

Network-Centric Warfare: A Mission Capability Perspective

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Abstract

To attain a mission capability perspective of network-centric warfare, some pre-requisite steps must be performed. The first step is to adopt a holistic capability management posture, which effectively installs the intellectual and management underpinnings essential for an effective capability transformation campaign. The next step is to discern and document the network centric warfare capability in terms of an enterprise model. This enterprise model is broken out into four views: business, operational, systems and technology views, all of which is tightly coupled through a pervasive logic framework. Consequently, a change in one view ripples through to corresponding changes in adjacent views, as appropriate. This enterprise model is the conceptual glue that bridges the mission capability planning/force development paradigm¹ to network centric operations, without loss of logic or context.

A national military enterprise model has been in development since the fall of 2001. One component of the national military enterprise model is a military operations capability reference model. A reference model is independent of organization, process and technology. For example, battlefield situational awareness is an enduring military function performed throughout the history of warfare using different means and ways. The military operations capability reference model depicts all such enduring military functions, their inter-relationships to one another and the corresponding information exchanges.

The next step is the analysis and design of organizations, technologies and processes specifics relative to the NCW MCP operational requirements. Defining a future network-centric warfare capability state is referred to as a target architecture, whereby a corresponding capability migration strategy can be determined, based on development priorities and available resources. This capability migration strategy is the program-level equivalent to and necessary for the guidance of project-level evolutionary acquisition initiatives.

INTRODUCTION

In the final analysis, a military force that can holistically understand, rigorously plan, efficiently assemble and effectively apply their military capabilities, in a manner superior to their adversary, will have the highest likelihood of successfully fulfilling their assigned missions. The general nature of the above statement bears no resemblance to the immense effort, cost, complexity and risk incurred to bring about military success on the battlefield. In many ways, the relative success in assembling a network-centric warfare capability will be measured in direct proportion to decomposing its inherent complexity. Complexity that manifests itself relative to various mission scenarios, international law, coalition interoperability, non-combatants through the requisite levels of command & control seamlessly across technical interfaces, so ultimately the mission can be successfully accomplished by soldiers in harm's way, all of which (and much more) must come together transparently at an unknown time and place.

The opening paragraph of a leading Network Centric Warfare (NCW) publication [1] states, *Innovation is inextricably tied to changing long-held precepts about the way we do things. Culture, rules and tools determine how things get done. The concept of a mission capability package² (MCP) is a useful way of doing business.* The concluding paragraph of the "Making NCW a Reality" chapter states, "What is necessary is a mission-by-mission review of how we can meet these challenges we face. Since military

¹ Equivalent to the "mission capability package" construct used by DoD C4ISR Coop Research Program.

² MCP consists of a concept of operations, command approach, organization, systems, and people with a prescribed level of expertise. Implicit in an MCP is the nature, distribution, and utilization of information.

organizations need to continually accommodate change relative to the nature of their missions, the creation of structured “change processes” are required to facilitate and develop new mission capability packages and translate them into operational capability.” This transformation challenge is echoed in a recent NCW paper [2] by VAdm Arthur Cebrowski and John Garstka, where their concluding narrative states, “All elements of the network-centric warfare model must move forward if the promise of the revolution is to be realized... A [transformation] process for the co-evolution of technology, organization and doctrine is required.”

AIM

The aim of this management paper is to offer a capability-based management perspective to NCW. The first part of this paper introduces a capability-based management framework ³[3]. The second part of this paper will use the capability-based management framework to provide a NCW military capability package instantiation overview.

PART ONE: CAPABILITY-BASED MANAGEMENT FRAMEWORK

Knowledge Management in Capability Terms

What is knowledge management (KM)? Although there are many complex facets to KM, the following basic description of KM will be sufficient for the purposes of this management perspective: *knowing what we know, capturing & organizing it and using it to produce desired results*. Often two questions are posed to focus KM efforts: “What is the job & what is the knowledge base to do the job?” That means mapping knowledge to business processes, where critical knowledge distinguishes itself in the context of the customer relationship [4]. Typically management has not done this very well⁴. Ideally to fulfill this role, management should render a single representation of how business is done by depicting “what” functions are integral to the business and “how” these functions are performed. This depiction, also called an “enterprise model” (E-model), allows personnel to see themselves, their role and the value they deliver to their customers in relation to the whole enterprise effort.

All organizations, large or small, have an enterprise model... the extent with which it is documented and commonly understood is another issue. Typically a few individuals in any one organization are able to see the “complete picture” and understand how all the capabilities of the enterprise are intended to work together. These individuals were able to assemble this mental model by understanding the various perspectives of the organization, for example strategic, external, operations, support, technology and others. Table 1 compares the characteristics of these typical implicit models relative to an organization where the E-model is rendered explicitly.

<u>typical E-model</u>	<u>explicit E-model</u>
-implicit mental models some textual references	-single explicit graphically depicted model
-disparate documentation methodologies using various tools	-single integrated documentation methodology & tool
-some “purpose-built” business perspectives	-integrated view of all business perspectives
-inconsistent terminology & definitions	-consistent terminology & definitions

Table 1 - Enterprise Model Realities.

³ Portions of Part One of this paper were extracted from another paper written by the author see [3].

⁴ An executive recruiting firm surveyed more than 4500 managers, scientists and engineers, more than 500 corporate leaders in large companies around the world, 72% percent of who said knowledge is not reused across boundaries in their companies. Centre for Effective Organizations, Marshall School of Business, University of Southern California, 2000.

Simply put, attainment of an explicit E-model provides an unprecedented opportunity to achieve a shared, common understanding of “how we do what we do” across all levels and perspectives of the business. Clearly, an E-model with these qualities would greatly facilitate sharing⁵ of management’s purpose and design to conduct business, both today & in the future. All stakeholders gain to learn from an explicit E-model. From a culture perspective, an explicit E-model accelerates cultural transformation by codifying knowledge, which creates cultures that encourages innovation & agility [4]. Management is better able to inform and lead their workforce. The workforce is better able to learn and cope. These fundamental business basics just got a whole lot easier to achieve and culture change can consequently be accelerated. Now how exactly does one go about rendering their E-model explicit?

An Indispensable Capability Management Tool

One cannot live in an architect’s blueprints; one must construct the building represented by the blueprints, then move in and use it. A building’s blueprint represents extensive planning and design work and is essential for the construction engineer contractor to implement a complex structure. These same blueprints will serve as the basis to assess any future expansion or major renovation. The analogy between a blueprint and an E-model is accurate except in large organizations change occurs at a faster rate and organizations are typically more complex with a greater number and type of interdependencies to represent. But like a blueprint, an E-model should only be regarded as a means to an end.

The effort to assemble a rigorous, integrated intuitive E-model is non-trivial. Enterprise architecture (EA) is an evolving body of practice based on General Systems Theory⁶ (GST) defined “as a set of components that work together for the overall objective of the whole” [5] and supported by ontology theory⁷ [7]. Applying the discipline of EA decomposes enterprise complexity into different E-model perspective views, often known as: business, operational, systems and technology, each of which is tightly coupled through a pervasive logic framework [6]. These four perspectives provide a common context to communicate and resolve any enterprise relevant issue to all enterprise stakeholders⁸: senior staff, force development planners, operations personnel, project managers, system designers, procurement agents and includes stockholders, corporate partners and suppliers.

