PROGRAMATICS SYNCHRONIZING engagement to COORDINATE ROGRAMATICS SYNERGIZING effort to effectively COLLABORATE NTEGRATION





Before you is a collection of works that ascribe a multitude of programs that integrate capabilities which operationalize available opportunities to serve organizational objectives. It is an effort to illustrate how to leverage current capabilities in a way the serves to fulfill the goals that actualize their current vision. My hope that the adage "the pen is mightier than the sword" is true in both thought, word, and deed.

I have selected these papers from amongst over a hundred that I have written to address three simple questions that I am continually asked by senior leaders of government, industry, and academia . . .

Why do most organizations fail? How do we transform our organization? What must be done to empower the culture?

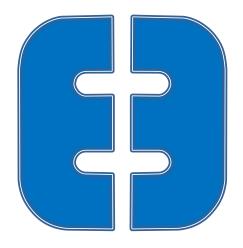
They are designed as reference to encourage an innovative approach to empower the application of creativity and ingenuity resident in each and everyone one of us. If they prime the pump for contemplation and stir in you the desire to *Think . . . Try . . . Test*, the hypothesis and suppositions before you and embark on a journey of exploration, then my objectives have been fulfilled.

I do not presuppose to have the answers for I am one that lives in the question. Mine is not a position to direct or infer, but to engage others in an effort to inspire courageous action. In the end, my goals and aspirations are to facilitate others to seize the opportunities that abound and share it amongst the community in an effort to serve **T.H.E.M**.

Mustang

Teach Help Empower Mentor







POTENTIAL OF INNOVATION

FOREWARD

CREATIVE - TALENT

Strategic Read Map to Innovation
The Future has Arrived
Cognitive Computer Conceptualized
Taking the Fiction out of Science Fiction
innovate / integrate / implement
IDEATION

COGNITIVE - THINK

COGNITIVE THINK
The Answer is the Right Question
Cognition in the Age of Knowledge
Artificial intelligence / Machine Learning
Analytics for a Purpose
The Value Proposition of Data
Knowledge surpass understanding
CONCEPTUAL - TRY

Failure the key to Success VAMRealties

VAMRealties:
AlMLearning
Operation Cognitive Computers
Unleash the Power of Information
COALESCE - TEST
Decision Support Tool - DST
Operation Lab Rat (BBINM)
Operation Chess Match
Data Operations Development
(Platform/Production/Pipeline)

PRESENTATIONS Innovation Modernization Artificial intelligence & Machine Learning ABOUT THE AUTHOR

Background Innovative Programs Publications



PROGRAMATICS OF NTEGRATION EMPOWER

PROGRAMATICS OF INTEGRATION CONTEXTUAL Synchronization Netcentric

Data Operations Development (DOD)

CYBER-OPS

Cyber Strategy A Future in the Clouds Clouds Considerations

COGNITIVE

Intellectual Diversity
Conscious Cognitive Computers
The Value Proposition of DATA a Strategic Asset
Data Driven Organization (ZDO)

CAPABILITIES

Dynamic Characterization Network Network As A Sevice (NAAS) Future of Technological Leadership Leaders of Technology (The LOT of THEM)

PROGRAMS Modeling Assess Visualize Eng Research Int Ctr Capabilities: Adv Brd / Innovation Team Capabilities Gaps Assessment (CGA) Modernization Services Capabilities (MSC)

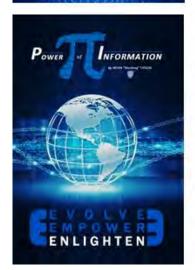
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Leaders of Technology – The LO.T. of T.H.E.M.
Operation Shape Shifter
Security Encapsulated Application Data Enclave
PRESENTATIONS

PRESENTAL Programtics of information Operationalizing Cyber Leadership

ABOUT THE AUTHOR

Past Programs Past Programs





POWER OF INFORMATION

FOREWARD

WISDOM

Evolving Knowledge into Understanding Unknown Knowns Unknowables

UNDERSTAND Tech Catalyst to Perpetual Understanding Capabilities to Operationalize Data and Info Into Contextual Understanding

KNOWLEDGE

Age of Knowledge Characterize Network Knowledge Operations INFORMATION

Operationalizing the Power of Information Chief Information Officer Unleashing the Power of Information Leveraging the Power of Information Chief Information Officer (CIO)

DATA

Data Driven Organization (2DO) Data: Strategic Msn Asset D SAMS/Maturation Chief Data Officer (CDD) Executive Guide to Data

PRESENTATIONS Leadership

ABOUT THE AUTHOR

Biography Past Programs







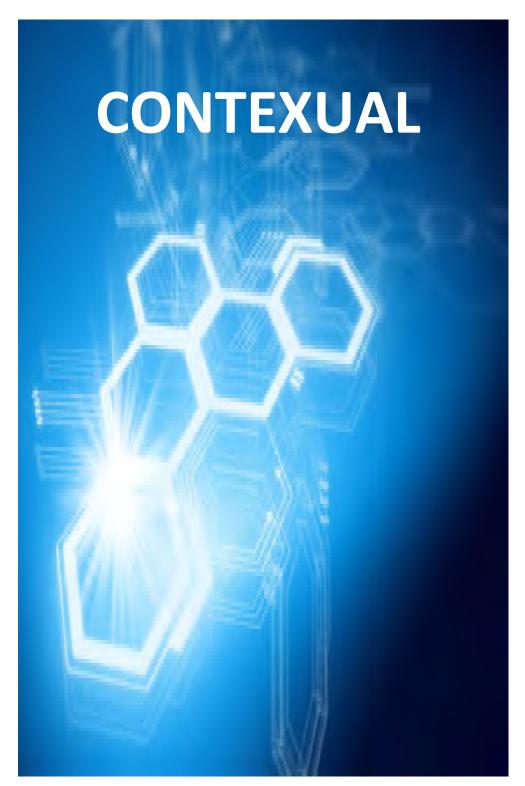
PROGRAMATICS OF INTEGRATION

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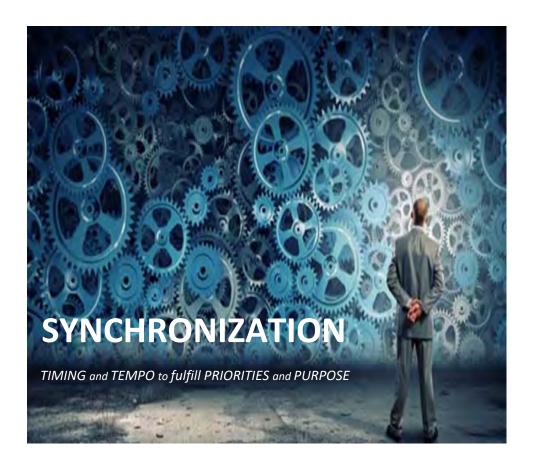


TAB 2



SYNCHRONIZATION





Considering today's quickly changing environment, leadership has never been more crucial to the success of an organization's ability to remain competitive on the highly competitive world stage. Similar to the strategic perspective one gains playing chess, or the operational insights attained by having become invested in the diverse business experiences that define our interconnected economic environment, leaders today must prioritize their efforts if they hope to achieve the goals and objectives considered critical to the ongoing success of their respective organizations. By extension, the ability to utilize resources to synchronize operations in this changing environment has become extraordinarily challenging. Considering the transformative nature of today's interlinked world economy, it is imperative to effectively synchronize operations to capitalize upon the adaptive nature of this dynamic environment.



The challenges associated with applying the diplomatic, information, military, and economic (DIME) measures necessary to address this increasingly volatile, uncertain, complex, and ambiguous (VUCA) environment pale compared to the enormous task of wielding and managing the burgeoning mass and unprecedented complexities that are the hallmarks of today's information environment. Coordinating efforts has never been more important, or more difficult. The technological challenges associated with modern engagements demand the criticality of synchronizing activities within organizational teams is analogous to applying the right capabilities in the right amounts to adapt to this supremely aggressive, yet interdependent environment.

When striving to achieve the degree of synergistic coordination to ensure a strategic advantage, the importance of good leadership is often overlooked. For instance, when seeking to establish the priorities that help teams maintain their focus on organizational objectives, today's leaders frequently overlook the need to outline the purpose of that effort, as well as its intended outcome. This shortfall in effective communications leads directly to lapses in establishing collaborative relationships essential to coordinating archetypical *team of team's* endeavors. Much like a conductor responsible for coordinating the many instruments and musicians that comprise an orchestra, today's transformational leaders must be flexible in their approach and be adaptive in their execution in order to overcome risk but remain aware of and receptive to opportunities typically overlooked by their competitors.

The enduring need to coordinate activities is synonymous with the kind of solid leadership needed to ensure victory on the battlefield. Realizing and utilizing the team's full potential requires every team member to understand fully and appreciate the criticality of their respective roles and responsibilities. In this case team members must fully understand and appreciate the larger purpose to be served by their contributions. Therefore, it is incumbent upon organizational leaders to ensure that their vision is universally understood by every member of the team, and that the team's roles and responsibilities lead directly to a unifying endeavor that fulfills the organizational goals and overarching objectives.



The aforementioned factors require leaders to utilize a cohesive approach to ensure focus on the organizations overarching vision to assure they fulfill their intent. This provides the necessary framework for managers to ensure processes are efficient, and for supervisors to ensure compliance. Each factor must be focused upon deriving those objectives that ultimately produce the *ends* (vision), provide a framework to achieve operational ways (processes), and the *means* that define the required activities (actions) to be effective. When properly communicated and coordinated, these actions facilitate those goals that provide synergistic team-focused outcomes and assure a highly functioning organization that derive competitive advantage on the world stage.



Ultimately, a clearly defined easily to understand strategic intent must be presented to managers and leaders via a framework that illustrates relational interdependencies. This affords every manager the opportunity to garner a comprehensive understanding of the objectives involved and every supervisor the guidance necessary to fully appreciate the requirements that must be fulfilled to achieve mission success. Once implemented, this overall approach offers the organization an opportunity to work collaboratively in a top-down approach with a bottom-up feedback loop. The illustration below indicates the three key factors present at each level—good communication, effective coordination, and collaboration—that are prerequisites for high performing team.



Today's rapidly changing environment makes it easy to become obsessed with instantaneous feedback via tweets, customer assessments, and various social media outlets. Yet, that instant gratification can also emerge as the distraction that prompts an organization to lose focus on what it should achieve and how those achievements should be accomplished. That loss of purpose introduces ineffectiveness and inefficiency into the organization, conditions that mean key players become disenchanted and at odds with each other. Under such conditions, the tendency toward living in the moment arises, which detracts from the leadership's ability to fulfill the organizational purpose.

Managers must establish the objectives that fulfill the goals set forth by their leadership. Supervisors must then identify clear requirements that informs the team of what actions must be accomplished to achieve these objectives. The results will be teams who clearly understand the expectations of what must be accomplished and how to contribute in a meaningfully way to achieve the intended outcome(s). This approach ensures a well-coordinated and collaborative engagement that drives momentum through a synchronized effort.

Organizational leaders must inspire and encourage their team by Teaching, Helping, Empowering, and Mentoring (THEM) to actualize their potential. As Simon Sinek described in "Start With Why," the concept of the golden circle (see below) offers a framework focused on the purpose and goals of the organization's mission imperatives. Sinek encourages leaders to adopt a coaching style to courageous seek solutions and seize opportunities that help organizations achieve their goals—in part by establishing well-defined operational priorities.

This foundational structure is critical to grow and progress. Without it, the organizational becomes complaisant and loses their way. This is evident in the mist of dysfunctional leaders who thrusts the organization toward adopting a more reactive mind-set, which weakens an organization's ability to meet its goals. To prevent that eventuality, it is essential that all leaders understand their roles and that they be held accountable to the organization for any shortfalls.



There are many examples of the detrimental effects associated with desynchronized organizations. For instance, leaders may step directly into processes (e.g., micromanagement), adopt a prescriptive attitude regardless of established requirements (become disruptive), or fail to have a clear understanding of their responsibilities (lose their strategic perspective). Such dysfunctional leadership thrusts the organization toward adopting a more reactive mind-set, which indeed weakens an organization's ability to meet its goals.

Ultimately, it is the leader's responsibility to encourage the organization to evolve through an inspirational vision that challenges that status quo. They must synchronize them in a way the fuels the momentum essential for the collective fulfillment of organizational objectives. By adopting the philosophy of an orchestra conductor, they recognize their role in synchronizing the constituent parts of the organization to work collaborative in perfect harmony to produce results (beautiful music).

Leadership is the key to an organization's ability to cultivate a caring and nurturing culture that promotes collaboration. This role is vital to an organizations ability to prosper in today's highly adaptive environment. Leaders must recognize their role is to support those in their care and are charged with the responsibility to teach, help, empower, and mentor (THEM) in service to the obtainment of organizational goals and objectives. To address, the following offers an intriguing, yet effective solution that speaks to the criticality of need for organizations to have leaders with "The Right Stuff."





LEADERSHIP



<u>PURPOSE</u>: If you find yourself riddled with doubt as you head into the next leadership position, then consider abandoning the opportunity altogether, before that self-fulfilling prophecy becomes reality. Demonstrating leadership is certainly not for the faint of heart, as it

demands full commitment to, and an abiding belief in what you are striving to accomplish. Since the organization expects you to provide inspiration and strength, you simply cannot afford exhibiting anything less than rock-solid stability. Your conviction must be unwavering and your determination unshakable. If you fail to believe in yourself, your hesitancy will become apparent, and those around you will not believe the example you strive to set forth for them to emulate.

VISION (leaders-synchronize): You must understand and be able to clarify the organization's vision, so everyone knows what is expected of them and how they can help the organization make that vision a reality. While you don't need to have all the answers or even be responsible for directing all of the action, you are indeed responsible for cultivating and capitalizing on the talent that can ultimately help the organization fulfill its stated objectives. By empowering and synchronizing activities to achieve the kind of synergy that defines team-focused, collaborative engagement, you will inspire everyone who works with you and for you. In short, your role is to encourage, acknowledge, and appreciate the contributions being made by those in your care. Performed correctly, your actions will instill a sense of purpose among those you lead, thus helping them focus levels of motivation they once considered impossible.

OBJECTIVE(*mgrs.-efficient*): Efforts should always be made to mitigate threats, sustain operations, and maximize effectiveness through efficient processes that produce profitable results. At the same time, however, you must hold a tight focus on building the organization and leaving it in better condition than it was in when you arrived. As you **teach** your team to work



smarter and not harder, **help** the members make meaningful contributions, **empower** them to take bold steps, and **mentor** T.H.E.M. to grow and evolve, you will be demonstrating effective leadership. Moreover, as your effectiveness continues to improve, you should neither be working to increase the team's reliance upon you nor expanding your role within the organization. Instead, you should be working to make yourself *unnecessary*. After all, only confident, self-sufficient organizations have the wherewithal to achieve increasing levels of success.

REQUIREMENT(supervisors-effective): Since a strong organization cannot be built on a weak foundation, you must inculcate a firm understanding of core values within the team. This includes establishing a vision for and determining a vector—and velocity—for the organization. When everyone embraces this vital notion, each team member will know who they are (values), why they exist (vision), where they are going (vector), and when all possible momentum must be applied to fulfill organizational goals and objectives (velocity). As you commence the process of organizing your team, begin by identifying what capabilities and capacities are needed to accomplish the organization's objectives effectively. Next, explore how you can organize and prioritize resources (such as people and equipment) to ensure efficient operations. Finally, understand when these factors need to be synchronized to ensure the team's ability to excel every, single time.

FUNCTION: The chart below illustrates how competent leaders focus on what must be done to be effective, how such tasks can be accomplished efficiently, and which actions are paramount to fulfilling the organization's goals. Understanding the varied roles of supervisors, managers, and leaders will help ensure that every team member knows their role and is empowered to carry out their responsibilities.

For instance, if the boss directs that a letter be sent to a recipient located on the opposite coast of the country, we understand that its **capacity** is small (*letter size rather than a box or pallet*) and that the **capability**



involved requires us to send that letter from our location to another. Further, when the boss states that our ability to achieve organizational objectives depends on that letter arriving by tomorrow, we synchronize the **timing** of our activities to ensure the letter is sent overnight (*though we must leverage available resources to achieve that outcome*). Luckily, commercial organizations provide this service for about \$25, and if we are asked to justify that fee compared to the cost of a first-class postage stamp, we do so by citing that the typical 2–3 day delivery window would fail to meet the boss's imperative for next-day delivery. The relationship between the three circles addresses resource management versus priority, which drives the various degrees of capacity and capability (*mass and maneuver*).

This framework, supplemented by the working example noted above, helps illustrate the roles and processes that are among the fundamental components of a high performing organization. As the leader, believe in your team and have faith in its abilities. Challenge each team member to be **creatively** think big thoughts. Be **courageous** by having a bias for trying, starting small and encouraging **collaboration** to scale up their efforts quickly. Finally, build an innovative team that can learn and evolve together.

To situate these principles effectively, we will place them in the context of a dynamic battlefield environment, where leaders and their teams face the consequences of the life and death decisions they make. As they apply resources, leaders and their teams obtain immediate feedback about the effectiveness of the actions they take versus the results they want to achieve. More to the point, the effectiveness of their actions must be absolute and the results permanent. Thus, opting for **effective** rather than **efficient** actions is critical to achieving the mission objectives that are intended to win the war. Today, however, we are easily distracted by our resource-constrained environment, which compels individual leaders to win battles at the expense of winning the war (which prompts penny wise, pound foolish decisions).



It is imperative to begin with the end in mind. Accordingly, leaders must demonstrate their ability to adopt a holistic perspective, which entails taking actions with regard to their intended outcome. This is illustrated in our operational wartime scenario in which the proper application of resources (in this case soldiers) will fulfill the requirements (battles) that achieve the objectives (commander's intent) associated with satisfying



vital national interests (goals and vision). For those unfamiliar with the nature of war, it is essentially a strategic engagement (commander's intent) achieved by the sufficient application of capabilities (war plans) geared to achieving the requirements (battle orders) that fulfill the objectives (mission imperatives) intended to secure victory (strategic goals that fulfill vital national interests).

In such a demanding and dynamic environment, it is indeed advisable to remain focused on the goals and objectives of the mission rather than its requirements alone. To do so, systems can be implemented that measure the value of each contribution and its effects on the probability of victory. The three circles represent vital contributions to the likelihood for success:



- **Tactical EFFECTS** (mass and maneuver): Delivering the right capability in sufficient capacity to meet mission requirements
- **Operational EFFICIENCY** (resource logistics): Providing the operational efficiency needed to sustain mission objectives
- **Strategic ENGAGEMENT** (timing and tempo): Prioritizing and synchronizing efforts to capitalize on collaborative synergies throughout all phases to achieve mission goals

Leaders must consistently outpace their adversaries to gain strategic advantage in their ongoing efforts to achieve victory on the battlefield. In military vernacular, this situation is expressed as **ends** (*strategic intent*), **ways** (*mission imperatives*), and **means** (*orders*). To achieve success, leaders must have a capable understanding of their enemy, the environment (*battlefield/Capabilities Capacity Circle*), and their available capabilities/capacity (*troops, equipment, training/Resource Circle*). In this endeavor, leaders rely on planners and managers to develop the processes that ensure mission success. They identify the best ways to apply capabilities in sufficient capacity to gain strategic advantage and achieve the commander's purpose or intent (*goals/objectives*).

To achieve success, they adhere to the sage advice of Sun Tzu:

"If you know the enemy and know yourself, you need not fear the result of a hundred battles.

If you know yourself but not the enemy,
for every victory gained
you will also suffer a defeat.

If you know neither the enemy nor yourself,
you will succumb in every battle."



Given the transformative nature of today's VUCA environment, the increasing complexity and growing demands require an organization to gain and maintain their competitive advantage. This requires that leaders are flexible, innovative, and able to adapt instantaneously to overcome these growing and evolving threats. For instance, General MacArthur likened war to football:

"On the fields of friendly strife are sown the seeds that on other days, on other fields will bear the fruits of victory."

To gain competitive advantage, coaches must assess the opposition's capabilities before they can employ the skills of their players effectively. In doing so, those coaches develop plans that enable their teams to overcome shortcomings (i.e., poor equipment, bad weather, etc.) and seize opportunities when they become apparent (e.g., a fumble or error). Unlike sports, however, the unforgiving nature of today's battlefield does not allow leaders to take time outs to assess, characterize, and evolve in this dynamic and ever evolving environment. Thus, leaders must be able to shift quickly from offense to defense—and vice versa—and retain the capability to influence the outcome of the battle.

The strategic application of offensive and defensive capabilities, sequenced properly and in sufficient capacity, will ensure fulfillment of the objectives considered essential to victory. Moreover, understanding the role of each player enhances our ability to apply resources against the adversary's deficiencies, thereby gaining strategic advantage. After all, each player is critical to mission success. If any are hurt, alternatives should still exist—after all, even the best quarterback must have a backup. Ultimately, given the dynamic nature of warfare, the leader's awareness of risk and ability to seize fleeting opportunities will mean the difference between victory and defeat.



Thus, leaders must act courageously and remain confident in their abilities and those inherent within their teams, to execute their assigned missions. Further, the leaders best able to adapt and evolve on the battlefield will also be those most capable of achieving success and gaining strategic advantage. Therefore, it is critical that such leaders synchronize the myriad resources that will help them focus overwhelming force against the enemy. Only through such actions will they accomplish those objectives associated with coordinating the activities that inspire courageous actions within their highly cohesive teams. In a *VUCA* environment, of course, the plan must be flexible enough to adapt to and/or overcome threats while recognizing and seizing unique opportunities.

Proper timing is essential when leaders work to synchronize the activities, roles, and responsibilities of each position. Consider the advice of Sun Tzu:

"Water shapes its course according to the nature of the ground over which it flows;

the soldier works out his victory in relation to the foe whom he is facing."

Aware that no battle survives first contact, leaders must rely on the adaptive nature of the environment and the unpredictable reactions of their troops (and those exhibited by the enemy) by synchronizing the activities that allow them to adapt to overcome new and unforeseeable events. Through timely injects and a firmly established feedback loop, leaders can enhance their situational awareness to the point of being able to identify opportunities that may help facilitate mission success. By maintaining a consistent focus on purpose and intent, leaders can ensure that the actions they take will push them closer to achieving the results they desire. However, this means more than merely achieving the requirements outlined in the Operational Order (OPORD). After all, as the environment changes the objectives, the goals specified in our vital national interests will necessarily change as well. Therefore, an adaptive process that facilitates evolving within that environment will contribute



greatly to winning the war. With respect to the modern axiom of exploring the art of the possible within the science of the probable, Clausewitz provided relevant insight in his writings "On War".

If the mind is to emerge unscathed from this relentless struggle with the unforeseen, two qualities are indispensable:

1: An intellect that, even in the darkest hour, retains some glimmering of the inner light which leads to truth;

2: The courage to follow this faint light wherever it may lead

Carl Von Clausewitz

SYNCHRONIZING THE FORCE

In a complex, wartime environment, the logistical sustainment of essential capabilities ensures that the right tool is available at the right time and place. In general, however, the most important U.S. capability is the determination and perseverance of our soldiers. These soldiers, which we should respect collectively as a national treasure, defend our freedom at great personal sacrifice. Thus, we should also do everything in our power to protect them. To that end, the Army is beginning to field uniformembedded sensors that provide real time monitoring of soldiers' vital signs and report their well-being in combat. The feedback obtained via sensorequipped uniforms keeps leaders informed of the stresses that affect soldiers during combat operations, such as the overall health of their force, the amounts of energy they are expending, whether they are losing momentum, or if soldiers are tiring or have been wounded. The scope of this information enables leaders an awareness of the reserve capacity, endurance, and level of strength that can still be expended during an ongoing operation, all of which also informs those leaders of both strategic risk and the propensity for success.



The intent behind such sensor-equipped uniforms is rapid identification of injured soldiers. In order to take the greatest advantage of every minute within the "golden hour," the key time available in which traumatic injuries can be treated successfully at properly equipped aid stations, requires an immediate notification of the casualty and the extent of their injury. This elevated awareness gives leaders the ability to determine the degrees of lethality and momentum needed to achieve mission success in such VUCA environments. That heightened awareness, as depicted in the third circle of timing (mentioned earlier), enables leaders to synchronize their engagements and manage their operational tempo. Through this proactive approach to influencing the environment, our leaders can effectively support, enhance, and execute (SEE) the battle in order to win the war.

- When (timing/tempo) to apply—
 Strategic C2—Causality/Consequence
- Where must it be applied—
 Operational C2—Coord/Collaborate
- What must be applied—

Tactical C2—Capabilities/Capacity

Relative to a combat medic's ability to save lives, the timely provision of effective treatment after an injury represents one of our greatest advantages. When such care is provided within the golden hour (mentioned above), the chances for a soldier's survival and recovery increase exponentially. By extension, effective triage has a significant, positive effect, both on the effects of the wound and on the psyche of our soldiers. With that outcome in mind, taking a more proactive approach to coordinating and synchronizing sustainment and survival efforts, facilitated by the development and fielding of sensor-embedded uniforms, will ultimately represent a significant combat multiplier for our forces at all stages of operational engagement.



Although Clausewitz advises that strategy is intrinsically simple, he also conveys that it is not easy. The capabilities offer the means to manage the complexities and dynamic nature of war. Thus, we must shift the concept of battlefield medical care from its historical focus on treating wounded soldiers to one that is more proactive and intended to preserve (or even increase) overall combat capability. In the past, efforts to prioritize care for wounded soldiers (triage) ensured that, often, casualties would return home alive. Soon enough, however, enemy combatants grasped the intrinsic value of medics and began targeting them. After all, each medic killed meant that untold numbers of soldiers would not get the care they needed to fight another day. The implications of these efforts have yet to be fully appreciated. To understand the intricacies of battle and its dynamic nature, its momentum must be managed effectively:

- Gain trust of the troops & boost their confidence: past actions represent a FOR that establishes paradigms
- Encourage courageous actions to eliminate fear among the troops: the present perspective illustrates current actions and notes that courage helps maximize potential
- Move past limitations and develop the ability to adapt to, or overcome circumstances: future actions are congruent to their range of abilities, its hope for success, and its propensity for victory

As these endeavors are synchronized to ensure the right application of forces at the right time and place to maximize accomplishing mission objectives and the potential for victory by synchronizing operations. Predictably, the introduction of an autonomously monitored system that reports the personnel status of the force means medical support organizations will learn quickly when soldiers have been wounded, be able to assess the severity of the wounds, and inform the operational commander of their impact on the ability of the force to pursue the battle. In addition, medical personnel will have the ability to determine from a distance the scope and priority of the care they must provide and synchronize their efforts with those of battlefield medics.



Overall, not only will this will mean that sufficient numbers of soldiers are available to prosecute the battle, but also that the survival rates of wounded soldiers can increase. However, since this capability prompts questions about the parameters of such triage care (with an eye toward preserving Mission objectives), measures must be taken to influence mission effectiveness:



Synchronize Priorities:

- **STRATEGIC:** C2-Causality/Consequence: Potential impact of injured to Mission
- **OPERATIONAL:** C2—Coord/Collaboration *Probability to save a life*
- TACTICAL: C2—Capability/Capacity:
 Propensity of saving a life at expense of many

Through organizing information and correlating it to the objectives at hand, the strategic leader becomes empowered with the means to assimilate essential and relevant information and properly apply it to current situations and resulting circumstances. During the assessment stage, it is therefore essential that a user's definable operational picture (*UDOP*) be developed to ensure decision makers are not inundated with unrelated information. The results of these endeavors will act as a catalyst



to provide commonality of Situational Awareness (SA) to facilitate collaborative actions. The lack of a Common Operational Picture (COP) creates challenges to the ability to vertically and horizontally depict the battlefield. Therefore, by establishing a COP, SA is elevated through the collaborative endeavors that synchronize actions within a netcentric environment. A common operational picture facilitates collaborative planning and assists all echelons to achieve SA. Therefore, it is through this COP that synergistic endeavors become aligned to produce clarity of focus to enable unity of purpose.

