
Analyze Marketplace	U											C	C						U																	
Design Product	U										U	U		C	C													U								
Buy Finished Goods				U										U		C	C																	U		
Control Product Inventory														U			U	C	U								U									
Ship Product																		U	C			U							U							
Advertise & Promote Product													U	U				U		C													U			
Market Product (Wholesale)												U	U	U						U	C	U														
Enter & Cntrl Customer Order														U				U	U		U	C									U					
Plan Seasonal Production				U										U									C					U		U					U	U
Purchase Raw Materials															U								U	C	C	U								U		
Control Raw Materials Inventory															U										U	C	U									
Schedule & Control Production														U	U								U			U	C	U		U					U	U
Acquire & Dispose Fac & Eqt					U	U																						C	C							
Maintain Equipment																							U					U		C						U
Manage Facilities																													U							
Manage Cash Receipts																			U		U										C					
Determine Product Profitability								U						U	U				U							U	U					C	U		U	U
Manage Accounts									U									U								U					U		C	U		U
Manage Cash Disbursements									U							U	U		U					U	U									C	U	U
Hire & Terminate Personnel		U	U				U			U	U																								C	U
Manage Personnel		U																																	U	C

Figure 17. Process/data class matrix

APPENDIX C

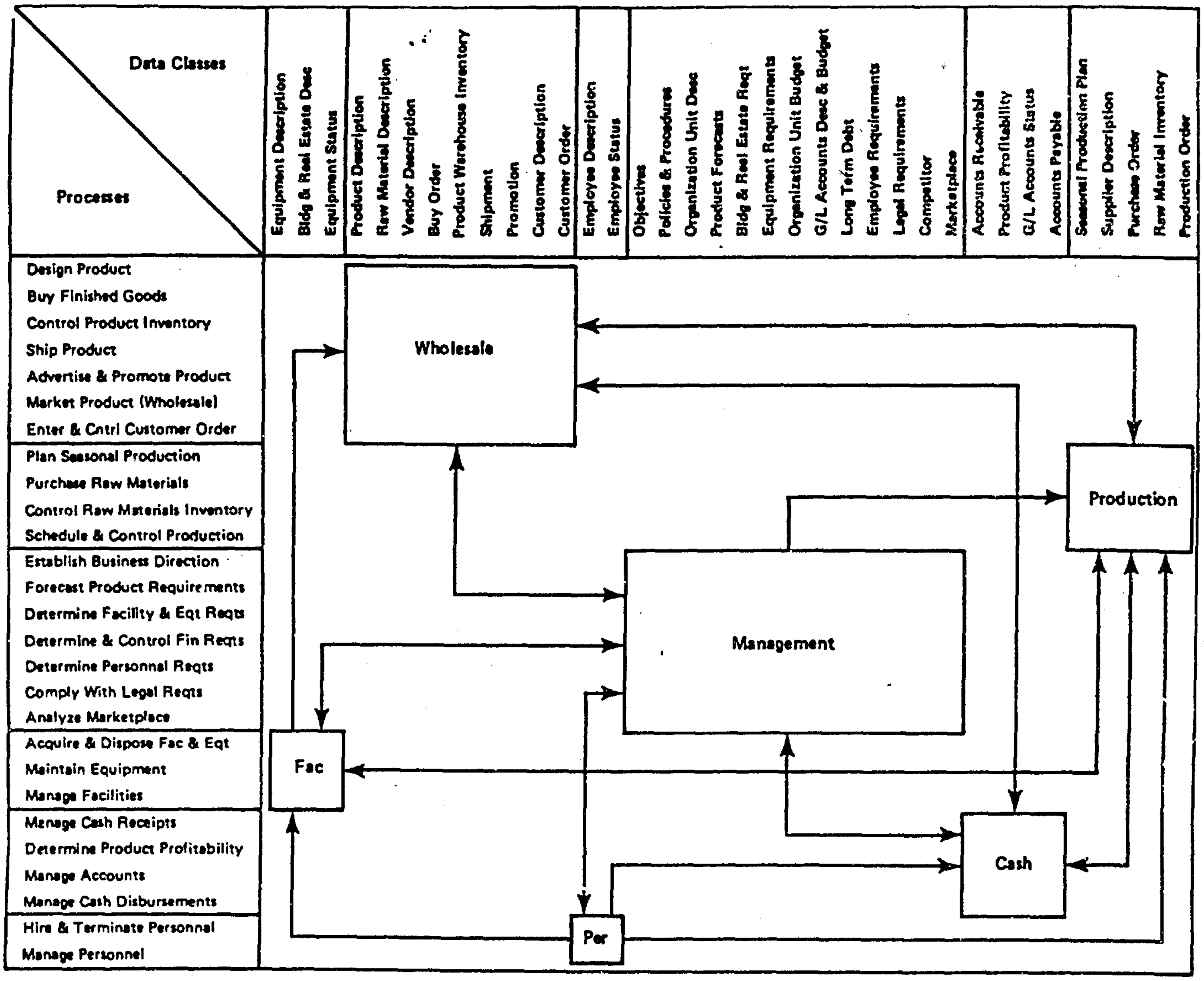

Figure 18. Information architecture flow diagram

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