Change, hence implementation is constant in most any modern military organization. Consequently the explicit E-model is increasingly recognized as an indispensable management tool to allow the management team to collectively understand holistically how all the corporate bits and pieces are intended to systemically work together to deliver the value for which the organization was designed. The measure of a good E-model is its ability to capture an organization as if it were a living, breathing system.

Defining Capability in Management Terms

“Capability” is one of those terms commonly used in business and government, which has a different meaning for every person who uses it. Capability is a powerful construct and thereby warrants a clear description in management terms. For the purposes of this paper, a specific capability consists of resources logically grouped together to perform a specific function that creates or performs something of value, in accordance with certain procedures and/or business rules. All capabilities have a physical manifestation. Capabilities are logically grouped to achieve specific outcomes or outputs, based on business/mission specific scenarios and imperatives. Modular designed capabilities can be re-grouped or massed to match requirements responsive to events or threat based triggers. An enterprise needs to first determine and then assemble a finite number of specific capabilities, the sum of which is necessary to achieve their overall

⁵ Knowledge sharing builds social capital, trust, moral and enables culture transformation.

⁶ During the 1940’s, a leading biologist Ludwig Von Bertalanffy set forth a new way to look at the structure of all life – the system. In describing this theory, author Geoffrey Vickers wrote:

“Every science begins by classifying its subject matter, if only descriptive, and learns in the process; and systems especially need this attention because an inadequate classification cuts across familiar boundaries and at the same time draws valid and important distinctions which have previously been sensed but not defined. In short, the task of GST is to find the most conceptual framework in which a technological problem can be placed without losing the essential features of the problem.”

⁷ Ontology is defined as theory about the nature of being or kinds of existents (Webster Dictionary 1981). Formally, an ontology consists of a set of terms, their definitions and axioms that inter-relate them.

⁸ Generally, the business and operational views are the most valuable to planners and operations teams, where the systems and technology views are coveted by IT folk and project implementers.

business goals or objectives. Recall one objective of GST is to find the most conceptual framework in which a technological problem can be placed without losing the essential features of the problem place, consequently we must expand the context of the capability description in a broader, more holistic management context resulting in a capability-based management equation⁹ as shown below in Figure 1.

$$\begin{array}{c} \text{Performance managed business goals} \\ = \\ \text{Accountability} + \underbrace{\text{Business Rules} + \text{Resources} + \text{Functions}}_{\text{Capability}} \end{array}$$

Figure 1 – Capability-based Management Equation.

Functions¹⁰ are a key component in this equation. The characterization of a capability (or the perception of it's utility) varies depending on resources apportioned to it and the effectiveness of the procedures that regulate it at any given time. Whereas in contrast, functions have a universal, enduring conceptual character, as illustrated by the following example. Conceptually, battlefield situational awareness is an enduring military function performed throughout the history of warfare. The physical capability adopted to provide situational awareness during the Franco-Prussian War of 1870 was the placement of observers in aerial balloons. Current NCW battlefield situational awareness is achieved by UAV and satellite capabilities. Consequently, it is this stable nature of functions that enable it to perform a central role from a management perspective, where functions offer an essential context for: resource apportionment, process design¹¹, organizational accountability and performance management. Consequently, the capability management equation is perhaps better expressed graphically as shown in Figure 2 below, where the function construct is correctly depicted as the fundamental management entity central to the capability-based management equation.

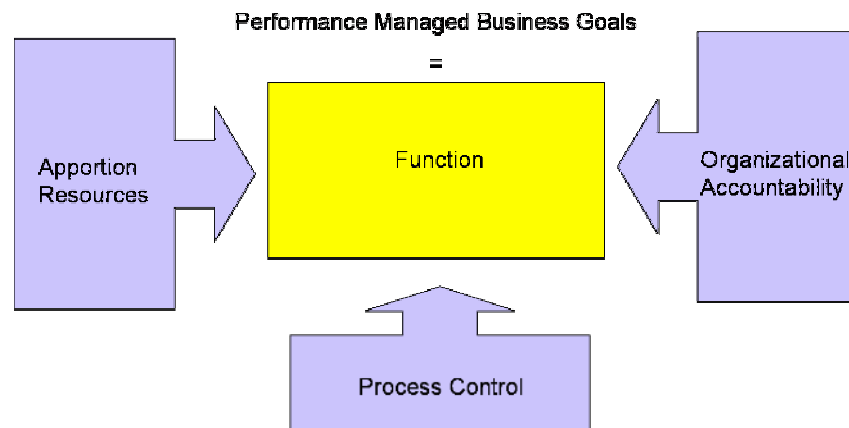


Figure 2 - Graphical Portrayal of Capability Management Equation.

Resources are always limited, therefore it is essential for management to prioritize resource apportionment based on the function's contribution to achieving business imperatives, such as: speed, innovation,

⁹ Derived from J.P.Caron's Master of Public Affair thesis titled "Application of Enterprise Management to Public Sector Human Resources Service Delivery" July 2001.

¹⁰ A function is an essential & distinct set of activities that produce value, requiring resources (i.e. personnel, information, equipment, infrastructure, processes and related \$).

¹¹ Process design prescribes how all the individual units of work must come together to achieve the overall goal. Activities of a process are related and organized, where they all work together toward a common goal. People performing different steps of a process must all be aligned around a single purpose, instead of focusing on their individual tasks in isolation. For those functions that are sufficiently complex and have high dependency on other functions, installment of systemic process control is required. Each function is achieved through the performance of a specific set of underlying process activities (i.e. task level procedures organized in accordance with the applicable governing policy). Process control improves task level efficiency and/or effectiveness.

frugality, quality, customer focus. Consequently, each function should be assessed for the apportionment of the following resource types: personnel/competencies¹², information, equipment, infrastructure and related \$ relative to its overall business priority or relative business value. Once the sum of all available resources are apportioned against all valid functions, senior management must assign the performance of functions to responsible organizational entities which will be held accountable for delivering the output or service intended of that particular function.

It is the role of the enterprise architect¹³ to determine the finite number of unique functions that constitute any given enterprise through the provision of an integrated systemic E-model. For example from the approximately 250 distinct basic functions that constitute the national military enterprise model, approximately 80 basic functions are specific to the NCW MCP¹⁴. Effectively the overall NCW complexity has been logically decomposed into 80 systemically depicted sub-functions. From a management perspective, once resources are apportioned to these 80 conceptual NCW sub-functions, they create 80 NCW discrete physical capabilities, the sum of which constitutes the overall NCW operational capability. The role of NCW transformation authority is to confirm these 80 explicit NCW sub-functions and design their physical capability instantiation. It is the determination of this finite number of NCW sub-functions that is of management significance because the NCW military capability package objective becomes a finite systems problem. Collective efforts can now be expended on unambiguous synchronization, alignment and coordination of these specific NCW sub-functions, as well as addressing NCW external functional interfaces.