A cost-benefit analyses must be conducted to ensure the most important issues are addressed first and that scarce resources are prioritized and applied precisely to meet the problems that pose the greatest potential threat. Full consideration must be given to opportune cost and potential benefits associated with action taken and results achieved. Implications of enlightenment build knowledge which establishes understanding necessary for transformation essential for success. Therefore, by elevating awareness and maximizing the value gained by reviewing our lessons learned through a broad Frame of Reference (FOR), understanding to be developed and matured to overcome the complexities of the VUCA environment.

To ensure that decisions can be made in full awareness of the causality of the associated second and third order of effects, predictive analysis modeling offers the potential to assess options and establish the best course of action. Thus, by coordinating, synchronizing, modeling and managing information through technological tools, an organization can efficiently correlate resource allocation in order to empower leaders to effectively fulfill their objectives. Therefore, technological capabilities must be developed that facilitate capturing, correlating, fusing and disseminating current and historical information. Once the means to continually update a shared *FOR* and validate current *SA* is achieved, actionable knowledge can be fused to produce the propensity for enlightened understanding which is necessary to shape the environment to the desired end state.



The need to apply an adaptive approach during the planning process will imbue strategic leaders with the necessary flexibility to develop branch and sequel plans essential to effectively confront a dynamic changing world environment. Adopting the mind-set that prior planning prevents poor performance; the need for accurate, timely and reliable information becomes critical to achieving the level of awareness essential for producing informed plans. Thus, those processes set forth within operational planning provides the mechanism necessary to elevate information through the cognitive process, which enables planners to devise approaches that are steeped in strategic forethought.

To assess the effectiveness of ongoing operations, measures must be taken to determine the value of each action and its respective contribution to the current mission. Doing so will ensure soldiers in combat receive the support necessary to sustain operations, and when necessary receive the medical care they need to ensure mission success. To facilitate the achievement of these objectives, state-of-the-art systems are being developed that provide net-centric integration of the capabilities of our future forces via real time, machine-to-machine interfaces capable of enhancing situational awareness. This enlightened perspective will enable real time assessments that can be used to characterize the battlefield to enlighten, empower, and evolve (E3) the leader's conceptual understanding of the options and opportunities available.

This coordination of air, ground and sea activities by an onsite command center will ensure that a collaborative approach is utilized to gain the greatest degree of synergism via a team-focused effort. The need for contextual understanding is critical to being able to access, characterize, and E3 this VUCA environment, and managing risk, momentum, and opportunities—all in real time. Considering the dynamic nature of warfare, opportunities to adapt and evolve are among the key ingredients to success. As a result, operational centers must have the types of current information that will enable them to observe, orient, decide, and act in response to novel and unpredictable opportunities. Clearly, abilities to adapt to and overcome risk and to take full advantage of opportunities are essential to ensuring effective and efficient actions on the battlefield.



At best, war is a dangerous proposition. Every soldier knows that each mission may mean causalities, yet they realize as well that operations are necessary to carry the momentum forward and achieve the objectives of the mission. More specifically, the need to re-engage a battle disrupts overall momentum, de-synchronizes ongoing efforts, and increases the risk of future casualties. Since such considerations can easily elevate risk to unacceptable levels, the need to remain situationally aware (facilitated by a technological net-centric approach that define today's capabilities) is central to leading our forces to success.

Nevertheless, the notions described throughout prompt a number of tough questions, specifically considering the long-range consequences of actions taken versus their intended results. For instance, are our triage efforts effective enough? Will they provide sufficient, mass casualty care to ensure the operation is successful? What degree of battlefield losses is considered acceptable given the overwhelming need to win the war? After all, operational failure would simply cost more lives, destroy momentum, and give the adversary the means to regroup.

From a strategic perspective, failure should never be reinforced. To that end, a system that links the skills of soldiers on the battlefield with current and future battles will afford better synchronization of medical care. Thus, medical assessments in the following four categories must be given with an eye toward preventing operational disruption:

- **Sustainment** momentum
- Resilience adaptive
- Reliable spare
- **Emotion** *impact*



Through a proactive and synchronized application of forces, leaders are afforded the opportunity to gain strategic advantage by managing the momentum and risk inherent in military operations. These efforts will help produce a useful contextual understanding that enables leaders to seek and seize the unique opportunities that present themselves on the battlefield. This "competitive advantage" will allow those leaders the means to capitalize on their ability to influence the timing and operational tempo of ongoing operations, and thus gain the strategic advantage they need to win our nation's wars by employing the full spectrum of our military capabilities.





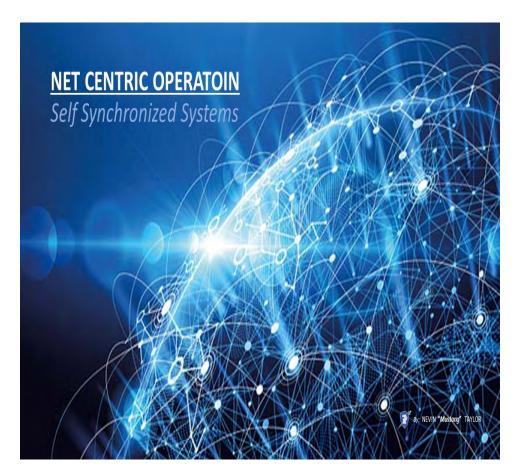
TAB 2



NETCENTRIC OPERATIONS





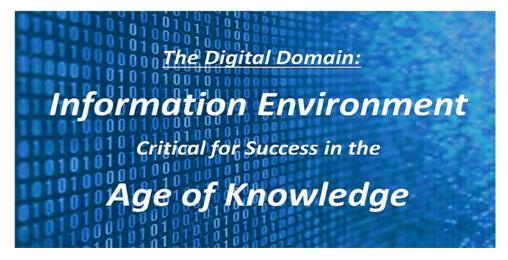


Information is the key ingredient to success in today competitive interlinked world environment. The ability to acquire, fuse and disseminate information is at the core of informed decision. The asymmetric advantage actualized through effectively leveraging and employing information is critical to competitive advantage in today's information environment that has thrust us into the age of knowledge. Therefore, it is essential to gain and maintain information superiority. History is replete with examples of the strategic value of being informed. The ability to make enlightened decisions is predicated upon timely, correlated and accurate information. As the world continues to flatten, reliance upon the information revolution and the evolving knowledge age has never been greater.



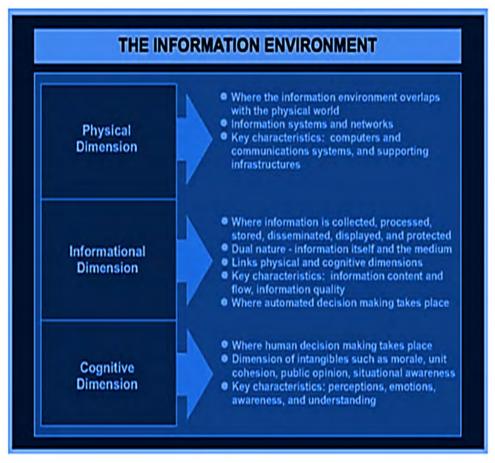
Hindsight paints a clear picture how to best deploy capabilities through effective synthesis of information. The digital domain is the environment upon which the guardians of data collect information. They serve as the catalyst to organize, fuse and disseminate it to influence and effect the operational implications of cognitive decisions. It hosts the wealth of collective information which provides the means to properly leverage and derive a strategic advantage from its capabilities. Thus, the need to gain and maintain information superiority within this environment is critical to obtaining a strategic advantage that supports the organization's objectives which serve to fulfill the goals that assure their viability now and into the future.

Today's organizations have realized the value of information and has incorporated process, tactics, techniques and procedures to leverage it to ensure success of current and future objectives. Information has long been accredited to a significance role in developing strategy. Clausewitz ascribes "If the mind is to emerge unscathed from this relentless struggle with the unforeseen, two qualities are indispensable: first, an intellect that, even in the darkest hour, retains some glimmerings of the inner light which leads to truth; and second the courage to follow this faint light where it may lead." We must be mindful of the lessons from history which inform current endeavors and prepare us for future opportunities.





Today's emphasis upon information has awakened the evolution and transition into the age of knowledge. How to amass, organize, fuse, disseminated and leverage information are at the core of success in today's digital domain. The criticality for timely accurate information is the critical component and the core of effective decisions. Informed decision, substantiated through an in-depth frame of reference made in full awareness of current situation, must be aligned to meet desired ends to militate ever persistent and persistent threats. The pervasive risk in today's digital domain should not distract from the opportunities to derive competitive advantage. We must not let our fear overshadow the potential that exist amongst the clear and presents dangers lurking in the Volatile, Uncertain, Complex and Ambiguous (VUCA) environment.





With the onslaught of technological means to manage this information it is understandable how one can easily be distracted by and put more emphasis on the newest tools as opposed to the end objectives. Utilizing these tools to develop the necessary user definable picture to elevate and become situationally aware is an important part of maturing the knowledge base that evolves understanding. Actionable knowledge is vital if you are to produce options that inform decisive actions attune to the great philosopher Clausewitz, who encourages to ascribe the wisdom known to him as military genius. The impact that information has upon the means to capitalize on opportunities has both direct and indirect consequences. The significance and reliance by leaders in industry has elevated to an operational level the implications of Information Operations (*IO*) and strategic communications and the influence it has on the world stage.

OPERATIONALIZING INFORMATION

Information is defined as the results of organized data. correlated an assimilated it becomes knowledge which understanding. It is this understanding upon which decisions are made. The quality of the decision is directly related to the timeliness and accuracy of the available information. The relational manner that it is presented, and the scope, breadth, depth and historical context is directly related to the value it offers. As information accumulation is compounding in excess of human capacity to assimilate, the historical tools of the past like books are unable to adequately keep pace with the advanced amassing of it. The technological innovations like phones, computers have provided a medium upon which to pass almost instantaneously information. The internet likewise has proven to a contributor to the accumulation of and contributor to the accessibility of information which is feeding the advancement of the information environment as we are quickly entering the age of knowledge.



The free-flowing growth of the internet has provided unprecedented access to all levels of information. Search engines have provided the means for near instantaneous access to the wealth of accumulated knowledge. It identifies the need and importance of asking the right question in order to find the relevant answer amongst an unprecedented vastness of accumulated information formulated into knowledge. The growing demand signal for data has required extensive and ongoing expanse of current systems to support the insatiable appetite for information.



Network growth, cell phone access and utilization have increased exponentially at an alarming rate. The means to manage this grow and provide secure, reliable information is increasingly become more prevalent in order to effectively operate an infrastructure that is available (accessible), reliable (secure and operable) and timely (mitigated latency lag). Reliance upon this information has resulted in the development of Network Control Centers, Operational Coordination Centers, and entire specialty to manage data at rest, secure information in transit, and provide operational capability and capacity of applications to evolve and operationalize knowledge. The expanse of data centers, networks with their integrated redundancy, and vast application's technological tools has created an environment which is interwoven into all aspects of operation that without it, organizations would be mitigated to a state of paralyses fed by the fear of securing and sharing data.



The necessity to manage and operationalize data in a way that transcends the applications of its constituent parts requires a new holistic approach to safeguard, aggregate, process, disseminate, and act on information in real time. The digital domain directly supports and enables decisions makers at all levels to indulge in the exploration, utilization, and integration of information into their daily activities. It is through the application of technological tools available in the information environment that we are able to apply this approach to leverage data in a meaningful way. By heading the sage advice of John Boyd; we can observe, orient, decide, and act upon information, and get almost instantaneous feedback through an iterative loop which illustrates causality and illuminate's consequence of actions taken measured against result to be achieved.

Unlike the traditional boundaries of warfare, in the information arena there is no front line, flanking movements or interior lines to protect or employ offensive and defensive countermeasures upon which to secure and adequately safeguard data. Mayfield paradox astutely points out that "to keep everyone out of an information system requires an infinite amount of money, and to get everyone onto an information system also requires infinite money, while cost between these extremes are relatively low." Thus, we should look to authorizing access as apposing to controlling it to ensure data is operationalized as opposed to merely managed. For without the proper application of data, its value becomes a liability.

As we endeavor to segment efforts to proper manage this diverse and rapidly evolving environment, Information Operations (IO) is described as the integrated employment of electronic warfare (EW), computer network operations (CNO), and operations security (OPSEC), in concert with specified supporting and related capabilities to influence, disrupt, corrupt, or usurp adversarial human and automated decision making while protecting our own. The core competencies of the information environment required to effectively accomplish these missions require unfettered access to information. Through the application of information current threats put at risk and establish vulnerabilities to the ability to rely on information and the criticality of how best to safeguard it.



This was recognized in December of 2005 by the then Secretary Rumsfeld when he ascribed that "the cyberspace domain is complex and evolves at astonishing rates, increasing the challenge of ensuring strategic advantage in this domain." The Secretary then announces, "the National Military Strategy for Cyberspace Operations is an important first step toward ensuring our own freedom of action in this contested domain while denying the same to our adversaries." He provided a 2015 DoD Cyber Strategy that is well worth the read. I would suggest that organizations would be well advised to take a similar course of action and employ an iterative approach to capitalize upon and similarly actualize the capacity of this new domain.

Through this digital domain, information must be protected, leveraged and operationalized as a vital asset for their success through four strategic priorities:

- 1. Create an environment to operating within the competitions decision cycles
- 2. Integrate capabilities across the range of diverse operational imperatives
- 3. Build capacity in both reliability and resilience to assure the viability of the system
- 4. Manage risk measured against opportune and actual cost benefit analysis

The digital domain is an environment in which information superiority predicates reliable, timely and effective access to data. The criticality to coordinate and collaborate in today's interlinked world require instantaneous acquisition, analysis, and adaptation of reliable, timely and trustworthy information. For information to be effectively leveraged the ability to actualize operational capabilities that is scalable to mission essential capacity is essential to derive asymmetric strategic advantage on the world stage.

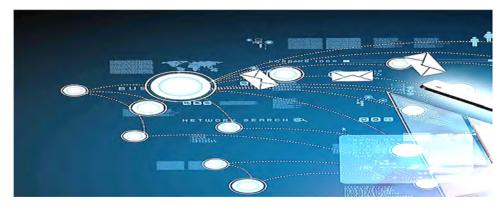




STRATEGIC COMPETATIVE ADVANTAGE

In a globalized and economically linked world in which scarce resources are rewards to be fought for, information elevates awareness and helps identify the challenges posed by these increasingly constrained resources. Thus, we must have an awareness of where such resources can be found, how they can be leveraged, and when to act since that knowledge is essential for success in today's global environment. It is through this information medium that the message communicated by these groups elevates awareness and informs their actions.

Organizations must strive to understand the implications associated with this dynamic medium since the information revolution shapes and even alters the nature of conflict across the spectrum. They therefore utilize available resources across the spectrum of the digital domain to assure the ability to coordinate/collaborate/communicate. This underscores the need to consider the confluence of a myriad of requirements and faltering resources which mandates a focused and unified enterprise effort. Given the complexities that are associated with our global environment, effective planning to mitigate the threats posed in this Volatile, Uncertain, Complex and Ambiguous (VUCA) environment are essential.





To derive competitive advantage, organizations must effectively harvest information to produce strategic plans that identify options and opportunities to evolve their business, manage risk, and identify threats. Effective planning driven by strategic and heightened awareness of those actions necessary to fulfill current and future requirements will facilitate an adaptive plan predicated upon an ability to remain flexible and nimble in this VUCA environment. The implications are great given the cascading impact of supply and demand signals in a competitive environment that evolves at lightning speed. Thus, an informed decision maker in full consideration of the art of the possible evaluates the realm of a diverse means to maximize opportunities while minimizing and innovative unintended consequences. With increased emphasis on operational and strategic advantage by understanding how the transformative nature of this environment develops a shared awareness, adaptive planning and the ability to incorporate lines of operation and identify critical decision points upon which the concept of operations depends are paramount.

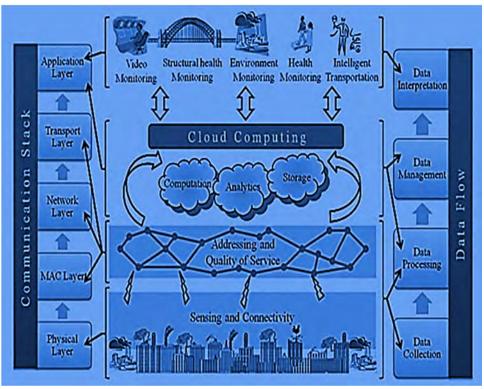
At the operational level, the state of being net-centric leverages information, operationalizes knowledge, and provides the catalyst to integrate emerging tactics, techniques, and procedures to achieve effective, efficient, agile, and adaptive competitive advantage. Such netcentric operations can be leveraged to increase the speed of C3 to improve precision, elevate awareness, and achieve an interconnected self-synchronizing environment. Seamlessly integrating organizations into a data driven environment affords the ability to implement and adapt a myriad of diverse solutions simultaneously. Given the dynamic nature and the inherent vulnerabilities and the associated implications and impact of actions upon the system reaffirms that the influence and resulting effect that the environment has on the organization.

The prescript opportunity afforded from historical examples, provides the opportunity to model current problems within the confines of a closed system. The resulting analysis reveals forecasted deterministic reaction given understood conditions resulting in relationships of corresponding



events that must be understood in order to establish forethought and identify predicators given a fully fused correlation of past action aligned to current threats. This prescribes an opportunity of self-evident decisions-based enlightenment given available options and unrecognized opportunities in this pervasive environment.

Given today's environment is impacted exponentially by an open system that is dynamic and ever-changing, the necessity for current and accurate information correlated to current circumstances reveals opportunities to explore the second and third order of consequences from actions taken to results achieved. It is an understanding of actions relative to the environment which elevates awareness to prepare pre-emptive activities to events while and even before they unfold. For only through knowing what you are looking at, organized by a user definable picture (UDOP), the implications and effects of the resulting outcome can and should be operationalized to derive an asymmetric advantage.





INFORMATION SUPERIORITY

Given that information is power and the ways and means to leverage that power are tied directly to an organization's future viability, it is understandable that their information systems are constantly under attack. The necessity to gain and maintain information superiority is equal to the necessity of gaining and maintain physical security of assets, facilities, intellectual and monetary capital. Because awareness opens our eyes to the mistakes of the past, it will also prevent us from retreating to familiar ways that become predictable and prone to attack. Clearly, heightened awareness is a prudent course of action to collaborative efforts that synchronizes engagements between potentially desperate entities. Adaptive flexibility coupled with the capacity for an increased operational tempo allows for the application of a full range of our capabilities predicated forethought as to what actions must be taken to derive at the desired results to be achieved.

Whether via space, airborne or human interaction, the sourced data must then be parsed, cleaned, and organized. At this point, it is fused into information and compared to previous information in order to correlate it in comprehensible elements. Data mining commences through modeling tools designed to analyze algorithmic defined parameters established to identify patterns. Once the patterns begin to emerge that influence the problem set, alerts are sent to inform stakeholders of the implications of this new information as relative to their critical information requirements.





The complexities and cost associated with the automation of this process cannot be overstated. Direct correlation is rather simplistic, but the relational data is only evident within the context of a system which is cognitively aware. The human interface to support this requirement introduces the frailty of inefficiency, cognitive bias, and limited comprehension into this complex equation that monitors and measures this dynamic ever-changing environment. Ultimately, relying on anomaly detection as opposed to pattern learning is ill conceived due to partially developed assumptions and in turn, low-fidelity models. ¹

All level of monitoring problems are separated into more focused concepts and entities as it progresses through the model. In the last level, definable indicators measure and assess observable events. Finally, the model endeavors to correlate the assessment along with the results derived from patterns identified by the computational analysis. Computerized scientific computational injects are simplistic and limited to hierarchical interpretation through a Generic Intelligence Processor (GIP) resulting analysis is merely the highest common denominator associated with historical empirical analysis through free-text.

Ultimately, feedback and discernment determine common patterns. These patterns are then graphed to represent correlating events to establish suppositions. The resulting analysis correlates separate disparate problems into more focused concepts. By establishing definable indicators, which are then measured and assessed against observable events, the model endeavors to correlate pattern recognition identified by the computational analysis. Through the validation process, forecast analysis provides insights to reliable actions that are taken from the data which is the baseline for current future decisionary processes. It is through this iterative approach, actions can assess potential for a litany of alternative possibilities. Through this progressive process the ability to assess current circumstances, characterize interdependencies in the VUCA environment allows for elevated awareness that enlightens understanding to empower actions to achieve requisite adaptations to evolve to the desired end state.



NETCENTRIC OPERATIONS

Given the pace and persistence on adapting in this high paced environment, the value of synchronized strategic action requires good strategic communications and effective Information Operations in order to achieve Information Superiority. However, the predilection for technological gadgets and periodic misapplication of net-centricity often distracts us from engaging effectively in the digital domain. Today's leaders not only must be astute to remain focused on their goals and objectives, they must also know how to use technology as a catalyst to coordinate, collaborate and communicate (C3) in order to provide clear and concise direction to their teams. Given their unfamiliarity of this new information environment, that must be cognizant of its ability to inform and actively influences paradigms and perceptions. Thus, a war of words represents the inconsequential byproduct and outcry of the emotional and intellectual perspective to secure the future in a way that not only benefits their interests but also precludes long-term harm and consequence to their strategic partners.

The information revolution's ability to influence and effect this fragile environment through a war of words and ideas elevates the implications of public opinion to a new plateau. Thus, responsiveness and the significance of awareness is vital to effectively implement strategic planning, operational design and tactical employment. For through a well-informed adaptive plan with sufficient resourcing and flexibility to achieve the objectives, the opportunity to focus collaborative efforts that benefit collective objectives is informed from an elevated awareness that provides and even creates an asymmetric advantage.

As organizations drive toward achieving shared awareness and endeavor to be self-synchronizing, Net Centric Operations (NCO) gives them the means with which to adapt and influence the tempo of operations while transcending its traditional barriers. ² A net-centric approach makes it possible to achieve a centralized strategic intent that enables the



² Rand study, p. 1

decentralized employment of tactical operations. Thus, the ability to leverage net-centricity will ensure collaborative engagement that assures the greatest strategic asymmetric advantage.³



SUMMARY

Ultimately, a concerted enterprise approach is critical for the implication of the resulting actions taken to affect ascribe organizational goals and objectives. The necessity to act with unity of focus and effort is essential if synergistic team focused endeavors are to provide competitive advantage throughout all phase of operations. While timeliness and profitability continually decrease risk the need for C3 are on the rise, however the necessity to leverage information superiority in order to derive value from operationalize information in the digital domain is paramount.

Through rapid and decisive operations from a system of systems analysis, there is value to be found in understanding the causes and effects of our actions against measures of performance and desires to be achieved. Given that the environment adapts in an open system faster than new tools can be created—and their proficiency mastered—the continual assessment of the effectiveness of current technological tool must also continual evolve. By leveraging efforts to evolve awareness to enlighten understand, matured TTPs to improve future engagements, we must be mindful to remain vigilant despite the ambiguity of the VUCA environment.

³ Groh

The results of our actions will influence—if not dictate—the effects and consequences of the actions taken measured against the desired results to be achieved. The awareness of social and cognitive interactions derived from using sound judgment are factors that weigh heavily on the potentiality for success in this competitive space. Thus, net-centric endeavors and associated tactics, techniques and procedures (TTPs) must be applied to assess, integrate, predict, or even respond to the complexities introduced by the human dimension.

Caution should be taken to preclude allowing the scientific application to dictate or override the operational art. Demonstrably, by relying too heavily on technological tools could potentially lose focus of their changing environment, fall prey to the risk of predictability, suffer from the inefficiencies associated with groupthink, blur the operational picture, or ignore the benefits of military genius. In the end, we must accept that flexibility is the key to success in this new dynamic environment. By leveraging an adaptive approach to engage and evolve within the decision cycle, we will benefit from our ability to leverage self-synchronizing systems that inform us of those options and prevailing opportunities to capitalize on this ever-changing environment.



⁴ Groh, p. 332

⁵ Groh) (Liang and Liang and Xiangusi





TAB 3



Data
Operations
Development



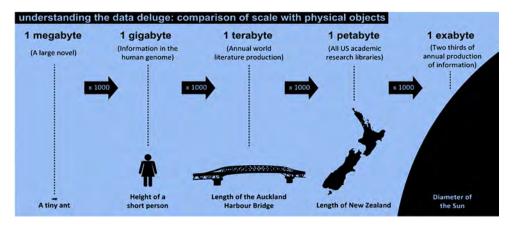


The information revolution is in full swing transitioning the world rapidly into the age of knowledge. A plethora of terms from Artificial Intelligence, Machine Learning and Analytics has awakened the need to leverage technological tools to facilitate making the right decisions with higher fidelity than previously thought possible. With an ever-increasing demand signal for data to inform decisions, the need to establish a platform, like a library to store, structure, and sustain the demand signal for data is a critical capability for making informed decisions. Likewise, a pipeline to provide timely relational context for the flow of information is an essential component to maturation of knowledge that feeds the cognitive process critical to making wise choices.

As we begin to appreciate the causality of actions measured against anticipated outcomes to be achieved, we begin to understand the interdependent relationships that drives the motivation to produce the intended outcomes desired. It is through the wisdom to acknowledge the potentiality of outcomes predicated upon current circumstances that the benefits of actualizing data as a vital strategic asset for the organization's propensity for success. It thus critical to have the right information at the right place and time in order to achieve competitive advantage in today's interlinked world environment.



Data serve as the foundation of fact upon which decisions are made. Thus, unencumbered access is imperative if reliable choices are to be enacted upon given available options to capitalize of evolving opportunities. Liken to the books in a library that provide historic context of the knowledge of the ages, we must collectively store data and structure it in a way to make it visible, accessible and understandable. Therefore, a mechanism akin to ensure it is fit for purpose and operationally relevant will assure reliable and timely information upon which to mature knowledge that can potentially surpasses understanding. It is through this elementary process that establishes a common reference upon which to contextualize and mature knowledge that affords the means to evolve the cognitive process to make enlightened decision.



Given the growing demand signal, data is being produced at an alarming rate. However, as John Naisbitt identified, "we are drowning in information but starved for knowledge." Given the complexity which is a direct result of a lack of structure, we are inundated with vast amounts of data that precludes our current capacity to effectively manage. This onslaught of information continues to grow as does the insatiable quest for knowledge. The results is an unsupportable desire to make informed decisions given the lack of current structure to provide sufficient references to past actions and outcomes. This coupled with growing perturbations from analysis paralysis feed society's risk aversion to the consequences of making mistakes.



Therefore, it is imperative that a formal process be establish with standards upon which to access, characterize this environment to enlighten and empower decision makers to evolve in an iterative fashion (ACE). Through this approach the ability to effectively **collect** and **catalog** data will provide the means to register and define it to ensure it is discoverable. Secondarily by providing structure will afford the opportunity to search a vast array of data liken to the Dewy Decimal System in place in most libraries. Third, the need to **Correlate** the resulting facts into a query will assures **contextual** understanding.

Recent progress in machine to machine processing and autonomous transactions within this system provide the necessary means to digest and contextualize analytical information by means of artificial intelligence. The need to ascertain the **Cost/Benefit** analysis to informs our ability to understand dependencies and thereby **characterize** the cause and effect or **causality** of actions taken measured against results to be achieved are the key factors in predicting potential **consequences**. Through this iterative approach to learn and evolve, we must remain focused upon actualizing opportunities through a **coordinated** process that **communications** and synchronizes progress in a collaborative endeavor. It is through this process that we are able to derive a synergistic engagement in our ongoing efforts to achieve organizational objectives.

The ten steps (collect, catalogue, correlate, contextualize, cost/benefit, coordinate, communicate, causality and consequence) are referred to as 10C and illustrated below to outline the evolving nature of this integrative process. It provides a functional framework upon which to build a data architecture that ensure data fit for purpose, operationally relevant and leveraged to fulfill organizational objectives. To achieve these objective, it is necessary to establish a foundational platform and production capability to leverage data as a strategic asset. It is through the maturation of this formalized endeavor that contextual knowledge will inform and evolve understanding.