Function: Characteristics of the Fundamental Management Entity

Recently a NATO country's Military Health System completed an end to end transformation only to find significant disconnects between the level of funding for the military health sub-functions to be performed compared to the user expectations of health services delivery. This military health system capability transformation effort was deemed a failure due to the accumulative consequence of cost forecasting versus service delivery expectation inconsistencies. As previously discussed, the cost of conducting the business of a military health services capability would have been rendered explicit for planning purposes if all military health sub-functions had been identified and the total health system resource budget apportioned against them. The more challenging aspect of this capability scenario was the disconnect in terms of service delivery expectation. If the assertion that the "function" is the fundamental management entity is valid, then how would the above problem be otherwise addressed in a capability based management framework?

The lack of success in the above military health system transformation effort was not a result of a systems or technology level difficulties, but rather it would appear transformation planners failed to recognize the devil in the management details. This basic, yet critical oversight would not have occurred if a full understanding of a function's characteristics had been leveraged for the purposes of this transformation

¹² With the exception of personnel resources, shortcomings with respect to all other resource types can be generally resolved through the expenditure of sufficient funds. The human dimension and the associated sensitivities of the personnel resource type results in far greater management effort to responsibly apportion this resource type. In a military environment, only time, planning and development of an organizational culture that embraces change & learning will remedy the lack of adequate personnel competencies and experience being available for the right job at the right time. It is sorrowfully inadequate to assume that matching an individual with a prerequisite trade and rank to a position will suffice in the demanding work environment of a NCW MCP. The HR challenge is further exasperated because the changing nature and employment scenarios of the military "job" and its required competencies which is constantly evolving relative to new NCW capability employment concepts and technologies. Despite the above tremendous pressures, military HR staff cannot hastily design occupational structures, arbitrarily minimize occupation standards or expedite HR processes because of the invaluable nature of personnel resources compounded by the inherent high risk of the NCW work environment. In summary of all the resources types to apportion, HR is unequivocally the most challenging and prone to being the limiting factor in attainment of the desired NCW capability end state (i.e. if development of the NCW capability is priority one, then the military personnel production capability should be priority two candidate).

¹³ A full technical discussion on the significance of Enterprise Architecture (EA) frameworks and methodologies relative to these complex constructs such as functions, capability reuse, logic inheritance, context hierarchy, consistency of abstraction, systemic depictions, process control, information flow, etc. is beyond the scope of this paper. These EA concepts are the key to getting it right. Suffice it to say, current large organizations are incredibly complex, dynamic systems. If the corresponding EA methodology is not capable of capturing all the complexities of that business system, then it will only be a matter of time before management starts paying for that which is falling through the cracks.

¹⁴ Proact Business Transformation Inc have developed generic E-models for the high tech, retail, hospitality and defense/security industry sectors, which are then customized during implementation into specific client organizations.

endeavor. From a management perspective, functions perform different roles and can be categorized into three basic types:

- Governance functions – These are designated enterprise overhead functions designed by management to regulate the enterprise system. A preponderance of ad-hoc committees not otherwise associated with these designated governance functions is an indication of enterprise governance dysfunction.
- Primary value chain¹⁵ functions – These are the functions that directly contribute to the creation of value commensurate with the enterprise's mission and/or mandate. Clear interfaces and concise handoffs between functions along the value chain are key to balancing the conflicting, yet healthy friction, between efficiency and effectiveness.
- Support functions – These functions manifest themselves horizontally throughout the enterprise as they serve to enable the successful prosecution of governance and value chain functions.

The apportionment of resources to each function provides a quantitative representation of that function's role or purpose. To ensure qualitative clarity of a function's role or purpose, the following minimum attribution types needs to be determined **for each function**:

- Description – This is a general description of the functions purpose, primarily expressed in terms of services and/or value delivered.
- Function Validation Source – This attribute documents the authority from which this function was derived and by default confirms the description and associated terminology used.
- Regulating Policy – This attribute documents that official direction and designated standards, which regulates and controls the prosecution of this function.
- Concept of Operation (CONOPs) – This is a key qualitative attribute. It describes how this capability is intended to perform in accordance certain operational scenarios. For example, the CONOPS for the NCW ISR function may be: centralized collection planning and tasking with distributed collection and information analysis, concluding with centralized knowledge fusion and exploitation. The CONOPs expressed here must logically conform and align with the CONOPs of the parent function and prevail relative to any child functions. The resultant roll-up of these complimentary CONOPs from all levels ensures unified action and the overall desired capability manifestation or outcome.
- Incoming Service Delivery Level – This attribute captures the service delivery expectations from an up stream value chain function or contributing support functions in relation to the receiving customer function. It is recommended this attribute be formalized as a Service Level Agreement (SLA) if the two associated functions bridge organizational boundaries. This attribute is key in defining clear handoffs between functions, particularly important when many services flow into a given function (i.e. the military operations function presented in Part Two of this paper).
- Outgoing Service Delivery Level – Similar to above, this attribute captures the service delivery expectations from an up stream value chain function or contributing support functions in relation to the receiving customer function. This attribute is key in defining output service/value metrics for performance management.

Since each function is derived from a hierarchically logical decomposition and is systemically linked through service function modeling, the net result of any function with the above attribution set completes the articulation of capability requirements from a management perspective. One could hypothesize the difficulty encountered by military health system transformation scenario above would have been avoided if the finite set of health system functions were explicitly depicted in a systemic graphical representation complete with the associated functional attribution above.

¹⁵ Those activities performed to bring about the desired value output or outcome (i.e. designing, producing, marketing, delivering and supporting a product or service).

Capability Paradigm

The preceding narrative has established the necessary management environment within which capability-based management may be achieved. This “capability paradigm” enables all current business practices to align in one common framework resulting in a more holistic understanding by management. Expressed differently, the capability-based management framework offers a best practices meta-model within which best practices are systemically integrated and collectively leveraged enabling in higher level of enterprise management performance (see figure 3). The following list attempts to characterize this new E-model enabled capability management paradigm:

- single, intuitive, rigorous, systemic view of conducting business, independent of organization;
- enables an informed & culturally responsive workforce;
- opportunity to assess business issues in a holistic, systemic analysis manner;
- enabler of knowledge management;
- increased clarity of resource apportionment;
- provides greater insight to support decision making;
- allows for a common context, portrayal and subsequent understanding of virtually all mgmt issues; and
- provides function-based framework for performance management, accountability & governance.