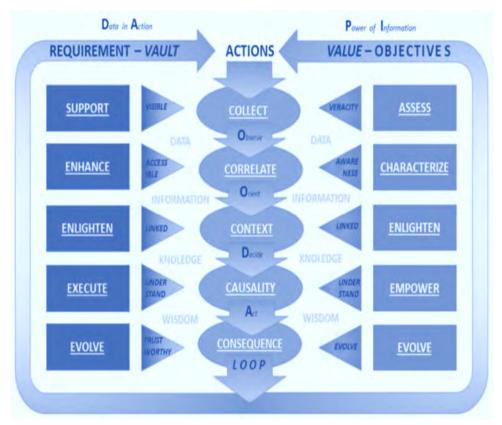
OBSERVE	PROBABILITY	SCIENCE	OBJECTIVE
1C. Collect	Store	DATA	WHAT
2C. Catalogue	Structure	INFO	WHERE
OREINT	PERSPECTIVE	ART	OBJECTIVE
3C. Correlate	Relate	FOR	HOW
4C. Context	Understand	SA	WHEN
DECIDE	POTENTIAL	THINK	OBJECTIVE
5C. Cost/Benefit	Assess	ST	WHY
6C. Characterize	Know	КО	
ACT	PERFORM	ENGAGE	OBJECTIVE
7C. Coordinate	Synchronize	C2	WHO
8C. Communicate	Disseminate	сто	
LOOP	PERPETUATE	EFFECT	OBJECTIVE
9C. Causality	Dependencies	Feedback	LEARN
10C. Consequence	Results	Trend	

To operationalize this effort, it is essential to create a data platform that registers and deconflict authoritative data sources. The result of this mechanism provides a dictionary to establish an authoritative source that identifies those common references to ensure everyone is on the same page to facilitate collaboration through an enterprise data dictionary (EDD). At the second stage in the process, the information is structured in a way to provide a catalog to identify where it is and how to get access to it through an information asset catalog (IAC). Th EDD and IAC serve as the foundation upon which to make data visible so that it can be discovered and information accessible to allow it to be searched. The result is well-organized and structured data that can be easily shared across the enterprise.

As the demand for timely information continues to expand, the volume of data and associated complexities is growing exponentially. Therefore, measures must be established to assess the quality of data and the level of confidence in which can be placed in the relationships essential to operationalize and harvest its inherent value. Thus, an enterprise information model is foundational to effectively operationalize data through the aforementioned 10C process. This three-step approach of registering collected data into an enterprise data dictionary, structuring it into an information asset catalog provide an integrated contextual picture

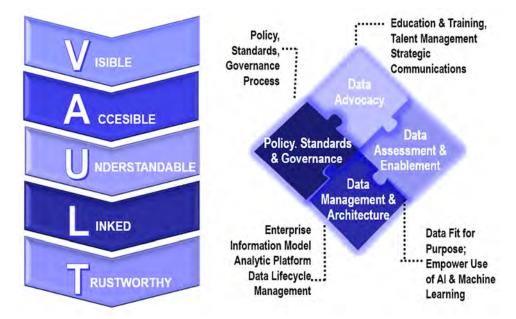


that serve to leverage those operational options that capitalize on organizational opportunities.

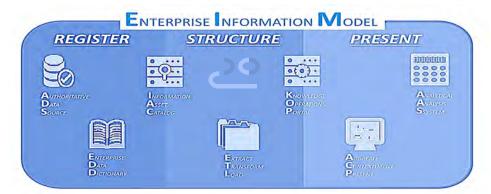


The following process of making data visible, information accessible, knoweldge understandable and linking it in a way to enlighten, empower and evolve awareness provides a porpensity to make wise choices. Over time the veracityt of data and confidence within the relationships will establish the trustworthiness that can be placed both on the facts and dependencies within the congitive process (VAULT). The resulting iterative, three-step approach to leverage this VAULT framework will provide the ability to move beyond traditional data resource management to operationalize it in a way that garners organization the means to harvest the inherent VALUE of information. The resulting policies will establish the requisite standards and process to assure the ability to collectively work in collaboration to leverage data as a strategic asset.





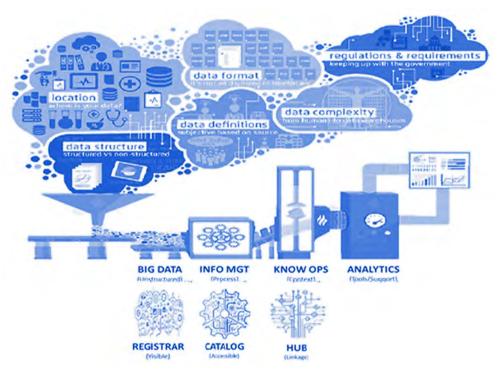
To achieve this, it is necessary to establish an enterprise information model (EIM) to formalize a data architecture to ensure collaboration across the enterprise. This strategic framework is the blueprints upon which to build a platform to ensure availability of data across the organization. It serves as the foundation upon which to establish a data driven organization. It is the source of knowledge and is the reference upon which operational decisions are made. Ultimately this platform provides the vehicle to enlighten knowledge, empower decisions, and evolve through a progressive approach to learn in today's interconnected work environment.





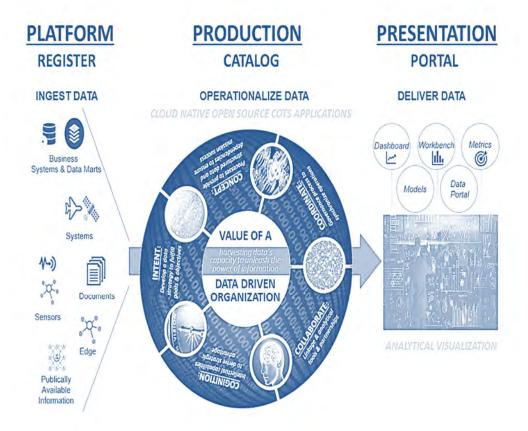
The following cloudbased system offers a framework to ensure the ability for the enterprise access to data. This is essential to their ability to **access** veracity, **characterize** relationships, **enlighten** dependencies, and **empower** actions that **evolve** (*ACE*) opportunities to provide quintessential analytics analysis essential to support the cognitive process. It is through this endeavor that we are able to expand the Art of the Possible with the current confines of the Science of the Probable.

With the assistance of technology, we are now able to consistently matrix and measure the maturation of data from the point of ingestion through all phases of operations to inform and evolve situational awareness. It is this process that affords the means of validation through prescriptive modeling and heightened awareness derived from predictive modeling to manage expectation. New to the system is the advent of potentiality modeling to manage consequence management of probable and possible outcomes.





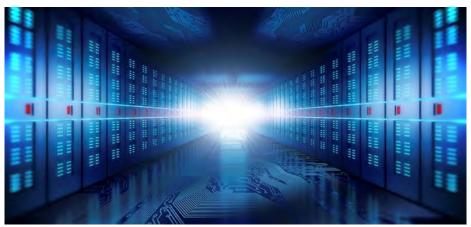
Assessing past performance and characterizing the current state offers the opportunity to ascertain options and potential opportunities in the future state. It is through this process that a data driven organization leverages data as a strategic asset to harvest the potential to make informed decision given current circumstances. To achieve this, a strong foundation upon which the initial operational capabilities (IOC) derive the aforementioned 10C step process is necessary to manage and mature data. Once the platform is built the process of operationalizing data to enlighten, empower and evolve (E3) the organization is accomplished through harvest value throughout the production phase of registering, cataloging and presenting data.





Building a data driven organization is like building a house, first you must identify those capabilities/functions you need and create an architecture that provides those specific service. Once complete a foundational platform developed to support those functions that are necessary to achieve organizational objectives. Once in place, are the production facility provides for the requisite functionality to enhance mission effectiveness. A feedback loop measures progress toward organizational objectives that serve overarching goals. Through this iterative process of transformation, the necessary growth, adaptation and progress is achieved to support, enhance and evolve (SEE) mission success.

The chart outlines the process of establishing the requisite platform and pipeline of a data driven organization. It illustrates the steps and maturation process to evolve knowledge that surpasses understanding. By leveraging the capabilities and functionality of both the platform and production plant the ability to unlock the VAULT of understanding and derive VALUE will respectively afford the opportunity to make informed wise choices. Through a proactive approach to learn in an iterative endeavor to optimize mission effectiveness the potential to achieve those objective that fulfill organizational goals can be assured. The ascribed approach to illustrate the options identified by a data driven organization will illuminate the opportunities to capitalize on a fact-based approach to inform a cognitive approach that leverage data as vital organizational strategic asset.





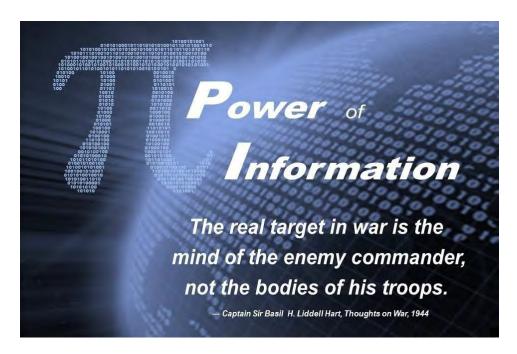


TAB 4



CYBER STRATEGY





CYBER STRATEGIES

Given the recent Cyber Strategy developed by the Secretary of Defense, he charges us to remain vigilant in the defense of our great nation. Therefore, it is critical that cyber is operationalized in a matter that ensure the United States is prepared to win our Nation's wars. As we embark on this journey, we are well advised to head the words of Carl Von Clausewitz..."Two qualities are indispensable: first an intellect that even in the darkest hour, retains some glimmering of the inner light which leads to truth: and second the courage to follow this faint light wherever it may lead."

Cyber warrior must be able to remain focused on the stated objectives as he or she begins operating in the new and ever-changing information environment. Moreover, as they operationalize the cyber domain, it is critical that they are cognizant and fully consider their actions and how they are aligned to fulfill their objectives void of unintended consequences. For it is within this information environment that their influence has direct forbearance upon the outcomes which support and ensure the prosperity and preserve freedom of action within the digital domain.



Engagements in cyber not only support and enhance operations; they serve to change the character of war. Ultimately, the express and implied goals of cyber operations are to create the strategic advantage necessary to gain and maintain information superiority. By extension, therefore, dominance within cyber operations means wielding strategic advantage or achieving information superiority.

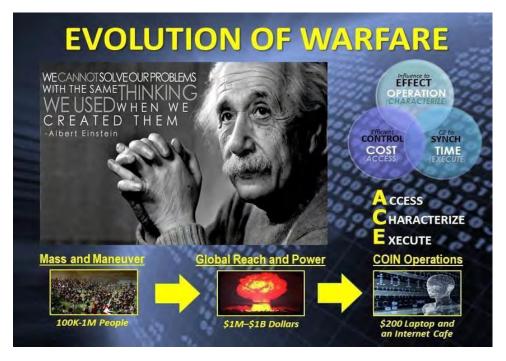
History demonstrates repeatedly that victory in war typically goes to the combatant best able to amass and direct substantial military might capable of imposing their will and protecting their interests. As technology continued to evolve, refinements and improvements in weaponry and tactics gave strategic advantage to the most innovative actors on the world scene by enabling them to overcome capacity shortfalls. The result is strategic advantage achieved via superior capability on the battlefield.

During the Cold War, sustained technological advancements gave weapons the ability to destroy more overall area than the Earth could possibly regenerate. This overkill ratio, referred to doctrinally as mutual assured destruction, resulted in promoting timing as a critical element in deriving comparative advantage for those who could capitalize on the synchronous capacity inherent in network-centric warfare. In today's world, we seek ways to leverage the resources necessary to maximize the effects of our capabilities and capacity. In that search, information is the critical component that guides us in integrating and synchronizing operations in order to overcome adversarial threats.

By concentrating on our ability to Support, Enhance and Execute (SEE) operations and the cultural paradigm inherent within this domain, we can develop an understanding of WHY certain operations are important (Information In War). For it is through these efforts that we will develop the requisite knowledge that will enable us to incrementally ENHANCE HOW to proceed (Information Operations). Combined, this will afford us the strategic advantage of realizing WHAT is to be EXECUTED (Information Warfare).



Since the Industrial Age, the Information/Knowledge Age has become critical for success. As we endeavor to embrace and attempt to harness the power of information it has become the essence of strategic advantage within the world environment. This immensely broad area continues to evolve and transform at the speed of light. Thus, it is especially important that we are cognizant upon our growing dependency on technological capabilities or "critical mass" of the vulnerabilities inherent in cyber ops.



The magnitude of challenges which confront us in today's rapidly evolving information environment are compounded by a multitude of obstacles. Our constrained fiscal environment, inflexible organizational processes and a risk-adverse culture inhibits innovation. Within the cognitive phase, however, strategic tradeoffs within the decision space disclose opportunities that enable us to navigate the Volatile, Uncertain, Complex and Ambiguous (VUCA) environment. It is within this risk-adverse culture that precludes us from overcoming threats and availing ourselves of the opportunities so prevalent in the new digital domain.



To counter increasingly broad-spectrum threats we face today, Secretary Carter's recently developed a Cyber Strategy directing the DoD to remain vigilant—regardless of domain—in the defense of our nation. That strategy highlights the importance of operationalizing the digital domain, which is vital to every aspect of military operations. As described in the 2013 – 2015 Director of National Intelligence report, cyber threats represent the United States' topmost strategic risk—well ahead of terrorism.

The complexity of our systems requires continual patching of thousands of networks across the globe; however, it has proven difficult to establish a structure with the requisite visibility to defend this diverse network. We must characterize the intentions of our adversaries and assess their capabilities in order to focus the efforts we must take to mitigate the threat. In doing so, we must learn to manage this inherent risk and find ways to overcome actions focused against us by our adversaries. Most importantly, we must maintain our freedom of action in cyberspace so that we can either respond in kind or impose our will on those adversaries at a time and place of our choosing.

The unrelenting actions being taken by our adversaries have telegraphed their intentions to acquire disruptive capabilities and leverage the destructive capacity of the cyber domain. Stated otherwise, cyber actors are undercutting U.S. strategic and technological advantages by targeting our diplomatic, information, military and economic cores. Even more alarmingly, the growing threats and complexities associated with our technological age make it more difficult, by an order of magnitude, to manage the confidentiality, accessibility and integrity of our information. Thus, it is imperative that we characterize, assess and act quickly on information to identify and overcome immediate threats and vulnerabilities.



Moore's Law holds that technology evolves every 18 months. By extension, the Internet is growing beyond the ability of most people to conceive both in its breadth and scope. For instance, the "Internet of things" derives from our sustained demand for enhanced awareness via an always-connected profile. In 2015, the Internet Society—a non-profit entity dedicated to preserving the Internet as an open platform—estimated that Web volume will increase to 1 billion Internet hosts and 3 billion Internet users worldwide. Similarly, Cisco Systems, Inc. estimates that 15 billion Internet-connected devices are currently in use. A joint Cisco-IBM research study projected that worldwide data volume will double every 18 months at a rate of quintillion bytes daily.

There is indeed a clear and present need for us to develop a comprehensive cyber deterrence strategy. For our adversaries are lurking, right now, in this amorphous and limitless domain. The actions being taken by those adversaries place our systems at considerable risk. Specifically, the global proliferation of malicious code and software—malware—which continues to threaten U.S. networks, the data they store, and the mission they assure.

One of Von Clausewitz's most renowned aphorisms is that "War is merely the continuation of politics by other means." State and non-state actors conduct cyber operations or wage cyber warfare to destroy, manipulate or disrupt our industrial control systems. This allows them to influence public safety and national security in order to subvert trust and confidence. As deleterious as this may seem, however, those actions can be defeated by employing heightened situational awareness, which allows us to manage and mitigate the risk.

By applying the credible strategic aim of pushing and pulling trusted information within the information environment; we can increase situational awareness and advance knowledge to make better-informed decisions. In short, the cognitive process facilitated by efforts to Assess, Characterize and Execute of (ACE) cyber operations affords a predictive capability to outthink adversarial attempts to create and inflict havoc.





We must capitalize on the predictive capacity of ACE which allows us to see the best way forward to execute actions in order to gain and maintain dominance within the information environment. This will enable us to overcome a broad range of threats and unpredictable challenges levied by adversaries, from non-state actors to nuclear capable nations. Moreover, despite the rapid and exponential advancement of the digital domain, we must exude agility in this inherently VUCA environment. Therefore, in coordination with other services and agencies, today's Cyber Warfighters are expected to conduct the Department of Defense Information Network Operations (DoDIN Ops) and Defensive Cyberspace Operations (DCO) necessary to overcome this growing threat.

The establishment of resilient and trustworthy systems with tighter human-machine interfaces will provide our personnel with dependable information when and where they need it most. By organizing, training and equipping Cyber Warfighters to be experts in their field, we can and will protect and assure the US vital national interest. Despite the currently constrained fiscal environment, we must optimize the planning, programming and execution of information technology investments to sustain the synergistic advantage upon which our nation depends. By collecting information to evolve our Frame of Reference (FOR), control it to safeguard its strategic value and exploit opportunities that ensure our ability to fulfill our mission objectives, we will maximize warfighter effectiveness in the following areas.



Goal 1: Provide trusted information when and where it is needed:

- compress the information flow within the kill chain
- apply common data standards in all mission areas
- attain operational and technical resilience
- improve interoperability and effectiveness
- prioritize secure capabilities

Goal 2: Organize, train & equip Cyber Warfighters to be experts in their field:

- cultivate innovation to capitalize on cyberspace capabilities
- provide qualified Cyber Warfighters to execute, enhance, and support mission success

Goal 3: Strengthen mission assurance for freedom of action in cyberspace:

- provide cyber capabilities for mission assurance
- shorten the kill chain and increase decision-making speed

Goal 4: Optimize planning, programming, and execution cyberspace investments:

- flexible dynamic processes for capital planning and investment
- ensure competitive advantages to sustain and modernize cyber





All plans begin with the end state in mind, since that objective enables us to focus clearly on goals that will fulfill our intermediate and ultimate objectives. Thus, developing a top-down perspective makes our warfighters aware of themselves, their adversaries and their environment, all of which are vital to understanding the best way to achieve their objectives. Supporting and enhancing their actions by making informed decisions and capitalizing on their strengths (while mitigating their weaknesses) will enable us to gain asymmetric advantage over our adversaries.

We must therefore, cultivate actions which control escalation and shape the conflict environment at all stages by integrating cyber options into all aspects of planning in order to effectively apportion Cyber Mission Forces. The result of which will ensure adequate campaign planning that assess and identify gaps and establish initiatives geared to pursue a DoD cyber deterrence posture and strategy that will inhibit state and non-state actors from conducting cyberattacks on the United States of America.



In the Secretary of Defense Cyber Strategy, we are directed to be mindful of our responsibility of being a capable defender of the U.S. homeland and U.S. interests during times of peace, crisis or conflict. By characterizing, assessing and mitigating risk in the rapidly evolving cyber domain, we will ensure strategic global stability by engaging in information sharing, interagency coordination and building bridges to the private sector, all of which will establish alliances and partnerships abroad. Such collaboration will ensure our ability to successfully achieve our three primary cyberspace missions:

<u>FIRST</u>: Defend networks/systems/information in & through cyberspace domain

SECOND: Defend against cyberattacks and conduct operations to counter attacks that could threaten loss of life, significant property damage, adverse consequences to U.S. foreign policy or serious economic impact. (The achievement of this mission is particularly difficult since the U.S. has a limited and specific role to play in defending the nation against cyberattacks. For as the private sector owns and operates over 90% of all networks and other examples of cyberspace infrastructure, it represents the first line of defense. Accordingly, they must prioritize the protection of those networks and data by investing in improving their own cybersecurity.)

THIRD: DoD must provide integrated cyber capabilities in support of military operations and contingency planning in order to:

- disrupt an adversary's military-related networks or infrastructure
- deter or defeat strategic threats in other domains



By investing in technical capabilities designed to carry out cyber operations, we can develop capabilities that validate and continually refine adaptive command and control mechanisms. This will ensure the presence of efficient and reliable C2 nodes that promote unity of effort across all three cyber missions. To field a cohesive, well-integrated and enterprise-wide cyber modeling and simulation capability, we must establish a data schema—databases, algorithms and modeling and simulation environments. Such advancements will ensure our ability to defend the information environment, secure the network and mitigate risks to missions.

Through continuous network monitoring, developing strong personnel reliability programs, improving cybersecurity training and reporting and tracking suspicious behavior, we will cultivate a culture of awareness to anticipate, detect and respond to insider threats before they can adversely impact our mission. In general, cyber protection will ensure the technology is leveraged appropriately to produce information that feeds the decision-making process.

In taking steps to identify, prioritize and defend its most important networks and data, we will plan and conduct exercises that will operate within degraded and disrupted cyber environments. We will also strive to advance technology in an effort to develop innovative approaches to enhancing, building and employing Joint Information Environment (JIE)-based network architectures that are more defendable, thus mitigating and protecting against cyberattacks and cyber espionage.

Ongoing efforts to build the Joint Information Environment (JIE) single security architecture (intended to adapt to and evolve based on current and future cyber threats) will enable a robust network defense and shift the focus from protecting service-specific networks to establishing a unified approach to securing the enterprise.





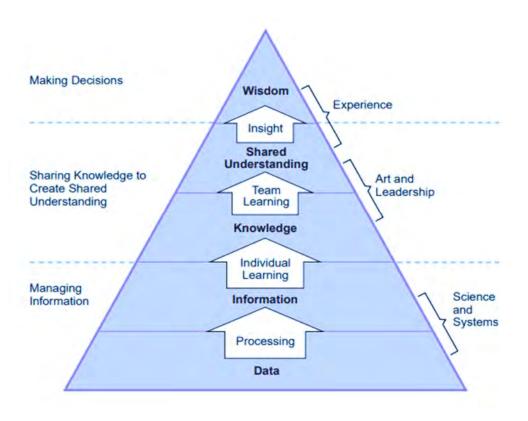
The resulting framework integrates and advances the cybersecurity architecture by including anomaly-based detection capabilities and data analytics intended to identify vulnerabilities. The awareness of these threats and the application of advanced encryption methods will establish a best-in-class cybersecurity practice that will ensure situational awareness of network threats in order to assess and mitigate risk.

In Summary, as the information environment continue to evolve at a blinding speed, we must remain flexible and versatile, and shift to inherently agile, deployable and networked systems. As mentioned, such systems must be resilient and trustworthy, and they must have an improved interface exemplified by cloud computing and smart machines. This combination will provide our Cyber Warriors with trusted information when and where they need it most.

Despite contemporary constraints and a risk-averse culture, we must ensure that our cyber warriors are both nimble and adaptable. To achieve those qualities, we must strive for a degree of resiliency that will allow us to continue to operate despite a degraded environment. Further, we must take actions to ensure mission assurance given the evolving threat. That outcome will be accomplished by supporting and fulfilling DoD's five strategic goals for its cyberspace mission:



- Build and maintain ready forces and capabilities to conduct cyberspace operations
- Defend DoD information network, secure data & mitigate risk to DoD missions
- Be prepared to defend the homeland and U.S. vital interests from disruptive or destructive cyberattacks of significant consequence
- Build and maintain viable cyber operations and plan to use those options to control conflict escalation and shape the conflict environment at all stages
- Build/sustain robust international alliances and partnerships to deter shared treats to increase international security and stability





In all, attribution is a fundamental part of an effective cyber deterrence strategy, as it facilitates the ability to unmask an actor's cyber persona, identify the origin of the attack and ascertain the tactics, techniques and procedures being used in order to launch response and denial operations. In short, we must defend the DoD information network, secure our data and mitigate risks to the mission.

Ultimately, we must acknowledge the implication and effects of our adversary's ability to wage war and the clear and present danger they present to the United States. Their unrelenting have demonstrated their intentions to acquire disruptive capabilities and leverage the destructive capacity of cyberspace. Since DoD's networks and systems are demonstrably vulnerable to intrusions and attacks, we must be capable of operating in a contested environment to ensure mission assurance.

The following are the building blocks to operationalizing the strategic objectives:

Information Warfare: influences integrity/veracity of data:

- **P1** is ORGANIZED Data into INFORMATION
- **P2** is CORRELATED Information into actionable KNOWLEDGE
- P3 INFORMS the cognitive process of UNDERSTANDING





Thus, in the rapidly evolving world of cyber we must be mindful to: OBSERVE – to elevate & elevate awareness as we endeavor to ASSESS our environment

- **ORIENT** as we evolve understanding in order to
- **CORRELATE** the interconnected relationships
- **DECIDE** –those strategic tradeoffs to ascertain how best
- **EXECUTE** operations that provides opportunity to
- **ACT** in a way that fulfills vital national interests



ULTIMATELY: Cyber OPS: ensure control/access to data while:

At REST—in data centers

In TRANSIT—across our networks

During PROCESSING—in our applications

Information Dominance informs decisions through the application of data to:

- THINK BIG (courageous vision)
- **START SMALL** (step out in faith)
- **SCALE QUICKLY** (believe in your purpose)





Value Proposition of Operationalizing Data as a Strategic Asset:

Exploring the art of the possible within the science of the probable in an effort to maximize options that derive optimum potential of opportunities is vital to the strategic advantage essential in today's highly competitive market place. The never-ending quest for answers to fix problems is currently distracting organizations from their ability to adapt and evolve in this high paced environment of change and transformation. This affixation upon deriving answers at the expense of exploring alternatives precludes their ability to explore quintessential question essential to their future.

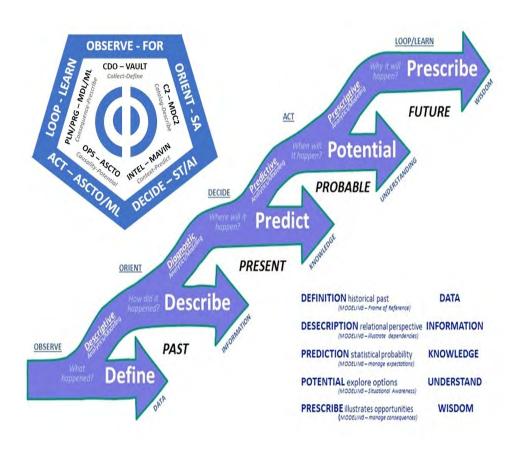
It is this imperative that they seek to explore the right question rather than find the right answer. By continuing seek answers without understanding of circumstances are the self-imposed shackles which preclude their ability to find and implement the progress they seek. It is this self-imposed impediment that binds themselves to the past confined by their predisposition of circumstances to blindly accept the status quo. This inhibits the essential progress necessary to derive competitive advantage as the industrial age is quickly becoming a thing of the past and the new information environment transformed our world to evolve to the age of knowledge.

In a world with so many questions as to what the future holds, where we are going, and when will we get there, one must understand that all too often, answers may no longer sufficient to survive in this rapidly pervasive environment which is transforming at the speed of light. Organizations are quickly realizing that yesterday's successes are no longer relevant and will lead to failure in this adaptive interlinked market where the strong no longer can compete with those that are nimble and adaptive in their approach.

It is within today's information environment that organizations become enlightened and empowered to know what requirements serve their objectives, how to apply them in a way that fulfills their goals which afford the means to capitalize on those options and opportunities as they present themselves. However, without the means to operationalize the data that is growing at an alarming rate, John Naisbitt cautions us that, "We are drowning in information but starved for knowledge."



The effort to harvest the value of information to know what must be done, how to accomplish it, and why it is important all starts with the facts that inform and derive the essential knowledge that surpasses understanding. It is the wise an astute individual that understands that data fit for purpose will paint a picture for those willing to see it. Likewise, information in action will illustrates those relationships essential to outline how to achieve it, and the contextual knowledge to derive awareness of those options to evolve understanding of opportunities available in today's information society. This journey of learning and exploration of the unknowns through the validation of the knowns and explorations of the unknowable's that ascribe the potential derived from living in the art of the possible in an effort to evolve the science of the probable.





This journey is a search to actualization their vision and view of the future as ascribed by Peter Pace, DoD's Chief of the Joint Staff, who advises:

"A leader who can decisively and intelligently make decisions within the context of understanding...has the ability to recognize patterns and changes and is comfortable with uncertainty and ambiguity Versatile and Creative, able to develop innovative solutions, thinking in time and context within the complex environment to bring about desired effects and thinks in terms of systems/linkages (effects) and is an expert learner."