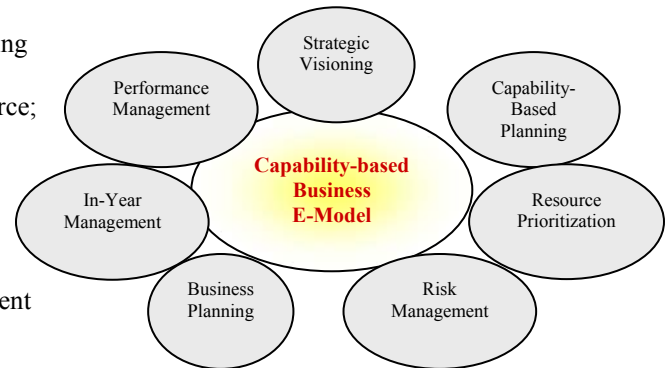


Figure 3 – Aligning Practices & E-Model.¹⁶

In summary, resourced functions result in physical capabilities performed by accountable organizations in accordance with approved policies and procedures as part of an overall enterprise system. Management becomes an exercise predicated on the continuous balancing of the capability-based management equation, where agile organizations are distinguished by their ability to rapidly reprioritize functions and reapportion resources accordingly with their changing business demands.

PART TWO: NETWORK CENTRIC WARFARE MILITARY CAPABILITY PACKAGE

Introduction

The July 2003 edition of Signal magazine [9] features an article titled “Transformation Transcends Technology,” that captures the “admonition from dozens of military and industry leaders who gathered to assess the status of transformation.” The remarks contained in this article were many, varied and all disconnected from speaker to speaker. These leaders did not have a common mental model nor arguably an adequate management paradigm to contextualize their remarks, as was evident in the following quotes:

- Admiral A.H. Konetzni Jr. USN, deputy commander and chief of staff U.S. Atlantic Fleet remarked, “*Military innovation pursued without solid intellectual underpinnings, without a clear vision of how it fits into the overall construct and without discipline can lead you down the wrong road.*” What specifically is that “overall construct” and does it have sufficient “intellectual” rigor to mitigate the enormous complexities of transformation?
- Cmdr. G.E. Glaros, USN, Office of Force Transformation states, “*we must resolve, not the number of computers, but we must use a holistic approach.*” What is that “holistic approach” specifically? Is the “approach” commensurate with the level of complexity it is intended to resolve? (i.e. a service paper and a PowerPoint presentation is entirely inadequate).
- K.J. Masback, Director of ISR Integration, Department of the Army stated, “*the U.S. Army is working toward a system of systems*” and that “*C4ISR now means more in the Army than it did in the past. It now includes ISR, medicine, logistics, personnel, and as a result, his service now*

¹⁶ Diagram derived from briefing by Major General D. Dempster, Director General Strategic Planning, Canadian Forces.

refers to C4ISR as 'battle command'.” What transformation methodology has the Army adopted “working toward a system of systems”? What is the Army “system of systems”? How is it depicted? How does it fit into the U.S. Military’s Joint “system of systems”? Does the Army’s new “battle command” construct differ from the Army’s “system of systems”?

The business of enterprise transformation is very difficult. It is the assumption of the author that above subject article would have featured the answers to these remarks as opposed to the “admonition” perspective highlighted ...if the answers were offered. Enterprise transformation demands a management approach, tools and commitment commensurate with the inherent complexity of the transformation task at hand. An imperative enterprise transformational tool is the E-model. The essence of enterprise architecture (EA) is the practice of identifying and structuring components to achieve a planned result. EA must take into account the environmental context and the interrelationships of components, both external and internal.

One important benefit of adopting an explicit management framework is that it provides an overarching context to situate and answer any of the above questions or issues. Transformational stakeholders ask questions from all points of the compass, yet they deserve consistency in the responses. Consequently the transformation management team requires a single shared functional vocabulary or risks the confusion of “being separated by the same language”¹⁷. Although some senior, mutually familiar transformation colleagues may leap through levels of abstractions and across conceptual paradigms with reckless abandon in the course of conveying ideas and resolving problems, this should not be assumed as the norm given the broad array of transformational stakeholders and their respective backgrounds. At this level of complexity, it is essential that all dialogue be conducted with a deliberate sense of discipline to mitigate unintentional miscommunication. Communication must comply with the management framework and its terminology such that the context of an intended message is first established, then preserved over the course of the conversation.

Part One of this paper has been about establishing the management conditions necessary to assemble a NCW military capability package... Part Two is about getting it done.

National Military Enterprise Model: Context is Everything

Discussion of a National Military E-model is beyond the scope of this paper, but it is essential in establishing the necessary functional context to discern a NCW military capability package (MCP). A national military enterprise model has been in development since the fall of 2001¹⁸ and will consequently be used to define the functional boundaries of the NCW MCP. The national military E-model is broken out into four views: business, operational, systems and technology views, all of which is tightly coupled through a pervasive logic framework, as shown in Figure 4 and described below¹⁹. Although each view serves a distinct purpose, each superior view defines requirements to be fulfilled by the subordinate view, which is satisfied through the assembly of the requisite view-specific capabilities. The aggregation of these modular capabilities is assembled to fulfill the composite enterprise requirement initially established in the business view. Consequently, a change in one view ripples through to corresponding changes in adjacent views, as appropriate. Each view is composed of numerous models, but it is beyond the scope of this paper to discuss this level of detail, except where warranted in support of the NCW MCP explanation.

¹⁷ In the waning days of DEC computer, an internal business consultant tells of a handful of top executives who had worked together for more than a decade where they all talked to one another about “architecture” of computer systems. When discussing the company’s strategic plans, each had a different idea of what “architecture” meant in DEC’s context.

¹⁸ The author and Art Caston of Proact Business Transformation Inc. have co-developed the National Military Enterprise Reference Model using the Proact Business Transformation Toolkit® tool and methodology. The Canadian Department of National Defence has participated and supported in portions of its development.

¹⁹ Proact Methodology Overview version 1.0, Proact Business Transformation, Inc.

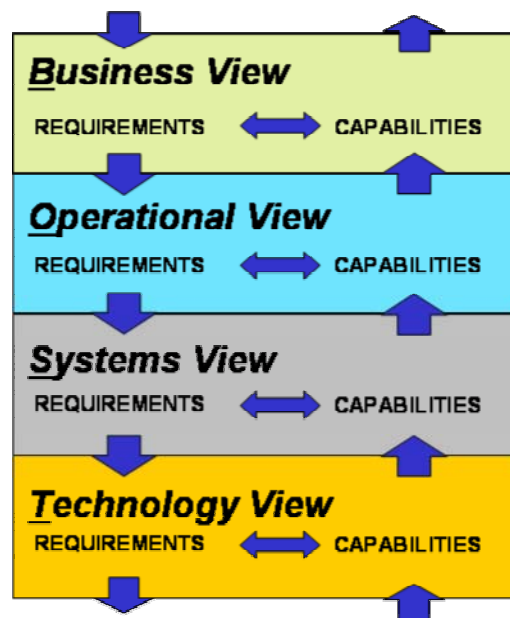


Figure 4 – E-model Framework ©Proact Business Transformation Inc.²⁰

- The Business View (B-view) caters to the strategists and planners involved in assessing adversaries, mission scenarios, mutual defense commitments and provides a framework for providing advice, establishing defense policy and programs. The B-view also captures national military relationships with defense industry and military partners that are described based on the services that flow between them (i.e., provision of foreign military installations, development of classified technology). This approach is very useful in identifying interoperability, procurement and outsourcing opportunities.
- The Operational View (O-view) describes the essential functions of the national military enterprise. The O-view is based on functional representations of essential operational capabilities. These functions are linked by the services they provide to other functions or external entities. These service functions provide clean delineations for defining information exchange requirements, designing process interfaces, establishing meaningful performance metrics, and aligning organizational accountabilities.
- The Systems View (S-view) identifies functionally logical systems, their information exchange requirements and their components that can also be represented by the system services they provide.
- The Technology View (T-view) contains the architecture models that are used to design the underlying technology infrastructure, including the weapon platforms, sensors, user devices to access applications, the computers that run the applications, and the networks that connect it all together.

National Military E-Model Business View

The business view defines the overarching military context within which the national military enterprise operates and consequently must model those external entities that influence the conduct of a nation's military. The following non-exhaustive list is representative of B-view entities: that military's national government, other government departments, other levels of government, military allies, adversaries, applicable non-governmental organizations, host nations, industry, academia, research & development institutions, suppliers, vendors, the public at large and individual citizens considering military service.

Of the 4 views, one would assume that the business level is the most straight forward and would receive unanimous senior management agreement regarding its makeup and contents ...not true. For every senior

²⁰ Used with permission

military official there is a different description as to “what is the business of the military” (usually based on environmental service persuasion). Getting the national military B-view right is key to enabling a successful NCW MCP effort; consequently the following constituent B-view models are outlined below. The sum of these models provides the Defense and Security Framework for providing advice, establishing defense policy and recommending defence programs to the government and related stakeholders.

- The Security Commitments Model identifies the Stakeholders, the various military commitments and their relationships with operational partners in the context of geo-political jurisdictions.
- The Security Relationship Model extends these military commitments to define specific security capabilities provided by friendly security enterprises (operational partners) to mitigate various threats and perils against protected and valued assets.
- The Resources Model identifies the specific types of assets that required by the friendly security enterprises to constitute a relevant and credible security force.
- The Program Model identifies the various change or transformation initiatives that are underway or planned to improve or enhance the performance and delivery of security capabilities.

National Military E-Model Operational View

Explicit identification and characterization of the NCW MCP functional boundary interfaces relative to the entirety of the supporting national military establishment is critical to ensuring the NCW MCP work is not predicated on false or inadequate peripheral assumptions. Ultimately the NCW MCP will need to align & comply with the overall national military E-model (see Figure 4), whether it is implicit or has been explicitly rendered.

There are five national military major enterprise functions (see Table 2 below). It is from these five major enterprise functions that all other military sub-functions are derived through logical decomposition based on the service(s) rendered by any given function (called service function modeling). A fundamental principle of good architecture is to define modular components or “capability building blocks” that can be de-coupled with well-defined interfaces. Consequently this service based decomposition logic uses **services** to describe these capability building blocks. These services can then be called upon to support new scenarios, changing missions and fluctuating demands.

Major Function Name	Major Enterprise Function General Description	NCW MCP Relevance
Departmental Planning & Direction	- producing and implementing departmental policies and strategies to achieve broad government military security objectives	-provides the strategic guidance on the NCW MCP capability requirement & the associated transformation funding
National Military Force Development	-bringing professional knowledge, analysis and judgment to bear on the task of designing and optimizing the military’s capacity to act relative to its future force	- the strategic planning aspect of capability based mgmt resides here and includes doctrine development & experimentation
National Military Force Generation	-bringing current forces to a state of readiness for operations by assembling and organizing personnel, supplies and material/equipment	-military forces are drawn from this function to conduct NCW operations, reinforce “train as you fight”
National Military Operations	-conduct military operations, where the military Chain of Command is responsible to execute both routine & non-routine missions	- the NCW MCP resides here ; NCW is a military operations CONOPs predicated on network technology

Departmental Support & Sustainment	-provide materiel and administrative support to forces by supplying personnel, and procuring & maintaining supplies/equipment	-national level support & sustainment flows from this function into NCW operational specific logistics sub-functions
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Table 2 – Situating the NCW MCP relative to the National Military E-model.

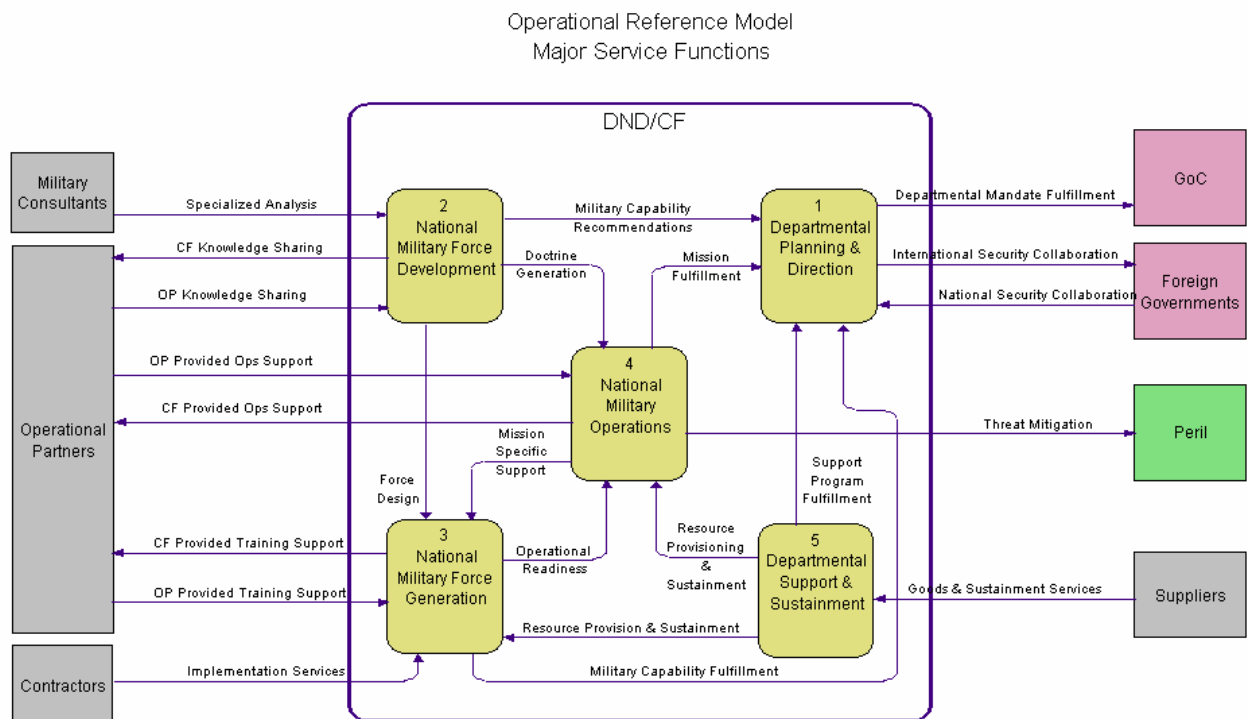


Figure 5 – Service Flow Depiction of Major National Military Enterprise Functions.