Thus, the strategic value of data lies in our ability to leverage it as a strategic asset to inform and evolve our understanding which affords wise decisions in today's transformative interdependent world environment. It is therefore imperative that we not merely manage data but operationalize it in a meaningful way in order to derive its inherent value. To harvest the value resident in data, we must organize, structure and apply it that affords the means to inform those strategic cost/benefit trade-offs that illuminate the causality of action measured against potential consequence.

By establishing an operational platform to serve as a collaborative catalyst to collect and store data in an effort to make it visible, correlate and mature meta-data/structure it into information that is accessible and contextualized to illustrate the application of knowledge affords the opportunity to make informed decisions. By linking data that is Visible, Information that is Accessible, Knowledge that is Understandable within context, one can easily Link it to establish and what level of confidence and Trustworthiness (VAULT) they can place in the resulting collection of facts (data), correlation of relationships (information), and contextual presentation (knowledge) upon which to evolve understanding in their ongoing effort to make wise decisions. This platform offers the ability to leverage data and refine processes in order to identify causality and analyze consequences of actions taken measured against potential results to be achieved. Through a formalized program that establishes a data driven organization (2DO) we can derive strategic advantage through the illumination of available options (understanding) and leveraging opportunities (wisdom) to ensure effective decisions that influence and effect the environment in a way to assures their goals/objective.



Today efforts in analytics are being undertaken to solve complexities of this persistent unyielding environment in an effort to fix problems, solve challenges, and evolve in today's volatile, uncertain, complex, and ambiguous (VUCA) interlinked world marketplace. Without a strong foundation to facility the collection of data, a process to register it into an Enterprise Data Dictionary (EDD), correlated and structure it into an Information Asset Catalog (IAC), the ability to present contextual knowledge will be increasing difficult to achieve. The challenges associated the exponential growth of data and the resulting complexities with the relationships associated with its application, manifest themselves given the dependencies and reliance's placed upon it. Throughout our assessment and analysis efforts, we can identify those critical ingredients in the cognitive process of making sound decisions and provide autonomous processes to assist in measuring and monitoring progress.

Without the structure and approach, we are left without an opportunity to validate and verify both the facts and correlate relationships, associated in our ongoing efforts to ascertain causality and potential consequence. Additionally, we become transfixed and constricted in a way that preclude the ability to evolve and transform the organization. Therefore, it becomes imperative to assess, monitor and analyze internal and external trends to ascertain the potential for progress to assure the essential adaption and transformation in today's rapidly evolving marketplace.





History offers ample evidence that enlightened decisions represent the essential core of strategic advantage. The synthesis of historical and current information is the basis upon which leaders make informed decisions. By organizing data into information, it can then be matured and fused into knowledge. Through the benefits of the cognitive process, the opportunity to leverage one's awareness per their frame of reference derives the antithesis of enlightened decisions.

"Know your opponent and you will never lose, know yourself and you will always win."

-Sun Tzu

To establish a data driven organization the focus must be upon the maturation of knowledge that derives understanding. Strategic leaders must cut through the fog to mitigate the friction inherent in today's pervasive today's competitive environment. It is through the value informed decisions that affords one to overcome the long overlooked and even discounted opportune cost consideration in the cost benefit assessment.

A lack of learning from experience informed by hindsight precludes failures and shortcomings attributed to uninformed decisions based on a lack of awareness. Given the complexities of the modern world, the strategic decision maker must be able to make enlightened decisions facilitated by heightened awareness and sound cognitive skills. Understanding what one is aware and unaware of, or does not understand, is a critical competency if not the cornerstone of informed decisions. Thus, it is essential to understand the strategic ends, ways and means to ensure the fulfillment of organizational objectives. Based on the foregoing, strategic critical thought elevates knowledge, which through increased situational awareness and a good frame of reference, develops understanding.





DATA DRIVEN ORGANIZATION

The world is changing quickly with new technologies, threats, and opportunities

Cognitive Influencers within Cognitive Decision Making



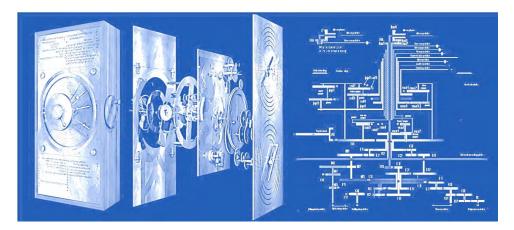
OBSERVE	PROBABILITY	SCIENCE	ОВЈ
1C. Collect 2C. Catalogue	Store Structure	DATA INFO	WHAT WHERE
OREINT	PERSPECTIVE	ART	OBJ
3C. Correlate 4C. Context	Relate Understand	FOR SA	HOW
DECIDE	POTENTIAL	THINK	OBJ
5C. Cost/Benefit 6C. Characterize	Assess Know	ST KO	WHY
ACT	PERFORM	ENGAGE	OBJ
7C. Coordinate 8C. Communicate	Synch Disseminate	C2 CD	TRAN-
LOOP	PERTUBATION	EFFECT	OBJ
9C. Causality 10C. Consequence	Dependencies Results	Feedback Trend	TRANS- FORM- ATION



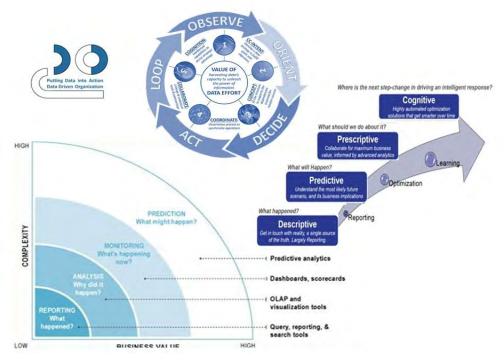
. . Cognitive Understanding Inform Decisions

While we hope for the best, hope is certainly not a plan per se, it is nonetheless essential to inspire and encourage us to venture out to seek understanding of how to approach opportunities in search knowledge of what must be done to overcome extant circumstances necessary to achieve future goals in the effort to fulfill organizational objectives. By remaining incessantly curious, we can discover new opportunities to overcome old obstacles. One of the earliest examples of the benefits of leveraging technology to inform and enlighten is the Antitheta. A two thousand analysis tool which played a pivotal role in understanding the relations of interdependent circumstances as well as the influence they exert on our environment. The Antitheta mechanism predicts the movement of the moon and stars, through relational analysis to inform and predict a multitude of events including sunrise, sunset, eclipses and tidal effects. By determining prevailing circumstances and designing efforts intended to negotiate their influence on the environment, this ancient device helped to convey the evolutionary nature of the effects those elements had on the environment.





This device serves to illustrate the causality and resulting consequence of actions taken measured against results to be achieved. However, without the benefit of data structured and correlated into information, the resulting contextual output would not derive benefit. This it is imperative that we examine how our actions effect the environment through a scientific approach to assess, characterize in a consistent manner if we are to become enlightened and empower of to evolve in today's interdependent information environment.





The core of fact-based decisions requires data that is Visible, information Accessible, and knowledge Understandable if we are to put it into context by Linking it in real time to establish at what level of confidence and Trust we can place in it (VAULT). By unlocking the VAULT of understanding, a platform can afford a consistent approach to mature this process in our ongoing efforts to make wise decisions informed by fact. Over time, we will be able to identify trends that afford the means to prescribe and predict options based on past lessons learned, to better understand our present environment in order to profit on the potential of future possibilities.

"All men can see these tactics whereby I conquer, but what none can see is the strategy out of which victory is evolved."

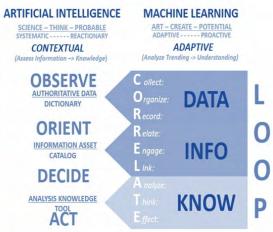
- Sun Tzu

Answering the challenges, you face today:

The extraordinary volume and complexity of today's challenges and the crosscutting nature of our interlinked and dependent society demands actions taken are given careful consideration to determine potential consequences. For those willing to listen to their data, this cognitive endeavor provides the opportunity to consider the probable and potential causality of actions compared to the desired results. Once data is visible, accessible, understandable and linked, it conveys to recipients a level of trust that it can influence their environment in the manner they intend. Ultimately, leaders must have the vision to seek the art of the possible, the inspiration to explore the science of the probable and the courage to think big, start small and evolve quickly. - OODA Loop (within the decision cycle...the answer is not as important as the process of evolving, adapting and overcoming the adversary). Ours is not a problem looking for a technological solution or resource-constrained limitations; rather, we are searching for an informational leader who inspires us to think creatively, act courageously and evolve continuously.



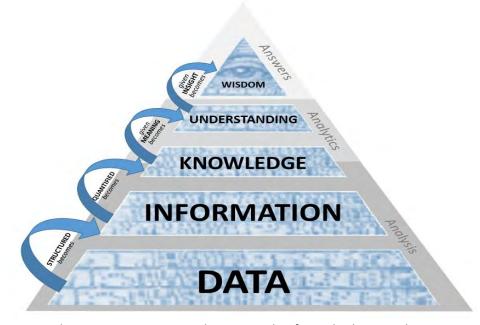




Given the increasing number of decisions, the complexity of options and the implications or consequences to mission success, senior leaders need timely indicators and capable modeling systems that identify opportunities and potential risk as well as the probability for mission success. Compounded by the vast amount of information being generated by massive amounts of data, coupled with the persistent threats that is a characteristic of this VUCA environment, the opportunity to make fact-based decisions to assure mission success is critical in our pervasive and dynamic environment. To these ends, analytics can help today's organizations with many of the specific challenges they face to derive competitive advantage by:

- Deciding where to invest in order to evolve
- Getting more value by optimizing efforts to maximize effectiveness and efficiencies
- Identifying the best way forward
- Solving complex scheduling problems
- Getting more cycles out of operations
- Optimizing a portfolio of investments
- Accelerating response time





In conclusion, it is imperative that we evolve from the historic documentation, storage, and management of data to leveraging it as a strategic resource vital to the organization's competitive advantage. This is done thorough unbiased assessment of the facts (data), characterization of the relationships (information), to establish the resulting operational implications (knowledge) which formulate the quintessential foresight (understanding) to make decisions that assure mission success (wisdom). It is thus imperative that we seek enlightenment so that we can empower our organization to work smarter not merely harder through an effort to evolve and progress in this highly competitive environment. This is done through fact-based decisions aided by analytics and AI tools which establish contextual understanding. By identifying options and opportunity to adapt, transform, and evolve, organizations can capitalize upon trends illustrated by temporal analysis through Machine Learning to know what to do, how to do it, and when it is necessary in order to maximize return on operations (effectiveness) and return on investment (efficiencies).



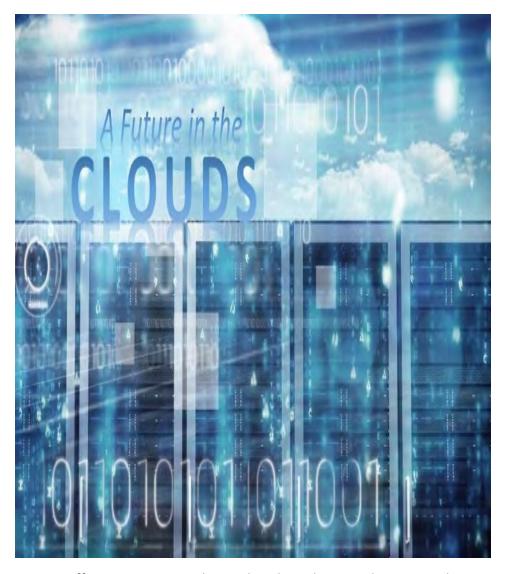


TAB 5



A FUTURE IN THE CLOUDS





Current efforts to operationalize and evolve cyber in order to provide more capability and capacity are a continual challenge in our resource constrained environment. Efforts to utilize the capabilities of cyber as a catalyst to provide for a strategic advantage through collaborative synchronized efforts are ongoing. The need to carry out these endeavors efficiently is directed in guidance from Public Law 104-106, Division E, Clinger-Cohen Act of 1996, the 25-Point-Implementation-Plan-to-Reform-Federal Information Technology and countless other legislative documents. (GOV, n.d.)



This legislation directs for and provides guidance to establish roadmaps to operationalize ongoing efforts which are currently underway to consolidate data centers, standardize process and procedures and eliminate redundancies. Cloud computing has surfaced on the horizon as a potential solution to the panacea of current technological challenges. It offers a means to fulfill these requirements and afford increased accessibility with a promise to provide increased capacity and capability all while lowering overall cost. This and other solutions to current and future challenges ascribes opportunities like the Joint Information Environment (JIE) which are addressed in the U.S. CIO's and the DoD cloud computing strategy. (Cohen)

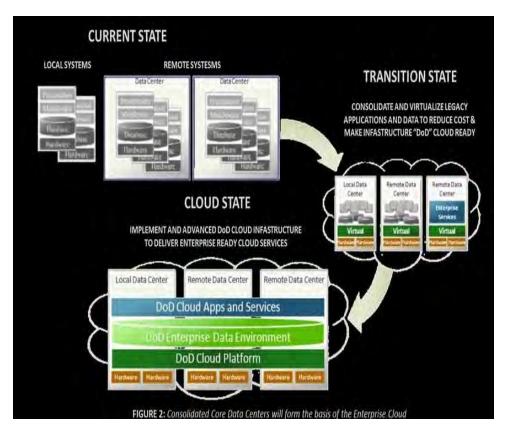
In these documents, the U.S. *CIO* addressed the need to curb and consolidate U.S. government datacenters that have grown from 432 centers in 1998 to 2,904 in 2010. These data center consolidation efforts bear a significant portion of the US IT \$80B annual price tag. Currently *HDS* and Treasury top the list on projected spending in this area, and *DoD* comes in a close third followed by the Veterans Administration. Given current estimates for cloud computing of \$20B, this technology and growing trend proves to be a worthwhile endeavor to provided increased capability at lower overall cost. (Vivek)

The previous *DoD CIO* has provided their direction and intent of the guidance in their July 2012 strategy on cloud computing. Cognizant of the security, accessibility implications their strategy addresses and provides a roadmap forward as outlined in figure 2. As this pictorial illustrates the requisite elasticity of the enterprise to accommodate the demand signal for an insatiable thirst for data affords the opportunity to streamline operations in *DoD's* effort to consolidate data center and direct their focus to migrate to the cloud. (*Takai*)

They postulate that the cloud provides many solutions both in storage, backup, access and the necessary elasticity essential growth. These reports identified that areas not addressed are essential for its capabilities that they foresee provide the necessary catalyst for change. They emphasize ongoing concerns over accountability or more specifically the control of

the data. Many have provided resolution to these concerns with internal cloud solutions, however given the definition of internal clouds and data centers, they do not clearly differentiate between them. (*GOV*, n.d.) (*Takai*) (*Vivek*)

The policies that ascribe the roadmap on cloud provide a necessary catalyst to move forward and fulfill the intent and objectives of legislation to drive efficiencies in *IT*. However, it will be necessary to transform the culture which traditionally has found it challenging to forego control of administration of their systems and the data they maintain. However, given our budgetary constrained environment it will be difficult to overlook the potential savings that will undoubtedly motivate them to take action. Theses fiduciary limitations will more than likely serve as the justification to buy into additional risk using the direction for efficiencies as outlined in the Clinger Cohen act as their mantra and authority.





Decision makers would be well advised to consider the second and third order of effects or causality of their actions and the resulting consequences of their decisions. Once the actual as well as the opportune cost benefits (risk and opportunities) that migration to the cloud offers, the resulting capabilities and efficiency to be derived in both current and future benefits become evident in today's demanding information driven society. Therefore, it is incumbent upon CIO's within government to be mindful of the Clinger Cohen act of 1996's and look to it as a call to arms to develop cloud strategies in order to initiate and facilitate the requisite change essential to gain and maintain competitive advantage within the transformational domain of cyber and the rapidly evolving information environment. (Takai) (Vivek) (Cohen)



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TAB 6



CLOUD CONSIDERATIONS





Assurance of your Information amongst the Clouds

EXECUTIVE SUMMARY

As we evolve from the industrial revolution into the information society we have quickly learned to leverage knowledge as we step into the age of enlightenment. In this journey, we must ensure that we have developed an adequate information support mechanism that matures our Frame Of Reference (FOR) of how we see the world and adequately evolves our Situational Awareness (SA) to understand the dynamics of this everchanging environment in which we live. Currently our information managers are faced with the tough job of streamlining the collection and organization of information to afford the knowledge operators the opportunity to fuse and correlate it in order to harvest its inherent value. Only by unleashing the power of information will we be able to garner an asymmetric advantage on the field of battle. Sun Tzu recognized the power of knowledge and advises us to, "Know thy self, know thy enemy. A thousand battles, a thousand victories." (Tzu, 2n Century BC)



Current cloud endeavors are an attempt to address an increasing need for accessibility to information. The necessity to provide this information in a timely and secure manner has been a topic of much discussion and of great concern. As dependency upon this information increases, so does the threat from those to access, deny or manipulate it. (Coram, 2002) With this in mind, this paper will explore the challenges of establishing a cloud that provides for non-repudiation of the data contained within our current infrastructure. Ultimately, the assurance of the integrity of the information and our ability to authenticate and establish assured access to it is a critical necessity for establishing a trusted information environment. Industry at all levels agree the greatest challenge in this endeavor is to provide a network capable of securing the veracity of data at rest, in transit and as it is applied throughout all phases of operations. Hence confidentiality is essential if we are to create an environment upon which confidence can be developed to in turn provide for a medium from which a trusted information environment can be established. Thus, a implementation of sound policy and technological capabilities exposed by cloud computing presents an opportunity to further interlink and connect the world.

I. <u>INTRODUCTION</u>

The goal of information operations is as Sun Tzu advised, "The general who wins the battle makes many calculations in his temple before the battle is fought. The general who loses makes but a few calculations beforehand." (Tzu, 2n Century BC) Currently the United States Information Technology environment is plagued with high latency which precludes the opportunity to provide high fidelity of knowledge to effectively to shape our strategic perspective. The growing need to leverage technology in a way that unleashes the power of information to maintain the asymmetric advantage upon which the US has grown to rely (Kundra, 2011) is established in the framework of the National Institute of Standards and

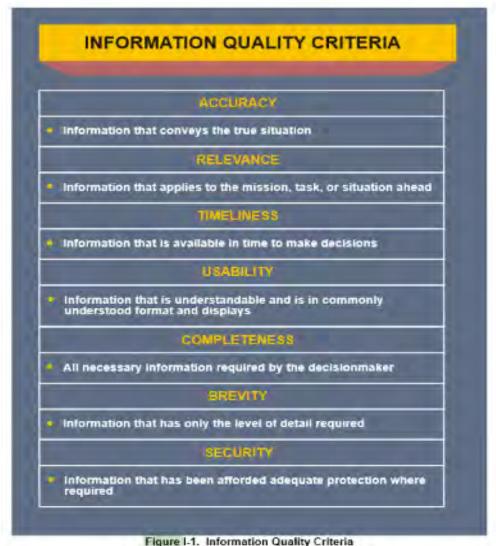


Technology (NIST). In their Special Publication 800-145, they proposed a baseline for a Cloud Computing strategy that defines "cloud computing as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (NIST, 2011) Therefore, we must determine how best to design/architect our infrastructures in order to leverage it in a way that provides for flexible and adaptable capabilities. (Kundra, 2011)

Given the ever-increasing demand placed upon the information environment and the necessity to integrate disparate systems in a way that precludes fragmentation requires the application of technology in a manner supports, enhances and evolves (SEE) organizational objectives. Only through effective design and efficient application that affords resilient engagements can essential redundancies serve to safeguards our system to overcome security concerns. (Franklin D. Raines, 1996) The implementation of cloud computing is a foregone conclusion that most expert agree, done properly, will serve for the objectives to provide much need capability that will allow greater accessibility and efficiency to the environment information. With a rapidly increasing demand signal and ever decreasing resources, cloud computing affords the opportunity to work smarter instead of harder. Thus, the focus of this paper will frame how the cloud should effectively and efficiently be implemented to ensure proper evolution and maturation of information that is both reliable and confidence with these systems. It is the trust one has in the quality of information and the trustworthiness of the systems that store and disseminate it that is at the heart of concern for our impending transition to our future in the clouds.



II. ASSETS OF VALUE

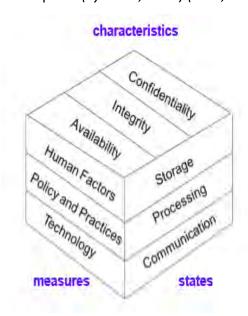


tion access the exitoria upon hour to access its quality. (Chief 2010) These system

[Figure 1 from the publication assess the criteria upon how to assess its quality. (Chief, 2010) These systems must be designed, integrated in a manner that leverage Federal Risk and Authorization Management Program (Fed RAMP) IA's focus.]

Most acknowledge the challenges with implementing and integrating architectures that ensure the cloud provides the necessary cyber security, continuity of operations, and Information Assurance (IA) is essential to providing reliable networks that ensure non-repudiation. It is through this framework that the opportunity to effectively collect, correlate and fuse information in a way to S.E.E. those options to capitalize on opportunities as they present themselves.

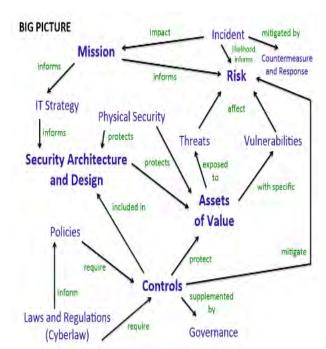
The chart below illustrates the necessary relationships of controls, assets of value, risk consideration and security architecture and design to support mission requirements. Once policies and architect are put in place to provide the necessary controls that mitigate risk, establishing measures of trust in the availability, integrity, authentication, confidentiality, and nonrepudiation of data will be essential to assess and determine the value-added proposition of cloud computing. For with adequate measure to protect, detect and correct attacks from denial of service and malicious manipulation of data, this new capability will prove its value to the enterprise. (Systems, 2006) (NIST, 800-59)



The greatest challenge of the cloud today is the ability to ensure confidentiality, integrity and availability in the data while at in transit rest, or during operations. The McCumber Cube provides an excellent pictorial representation of the building block which the upon characteristics of the state of the information environment and the measures upon which the cloud is to be developed will support the eves and flows of storage, processing and communication.

(McCumber, 2004) The need to protect personal and professional information has economic sensitive information is critical if the systems is to be relied upon. Therefore, prudent step should be taken to preclude disclosure per CNSSI 4009. (CNSSI, Web Down) This pictorial dependency clearly characterizes that if people effective leverage technology with good tactics techniques and procedures in compliance with ascribed policies and in accordance with applicable laws they can and will ensure reasonable accessibility to the data entrusted to the care.





Ultimately, the level of protection in both time and accessibility is directly related to its current and long-term value. Therefore, the ability to mitigate risk by adequately protecting, detecting and correcting inherent vulnerabilities of the cloud through training of proper people, development of policy, and implementation of technology will he critical to establish the

necessary trust to provide the means to transform the information environment. Understanding that the ultimate responsibility to protect data resides with people entrusted with its care, they must therefore ensure systems are properly configured to assure only authorized access is allowed to those properly cleared personnel. (Code)

Trust but verify are necessary action taken to fulfill the requisite results to be achieved. Authentication is essential to ensure authorization provides attribution for actions to mitigate potential efforts to preclude data manipulation or degradation. (CNSSI, Web Down) The ability to authentic the identity of those on an access list becomes crucial and biometrics offers an opportunity to preclude corrupted credentials while cryptology serves to secure system to establish vital network protection. Ongoing efforts to assess, characterize and protect actions and activities on systems identifies discrepancies and deficiencies that must be managed and mitigated in today's volatile, uncertain, complex and ambiguous (VUCA) information environment.



One of the greatest challenges of this new medium of cloud computing is to ascertain confidentiality of not only the networks but the information contained within. (NIST, 7298, Web cite Down) Past concerns with denial of service, access is now overshadowed with manipulation and loss of control of data at rest. The cloud offers greater accessibility to information and readdress the concern of ownership and control. Information is a commodity that is easily distributed, compromised and manipulated and increased reliance upon it make it a vulnerable target to attack. Thus, it is essential that measures to establish at how, when and what information must be protected are vital if a level of confidence is to create a degree of trustworthiness in today's interdependent highly adaptive systems.

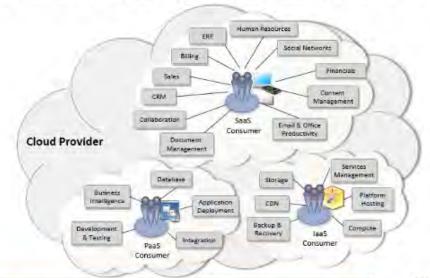
Risk = Threat x Vulnerability x Impact Countermeasures

Data at rest must be assessed to determine the impact from current risks despite available countermeasures to mitigate inherent threats and vulnerabilities. The veracity of information is becoming increasingly more important as is the level of impact that our reliance has upon it as our dependencies within it continues to grow. Therefore, it is imperative that we ensure once access is granted, adequate measure is taken to defend against the growing threat of information warfare. Information warfare is more insidious than cyber warfare for once the adversaries gains access to information, there is nothing to preclude unrestricted dissemination that instantly obfuscate its strategic value. However, unnecessary restrictions often render it useless given the inability to validate, correlate and evolve it within an over-restrictive environment which precludes its functional value.

The ability to segment clouds to provide private, specialized and hybrid centers to ensure the confidentiality and security of information offers the means to provide sufficient flexibility of different delivery models to compartmentalize and distribute information to public, private, and hybrid communities. This affords the necessary security precautions to preclude a cascading and intermingling data and thus ensure isolation to maintain adequate protection of sensitive information. Through the application of private clouds, the potential to minimize risk by adequately containing and controlling mission essential information within an isolated infrastructure

owned managed and operated by an agent or third party provides necessary precautions to preclude intermingled data. It is incumbent upon them to protect this highly confidential mission sensitive information and personal sensitive data like health, financial, and legal records. The community cloud is accessible by those assigned to the community to facilitate communications and collaborative. However, it is the Hybrid Cloud which is the most popular to date for its diverse application that provide the ability to situationally utilize the benefits from a mix of the capabilities.

Example Services Available to a Cloud Consumer

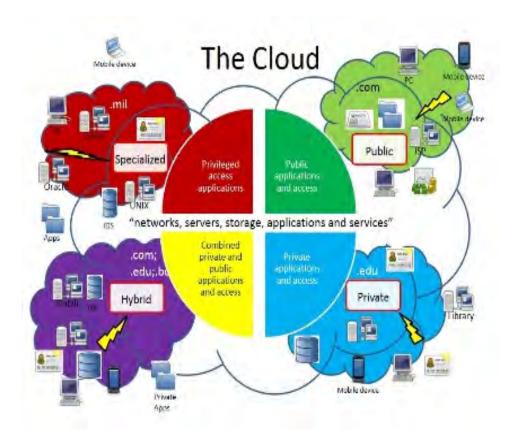


Information Technology Laboratory Cloud Computing Program



NIST's Cloud Computer Reference Architecture and roadmap provides for a scalable modular infrastructure to meet current and future needs. Within this document they identify the security and privacy challenges with recommendations to assist with implementation planning at all levels throughout the organization. Tim Grance the co-author reminds them that "Public cloud computing and the other deployment models are a viable choice for many applications and services. However, accountability for security and privacy in public cloud deployments cannot be delegated to a cloud provider and remains an obligation for the organization to fulfill." (NIST, Special Pub 800-144, Web Down) He encourages them to retain accountability of their data to ensure privacy and security.