The service flow depiction of major national military enterprise functions (Figure 5 above) must not be construed as a process or sequence diagram. For example, the reader should interpret the “mission fulfillment” arrow flowing from the National Military Operations major function to the Departmental Planning & Direction as “National Military Operations provides the service of “Mission Fulfillment” to the Departmental Planning & Direction function. In a private sector scenario, Military Force Development is analogous to product development, Military Forces Generation is analogous to production and Military Operations is analogous to service delivery.

Further examination of Figure 5 above reveals a propensity of service flow arrows converging into the National Military Operations major function, which offers a graphical confirmation of “ops primacy” where the majority National Military E-model functions exist to support the delivery of services to the penultimate military operations major function. The “threat mitigation” service flow arrow flowing from the National Military Operations major function to the external entity box titled “Threats & Peril²¹” further

²¹ Threats require a perpetrator, with the means and motivation to...

- possess weapons of mass destruction (nuclear, biological and chemical)
- attack or assault valued assets or resources
- infiltrate or occupy protected territory or property
- block access to or escape from protected territory, property or infrastructure
- seize, steal, confiscate, terrorize or kidnap valued assets or resources
- cause a environmental disaster

confirms the National Military Operations major function has a comparatively unique status relative to the other functions as characterized by Table 3 below.

National Military Ops Functions	Other Military Functions
Transpires in an event driven state	Transpires in a stable state
High risk conditions	Low risk conditions
Rapid decision cycle time	Low/moderate decision cycle times
Planning horizon: minutes/hours/days	Planning horizon: months/years

Table 3 – General characterization of military enterprise functions.

It is the opinion of the author that, it is **only now** that this paper has established a sufficiently adequate management paradigm (i.e. capability equation, E-model tool) and the minimum necessary context to commence a concise discussion of NCW analysis and design, with sufficient intellectual underpinnings to achieve our military capability package objective.²²

Military Operations Capability O-View Reference Model: Context Remains Everything

The military operations capability reference model is fundamental to attaining a holistic network-centric capability perspective. By applying the discipline of enterprise architecture, the complexity of the military operations problem domain is decomposed into a set of logically integrated, intuitive reference models in graphical form. The operational view models are assembled and compliant with a thorough understanding of the greater “military business context” assembled in the B-view. The central model in the operational view is the service function model, which explicitly renders the finite set of unique functions that collectively constitute military operations, their inter-relationships to one another and the corresponding information exchanges.

The Military Operations function presented in Figure 5 – Service Flow Depiction of Major National Military Enterprise Functions functionally decomposes into five sub-functions as shown at Attachment A. These five sub-functions inherit the context of all service flows from the parent function. It is impossible to examine the decomposition path of all five sub-functions within the confines of this paper, so an “operational level situational awareness” functional scenario thread will be adopted for exploration.

The author must abrogate the convention of fully explaining all figures introduced in papers due to the semantic richness of Attachment A relative to paper length constraints. Consequently readers are encouraged to examine the context and service flows relative to the *4.2 Operational Level Ops* function in accordance with the service flow interpretation, first introduced in association with Figure 5 above. Full understanding of Attachment A is only achieved by examining the function attributes (as presented above). The following *4.2 Operational Level Ops* function description (not a definition) is as follows²³:

Strategy is the sole authoritative basis for operations. The operational commander's principal task is to determine the sequence of action most likely to produce the military conditions necessary to achieve the strategic goals. Activities at this level link tactics to strategy by establishing operational objectives. These activities imply a broader dimension of time and space than do tactics: they ensure the logistic and administrative support of tactical forces and provide the means by which tactical success are exploited to achieve operational objectives.

•operate a vehicle, facility, or equipment in a dangerous manner
Perils include acts of nature such as...
•floods, wash-outs, ice/snow storms, and mud/snow slides
•hurricanes and tornados
•earthquakes and volcanoes
•droughts

²² There are two abbreviation used in Attachment A requiring clarification: OP – operational partners, and CF – Canadian Forces for whom the author originally conceived the model.

²³ Recall, what is being examined in Attachment A is a service function reference model composed of enduring functions and relationships. The specific functional attribution would change based on the specific national military instantiation.

One can quickly appreciate the collective semantic power and doctrinal benefit²⁴ rendered from Attachment A, when the five Military Operations sub-functions are systemically rendered (and supported with all additional associated functional attribution), while maintaining the context of all external supporting functions and enterprise external stakeholder entities. This holistic depiction mitigates stovepipe analysis and design. Navigating horizontally and/or vertically through the model allows for the comprehension and assessment of the branching and convergence of multiple value chain paths.

Pushing on, readers are now asked to look at Attachment B, to examine the functional decomposition of the 4.2 *Operational Level Ops* function into four sub-functions. Attachment B provides an explicit context of the 4.2.3 *Situational Awareness Analysis* function relative to the other Command and Control functions while concurrently capturing the essential operational requirement to share situational awareness across all levels of command. Many readers will feel more comfortable with interpreting Attachment B because they have now reached a level of decomposition fidelity that is of greater familiarity. This paper has taken readers through considerable levels of abstraction and we are almost where the “rubber meets the road.” Traditionally, many military projects start roughly about here without the context established *here to fore* and stovepipe solutions resulted with expensive follow on integration work and legacy headaches. It may have been an intellectually challenging journey but transformational leaders can rest assured in the knowledge they have rendered explicit all the inherent complexities of the MCP endeavor associated with the Operations View perspective (recognizing the System and Technology View complexities have yet to be addressed, but the functional context has been rigorously established).

If you were more comfortable with the level of abstraction presented in Attachment B, Attachment C will feel as familiar as your own slippers. The depiction of 4.2.3 *Situational Awareness Analysis* function as a “basic function” in Attachment C indicates this is the lowest level of functional decomposition where the information requirements and information outputs naturally reside and are documented accordingly. Expressed differently, the information subjects whose arrows flow into the basic function represent the essential information subjects necessary to perform this function. The information subjects whose arrows flow away from the basic function represent the information outputs created by the function for utilization by this and other functions.

It is from the substantive context inherent in a basic function from which process design commences. If you were to decompose the 4.2.3 *Situational Awareness Analysis* basic function, one would view the underlying process or workflow diagram that depicts the sequence of individual worker level activities. With this degree of worker/task fidelity, HR specialists can definitively assess competency requirements relative to work to be performed (including job descriptions if warranted). A detailed explanation of process modeling is beyond the scope of this paper, but it is important to note that it is at the process level where the model transitions from the conceptual to the physical domain. Lastly, to ensure the greatest effectiveness of a mission critical value chains (grouping of functions) their underlying processes would be interconnected and/or integrated. For example, if a value change consisted of 9 functions, you would commence the process relative to basic function “1” move through the value chain at a process level and emerge at the end of the value chain at basic function “9”.