The plethora of services currently available include Software as a Service (Saas), Infrastructure as a Service (IaaS), and Platform as a Service (PaaS). SaaS the most common of the three offers third party applications like email and office applications. By leveraging PaaS and SaaS in today's highly rapidly evolving information environment ensure the means to transform at the speed of necessity. This approach assures that only those services necessary are charged which provides essential elasticity to S.E.E. future requirements. By leveraging both capabilities effectively will ensure the ability to provide laaS which is vital for the competitive means to serve the strategic objectives of the organization. (Bohn, 2011)



The opportunity to host public uncontrolled information on cloud service providers continues to show great promise. This precludes the necessity to procure, plan, and program internal capabilities. But caution must be taken for information resides on their system and therefore must be limited to data which you can entrust to their care. Ultimately are these service offerings that provide essential elasticity to adapt to a constantly changing environment which affords the means to adapt and overcome current threats while capitalizing on those options to harvest potential opportunities in today's highly dynamic interlinked world. (NIST, Cloud Computing (SP 800-145), 2011)

Efficienty	V-10-1	
Cloud Benefits	Current Environment	
 Improved asset utilization (server utilization > 60-70%) Aggregated demand and accelerated system consolidation (e.g., Federal Data center Consolidation initiative) Improved productivity in application development, application management, network, and end-user devices 	Low asset utilization (server utilization < 30% typical) Fragmented demand and duplicative systems Difficult to manage systems	
Agility		
Cloud Benefits	Current Environment	
 Purchase "as-a-Service" from trusted cloud providers Near-instantaneous increases and reductions in capacity More responsive to urgent agency needs 	Years required to build data centers for new services Months required to increase capacity of existing services	
Innovation		
Cloud Benefits	Current Environment	
Shift focus from asset ownership to service management Tap into private sector innovation Encourages entrepreneurial culture Better linked to emerging technologies (e.g., devices)	Burdened by asset management De-coupled from private sector innovation engines Risk-averse culture	



The ability to link and drive collaboration is a synergistic catalyst for productivity. A singular focus on de-conflicted data precludes distraction on our confuted chaotic world. The functionality and diverse use of these service provides the framework upon which to grow and expand as illustrated in NIST's examples of services available to cloud consumers. (NIST, Cloud Computing (SP 800-145), 2011) It is these frameworks and the resulting standards and policies which ensure the effective establishment of cloud services that ensure adequate security and confidentiality provides accessibility to only authorized users while precluding unnecessary impediments to the use of data to inform decisions.

Cloud Consumer/Provider Activities

Service Model	Consumer Activities	Provider Activities
SaaS	Uses application/service for business process operations	Installs, manages, maintains and supports the software application on a cloud infrastructure.
PeaS	Develops, tests, deploys and manages applications hosted in a cloud environment	Provisions and manages cloud infrastructure and middleware for the platform consumers; provides development, deployment and administration tools to platform consumers.
InaS	Creates/installs, manages and monitors services for IT infrastructure operations	Provisions and manages the physical processing, storage, networking and the frasting environment and cloud infrastructure for laaS consumers,

Information Technology Laboratory Cloud Computing Program

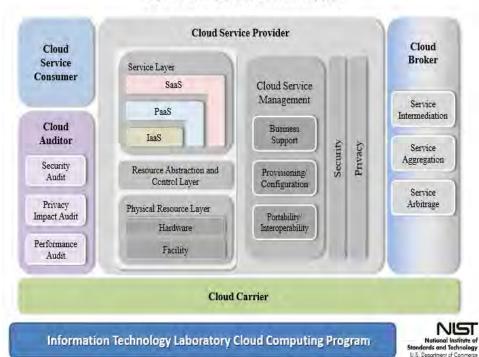


The aforementioned risk imposed to security, privacy and performance continue to present a clear and present danger in today's digital domain. The overriding fear of failure precludes a future where resiliency and adaptability will provide options to overcome a growing threat to data at rest, in transit and during application. Thus, a new approach is essential to address intended and unintended consequences result from a lack of a comprehensive architectural design to adequately provide essential flexibility to ensure visible data, accessible information that enlightens understanding to empower leaders with the ability to evolve in this dynamic domain.



There is not a one size fits all solution when it comes to cloud computing. Each architect, policy and implementation must be custom fit the organization they are to support. Developing a means to address CIAAN concerns, provided necessary resiliency for current and adaptable means to provide for future requirements are critical. Backups, distributed operations, and adequate security measures to evolve confidence and build trust will ensure that the efficiencies gained in this endeavor are not at the expense of operational sustainment. By leveraging the five characteristics and three measures as outline in McCumber's cubic model will ensure a comprehensive strategy to combat current and future threats. (Onwubiko, 2010) This approach will ensure the requisite consideration necessary to identify the means to engage available services that leverage a full array of capabilities that ensure our future in the cloud fulfills its promise to provide strategic competitive advantage on the world stage. (NIST, FIPS 99, Web sit down) (Williams, 2010) (Amab Dutta, 2013)

The NIST Cloud Computing Reference Architecture

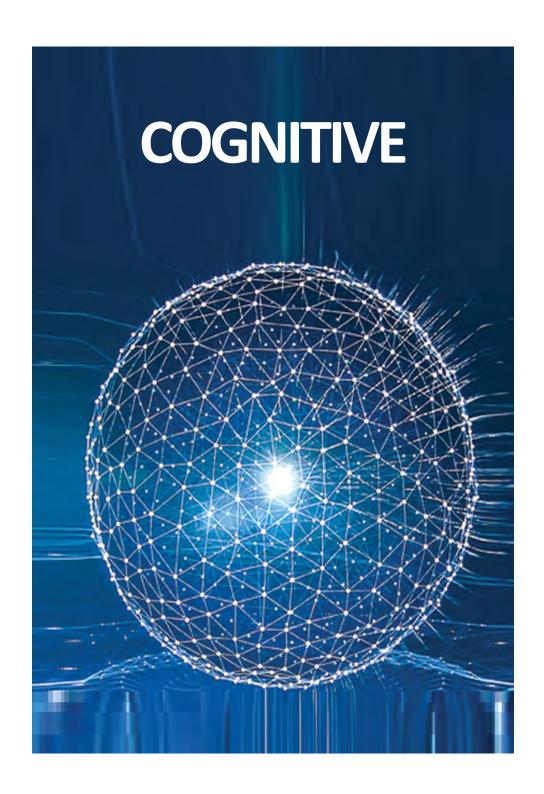




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TAB 7



INTELLECTUAL DIVERSITY





Diversity offers a different perspective and varying viewpoints upon which to make informed decisions. Today's efforts to standardize and normalize operations, has direct forbearance on the effectiveness and resilience. We become single-minded in our efforts to be efficient and reliable. I would tell you that Artificial Intelligence and Machine Learning are just another means to apply technological tools to baseline operations in our ongoing efforts to subjugate dependencies through ongoing efforts to standardize and manage operations.

The preoccupation to manage, not operationalize knowledge, is done so in effort to make the environment comply with our predetermined expectations. The results of this approach ensure sustainment of the status quo and serves to minimize or even mitigate disruption. The need to be safe, secure, and standardize stagnates our ability to explore new environments and does not encourage or empower us to evolve.



The word innovation is the latest buzz word in an effort for organizations to re-invent themselves. As they look to reassert their preeminence when they should be endeavoring to redefine themselves. It is through the creative process of imaginative exploration that is at the core of the innovative process. Ingenuity is the manifestation of actualizing the good idea and should serve to transform the operational endeavor.

Often people convolute this process in an effort to avoid a revolutionary engagement that would disrupt the status quo at the expense of the evolutionary process. This can be seen in at all levels, especially leadership in most organization today. As they endeavor to manage their organization and maintain business as usual, they surround themselves with people who think and act like they do. They fail to extend diversity beyond traditional measures, which precludes deriving the benefit of varying perspectives informed by a multitude of differing backgrounds.

They find themselves with a senior leadership team conforming to a narrow assimilation of people, like themselves, as the reaffirm their place in the organization. The resulting are characteristics attune to group think which binds and usurps them to a predefined stagnant future. Please note I am not suggest dissimilar values but assert that a strong leadership team must have a plethora of diverse perspectives if they are to capitalize on the benefits of a strong and agile team. For it is in the differential of viewpoints that offer a multitude of options to explore and capitalize on opportunities as they present themselves.

With this in mind, I would encourage leaders not to just abide by a diverse workforce as the right thing to do, but to embrace and encourage it for the value it has to offer the future of your organization. People are not a number and their contributions to the organization as a result of their diverse viewpoint precludes the organization from self-limiting itself. Thus, I would encourage organizations to look at the diversity of their workforce not only against traditional measures, but to include experiential diversity which offers a multitude of perspectives upon which to ensure a rich and varying viewpoint that provides the quintessential ingredient to make informed decisions.



I myself am associated with multifaceted organizations which pride themselves on intellectual discourse in an effort to explore options that cultivate and harvest new opportunities. It is through this exploration that teams in conflict eventually find balance which derive solutions that work in all environments. Thus, I can attest first hand as to the imperative for leaders from all walks of life to courageously present diverse perspectives with contrary views and embrace the disruptive nature to actualize the benefits of continual reassessment. This journey of exploring the Art of the Possible will afford the means to stretch the Science of the Probable to unforeseen and at times unforeseen new heights of self-discovery as the organization continually redefines itself to remain competitive in today's ever-changing world.

Therefore, I would encourage you to embrace the differences of those around you and celebrate them as a source of strength which assure vitality of the future of the organization. For through cultural, gender, and experiential diversity the plethora of varying options serve to identify those opportunities that best serve the goals and objectives of the organizations that we are associated. Thus, we should welcome and applaud differences of opinion and perspectives that disrupt the status quo as a catalyst to unlock the potential to expand our thinking and transform our perspective. Ultimately, it is through our diversity that is at the genesis of our ability to find the opportunity to explore, learn and evolve as an organization.





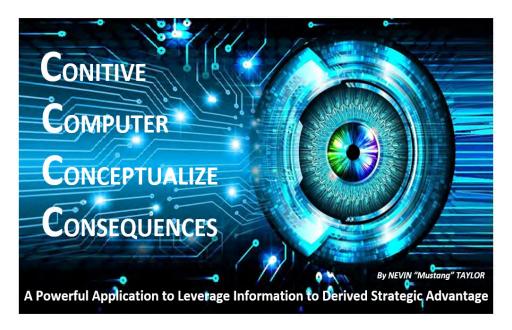


TAB8



COMPUTER CONCEPTUALIZE CONSEQUENCES





Putting the Pieces Together to Make Informed Decisions

The ever-increasing need for efficiency in our more-for-less world requires the ability to leverage capabilities to ensure mission success. Now more than ever, demands a formative ability to understand the consequences of potential decisions through assessments that model and ascertain potential outcomes before they are enacted. By modeling activities to determine operational effectiveness and managerial efficiencies, the ability to formulate adaptive planning and prioritized program is imperative if we are to actualize the strategic objectives to be served.

The Cognitive Computer to Conceptualize Consequences is a long way from the days of peanut butter spreading small budget cuts and waiting for the impacts to become clear. The tool permits a responsible, prioritized reduction in capabilities with enlightened awareness of the operational picture and facilitates proactive decisions by highlighting potential trade space; the result is improved expectation management. This ability to adapt to a changing economic climate and supports emphasis on Information as a vital strategic asset to apply past actions (prescriptive modeling) against present performance (predictive modeling) to ascertain future propensity (potential modeling) to explore options to capitalize upon opportunities.

In the past, emphasis was placed on applying resource to maximize efficiencies at the expense of effectiveness. Resources leveraged to provide fast, good or cheap capabilities; when any two are optimized, the third becomes the tradeoff. In other words, to get a quality product quickly, you should expect significant cost. By depicting operational implication to outcomes (effects) and processes (operations), we are able to prioritize against organizational goals to fulfill the objective that support their goals (strategy). These relationships can be visualized to illustrate the implications of the element of time and integrate it into the computational formula.



The necessity to assess prioritized planning along with efficient programing in full consideration with past conditions, present circumstance, and future conditions affords the opportunity to prepare and, in some case, create the future we seek. C4 collates data in a manner that quickly validates its veracity and illuminate's relationships that were previously "unknown unknowns". But asking the right question can often be far more beneficial than answers without context; even valid data may not improve understanding of how your actions will affect the environment unless they are seen in relationship to the whole.



The tool's most valuable role is in raising the user's awareness from the micro to the macro perspective, allowing decision makers to understand the larger impact of tactical financial decisions on meeting strategic objectives. Ultimately, it affords us the opportunity to understand not just what to do, but why we should do it. By providing enhanced transparency, the ability to increase clarity management expectations as it identifies those influences that effective consequences in the future. Through a pictorial assessment that informs available strategic trade space, decision is made proactively vice in reaction to current conditions.



To remain relevant in a dynamic world, we must focus on the objective and not become distracted by obsolete requirements. This top down holistic perspective ensures focus on organizational goals as opposed to a myopic distraction upon bottom up requirements. By exposing the cause-andeffect relationship between a decision and their outcomes prior to enacting upon them affords the means to optimize effectiveness and efficiently leverage resource to maximize productivity. With great visibility offered by C4, the power to evolve and transform fully informed by potential causality and resulting consequence of a relational data analysis. Ultimately, this capability improves our ability to understand the environment and turn limitations into opportunities through creative application of the cognitive capacity offered through this innovative conceptual capability. In the words of Winston Churchill . . .

"Now that we are out of money, we must begin to think."



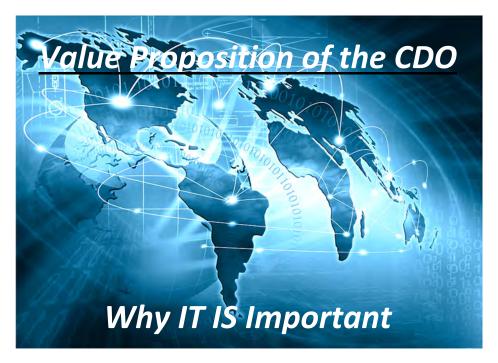


TAB9



THE VALUE PROPOSITION OF DATA AS A STRATEGIC ASSET





What Analytics Is:

In today's high paced and rapidly evolving information environment, having the right information at the right place and right time is critical to derive strategic advantage in a highly competitive interconnected world. To accomplish this, analytics provides enlightened awareness informed by trustworthy data to unlock the power of information. Through effective analytics the CDO affords the identification of opportunities against the assessment of risk to determine the best course of action in order to achieve organizational strategic objectives.

Whether leveraged to assure good strategy, improve effectiveness, or ensure efficient allocation of scarce resource, unlocking the inherent value of data ensures enlightened understanding of the probability of success and potential options through modeling in today's volatile, uncertain, complex and ambiguous environment. The following are just a few of the

values that organized data that is correlated into context of informed knowledge fuels the cognitive process:

- Insight into difficult problems
- Improved processes, productivity, and performance
- cost savings and effective resource allocation
- Scope options and opportunities
- Accurate predictions, plans, and forecasts
- Increased mission
- Assurance/reliability/effectiveness
- Increased efficiencies and streamlined process
- Superior ROI





The Analytics Value Proposition:

The deliverables of a CDO should be data structured and organized to establish its veracity and information correlated to establish the context so that it can be modeled and assessed in a manner that informs the cognitive process. The result of which is analytics that illustrates probable and potential consequences in order to manage expectation and illustrate potential outcomes against organization's strategic objectives:

- Big data Finding hidden clues to improve mission capabilities and capacity
- Business insight Providing quantitative and operational insight into complex problems
- Business performance Improving mission performance by embedding intelligence into an organization's information systems to improve decision making
- Cost reduction Finding new opportunities to decrease cost or resource allocation
- Decision making Assessing the likely outcomes of decision and uncovering better alternatives
- **Efficiency** *Increasing return on investment*
- Forecasting Providing a better basis for more accurate forecasting and planning
- Improved scheduling Efficient synchronization of staff, equipment, events, and activities



- Planning Applying quantitative techniques to support operational objective and tactical engagements that fulfill strategic intent
- Productivity Helping organizations find ways to make processes more productive and efficient
- Quality Improving quality as well as quantifying and balancing qualitative considerations
- Resources Gaining greater utilization from limited equipment, facilities, money, and personnel
- Risk Measuring threats quantitatively and uncovering factors to managing and reducing risk
- Throughput Increasing speed or throughput with a focus to decrease disruptive delays





Answering the Challenges, you Face Today:

Given the increasing number of decisions, complexity of the options and the implications or consequences upon mission success, senior leaders require timely indicators and enlightened modeling systems to identify opportunities and risk to ascertain probability for mission success. Compounded by the vast amount of information that is being generated by massive amounts of data combined with persistent risk in this adverse environment the opportunity to make fact-based decision to assure mission success is critical in this pervasive environment. As a result, analytics can help today's executives with many of the specific challenges they face, such as:

- Deciding where to invest capital in order to grow
- Getting more value out of ERP, CRM, and other software systems
- Figuring out the best way to inform a logical approach forward
- Solving complex scheduling problems
- Getting more cycles out of ATO
- Optimizing a portfolio of investments
- Speeding up response time





Goals and Objectives the CDO:

This exploratory process illuminates opportunities and risk in order to inform the cognitive process to ensure informed decisions. To that end it is imperative that the CDO's DATA Directorate organize and structure data to assess it veracity. The INFORMATION Directorate correlates information to illustrate linkages of their supporting supported relations in order to put it into context. Then the KNOWLEDGE Directorate models it through a cost benefit analysis to quantify the probable and potential Strategic Tradeoffs and resulting consequences of actions taken against resulted to be achieved in order to ascertain the Value Proposition which identifies the potential Return on Operations (ROO) and Return on Investment (ROI).





TAB 10



DATA
DRIVEN
ORGANIZATION
2DO





"We are drowning in information, while starving for wisdom. The world henceforth will be run by synthesizers, people able to put together the right information at the right time, think critically about it, and make important choices wisely."

- E. O. Wilson

As I endeavor to outline the concept in terms that have operational relevance, the following framework is intended to leverage data as a critical asset in service to creating a data driven organization focused upon the fulfillment of their overarching goals and objectives. The result is an informed organization with the requisite knowledge that illuminates understanding to illustrate those options that identify opportunities to make wise decisions. Even though rudimentarily obvious to most, the cognitive process has bogged down given the growing mass of data and resulting complexity of interdependent information that is relied upon for even the most basic decisions. As the world is quickly transiting out of the industrial age into the age of knowledge the challenge that is before us is daunting.



The criticality of making informed decision in a society absorbed and innodated with information has created a risk adverse culture intolerant with less than pure knowledge upon which to base exacting decisions. Thus, their dependency upon collecting data, cataloging information, and correlating knowledge so they can contextualize understanding has created a demand curve which know no bounds. In a simpler time, the information cycle was driven by the daily newspaper, however in today's world of instantaneous access to the internet which has driven a 24/7 insatiable appetite for perfect awareness, and an impatience for less than perfect knowledge which permeates all aspects of day to day life. With all the information germane to any topic or question readily available, the tolerance for mistakes has created a risk adverse environment and a demand signal which is hard to manage.

Today's high pace interlinked world requires an adaptive approach to derive competitive advantage. The growing mass of data and associated complexities of information has increased the difficulty of knowing what the current facts are and understanding the interdependent relationships to fully appreciate the impact of actions taken measured against results to be achieved. With full knowledge and understanding, decisions become relatively simple. However, the task of acquiring data fit for purpose and structuring it into operationally relevant information that informs the cognitive process to determine strategic tradeoffs, is no easy task.

"Everything in strategy is very simple, but that does not mean that everything is easy"

- Carl VonClausewitz

By establishing processes and platforms to assist in the cognitive process we can more effectively assess timely facts that inform decisions and identify how they influence the environment in a way that positively fulfills our goals and objectives. Even with the ability to discover data and search information via the internet, we find ourselves challenged with knowing what to ask and how it effects our circumstances. With a dynamic environment changing and evolving at the speed of light, the growing list of dependencies make it hard to conceptualize. Thus, we must examine and know the facts that support the variables and understand the



relationships and provide timely updates to not only ascertain answers to questions, but be aware and appreciate the operations (addition, subtraction, multiplication, division, exponentiation, commutativity, associativity) and the implication in today's ever-changing environment. Liken to an algebraic formula, we must provide timely updates to the variables involved and collect the necessary facts (data) to acknowledge the extent of how their causality impacts the outcomes or consequences. Then we must properly understand those relationships in order to appreciate the implication of those dependencies. Once we establish the equation, we must find a way to pull timely factually correct data and then properly inject it into the right formula to produce the proper answer to the appropriate question.

Given full awareness of our environment and with an understanding (prescriptive modeling) of the associated dependencies we can become aware through probabilistic deterministic (predictive modeling) as to what to expect and know what options and opportunities exist (potential modeling) and how they can be applied to derive the propensity for the desired outcomes (strategic tradeoffs). It is through our ability to understand the causality of actions measured against results to be achieved that we can determine the potential consequences of these influence and their resulting effects upon our organization.

We need to be mindful that the effects are only appropriately measured and dependable in close systems given the ever-changing nature of our environment in open systems and the varied influencers that are hard to identify and approximate. Thus, we must constantly update the data and those effective variables given the dynamic relationships of this highly pervasive environment which is continually evolving transforming. Therefore, it becomes essential to link data autonomously to assure currency if we are to accurately analyze information (via Artificial Intelligence-AI) given the continually adaptations in our efforts to understand and learn the trends associated with causality and consequence (Machine Learning-ML) in this highly adaptive environment. By illustrating real-time knowledge that informs understand we can now Assess data, Characterize information, Enlighten knowledge, Empower understanding and Evolve (ACE) wise decisions.





A platform and process to continuously update the implications of actions taken and illustrating how the influencers effect the environment in unforeseen ways, we begin to understand the complexities associated with our efforts to support, enhance and evolve (SEE) this ecosystem. By assessing the impact of unintended consequences in today's interlinked world, we become aware as to how this organism performs and garner an appreciation of its characteristics which enlightens us to those actions that empower our ability to effect, evolves and transforms our circumstances to produce outcomes that are in-line with our objectives. Given the complexities associated with the open system and the unpredictability of influencers beyond our control, we struggle to assess how the manifestation of causality effects our ability to A.C.E. operations in an effort to shape and transforms paradigms and perspectives.

"If you know the enemy and know yourself, you need not fear the result of a hundred battles.

If you know yourself but not the enemy, for every victory gained you will also suffer a defeat.

If you know neither the enemy nor yourself, you will succumb in every battle."



DATA - Maturation



Frame of Reference (FOR) - Situational Awareness (SA) - Strategic Tradeoffs (ST) - Strategic Choices (SC) - Enlighten Empawer Evolve (E3)

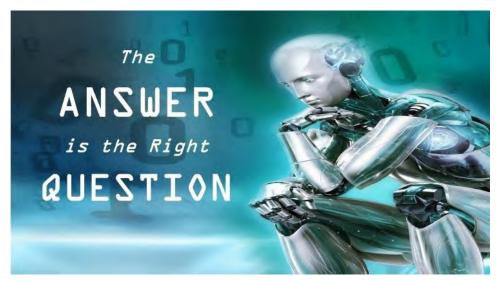
By creating a foundation upon which to assess facts as they evolve, characterize relationships and their interdependencies to elevate of our Frame Of Reference (FOR) heightened awareness, the propensity to make informed decisions affords an enlightened approach to assess the strategic tradeoffs. Thus, properly constructed this enterprise information model will allow the means to define and deconflict data sets to ensure we are communicating on common terms through an enterprise data dictionary (EDD). Then by structuring the relationships as we know them, we can identify where they reside and when they were last updated in common reference point, an information asset catalog (IAC). This affords the means to measure their dependencies upon decisions which inform our understanding of their characteristics throughout the maturation process. These steps offer a means to make data visible so that it can be discovered, information accessible and searchable, and understandable by assimilating it within context. The result is an opportunity to assess those options that serve objectives to make wise decisions that fulfill organizational goals. It is through a journey of exploration that organization evolve and transform to derive competitive advantage in today's volatile, uncertain, complex, and ambiguous environment (VUCA).



"The Concepts and experimentation are intended to be innovative and must be pushed to their extremes. Most experiments fail, yet through failure springs success. That is acceptable and is part of the price we pay for unregimented thinking and open-minded, disciplined experimentation."

Secretary Jim Mattis

In summary, today's CDO must present the foundation of fact (data fit for purpose) as we know it. Additionally, they must provide a structured approach to illustrate the relationships (*information that is operationally relevant*) as we understand it, and then measure the veracity and dependencies (*knowledge in action*) to determine their confidence in it as a measure of its trustworthiness. As they link it in real-time they ascertain its maturation as a manifestation of the adaptive evolution in their efforts to A.C.E. wise choices not just in the here in now but as an influence which shapes the future. In the end, it is about exploration of the question rather the search for the right answer which affords those strategic imperatives are adopted to transform the environment in a way that serves the organization's goals and objectives.





Growing dependency on the information environment and digital domains requires leveraging new tools and techniques to keep pace in our efforts to gain and even maintain our competitive advantage. For today's quest for data is growing beyond our ability to quinces which serves as a catalyst to engulf us into the age of knowledge. For in today's more for less competitive environment that infuses our ability to work smarter is unfortunately often overshadowed and even distracted by the necessity to work harder. In this new world transformed by technology, the days of brawns over brains are gone, as we realize that this new environment no longer assures the survival of the fittest but the most enlightened.

Gone are the days were data was merely managed and stored, the demand signal demands have increased as have the creation and aggregation of data at an unprecedented rate creating a condition which leaves us drowning in data and starving for wisdom. Data is the fuel that feed the quest for information that appropriately applied provides the requisite knowledge to enlighten understanding. To that end, I believe good decisions must be predicated on knowing those facts that inform understanding that illustrate those options to capitalize on opportunities as they present themselves. Given the rapid growth of data that doubles every two years, the related complexity is mind boggling. Thus, we must create tools to assist in the collection, cataloging, and correlation that contextually illustrate the causality and potential consequence of actions taken measured against desired results to be achieved. It is through this elevated awareness that timely relevant decisions can be made predicated upon one's situation and circumstance.

It is thus crucial that leaders are aware of their environment, and must SEE (support, enhance and evolve) to capitalize on those opportunities that provide for the competitive advantage and the fulfillment of those goals and objectives that serve their organization's purpose. Through clarity of thought and a concise unambiguous message they can provide their teams the requisite support by Teaching, Helping, Empowering and Mentoring T.H.E.M. to contribute in a way that maximizes their potential. It is thus essential to evolve and transform their organization if they hope to remain competitive in their efforts to create their future or they will subside to the harsh reality that they will devolve to a footnote in



history. Therefore, they need to understand that the past informs the present, but their vision will drive the organization forward to embrace if not create its own future.

- Leaders establish a Purpose Vision . . .
- Mangers align the Process Efficiencies. . .
- Supervisors capitalize on Potential –
 Effectiveness . . .

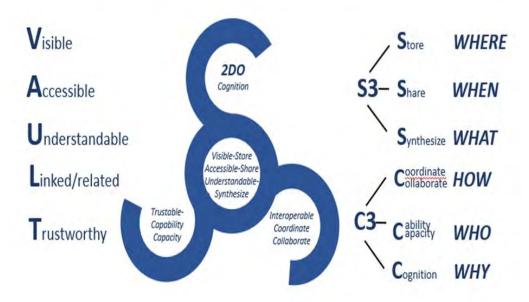
Ultimately, theirs is the vision of the future of unlimited possibilities unencumbered by the impediment of fixing rather solving their problems. This is done by establishing open communication that facilitates coordination to create a collaborative environment that synchronize efforts in order to capitalize on the synergistic byproduct of a team focused effort. One must be cautious to avoid the propensity of becoming distracted by yesterday's success at the expense of today's necessities. For their focus must be looking forward to precluding finding themselves living in the past quickly constricted by it and even condemning them to not just making history but becoming a part of it. Through a thoughtful approach to explore potential solutions, inspirational leaders serve to encourage their teams to courageously engage in planning and programming, focused upon building their organization in preparation to capitalize on opportunities.

- PEOPLE establish an organization's culture that create capabilities that assure goals/objectives engagement
- PROCESSES align sequences and synchronization operations to optimize efficiencies
- PLATFORMS assure consistent engagement to capitalize and harvest effectiveness



2DO - Goals and Objectives

Getting the Right Data (what) to the right place (where) at the right time (when) to the right person (who)



To that end, it is essential to develop a platform to collect and define data into an enterprise data dictionary (EDD), correlate and structure information into an info asset catalog (IAC), contextualize and present it into a knowledge ops portal (KOP). This offers the means to provide the enterprise a tool to discover the mass (Volume) of data by making it VISIBLE in order to measure its quality (Veracity). The second step in this process is to structure it in a way that makes information ACCESSIBLE and provides a means to identify its relationship and measure their dependencies upon it. And finally, it is essential to illustrate the facts that inform knowledge to contextualize it evolves in a way the UNDERSTANDING. By LINKING this in space and time we can elevate situational awareness that evolve knowledge to contextual understanding in order to make wise decisions. It is through this process that we can assess the TRUSTWORTHINESS to unlock the V.A.U.L.T. to understanding throughout all phases of the cognitive process.