Unfortunately it is beyond the scope of this paper to offer any discussion of the System and Technical Views, suffice it to say, the pervasive rigor and logic of the initial Business and Operations View are preserved and cascade into these subordinate views.

Validating the E-model through Scenario Assessment

Despite all the work this paper has implied, we cannot declare victory yet. It is essential not to commence capability migration planning efforts until the NCW reference model is validated. At this point in time, our efforts have allowed for the postulation of a finite set of capabilities and their service flow interdependencies commensurate with our NCW MCP endeavors (NOTE: we have switched from conceptual functions to planned physical capabilities). To confirm the integrity of our derived NCW reference model, it is critical to assess the model’s logic relative to all likely operational scenarios. The

²⁴ The model provides a significantly more effective and intuitive means to convey doctrine than does text.

model's logical integrity is deemed intact when an appropriate capability exists or is "evoked" in a manner sufficient to address the multiple functional requirements expressed throughout the entirety of a given scenario(s). Validation is essentially an exercise to determine if the qualitative and quantitative attributes of any given capability evoked by the scenario is able to respond sufficiently to meet the Commander's operational requirements. While model validation is best left to the operational research experts using their assorted simulation techniques and experimentation methodologies, it is only military Commanders' purview to declare validation, since it is only they who will manage all the assumed risk and the need to determine "how best to do business" with the military capabilities available.

Transformation Targets, Migration & Programmes

The next step is the analysis and design of organizations, technologies and processes specifics relative to the NCW MCP operational requirements. Management's role is to articulate the NCW capability migration strategy that defines the transformation path in terms of goals & milestones, risk thresholds, confirmed functional requirements, resource funding and otherwise remove bureaucratic obstacles, based on capability development priorities and available resources. Operational requirements should be expressed in terms of discrete NCW functions (not in terms of service environment or organization) to ensure compliance with the capability-based management framework. Defining a future network-centric warfare capability state is referred to as capability target architecture, which reflects the next logical, affordable, attainable, supportable capability change increment that is manageable within a designated risk threshold. Transformation to this capability target is achieved incrementally through the initiation and coordinated delivery of projects in the context of an integrated systems engineering transformation program²⁵ (see Figure 6).

Since it has been established that the NCW MCP is a finite systems problem, the discernment regarding the type and sequencing of discrete capability projects relative to the overall migration strategy's goals and milestones is clearly systems engineering problem domain. The purpose of any given transformation project is to improve the efficiency and/or effectiveness of a capability or set of capabilities. For example, if the current air power projection capability is characterized by multiple fleets of different fighter aircraft, the initial transformation target may be in pursuit of increased efficiency due to the high cost to maintain operational airframes, assuming a projected near term nominal adversarial like threat.

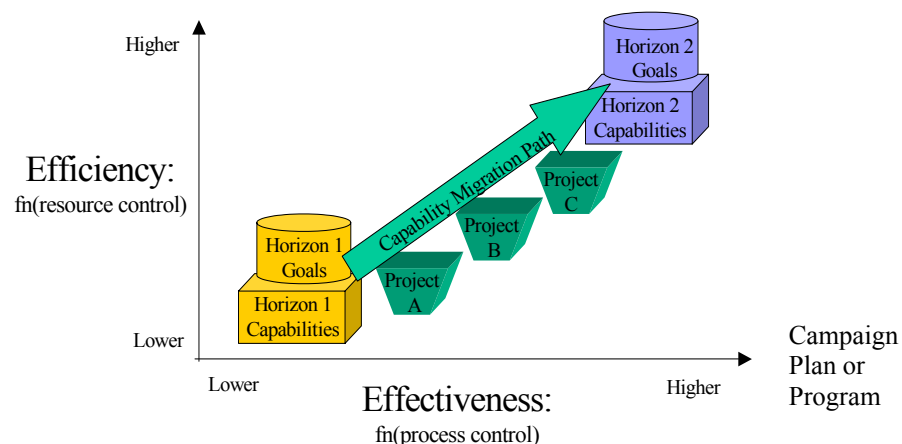


Figure 6 – Capability Transformation in Management Terms

Ongoing NCW transformation decisions must always come back to the capability-based management equation. For example, let's examine our air power projection capability scenario 10 years further into the future. In the absence of a capability disciplined management environment, typically there would be a

²⁵ "Management" types typically run the transformation program because this is where all the money comes to reside. Unfortunately, the lack of pervasive systems engineering rigor at this program level often results in poor, if not wrong program planning and resource apportionment decisions due to insufficient systems engineering analysis, relative to the complexity of the program implementation problem.

growing chorus of “it is our turn to get our new fighter jets” as the organizational-based management framework status quo has inevitably, protectively and sometimes irrationally become mesmerized with the capability candy in the front window. Adoption of a capability-based management paradigm and the explicit validation of the NCW MCP enables, if not demands, that the discernment of the next transformation target be derived from balancing the finite NCW systems problem domain. Balancing the NCW capability equation is impossible until transformation stakeholders have rendered it explicit; until then it remains a black art (for some... the blacker, the better). Because in the light of reality, transformation leaders need the pre-defined clarity of the NCW capability-based equation (and its constituent components) to ensure they have sufficient understanding to make informed NCW MCP decisions as they balance the move to new NCW capability targets while maintaining and operating current NCW capability systems, the sum of which is our NCW MCP at any given point in time.

Conclusion

VAdm Arthur Cebrowski and John Garstka’s transformation challenge of, “All elements of the network-centric warfare model must move forward if the promise of the revolution is to be realized... A [transformation] process for the co-evolution of technology, organization and doctrine is required” is a tall, but essential order to fill. Historically though, too often too many of our best intentions were inadvertently fixated with the lofty NCW heavens of the “what could be,” while stumbling over the complexities of reality. While the conceptual functions of military operations may be enduring in nature, our NCW capabilities physically exist today... good or bad; and we will continue expending enormous resources building new NCW capabilities... good or bad?

Our NCW MCP must be managed and transformed within the confines of time and resources. The purpose of this paper has been to suggest how to overcome the NCW transformation challenge, while gazing at the lofty NCW heavens of the “what could be,” but yet still having our feet firmly planted in our capability-based, explicitly rendered reality.