Collect

FACTS (data fit for purpose):

Correlate

DEPENDANCIES (operationally relevant information):

Contextual

AWARENESS (Knowledge in Action):

This process affords the means to leverage data in a way that informs us of available options to know what to do, understand when best to accomplish it, and the means to make wise decisions that fulfill those goals and objectives that serve the purpose of the organization. The results will be to optimize effectiveness, serve as a catalyst for change, and ensure the future prosperity of the organization to the mutual benefit of its customers, employees and stock holders.











TAB 11



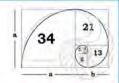
DYNAMIC CHARACTERIZATION SYSTEM



DYNAMIC CHARACTIZATION **SYSTEM**



OPERATIONS DST/BBM/EEE





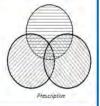
Tri Sect











Lab Rat









Chess Match

euralnets



CONTEXTUAL -> Understand

Analyze. Causality. COP Visualize.



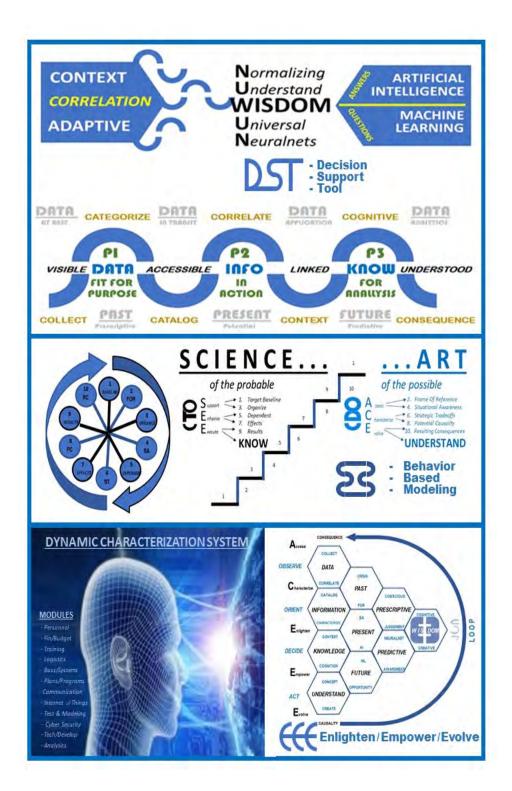
200 - Data Oriven Organization ACE - Assess/Characterize/EEE ADP - Adaptive Planning Process ADS - Authoritative Data Source BBM - Behavior Based Modeling

COP - Common Operation Picture D2D - Data la Decisions DST - Decision Support Tool

EDD - Enterprise Data Dictionary EEE - Enlighten/Empawer/Evolve

IAC -Information Asset Catalog MS - Information Management System ICN - Judgement / Cognitive / Neuralnet KOA - Knowledge Operational Assessment KUW - Knaw/Understand/Wisdom OMF - Operational Mission Facus TAG +









TAB 12



Network
As
A
Service





Network as a service (NAAS) is attracting substantial attention as the next global innovation in computing. Many people see NAAS as related to future capabilities, particularly as cloud computing and virtual networks continue to transform the way we store, access and process information. Yet NAAS is also frequently associated with Platforms as a Service (PAAS), Infrastructure as a Service (IAAS), Applications as a Service (AAAS), Communications as a Service (CAAS) and Security as a Service (SAAS) (referred to collectively as PIACS). Forward-looking capabilities such as these are not new. Rather, since their inception, many have been awaiting cultural acceptance by today's technologically complacent community, which is determined to retain its firm control over information. But the need for visible, assessable, understandable, linked and trustworthy (VAULT) information in today's open systems far outweighs the reluctance to implement virtual networks across a multitude of internal and external systems. In this highly competitive and interlinked digital domain, capabilities such as these offer numerous options that can facilitate an organization's ability to evolve:

VISIBLE - PAAS:

- Desktop Isolated data repositories
- Data Centers First generation data repositories
- Data Pod Second generation data repositories
- Cloud Computing Distributed data repositories



ACCESSIBLE - IAAS:

- Virtual Private Networks (VPN): Extends the functionality and policy compliance of a private network across shared or public networks
- Bandwidth on-demand: Network capacity adapts dynamically to existing demands based on requirements between different nodes or users
- Mobile network virtualization: Mobile communications conduit owned by other entities that serves as a radio spectrum or wireless network-based infrastructure for an on-demand carrier

UNDERSTANDABLE - AAAS:

Analytics

LINKED – CAAS:

- o Phone
- o Text
- o Email
- o World Wide Web
- Global Position Satellite (GPS)
- Quantum Interface

TRUSTWORTHINESS - SAAS:

- Risk Management Framework
- Data Veracity
- Information Resilience
- Knowledge Analytic
- Security
- o Defense in Depth
- End Point





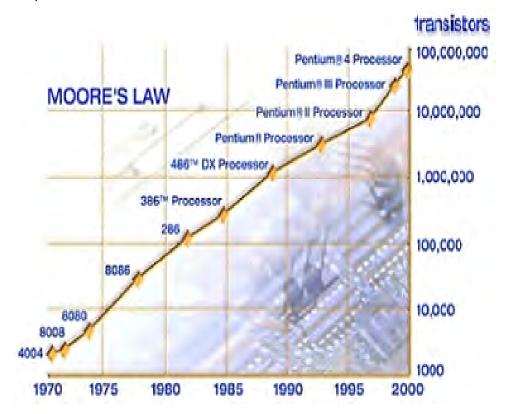
As cloud services and the application of network abstractions through virtual overlay networks that utilize tunnels and virtual switches have continued to mature, we now rely on flexibility to overcome risk and capitalize on the technological tools that enable us to gain and maintain our asymmetric strategic advantage. We now have at our disposal the means to quickly configure capabilities that address our customers' constantly evolving requirements. These dynamic applications can be configured on the fly to accommodate functional requirements and surges in demand at a place and time. Additionally, segmentation offers the ability to manage the infrastructure within a VPN via management application program interfaces (API). Networks with dynamic host configuration protocols (DHCP) for address assignment and linking domain name services (DNS) can address resolution and default gateways (router) to offer flexibility to meet current mission demands and adapt to overcome inherent and persistent risk in this volatile, uncertain, complex and ambiguous (VUCA) environment.



This overall approach provides the critical ability to address the remarkable expansion of data, which continues to double every two years, as well as associated complexity of technological tools. The resulting requirement to store, access and utilize such information meaningfully continues to prompt demands for technological tools capable of effectively managing data, relating information and adding contextual understanding to evolve contextual knowledge. Further, with respect to assessing the trustworthiness of that data, the asymmetric advantage derived from technology gives us the means to ensure its VAULT characteristics. In view of continuing efforts to capitalize on technology to support, enhance and execute (SEE) operations that are informed according to the level of veracity, awareness, linkage and understanding of the evolutionary (VALUE) nature of this VUCA environment, it is little wonder that demand has forced technological evolution to keep pace with an environment that has transistor count in our computer systems expand as illustrated in Moore's Law by a factor of 10 every 5 years in order to support cycle rates that are necessary to keep pace with the increased mass and resulting complexity of an exploding information environment.

Owing to the introduction of adaptive correlation, which enables a better understanding of these interdependencies and their association with relational computation, the need to provide the requisite degree of effectiveness will undoubtedly be offset by the efficiency obtained via interlinked and associated systems. Thus, the necessity to adapt to the VUCA information environment continues to be a primary challenge for most organizations. To achieve mission success, such organizations need a flexible and adaptive means to address data at rest, in transit and during application. As 20% of organizations now rely on cloud services (equating to a \$15B investment in cloud services), the astoundingly high expected returns on these early investments encourage other organizations to invest heavily in this new untapped market. Similar to efforts taken in the early 1980s to map and correlate storage devices and/or compress data to increase capacity resulted in improved organizational capabilities given the relation interlinking of data which not only increased the ability to store more, but the timely accessibility and efficiency of use. Likewise, cloud services will undoubtedly increase effectiveness over contemporary

storage methods by providing similar opportunities to optimize effectiveness through linkage of disparities among datasets while concurrently establishing both the veracity of data and information dependencies.



From a contextual perspective, this yields Fortunately, increasing demand and dwindling resources (again representative of conditions in the mid-1980s) are today driving organizations to invest heavily in this technology, as technological advancements will generate commensurate cost reductions. In sum, this demand becomes the catalyst that drives the cultural transformation necessary to cede control, which thus introduces opportunities to produce data with *VAULT* characteristics and better align such resources with the environment to access, characterize and evolve (*ACE*) operations. This process will inform us about data veracity, the accessibility of information and link dependencies, and it will improve our understanding of the VALUE trustworthiness of data that informs and facilitates the cognitive process.



Since increased bandwidth was cited as a major concern in 40% of today's top industries, the need for more services, available for reduced capital outlays, has driven more than 80% of such organizations to adopt some type of NAAS framework. Pay-as-you-go services offer substantial flexibility and facilitate rapid transformations within both the information environment and the greater cyber domain. The resiliency of these services accommodates surges in demand and assures the presence of capabilities that are essential to remaining strategically competitive in today's interlinked market. NAAS provides the all-encompassing services, managed at an enterprise level, that represent the dynamic backbone needed for peak efficiency and performance. This is particularly significant in today's virtual data centers, which are critical to organizations' ability to structure data in a timely manner while minimizing cost but maximizing capabilities and capacity when and where needed.



As we continue to utilize technology to gain asymmetric advantage in warfare, we must learn how best to procure, operate, manage, sustain and recapitalize our technological tools. All too often, many of those capabilities are obsolete by the time they reach initial operational capability due to the long lead time and costly nature of the research, development and integration phases. In terms of time, dollars and risk, the absolute need to remain on the leading edge of technological capabilities is extraordinarily costly. From a developmental perspective, we have arrived at a crossroads that demands new team approaches to thinking

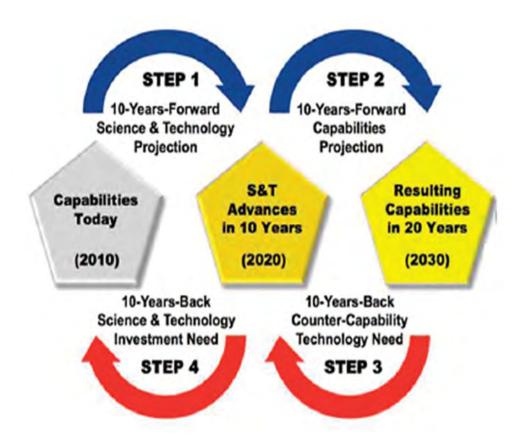
big, starting small and scaling quickly. By establishing a collaborative partnership with industry, we can still emerge as an early adopter, which will enable us to learn about and capitalize on new and evolving technologies. As we seek to address increased demand at lower costs and with seamless integration, such expertise would give us the means to work smarter rather than harder and ensure we maintain our asymmetric technological advantage.

Accordingly, we must institutionalize the ABC philosophy of *adopting* where we can, *buying* if we must and *creating* only when other options are unavailable. As we determine our position within the technological lifecycle, we will soon appreciate the imperative nature of emerging as an innovative early adopter, since that approach offers us the greatest potential to wrangle emerging capabilities and maintain our strategic advantage. Of course, one of the key challenges in the evolution of technological capabilities is keeping pace with the demand for modern systems that support current and evolving requirements and ensure that the right information is available at the right time and place to serve mission objectives.

Considering the overall technological evolution, revolutionary disrupters give exceptional opportunities to gain strategic advantage and embrace opportunities fail forward to move beyond inflexible programs. For example, the cell phone industry recognized early on that initial investment was a barrier for most of its prospective customer base. It became apparent that if industry officials entertained any real hope of attracting an expanded customer base, they would have to distribute cost, operation and recapitalization investments over the lifecycle of those assets. To achieve that outcome, they began with the longest duration asset (the 10-year infrastructure lifespan) and spread its cost to the other contributors (R&D, integration, operation) to recapitalize the cost and advance a single business model. Taking note of Moore's Law, they realized that cellphones had a maximize lifespan of two years, which meant they would be required to observe a 10-year infrastructure investment cycle and commit to a two-year customer base management cycle to stabilize the economic base of their business. This approach offers



an evolution necessary to prevent obsolescence and provide the growth necessary to retain and quickly expand the customer base. With industry now having validated two 10-year infrastructure investment cycles, customers can avail themselves of cell phones that require no initial investment, while industry has retained the ability to upgrade or recapitalize/modernize its technology every two years. This model adapts at pace with consumer demand for new capabilities at decreasing cost. The result is an almost unlimited access to data as well as the ability to communicate with others—usually at less than \$40 a month. Interestingly, the tools made available by cell phone-based communication which include includes the means to, communicate, coordinate, collaborate. The potential of the cell phone is limited only by our ingenuity in applying its capabilities now and into the future.





In contrast to the cell phone industry, the effectiveness of current policy related to Government-Owned, Government-Operated acquisition process pales miserably. It binds us to a five-year cycle, which always places us well behind current trends in today's typical two-year technological evolutionary environment. In short, this relates to the fiveyear Program Objective Memorandum (POM) cycle, which funds the development, testing, validation, procurement, integration and operation of technologies designed to support weapon systems with a lifecycle of 10-40 years. Yet while the *POM* cycle seems adequate for billion-dollar platforms with 40-year lifecycles, it is wholly inadequate for the support of systems influenced by Moore's Law (generally a 1.5-year technological lifecycle). Thus, adopting a Contractor-Owned, Contractor-Operated (COCO) model similar to the cell phone example, which uses distributed cost, amortized resourcing and technology refresh rates that keep pace with demand, would give us the means to adapt, distribute cost and eliminate the need for burdensome management approaches best left to those qualified to provide them. That approach would address the multiple needs inherent in PIACS and tie them into a disaggregated program that follows a COCO-NAAS model.

FASTER, ON-DEMAND Services



From service activation in days/weeks

... to minutes

Scale to meet demand in weeks/months

... in seconds

LOWER Costs & INCREASED Agility



From manual processes, truck rolls and fixed resources

... to automated, software-driven service fulfillment leveraging physical and virtualized infrastructure

INTEGRATED
Customer Experience



From adhoc, siloed management architectures, costly custom B2B integrations, and brittle customer experience

... to standards-based blueprint for delivering assured and orchestrated multi-provider NaaS with B2B API automation

NEW REVENUE Opportunities

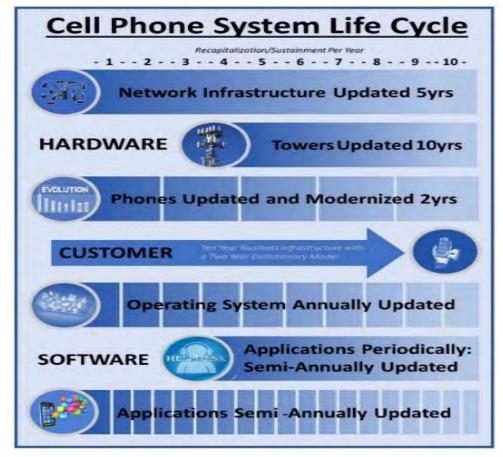


From limited, commoditized portfolio with fixed revenue model

... growing portfolio of differentiated NFV-enabled services with flexible and real-time monetization options



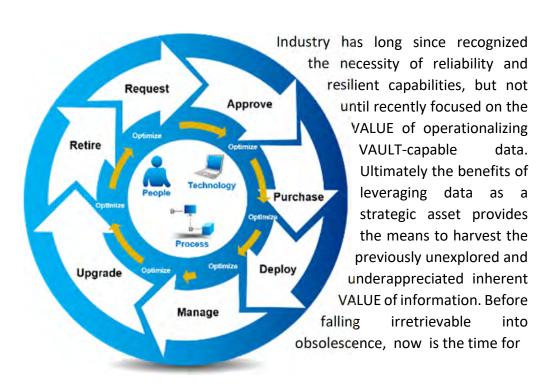
Technologically, current programs do not serve us well. Consider, for instance, that migration of current operating systems has disclosed that only a fraction of current systems today meets current technological standards necessary to migrate risk while providing increased capability in sufficient capacity to meet mission demands. Additionally, current applications have not kept pace with increased need to modernize aging systems that no longer serve our current needs. At this point, the burdensome nature of such systems inhibits, rather than facilitates the organization's ability to achieve its goals and objectives. Today's need for greater capabilities, capacity and mobility, along with enterprise-level management that would yield data with *VAULT* characteristics and information imbued with *VALUE* is paramount. *NAAS* offers both such an opportunity and the means to focus and exploit its untapped potential.





To overcome the many limitations imposed by inaccessibility, untimely integration and modernization, traditional computational capabilities must evolve in an integrative manner to ensure that VAULT data is interlinked with information to effectively support, enhance and execution mission objectives. The continual feedback loop facilitated by current mobile devices linked to cloud-based data frees users from the entanglements that restrict freedom of action and enables timely and dramatically more effective decisions.

To support current communication, coordination, and collaboration needs, we utilize smartphones that provide the means for visual, written, and audible exchanges facilitated by the Internet, GPS, phones, text, email and contextual data, all of which are available for approximately \$40 monthly. Coupled with the cell phone industry's comprehensive business model, that capability, enhanced by cloud-based storage, fulfills both the VAULT requirement and VALUE objectives.



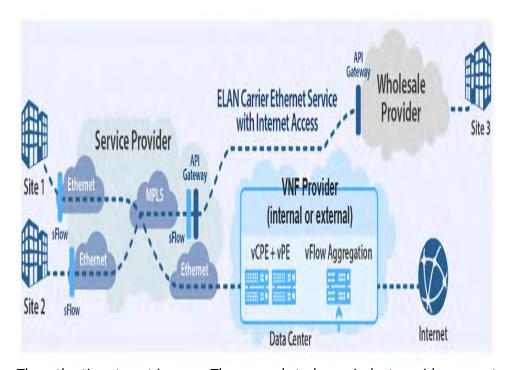


us to enter this market with the vigor and tenacity of purpose second to none. After all, risk that is managed effectively will demonstrate the benefits introduced via the resilience of this environment. Further, such informed management will enable us to achieve the required degree of reliability—at a significant increase in functionality and while deriving exponential decrease in cost. However, accomplishing this requires a concerted advocacy effort to overcome the ingrained desire to control data, which hinders our ability to progress.



Courageous, informed leadership means that the policies needed will be updated to achieve a collaborative approach that will lead—sooner rather than later—to a safe environment for data that offers unrestricted access. Ultimately, the need for awareness and analytics will translate to the best opportunity yet to learn about the options available in today's fast paced information environment. Cloud services and 24/7 connectivity allow us to harvest the strategic power of information, while analytics provide context to knowledge. Both are vital, as artificial intelligence and machine learning continue to enhance our cognitive capacity and enable us to become increasingly proactive. Thus, we can understand better what to do in a given situation, when to do it, and where it should be done. Using the tools and capabilities offered in a NAAS architecture, we can unleash the power of information to ensure the presence of a capable, efficient, affordable and timely system that will support, enhance and help achieve mission objectives.





Thus, the time to act is now. There needs to be an industry-wide request for information to identify current capabilities and develop the frameworks necessary to ensure the best implementation of PIACS under an NAAS umbrella. This should be followed by a request for proposals that will consider cost and timelines, as we seek primary and alternate approaches to ensuring the flexibility and resilience we need in this VUCA environment. This process would also ensure sufficient competition to prevent undue reliance on any single vender, and it would offer incentives to respondents whose proposals promise the best service at the lowest possible cost. Further, we must reject proprietary approaches that direct the operant services to multiple partners, as that eventuality would obscure the clear lines of responsibility and accountability upon which we should insist. Contracts should be awarded based on the contractor's ability to provide the stated outcome and should be based on metrics designed to assess efficiency, resiliency and reliability. Capability over capacity should be seen as the overarching objective, as it will ensure a focus on cutting-edge modernization, which will maximize service and become the catalyst for an asymmetric strategic advantage.



In summary, the growing cost of peripherals, coupled with an aging infrastructure that cannot keep pace with mission requirements dictates a new approach to providing the right information at the right place to ensure mission success. Therefore, it would not be prudent to continue investing in outdated technologies that provide limited capabilities and restrict overall capacity. Many organizations (and even some countries) utilize cellular technology to communicate (phone, text, email), coordinate (GPS), manage resources (financial) and enhance awareness (Internet, IOT). Thus, with good plans for procurement, integration, sustainment and recapitalization, we can obtain a resilient and reliable infrastructure that is capable of meeting all current and forecast needs at a markedly reduced cost. At a time when organizations are struggling to find the resources (time, money and labor) to sustain their outdated business models, cellular capabilities represent an effective and efficient solution that can be implemented within 30-90 days of decision and contract award. Thus, current fiscal constraints juxtaposed with growing mission demands all but demand a full consideration of institutionalizing an NAAS model to support our current and long-term requirements. Taking such action in the very near term will ensure our ability to remain competitive on the world stage.





TAB 13



FUTURE OF TECHNOLOGICAL LEADERSHIP



The Future of Technology Leadership

(It's all about leveraging data to ensure mission success.)

Not very long ago, technology was struggling for acceptance in the public and private sectors. It found itself largely serving an administrative role in the military where it was historically being adapted and implemented for increasing use in the area of operational support. But today times have certainly changed, with the emergence of steadily advanced fighter "armed" with millions of lines of code. The modern aircraft begs the question as to whether it is an airplane equipped with a computer or a computer that can fly. In view of our quickly increasing reliance on technology, it has clearly emerged as the critical element for mission success.

Yet, similar to the advent of fifth generation aircraft, the volatile, uncertain, complex and ambiguous environment in which we operate, coupled with the opportunities and threats that permeate that *VUCA* environment, is far more challenging than at any other time in history. Fortunately, those challenges can be mitigated by enhancing the



capabilities of critical staff members including the chief security officer (*CSO*), who both manages and leverages risk; the chief technology officer (*CTO*), who drives innovation; the chief data officer(*CDO*), who enhances situational awareness and the chief information officer (*CIO*), who galvanizes efforts to fulfill the specified mission. Arguably all are critical to the success of the mission and their collective vision is paramount to success on the field of battle.

Due to our critical dependence on technology and cyber operations to communicate, manage and operationalize mission systems, we must reconsider the approaches we are taking to capitalize on and protect the capabilities afforded by technology in order to maintain our strategic competitive advantage. To begin that process, today's CIO must employ proven as well as evolving CSO/CISO techniques to assess and manage risk. Likewise, the CTO must have both the ability and ingenuity to utilize current and developing technologies to fulfill mission objectives. Further, the CDO must always be prepared to unleash the power of information to gain strategic advantage, as doing so will ensure the organization remains capable of evolving in today's highly competitive and rapidly changing Whether for business systems, weapon information environment. systems or to inform strategic endeavors, the CIO must have the ability to leverage technology to overcome challenges and to seize unseen and unrecognized opportunities. Ultimately, the leadership, expertise and experience of these essential staff members will assure our ability to understand and utilize technology to the greatest extent conceivable.





Despite a competent staff, however, increasing costs, dwindling resources and the constraints imposed by Moore's Law require us to engage in collaborative partnerships with industry. By doing so, for example, the CTO will hone the ability to apply technology to achieve a degree of operational effectiveness that is at once coordinated, unified and unobstructed. By synchronizing those efforts with the actions being taken by the CSO, we can have greater certainty about our operational environment, as we can be assured that operant risk factors are being managed effectively. Further, the CDO will define the analytical context that will allow us to assess, characterize and evolve despite the unpredictable VUCA environment. Ultimately, they all will be responsible for the direction and application of these vital resources, and for providing the support necessary to coordinate efforts, inspiring them to augment missionrelated capabilities and imparting the vision that will enable the organization to meet current and future objectives. Based on the foregoing, we propose a multifaceted action intended to imbue critical staff members with greater authority. In short, that effort will yield a single point of convergence that will simplify the supervision and management of technological capabilities, whether for business systems, administrative support, weapon systems or analytical systems.







TAB 14



COLLECTIVE





I. STRATEGIC ASSESSMENT

There is currently increased emphasis to migrate to the cloud. The common belief is by interconnecting communities via this new medium they can gain the desired effectiveness and achieve efficiencies by leveraging evolving technological capabilities. Additionally, the requirement to consolidate data centers to be more efficient also affords the opportunity to realign information in a semantic web-based approach. This effort coupled with recent emphasis upon increasing the force's employment of telecommuting demands new and innovative ways to accomplish the tasks at hand. Therefore, the technological tools to interlink and bring personnel together through virtual teams will go a long way to facilitate mission success in these austere times.



The advent of remote video teleconferencing via a multitude of mediums provides the opportunity to virtually engage anywhere at any time. This coupled with remote access to email and instant messaging affords the opportunity to stay connected at work, while at home and during transit. This seamless integration of capabilities and instantaneous access to information affords the means to coordinate and communicate (C2) in a collaborative manner not previously attainable. Today's technological tools incorporated with the access afforded by cloud's capability to facilitate data sharing, provides a virtual means to instantaneously coordinate and collaborate like never before. Ultimately by leveraging today's technology we are afforded a unique opportunity to establish a Collaborative Oriented Learning environment which allows us to Leverage Evolutionary Cognitive capacity to apply Technology to Integrate and provide for a Virtual Environment (COLLECTIVE).

II. BENEFITS and ADVANTAGES:

Only through working smart in a team focused manner will we be able to find the best answers to today's complex and perplexing problems. As they say two heads are better than one and it is through a collaborative team effort will effective solutions that overcome today's overwhelming challenges will be found. To accomplish mission objectives, working collaboratively in the clouds affords the opportunity for many hands to make light quick work of even the most complex tasks. By linking powerful applications that coordinate a multitude of audio, visual documentation will we be able to provide a means to synchronize and manage a multitude of endeavors across the disparity of geographically separate locations. By providing a reference upon which to coordinate and schedule a variety of task in an integrated fashion, cloud services facilitate the essential visibility to ensure greater transparency for supervisors and managers to see and track workload of subordinates. Additionally, the ability to crowd source establishes a strong foundation upon which to evolve knowledge during the early stages of a projects in full consideration of those options to maximize the utilization of available resources. The inherent ability to leverage the collective experience and understanding of the entire team ensures a comprehensive and focused effort to derive synergy to expeditiously accomplish established objectives in fulfillment of organizational goals and purpose.



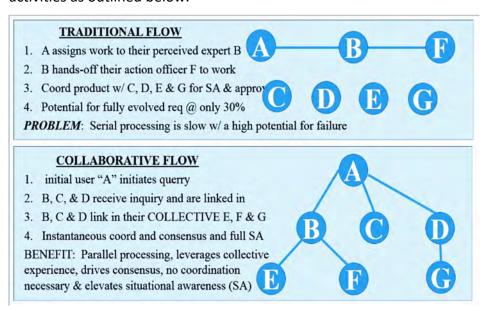


As projects are collectively worked, programmatically managed and concurrently published in a collaborative manner, future efforts can be informed by past actions instantaneously given cloud assess points. This ensures available data that informs options and opportunities to adjust and adapt to our everchanging environment that evolves at the speed of mission. These new cloud capabilities serve as a catalyst to align and mature processes that derive increased effectiveness and greater efficiencies. They serve to maintain current situational awareness in our efforts to explore and actualizing solutions in an ever increasingly complex volatile, uncertain, complex and ambiguous (VUCA) world environment. By linking the existing tools in office software applications and cloud services provide increase accessibility and convenience of current tasking system through services offered by cloud computing which provide untapped opportunities to increase collaborations, reduce coordination and provide the necessary accessibility of a unified team focused effort.

III. CHALLENGES and DISADVANTAGES

It must be understood that the cloud environment is not without some inherent risk. A foremost concern of this new medium is the security, of ownership data which control and presents ongoing consternation. Therefore, the capabilities touted by cloud service providers must be assessed against the potential risk that will be incurred. Even though accessibility, reliability and backup are designed into the fabric of their offering, the implications to an organization's Risk Management Framework (RMF) and impact incurred to operations should be considered and weighted against the expressed benefits. Additionally,

the new enhanced functionality must be accessed against current policies and business rules in order to ensure processes and procedures are aligned to ensure adequate measures are taken to assuring prudent actions and activities as outlined below.



The greatest challenge in the current system tasking are delays incurred by serial coordination. Transitions are never easy and rarely accepted wholesale. However, the value consideration that this new capability offers will afford an exponential increase of output as a direct result of synergistic capacity resulting from a seamless highly unified platform. It is this approach that provides the means for parallel sharing, building and assessing opportunities previously difficult if not in some cases impossible to identify or recognize.

The lack of collective focus garnered by working in parallel precludes concurrent consensus. The benefits derived from this endeavor contribute toward an inclusive open-minded approach which provides instantaneous coordination through its collective contributions to mission success as indicated in the previous figure 1. Once the aversion to change is accepted, processes are matured, security concerns managed, and policies the provide opportunities to derive exponential benefit through the application of data that serves as a mechanism to improve responsive actions throughout the cognitive process.



III. IMPLEMENTATION STRATEGY

There is much to be considered when developing a roadmap forward. Not the least is the immaturity and lack of standards in this unexplored environment. Despite efforts to standardize the digital domain and information environment, the means to baseline against industry standard have yet to be fully developed and universally accepted. Therefore, by evolving this initial framework in a spiral development approach coupled with the necessary level of accountability facilitated by sufficient advocacy provides an iterative approach to think big, start small and scale quickly. The resulting congruence of operations will establish initial user confidence that manifests itself into trust in this new and pervasively unpredictable environment. (Johnson, 2013)

Implementing this strategy draws our attention to consider Cloud Services from a growing list of options. As such, migration to web enabled operating environment and the associated plethora of available applications require a strategic framework and an implementation plan to effectively derive the operational benefits within this interconnected domain. With free individual service offering, and low cost to entry corporate plans, the price point for their services is hard to beat. Make no mistake, these options are intended to lower the cost of entry and make way to incentive action in an effort to overcome risk adverse naysayers. However, be aware of supplement and utilization cost when considering the total cost of ownership to preclude unintended consequence from dependencies and increased utilization associated with this rapidly expanding capability and associated growing list of services and capabilities.

As most have experienced during transformation, the greatest hurdle to overcome is the cultural aversion to change. However, a well thought out strategy to fulfill the organizations vision and purpose affords sufficient advocacy and focus to collectively fulfill the organizations mission objectives. Thus, a sound concept of operations ensures collaborative engagement through a well-orchestrated implementation plan. Therefore, the criticality of establishing consistency of perspective ensures a focused



endeavor that matures processes and refines actions the provide requisite results through an improved governance process. By leveraging cloud services in conjunction with increased security through SSL encryption, client-to-client communications via SDCC and PSYC protocols the resulting environment provides safe and stable access to information. In time the pathway for great utilization of this evolving capability will undoubtedly increase leveraging and unleashing the power of information to provide greater functionality as a result of increased accessibility to the data critical ingredient to making informed decisions.



means to instantaneously provide Ultimately, the synchronous communications through virtual conferencing will in time develop better repoire through increased confidence which will undoubtedly improve trust in the system and teammates as the organization grows and evolve. In time, the network will become decentralized through shared RSA public keys and provide increased stability, decrease latency, to interconnect a collective in the same fashion as networks with peer-to-peer and friendto-friend protocols. It will not take long before users will incorporate these tools as part of all operational necessity and see it as a catalyst to their business process. Concerns of this new venture should be immediately addressed and responsively acted upon in order to adapt and apply technological challenges associated with implementing and integrating these solutions in today's risk adverse society. It is through this approach that avoidance can be transformed to advocacy in the adaptation of this capability which offers great capacity to lower cost and mitigate risk.





Ultimately the time for action is now as we embark on a journey of continual learning intended to facilitate the evolutionary process. For in the words of Patton, "A good plan, violently executed now, is better than a perfect plan next week." Therefore, incremental roll-out through a programmatic approach that establishes well defined milestones incorporating good communications to coordinate actions effectively manage expectations while encouraging good customer involvement ensures smooth transition in the evolutionary establishment of the new normal. By capitalizing upon these feature rich options provides the essential elasticity to adapt and apply new services to afford unforeseen functionality of remote accessibility, collaborative working and synchronous conferencing capabilities currently unavailable with current technological enterprise service solutions.

Through incremental implementation to ease the transition that concurrently builds repoire with the users, the opportunity for the community to collective and comfortably transition to a feature rich platform that delivers functionality and reliability allows users to take an iterative approach to evolution by learning to walk before they are required to run. In time they will become increasingly more comfortable which will allow their confidence in these collaborative tools to grow an establish familiarity in an environment that ensures their ability to more effectively shares files, manages messaging, and engage visualization through web meetings that provide a valuable addition to their work suite.





III. MATRIX TOOLS

The opportunity to baseline future efforts informed by past activities presents a formidable strategic advantage. The dynamic nature of the information environment and the dependencies on access to data has increased complexities of operations exponentially. It is increasingly difficult to calculate the opportune cost/benefits against options that present potential benefits to the organization's ability to optimize effectiveness and evolve proactively to effectively actualize opportunities in their future. However, the growing need to transition and transform demand has fortunately increased capabilities to offer increased flexibility through the inclusion of a collaborative approach that builds confidence and trust to courageously confront even the most complex problems.

The ability to assess past performance against current trends provides be a valuable opportunity to take a proactive approach to prepare for the future. It is through the instantaneous access to information utilizing cloud capabilities that we can facilitate greater connectivity which affords leaders, managers and team members the means to collectively C2 the big picture and prioritize efforts with a clarity of focus never before imaginable. The functionality of tracking contribution and productivity has never been greater. By assessing workload, the means to balance teams and align skill-sets to maximize productivity provides the context upon which to base how to best leverage resource that produce results. Ultimately the functionality offered by these technological tools assures the quintessential accessibility to allow a value-based assessment which empowers and facilitate each team members to actualize the potential to contribute to the organizations purpose.





V. BENEFITS TO THE ORGANIZATION

Overall, the prescribed improvements afford organizations the ability to leverage a team focused endeavor through these collaborative tools. The addition of remote accessible functionality will create an even greater interconnect world to further eliminate the disparity of distance and bring teams together to collaborate like never before. By utilizing these new tools, expectations will be more effectively managed, awareness elevated to enlighten leaders and empower others of those options and opportunities to evolve the organization. In addition to being more informed through available information, the potential to produce results given increased resiliency will elevate reliability. This will elevate confidence, increase trust and provide greater stability to evolve and sustain operations through a proactive approach to fulfill organizational goals and objectives.





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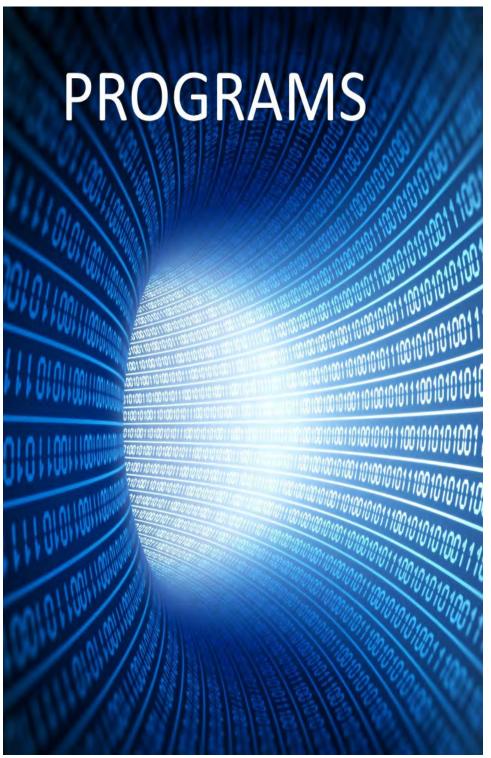
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Assessment
Virtualization
Engineering
Research
Integration
Center



BULLET BACKGROUND PAPER

BACKGROUND:

As the world continues to transform and evolve, the need to take an interactive approach to model in real time requires instantaneous assessments of the interdependent causality of potential consequences. The necessity to apply technological tools to virtualize engineering solutions requires the means for our research to determine the implications of integrating solutions into the enterprise and the propensity to scale to meet a growing mission need. Project MAVERIC provides the means to take an innovative approach to Think, Try and Test solutions to today's perplexing problems. It assures expeditiously the opportunity to operationalize capabilities through a programmatic approach to innovate, integrate, and implement through an iterative process to produce capabilities that provide products that transform the organization to remain competitive.

Modeling
Assessment
Virtualization
Engineering
Research
Integration
Center

PURPOSE:

Support, enhance and execute (SEE) efforts to Assess past performance and Characterize the impact through Enlightened actions that Empower opportunities to Evolve the organization to think, try, and test capabilities that optimize mission effectiveness we must develop a dynamic characterization system that ACE through a Judgement, Characterization Neuronet (JCN) system.

Assessment
Characterize
Inlighten
Modern Production

Characterize
Inlighten
Modern Production

Characterize

Characterize

Characterize

Characterize

OBJECTIVE:

Leveraging collaboration between government agencies, industry, and academia to ideate, innovate and implement through C2abit (Capabilities Advisory Board and Capabilities Innovation Teams) to leverage current and future capabilities to solve and evolve the organization. Through a formalized designing thinking program CGA (Capabilities Gaps Assessment) the means to test and model assure effective modernization (Modernization Service Capabilities – MSC) provides the means to Support, Enhance and Execute the Mission.

Support Enhance Execute



SCOPE:

Be establishing five centers to leverage existing efforts the opportunity to establish value within 18 months offers the means to modernize the Air Force. The need to SEE and ACE operations is capitalized by the following centers:

- FORAC FOR Assessment Center
- **SACS** SA Characterization Center
- **TTEC** T2 Enlightenment Center
- **DTEC** DT Empower Center
- **VMEC** Virtual Modeling Evolution Center

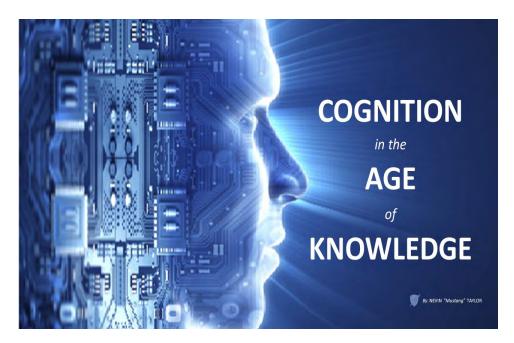
METHODOLOGY:

MAVERIC: DODevelopment, AIMLearning, and VAMRealities.

ACE: DST, OLR, and OCM

SEE: C2abit, CGA, and MSC

E3: CDO-Enlighten/CKO-Empower/CAO-Enlighten: COGNITION









CAPABILITIES ADVISORY BOARD CAPABILITIES INNOVATION TEAM

2AB IT

TERMS OF REFERENCE

FOR THE

C2abit - Think Tanks

Capabilities Advisory Board (CAB)
Capabilities Innovation Team (CIT)

PURPOSE

These Terms of Reference will establish the responsibilities, scope, and procedures for the Capabilities Advisory Board (*CAB*) and Capabilities Innovation Team (*CIT*) to provide the innovative capacity of *C2abit* to enhance Capabilities operations.

OBJECTIVE

The *CAB* are senior interfaces that are currently aligned to senior leaders of the organization. They will provide leadership and serve as a golden bridge to interface between industry, academia and government entities. The exist to leverage and capitalize upon future capabilities offered by the *CIT*.

The *CIT* will encompass a team of subject matter experts (*SMEs*) within industry, academia and government. Their formulation is intended to capitalize on their greatest assets; experience, ingenuity and business holistic acumen. The *CIT* serves as a catalyst to provide a symbiotic interface to capitalize on opportunities within the rapidly evolving information environment.

The collaboration between the *CIT* to capitalize on innovation and the *CAB* serves as an interface with senior leaders throughout the organization. The intent is to provide a means to solve problems and integrate future technologies to overcome current and future threats while leveraging capabilities in a manner that ensures mission success.

The *C2abit* is intended to capitalize on new technologies, examine and validate Tactics, Techniques and Procedures (*TTPs*) and identify risks in a Volatile, Uncertain, Complex and Ambiguous (*VUCA*) information environment.



SCOPE

This program will serve as a catalyst to provide a symbiotic relationship that facilitates a competitive advantage in this rapidly evolving environment. The *C2abit* will capitalize on existing alignment of *SMEs* to harvest the mutually beneficial potential derived from their vast experience.

METHODOLOGY

A *C2abit* Executive Director will facilitate the identification and formalization of the *CAB* and *CIT*. Senior leaders throughout the organization will be identified and be invited to participate in the *CAB*. *SMEs* holding key positions within the organization, academia and industry will be invited to join the *CIT*.

The *C2abit* Executive Director will serve as the *CAB* Chair to provide leadership and facilitate the collaboration and coordination between the *CAB* and *CIT*. A quarterly report, to include an executive summary, together with findings and recommendations will be presented to the governing body of the organization with findings, opportunities, and potential solutions.

The *C2abit* will engage the Capabilities Gaps Assessment (*CGA*) to establish a baseline and analyze the report's findings and provide a programmatic proposal to stakeholders. The membership of the *CAB* and *CIT* will be presented to leadership for coordination and concurrence.

RESPONSIBILITIES

C2abit Executive Director will access missions, functions, documents and files and provide current staff directories and organizational charts. Provide formal or informal directives that deal with applicable policies. Provide a quarterly Executive Summary of current efforts and future opportunities that are to be encapsulated in the annual report.

<u>Amendments</u>. This *TOR* can be amended, as additional information is made available. All parties must agree to such amendments.

POC. The C2abit Exec Dir is _____at (XXX) XXX XXXX.





CAPABILITIES GAPS ASSESSMENT



CGA – Design Thinking

Capabilities Gap Assessment

TERMS OF REFERENCE

PURPOSE

These Terms of Reference will establish the responsibilities, scope, and procedures for the Capabilities Gap Assessment (*CGA*) analysis to ensure the successful support of ongoing operational capabilities.

OBJECTIVES

The CGA provides insight as to how best leverage the technological tools of Capabilities to support, enhance and execute mission capabilities. Given the fluidity of the capabilities in today's Volatile, Uncertain, Complex, Ambiguous (VUCA) environment, the means to leverage the strategic value of our asymmetric capabilities in the technological arena must rapidly evolve to remain competitive. Ultimately capabilities' capacity is vital to mission success and its ability to support, enhance, execute (SEE) the mission which serves as a catalyst to integrate and synchronize operational effects.

SCOPE

This program will serve to provide technological solutions integrating capabilities by identifying relevant gaps, positively addressing shortfalls, synchronizing relevant corporate level efforts, directing policy and advocating for resources. The *CGA* is a collaborative effort to capitalize upon resulting synergies throughout the organization.



Through the evolution from the industrial age into the information age, ongoing transformation is essential to remain competitive within the *VUCA* environment. The ability to *SEE* crosscutting capacity is vital to derive an asymmetric technological edged. Thus, *GSA* will serve as a catalyst to drive innovative and evolve through a transformative effort to modernize and transform the organization.

METHODOLGY

The CGA Executive Director will facilitate the identification and formalization of the CGA. They will collaborate with division heads throughout the organization to identify gaps, shortfalls, best practices, policy conflicts and collect requirements essential to fulfill mission objectives. Once assimilated into an assessment report they will assess as to how best identify current threats and identify opportunities.

Through a myriad of think tanks, working groups, and test and evaluation groups to propose ideas, proposals and solutions to the organizations most perplexing problems. The culmination of these efforts will be captured in a quarterly executive summary including recommendations and actions to manage risk, integrate capabilities, and adopt solutions including suggested organizational training requirements.

RESPONSIBILITIES

The *CGA* Executive Director will access missions, functions, documents and files and provide current staff directories and organizational charts. Provide formal or informal directives that deal with applicable policies. Provide a quarterly Executive Summary of current efforts and future opportunities that are to be encapsulated in the annual report.

<u>Amendments</u>. This *TOR* can be amended, as additional information is made available. All parties must agree to such amendments.

POC. The *CGA* Exec Dir is _____at (XXX) XXX-XXXX.





MODERNIZATION SERVICE CAPABILITIES





TERMS OF REFERENCE

FOR THE

MSC - Game Theory

Modernization Service Capabilities

PURPOSE

These Terms of Reference will establish the responsibilities, scope, and procedures for the Modernization System Capabilities (*MSC*) to ensure the successful Assessment, Development, and Execution of innovative capabilities.

OBJECTIVES

The MSC will serve three functions:

- Evolve offensive/defensive capabilities operations to hone skills and evolve tactics, techniques and procedures (TTPs)
- Test, evaluate and certify experimental technologies from C2abit into current operational construct to assess resulting effects upon current capabilities systems
- Establish and operational baseline from which to assess and characterize the options and opportunities to develop new and evolve existing capabilities

SCOPE

This program will serve to enhance operations by evolve skills to:

- Provide personnel essential skills to assure mission effectiveness
- Educate and train personnel to be experts to effectively support, enhancement and execution (SEE) the organization's mission
- Strengthen mission assurance through refinement to TTPS that refine maneuver and promote freedom of action
- Optimize the planning, programming and execution of to derive essential effects and assure mission critical investments to support operational design and joint operation planning.



Overall, *MSC* will characterize and provide an ongoing assessment regarding the risk inherent within our environment and provide a conduit to evolve critical Capabilities *TTPs*. To that end, it will provide a safe environment upon which to test both new technologies, current operational constructs, capabilities, and skills of our warfighters.

METHODOLOGY

The MSC will take those gaps and threat identified by the CGA and present them to our best and brightest to ideate. It will offer them the opportunity to leverage new capabilities provided by the CIT without subjecting current systems to the risk of unintended consequences.

The *MSC* Executive Director will facilitate the identification and formalization of the *MSC* utilizing current and available assets. The activities of the *MSC* will inform policy, mature strategic endeavors and serve baseline and set future training requirements within Capabilities operations.

The MSC will provide ongoing recommendations to the organization and provide a monthly assessments report that will identify mission impacts and potential unintended consequences as a result of operating within a Volatile, Uncertain, Complex and Ambiguous environment.

RESPONSIBILITIES

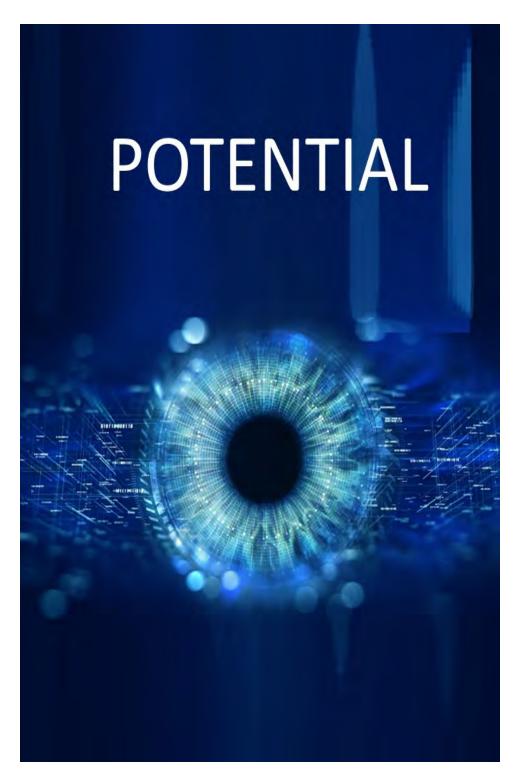
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<u>Amendments</u>. This *TOR* can be amended, as additional information is made available. All parties must agree to such amendments.

POC . The <i>MSC</i> Exec Dir is	at (XXX) XXX-XXXX.
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The L.O.T of T.H.E.M.

LEADERS

OF

TECHNOLOGY





Due to our critical dependence on technology and cyber operations to communicate, manage and operationalize mission systems, we must reconsider the approaches we are taking to safeguard and leverage the vital capabilities afforded by technology in order to maintain our strategic competitive advantage. To begin that process, today's Chief Information Officer (CIO) must employ proven as well as evolving security practices under the auspicious of the Chief Security Officer (CSO) techniques to assess and manage risk. Likewise, the Chief Technology Officer (CTO) must have both the ability and ingenuity to utilize current and developing technologies to fulfill mission objectives.

The Chief Data Officer (*CDO*) must always be prepared to unleash the power of information as doing so will ensure the organization remains capable of evolving in today's highly competitive and rapidly changing information environment. Whether for business systems, weapon systems or to inform strategic endeavors, the *CIO* must have the ability to leverage technology to overcome challenges and to seize unseen and unrecognized opportunities. Ultimately, the leadership, expertise and experience of these essential staff members will assure our ability to understand and utilize technology to the greatest extent conceivable.

Despite a competent staff, however, increasing costs, dwindling resources and the constraints imposed by Moore's Law require us to engage in collaborative partnerships with industry. By doing so, for example, the *CTO* will need to hone the organization's ability to apply technology to achieve a



degree of operational effectiveness. By synchronizing these efforts with the actions being taken by the *CSO*, they will have greater certainty about the viability of their operational environment.

Operational risk is an ever present and pervasive threat with a multitude of factors to be considered. To effectively manage this risk, all three must formulate a cohesive strategy to identify and illustrate cost benefit tradeoffs. This will ensure a collective approach to assure awareness of the implications and strategic trade space in this dynamic continually evolving environment.

Through the collaborative efforts of these individuals will ensure the ability to assess, characterize and evolve (A.C.E.) operations. The combine efforts of all four will assure a cohesive well-coordinated effort to effective optimize operations and efficiently leverage resources. The result will assure a highly dynamic fully mission-related capable organization with sufficient capacity and resiliency to adapt and overcome even the most aggressive engagement in today's highly competitive interlinked world environment.

Based on the foregoing, a multifaceted approach empowering these key positions with greater authority to swiftly and decisively act on behalf of the organization's interest is vital to the sustainment of these mission critical capabilities. This combined point of convergence will provide essential coordination and collaboration (C2) to effectively and expeditiously carry out their responsibilities.





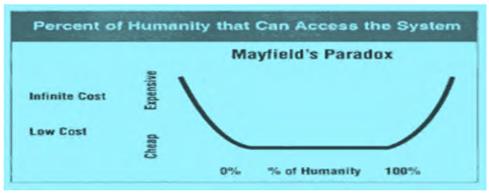


Operation
Shape
Shifter





Mayfield Paradox stipule that to restrict information system requires more money to defend it than that expended to attack it. The costs between some of these extremes are relatively low.



The cyber security field is aware that at some point in the curve, additional efforts are ineffective. At some point it becomes unrealistically expensive to add additional users.

RESOLUTION

By utilizing timing (*WHEN*), and reference points (*WHERE*) you can effectively operate in plain view of the adversary without the fear of OBSICATION, CORUPTION or BREACH of data. For liken to the old frequency hopping radios, your information will be able to exist in the cloud in plain view without fear that the intrinsic value of the data will be forsaken. For it is the expanse of the cloud which offers the means to leverage inherent flexibility to transition and transform in order to adapt and overcome the adversary's efforts to control and conquer the information environment. The flexibility offered by OS2 ensures the means to safely store, transmit, and apply data without the fear of the adversary being able to see and assimilate it.

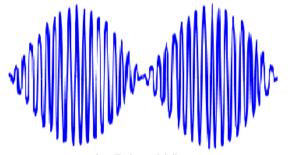


Frequency modulation

reference points (when they exist) in accordance to alternating synchronization in order to adjust and adapt the SHAPE (where they exist). Thus, the opportunity to disseminate information in the clear without the need for encryption can be accomplished void of security efforts.

PROPOSAL

If you alternate the amplitude modulation within the signal to disseminate binary code and utilize frequency modulation to synchronize an evolving signal or orient the reference points within the information environment you can SHIFT their



Amplitude modulation

The origin in this dynamic environment are pre-established on a level of a trusted relationship, and the references are adapted from and shifted by the reliance's and synchronization of the dependencies within this dynamic environment. Liken to the methods utilized by OTAR to adjust and adapt, OS2 does not store the linkage to its orientation to reference information in a traditional manner as was done through historic encryption endeavors. This is an evolving system that is focused upon references and relationships of data as it evolves with primary interest in where it is and when it's there to establish the confidence instilled in the level of trust that can be established to operate safely and securely in today's volatile, uncertain, complex and ambiguous environment.



SOLUTION

The adaptations within the system's relationships and those linkages which are generated as a result of the evolving nature of the information environment. By shifting the references, we can influence and shape the information environment to provide an environment that is both safe and searchable. Timing is the driver which synchronizes the adaptations to link and leverage the evolving and adapting nature of these relationships. When sequence is impeded in and through time it is done so in similar fashion as the old frequency hopping radios shifting phase to protect Liken to FAT table or the NTSC on a hard-drives that get corrupted, data loss is precluded due to disaggregated linkages within the cloud. It is these linkages which safeguard, manage risk and ultimately assure the opportunity to adapt to obfuscate and overcome threats without controlling the domain which historic predictability that is at the core of risk that necessitates mitigation in this interdependent dynamic domain. This approach provides the necessary flexibility to exist beyond the restrictions illustrated in Mayfield's Paradox, nor every present potential for a cascading failure. This establishes the peace of mind to operate without limitations assure that you exist in a safe environment as we endeavor to unlock the power of information.



IT IS HARD TO HIT A MOVIONG TARGET: Especially when it is phasing in and out of your environment

Mayfield; Cvitanic (2000). "Mathematical Proofs of Mayfield's Paradox: A Fundamental Principle of Information Security".

Information Systems Control Journal. 2. Retrieved 2010-07-12.



BULLET BACKGROUND PAPER on OPERATION SHAPE SHIFTER (OS2)

PURPOSE

To create a working demonstration of a Proof Of Concept (*COP*) for a technology that leverages and overcomes the adaptive nature of the Volatile, Uncertain, Complex and Ambiguous (*VUCA*) nature of the information environment. Under the premise that the adversary is already within the network, and with increased reliance and every growing threat, efforts are underway to develop new security concepts which affords the protection of our data through a security-encapsulated Application and Data Enclave (*SEADE – TAB 16*).

Leveraging the flexibility of a Virtual Application Data Center (*VADC*) and through an Enterprise-Level Security (*ELS*) approach, the capabilities to Operationalize Shape Shifter (*OS2*) in order to transform the current paradigm by characterizing and shaping the information environment exist. Through behavior analysis, the ability to shift the linkages and resulting references within current domains will offer concurrent adaptation that evolves beyond the currents threat's ability to do harm within today's *VUCA* environment.

Through this unique approach the ability to access current threats, characterize their impact and become enlightened of risk, empowered to adapt and overcome them, and evolve beyond their impact affords the means to *A.C.E.* operational effects of current interdependent systems within the digital domain. The results will be an unencumbered ability to communicate within this environment, elevate situational awareness and ultimately enlighten senior leaders as to the benefits of operating within this space by invoking the ability to adapt and overcome threats by leveraging timing and tempo in this dynamic environment.



DISCUSSION

BLUF: The need to offer a Technologically Reliable User-definable System that is Trustworthy (*TRUST*) requires an adaptive system that evolves and transforms at the speed of mission. OS2 will afford the means to overcome current and threats without impeding operational capabilities through the ability to Access, Characterize and become Enlightened, Empower and Evolve (*ACE*) operations in today's Volatile, Uncertain, Complex and Ambiguous (*VUCA*) environment. The capabilities it provides is critical to successfully operating in today's digital domain. The result of this endeavor will offer a safe opportunity to store, transmit without encumbrance.

OS2 will provide the means to apply information in a meaningful way to meet current and future mission requirements. It is through this freedom of action that data will be leveraged in a way that improves the ability to make it visible, accessible, and understandable through linkages ascertain its trustworthiness (*VAULT*). The result is a safe and secure environment that elevates situational awareness to provide contextual knowledge that inform understanding in order to make wise decisions.