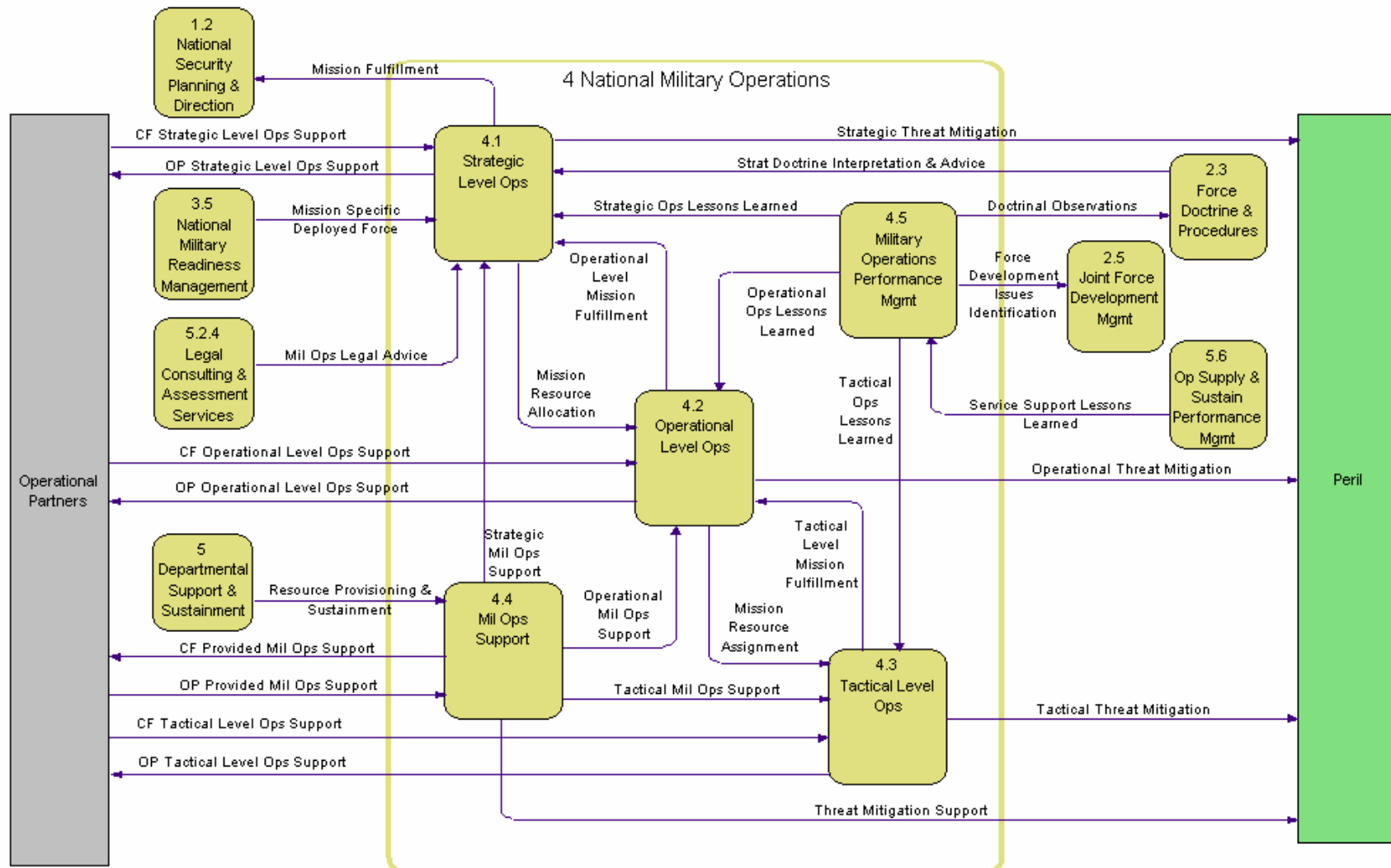
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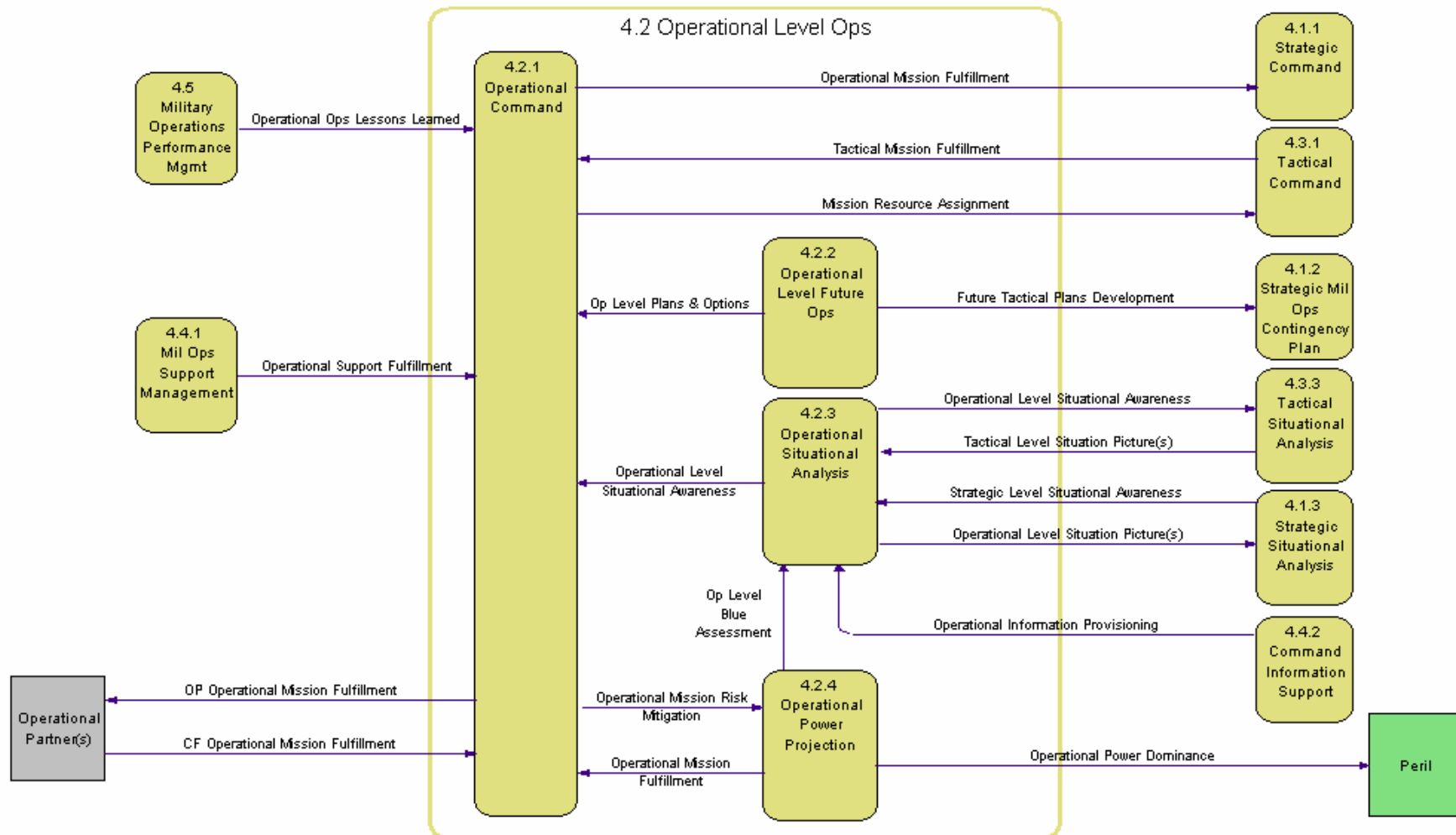
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Attachment A



Attachment B



Attachment C