WAY FORWARD

This cloud-based system precludes the entanglements of traditional route tables. The first level *laaS* pilot through a partnership with a Cloud Broker to afford utilizing a multitude of different systems concurrently. The second level virtualizes networks into this cloud environment eliminating the need for traditional systems to rely on traditional data centers. The resulting reduced cost will afford more flexibility in applying Risk Management Frameworks (*RMFs*) against traditional restrictive and controlling security models. The increased accessibility offers more options and opportunities to adapt and evolve in the rapidly evolving digital domain. The resulting benefits from distributed data precludes challenges associated with data lakes or warehouse. Through an adaptive fluid environment, the ability to overcome the encumbrances offer the means to unlock the VAULT to understanding.





TAB 21



Security
Encapsulated
Application
Data



Security
Encapsulated
Application
Data
Enclave



SEADE: Countering the Futility of Network Security

By: Mr. Frank Konieczny Lt Col Eric Trias, PhD, USAF Col Nevin J. Taylor, USAFR

We cannot solve our problems with the same thinking we used when we created them.

Albert Einstein

Today's media is flooded with stories of cyber-attacks prompting a loss of public confidence, resignations by senior officials, and a significant near-and long-term impact on our nation. Most of these breaches stem from known vulnerabilities in existing network security architecture, presenting a distinct danger to our vital national interests. These vulnerabilities, which vary in sophistication, could be as simple as using weak passwords (e.g., default value, simple number strings, or the word password itself). Slightly more sophisticated attacks leverage phishing attempts through e-mail or social engineering, designed to elicit unsafe action or information that would allow adversaries unauthorized access.

The notion of "defense in depth" has been touted by leading security organizations (which rely on the National Institute of Standards) as the basis upon which a security framework can be developed to safeguard our networks. The depth includes both physical security protections (walls, gates, locks, guards, and computer cages) and logical security measures (network firewall and intrusion detection). However, no matter how many layers of network perimeter protection are employed, adversaries continue to overcome defenses through using a variety of countermoves or by exploiting poor cybersecurity practices.



Furthermore, successful cyber-attacks highlight the fact that disciplined cyber hygiene is necessary but not sufficient to prevent all potential attacks. Systems are simply too complex to defer application and data security to the supporting network's defense appliances and infrastructure. Therefore, we propose that, from their inception, applications must be designed to protect themselves as stand-alone entities with security built-in and with minimal security dependence on network security appliances (e.g., firewalls).

As Secretary of Defense Ashton Carter proclaimed during a speech at Stanford University, to keep systems secure, we must build "a single security architecture that's more easily defendable and able to adapt and evolve to mitigate current and future cyber threats."1 We propose that this next evolution be a "designer" security package at the application level: the security-encapsulated application and data enclave (SEADE) architecture composed of a virtual application data center (VADC) and enterprise-level security (ELS). SEADE will redirect the responsibility for an enterprise level network security perimeter to each application. It will act as a separately secured virtual container that offers users enhanced data access and produces an application package that is exceedingly difficult to penetrate and easy to port; furthermore, SEADE requires little maintenance.

Insufficient Network Perimeter Defense

In the past, strategic endeavors in this area have focused on safeguarding the information that resides within our networks by building higher and thicker walls around our crown jewels, posting gate guards that interrogate everyone entering or leaving, and establishing multiple checkpoints. These efforts attempt to mitigate accessibility, the very capability our modern networks have been designed to provide. Clearly, this has been a losing proposition because the cost to safeguard these networks far exceeds that associated with attacking and penetrating them. It also impedes unobstructed and timely access by our forces to the information they so critically need.



The current network enclave defense model parallels these classic perimeter defenses by restricting accessibility to apparently valid users or transactions. It does little to define the purpose behind the effort. Thus, without a clear understanding of what is to be defended, we are left with the daunting task of defending everything in our "house/fort" without having any opportunity to prioritize a specific effort, such as those that will likely have the greatest impact on our ability to accomplish the mission.

It is imperative to note that our traditional approach to protection using only network boundaries is rendered useless when an adversary is already inside the network. Based on recent events and given current levels of network complexity, it is unlikely that adversaries will appear via concentrated denial-of-service attacks as was once the case. Rather, we would be well advised to conclude that such enemies already exist within our networks. More realistically, they are striving to hide their presence in order to harvest information that represents the lifeblood of our companies, plans, and/or intellectual property. Consequently, the three core considerations that must be governed by security measures are (1) accessibility, (2) confidentiality (including the determination that data is correct and has not been altered), and (3) integrity (which relates to the essence of our trust in and reliance on information used in the decisionmaking process). The complexity of recent cyber-attacks has indeed increased. Although they were once focused on pilfering or manipulating data, such attacks now seek not only to steal critical data but also to undermine its use within operational command and control centers. Indeed, threats that have remained dormant until triggered by a specific event (e.g., zero-day attacks) can have devastating consequences at the most inopportune times during military operations. Therefore, we must elevate our awareness of such threats and manage the associated risk by determining what must be defended, how such defenses will be carried out, what objective will be fulfilled, and why it is important. Ultimately, networks that continue to offer unfettered accessibility (albeit a worthwhile quality) will fail to secure the intellectual property that populates today's information environment. Clearly, then, we must take a step back and ask ourselves what we should defend. Should we protect the roads and highways (i.e., the network) leveraged by users and adversaries alike? Or should we protect the data and intellectual property inside?



Current State of Enterprise Defense

Today's perimeter defenses are instrumented for network-traffic-based analysis that assumes nothing bad will happen to applications/data if those defenses prevent malware transactions at the entrance. The solution—based on consistent, quick recognition of these rogue transactions—works well if one knows and understands all of the acceptable transactions so that the complement can be characterized as unacceptable (*i.e.*, blacklisting undesirable network traffic).

Another defensive approach entails isolating the application from external access channels, but business requirements mandate access to areas inside the perimeter for collaboration (data sharing), interaction (web services), mobile/remote access (virtual private network), and business-tobusiness links. Hence, it is extremely difficult to determine which traffic to block because of multiple exceptions that must be accommodated for the business to function. Blacklisting has become slow and unwieldy to maintain and does not scale well, especially with the increasing adoption of IPv6.2 Whitelisting at the perimeter level has become unmanageable due to the thousands of entries to maintain. The fact that the walls have to allow a superset of all of these exceptions creates a porous perimeter. Moreover, adding new or removing existing exceptions may cause unintended effects on other applications, typically discovered only after implementation. Further complicating the situation is the continuing maintenance requirement—for example, obsolete exceptions persist in configurations because of a failure to notify administrators to make the updates.

Compounding the situation is the scaling of network defenses to billions of transactions. The usual response to keeping pace with performance demands has been to increase the sophistication and scale of network defense appliances. Unfortunately, these "improvements" exert more overhead and cause greater latency (despite appearing faster or more robust) and do not always produce more effective systems.



There must be a better way to defend information. We need to recognize and account for the adversaries among us in order to operate within this contested environment. Since our cyber adversaries have made their presence known, we must find novel ways to defend the vital information (today's crown jewels) that enables us to maintain our competitive edge, all the while accepting the idea that we will be operating in a contested environment. As we focus on protecting our property and establishing tighter security perimeters, we will also develop the ability to scale our approaches quickly and overcome continually increasing threats.

In the past, isolated enclave architecture was the initial design of the network— each group had its own enclave with no outside connectivity. The desire to share information led to connecting these enclaves, which generated some concern, but a trust agreement existed between them. As enclaves became increasingly interconnected, the level of trust degraded further, especially when control was lost, and anonymity became pervasive within the World Wide Web. Regaining this trust involved employing enterprise perimeter defenses to control access to information and restricting data availability to maintain some degree of confidentiality.

Although this problem has long been recognized and many alternatives have been proposed, only a modicum of success has been achieved in safeguarding intellectual property. The obvious alternative is to construct multiple layers of network perimeter defenses that provide adequate confidentiality of strategic data. However, this approach requires that different settings, configurations, or tool sets be established at each point in the layered defense. Ultimately, such an action increases the maintenance burden and produces delays in transaction flow, the combination of which impedes timely dissemination of vital information.

Incident Identification/Reaction

Considering network perimeter defenses are generating logs/alerts to billions of transactions in a large organization, how does one analyze these into a coherent picture? Even more desirable, how can one detect in "real time" that malware is present and that an incident can be prevented? This



problem is difficult because little information exists to determine which application a specific transaction belongs to unless additional network defenses are placed in multiple locations in the enterprise, usually near data centers, to record and analyze all network traffic. Of course, this scenario generates even more data for analysis, and one winds up looking for the proverbial needle in a stack of needles. An obvious solution involves using special-purpose "big data" analysis tools such as predictive analysis techniques, cross-correlation analysis, and so forth, with plenty of storage for historical transactions. Obviously, this analysis overhead further adds costs and resources to defense efforts. There is a better way.

A Better Way

Since attacks continue despite our best network perimeter defenses, what if we begin with the assumption that adversaries are already on our networks? Consequently, we must adjust our threat model and think differently to protect our data and intellectual properties. What if we decrease the attack surface down to the application or data level with the same security capabilities currently used for perimeter defense but specialized for the particular application or data? This vision lies at the heart of the SEADE concept, which defuses the overall attack surface from gateways guarding the enterprise network perimeter to thousands of individuals, specialized security enclaves. The multitude of enclaves, consisting of multiple products and specialized configurations, will force the attacker to increase his effort to penetrate a single application. Since each security enclave is specialized to a specific application, the attacker must customize attacks per application rather than focus on penetrating the perimeter to expose the entire network. Thus, it will no longer be possible for adversaries to exist unchallenged inside our networks.

SEADE—Virtual Application Data Center

Virtualization technology, available in the cloud or virtual data centers (VDC), has made possible the virtual application data center concept. A VDC is a software-defined data center that supports "infrastructure as a service" for applications. It is a commodity readily available in many



commercial and government cloud data centers. We utilize a *VDC* to define a *VADC*. Essentially, one *VADC* is dedicated to only one application, which is supported by a platform as a service (*PaaS*). It consists of virtualized network monitoring and defense capabilities like firewalls and deeppacket inspection along with its associated web access point, database firewall, and traditional PaaS components of web servers, application servers, and database servers. *SEADE-VADC* extends this concept for each application.

A significant security benefit of this architecture is that network traffic can remain encrypted until it enters the VADC. Only after packets enter the VADC are they decrypted and inspected. Within each VADC, the application developer has tailored the network inspection defenses, which were "baked in" from the design phase, to the specific ports/protocols, transaction size/format, parameter range, and so forth, for that single application.3 For instance, some applications may be tuned to support deep-packet inspection with abnormalities reported to the appropriate computer network defense service provider (CNDSP). Individual application risk management will drive the tailoring requirements. The VADC will improve the levels of accessibility and confidentiality by recognizing specific threats immediately and preventing an incident from occurring.

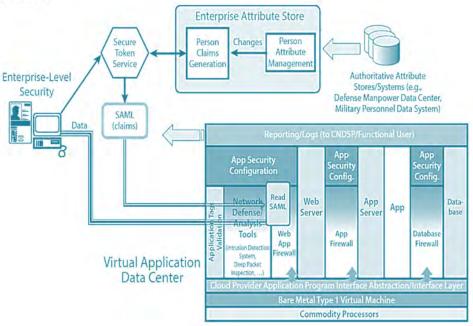
SEADE—Enterprise-Level Security

ELS is a dynamic attribute-based access-control system developed to reduce overall security risks by automating the access process, based on authoritative, related attribute information.4 Today, each application has a uniquely configured access-control scheme maintained by system administrators, primarily based on users and groups, which can be quite labor intensive. In the Air Force, the process is further burdened by a formbased, administrative-access approval process. As a new paradigm, ELS automates the authorization maintenance process: validates preconditions for access, such as training, security clearance, rank, and so forth; and allows a person access when an application-owner-defined set of conditions is met.



Accessibility to data is controlled by claims, based on a person's (or an entity's) attributes, dynamically generated and propagated when attributes change.5 Claims can be additions, deprecations, or modifications to existing access rights. They are transmitted via encrypted channels, based on user-access requests in a security assertion markup language (SAML) token. A standard handler evaluates and validates the token (content, timing, and authentication) and passes the claim for access to the application. Logging occurs for every access request, and erroneous access information is sent to the appropriate CNDSP. A standard handler ensures that SAML validation and access logging are performed correctly, further freeing the application developer from producing similar capability.

ELS will improve the levels of integrity and confidentiality by preventing unauthorized data access. As shown in the figure below, SEADE combines both concepts (VADC and ELS) and is delivered as two VDCs—one for the application (VADC) and the other for the ELS claims engine (which includes the secure token service, enterprise attribute store, and generated SAML claims).





Benefits of SEADE

Employing *SEADE* throughout a large enterprise-level operation generates benefits:

- Enables application portability. SEADE promotes such portability by enabling applications to be hosted in any virtualized environment. Thus, owners have the freedom to maneuver applications where they are needed to meet operational and resiliency requirements.
- Expedites application deployment. Multiple SEADEs employed throughout the enterprise will significantly decrease the manpower associated with developing and fielding an application. Since network and application defenses are included in the standard PaaS environment, the application itself remains just the logic of the program as it inherits all of the security controls of the PaaS. This architecture has demonstrably decreased the time to production from months to weeks. Since a standard ELS handler may be used for the SAML token, the application developer need only code to the ELS handler's application program interface, further decreasing deployment time.
- Facilitates accreditation. Since applications are encapsulated with their own security functions, porting them into new hosting environments will be minimal, including justification of security measures to meet the accreditation process.
- Eliminates individual access requests. Dependence on form-based administrative processes will be eliminated, and system administrators' access-management burden will be significantly reduced. There will no longer be user and group permissions to maintain per application, drastically reducing the man-hours required to perform this basic system-administration function.



- Provides immediate user access. Users will have immediate access to applications and data, based on their attributes (e.g., position, training, duty location, and so forth). As soon as the authoritative data source is updated with their personnel information—say, to a new assignment—then users will be granted access accordingly.
- Includes "baked-in" security. Application development will change fundamentally by baking in security from the start. Developers will integrate network defense configurations (e.g., whitelisting) into their VADC. Further, they will have more options and stronger security-related capabilities by having various network appliances at their disposal. Developers must now think holistically and produce applications to respond to and interact only with defined, valid, and recognized inputs.
- Focuses incident reports. Instead of having cyber war fighters look at streams of network transactions, trying to determine an abnormality, incident reporting is narrowed to the actual application with detailed information, based on the application's tailored security profile. The CNDSP will be alerted only when thresholds are triggered.
- Reduces the number of network administrators. Network security operators will no longer have to make network appliance configuration changes (e.g., firewalls, proxies, and intrusion detection systems) to "allow only" legitimate traffic and block known, bad traffic. Additionally, less time will be spent on configuration management meetings to approve mundane changes to network appliances.
- Provides operational resiliency. Since the VADC is composed solely of virtual components, if an abnormality



is detected, the application can be dynamically reloaded from a previously known good image, or snapshot, to continue processing. As an added resiliency measure, SEADE instances can be spawned at multiple locations and numerous environments to attain heightened redundancy and increased mission assurance.

- Enables continuity of operations (COOP) and agility. By leveraging virtualization, one can provision applications in multiple environments, as well as COOP to another data center, provided that data has been streamed to the COOP site. This capability of provisioning anywhere further decreases the time for provisioning and provides significant mission agility.
- Reduces insider threat. This new paradigm enables creative approaches to data protection. Vulnerability to an insider threat will be reduced since ELS will block unauthorized access and track all access to applications or data. This information can be used to detect or predict abnormal activities. With appropriate data-access tagging, exfiltrated data will be unreadable outside an environment without SEADE.
- Improves confidentiality, integrity, and availability. The SEADE combination of ELS and VADC capabilities significantly increases the confidentiality and integrity of the data by preventing unwarranted access and availability of the application (and data) by dynamic analysis and elimination of threats to the application itself.
- Maintains CNDSP. The current CNDSP framework does not have to change. Alerts within each SEADE can be sent to the appropriate CNDSP unit, which will continue to triage alerts accordingly.



Trade-Offs

The primary trade-off with employing SEADE is that instead of relying on and deferring to network perimeter security, application developers now will be responsible for considering application security and ELS controls during design, test, and development. The developers must become intimately familiar with their application to address issues for both expected and unknown stimuli. This will undoubtedly increase the initial cost of system development, but it will ultimately save innumerable manhours and will improve data protection. Developers will be responsible for ensuring that security is incorporated from the onset rather than waiting for operators to address the need retroactively. Another trade-off is the building of a supporting environment for SEADE services. Application and functional owners must define and govern attributes required to provide the granularity necessary for applications to have the correct level of access-control fidelity. These attributes must come from known, authoritative data sources that have to be identified and integrated into enterprise attribute store for ELS's use.

Consolidated Enterprise Information Technology Baselines

Today, technology moves so quickly that one will never reach a 100 percent best solution in a reasonable amount of time. Agile solution delivery is the best approach to a problem via focused sprints and spiral development so one can adjust as the available technology changes. This affords the ability to capitalize on and garner strategic advantage from nimble actions and innovative solutions. Unfortunately, this paradigm shift unsettles many people who expect predefined requirements with predestined end points. However, this traditional approach only wastes resources as the environment and requirement change in their midst. As the cheese constantly moves in technology and cyberspace, we must be adaptable and decide to venture out to embrace the changes—lest we risk starvation.6 We must harness and guide this spirit of innovation and provide a framework for inserting new technology—methodically and expediently—into our environment.



Accordingly, it is in this vein that the Air Force chief technology officer established and manages the Consolidated Enterprise Information Technology Baselines (CEIT-B) framework to purposely shape, adopt, and deliver a standard information technology environment. This disciplined effort conforms to the agile paradigm as the future target baseline is developed.7 SEADE is a substantial component of CEIT-B that addresses security, portability, and efficiency requirements. Additionally, the Air Force, through CEIT-B, is addressing and informing the joint information environment (JIE) requirements for Department of Defense-level enterprise requirements.

CONCLUSION

The Air Force, as a service, emerged from technology. We must continue to harness the same innovative spirit for cyberspace that has enabled us to dominate air and space. Innovation is the fuel for future success, and we must keep striving to embrace new ways of solving our difficult problems. SEADE, comprised of a VADC and ELS, is a fundamentally different paradigm that will change the way systems are developed, deployed, and defended. By providing a separate security enclave for applications in a VADC, enabled by ELS dynamic access control, we can protect our most important treasure—the data within—as we continue to operate in a contested environment. The SEADE architecture will increase the speed of both user access and application delivery to the mission, decrease day-to-day management of the network and applications, and counter the futility of network perimeter security.

Notes

Sons, 1998). 7. SAF/CIO A6 CTO, CIET-B, Target Baseline 2.0, 2015, https://intelshare.



^{1.} Cheryl Pellerin, "Carter Unyeils New DoD Cyber Strategy in Silicon Valley," US Department of Defense, 23 April 2015,

^{1.} Cheryl Pellerin, "Carter Univeils New DOD Cyber Strategy in Silicon Valley," US Department of Defense, 23 April 2015, http://preview.defenseslink.mil/news/newsarticle.aspx?id=128659. Pub (Internet Protocol version 6) is the latest Internet standard protocol that uses 128 bits versus the current IPv4's 32 bits. The new version has capacity for every person on Earth to have billions of Internet addresses personally allocated. Therefore, blocking by individual address or range of addresses will no longer be effective or efficient.

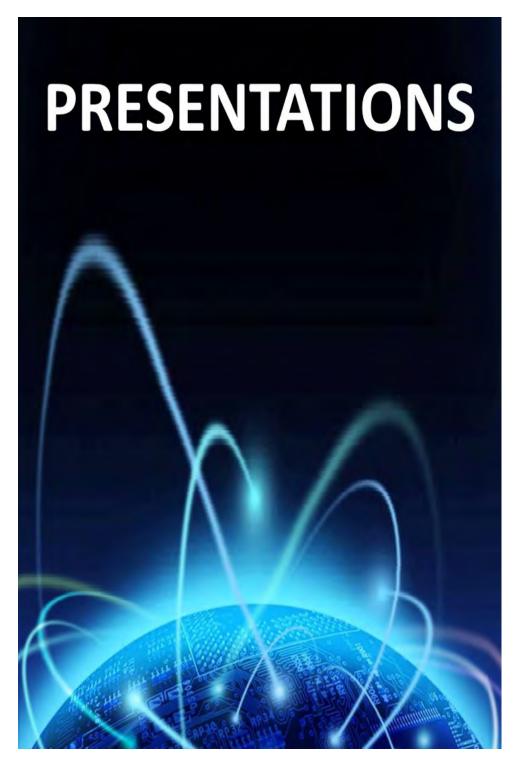
3. "Baked in" refers to integrating desired security features at the initial stage of design and development as opposed to adding them on (i.e., "bolted on") after the product has been released.

4. Vincent Hu, Adam Schnitzer, and Ken Sandlin, "Attribute Based Access Control Definition and Considerations," National Institute of Standards and Technology Special Publication 800-162, n.d., http://csrc.nist.gov/projects/abac/july2013 workshop/july2013 abac workshop abac-sp.pdf.

5. Coimbatore S. Chandersekaran and William R. Simpson, "A Uniform Claims-Based Access Control for the Enterprise," International Journal of Scientific Computing 6, no. 2 (December 2012): 1–23.

6. Spencer Johnson, Who Moved My Cheese? An Amazing Way to Deal with Change in Your Work (New York: G. P. Putnam's Sons, 1998).









TAB 22



PROGRAMATICS OF

INFORMATION



VISION

WHY do we exist? (Purpose)

I Believe:

DECISION SHOULD BE

- Informed by high quality data - Aware of potential consequences - Focused upon organization's objective

ACTIONS SHOULD BE

- Purpose driven to fulfill ENDSTATE of **strat** vision - Integrated in a way to efficiently synch **ops** goals - Accomplished to effectively allocate resources to fulfill **tactical** requirements that serve objectives

Cyber Operations Serve to

- Execute actions to fulfill US strategic ENDS
- Enhance operations in WAYS to ensure success
- Support efforts to manage resources MEANS

- (uani

EVOLUTION OF WARFARE

Frame of Reference (FOR)



100K-1M People

Mass / Maneuver-Napoleonic / WWI / WWII (Industrial)

Localized Regional Confrontation over Borders

Information historically traveled slowly and Army's had considerable time to react to events as they unfolded



\$1M-\$1B Dollars

Global Reach / Global Power - Cold War (Scientific)

International Confrontation Between Super Powers

➢ Given advent of machines and technology, victory belonged to those more able to rapidly adapt to their environment

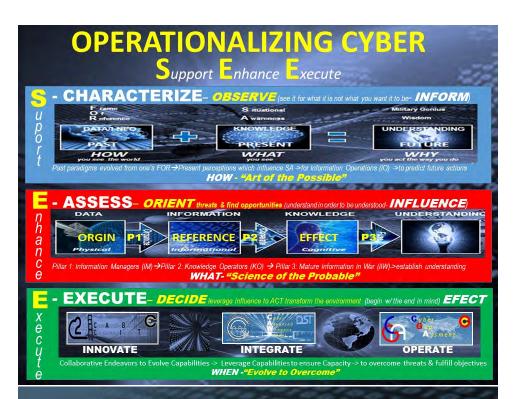


\$200 Laptop and an Internet Cafe

COIN Operations— War on Terrorism (Information)

- World Endeavor to Garner the Hearts and Minds
 - Today the world evolves through the information revolution into the age of knowledge at the speed of light, thus the necessity to evolve and adapt to this rapidly changing environment is paramount





STRATEGIC ENDEAVORS

What is to be Accomplished? • Commanders Intent/Vision- ENDs • Goals/Objective

What Problems are to be Solved?

OBSERVE: Assessments – SA

Assumptions

What Threats are we Facing? ORIENT: Risk Management – WAYS

Vulnerabilities

What Resources Can be Leveraged?

DECIDE: Opportunities - BENEFITS • Capabilities/Capacities

What is the Likelihood of Success?

ACT - Deterministic - MEANS

Contextual/Adaptive

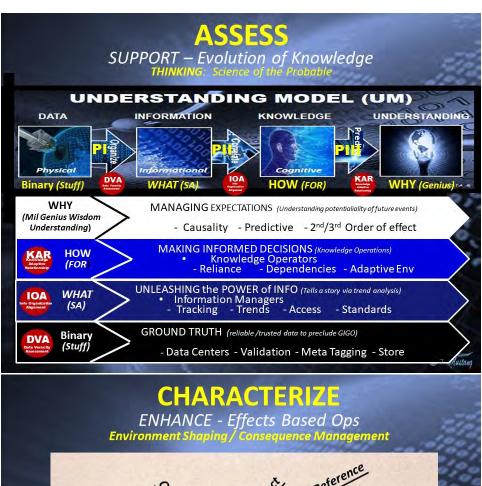
Two qualities are indispensable: first, an intellect that, even in the darkest hour, retains some glimmerings of the inner light which leads to truth; and second, the courage to follow this faint light wherever it may lead.

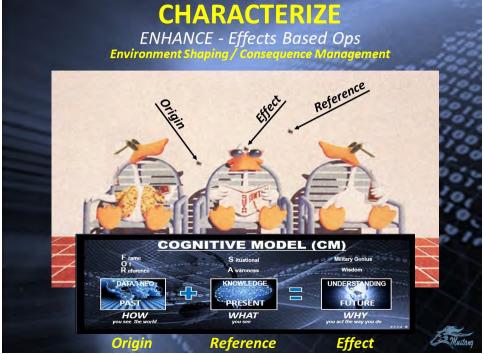
- Carl Von Clausewitz

FEEDBACK - Leadership

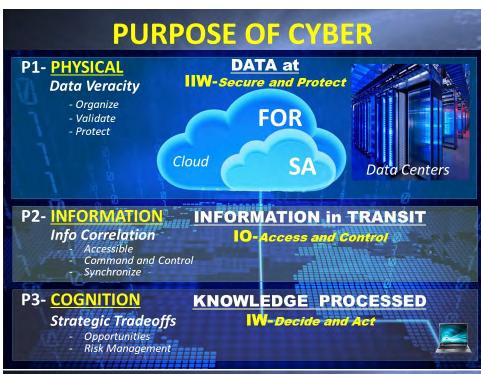
Vector/Velocity

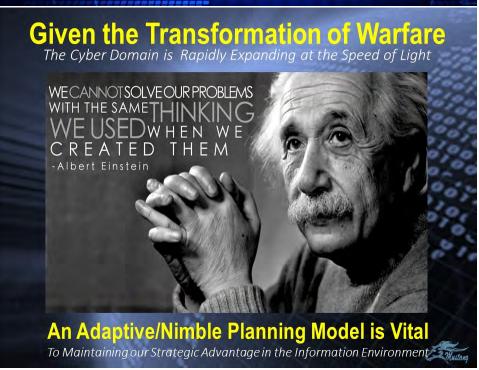














CYBER OPERATIONS WHAT...we do to accomplish this? Transform Hearts/Mind



P1 -SUPPORT: Information Analytics: ensure alignment & allocation of RESOURCEs ORGANIZE: Information Managers (IM)- Meta Tag where/when (INFORMATION)



P2 -ENHANCE: Business Analytics coordinate/synchronize TIMING

CORRELATE: Knowledge Operators (KO) – understand relationships (COGNITION)



P3 -EXECUTE: at rest, transit and during processing CAPABILITIES ENGAGE: to fulfill opportunities and overcome risk to influence IE (PHYSICAL)

UNDERSTANDING MODEL

DATA

INFORMATION

KNOWLEDGE















OPERATIONALIZING CYBER

IACTICA

Pillar I: FOR/Origin- Information In War (IIW)

- Assess
- **Associate-** Correlate/Relate
- Account Non-Repudiation
- Access
- Control
- Assuredly
- Reliability
- **Asynchronous** Cord/Synch

- Pillar II: SA/Ref- Information Operations
- Goals
- Objectives
- **Ends**

- DNS
- Virus
- Scada

Pillar III: ST/Effect- Information Warfare (IW)

DOMINANCE- Cognitive

- World Opinion
- Wisdom
- Motivation

SUPERIORITY- Physical

- Vulnerabilities
- Reliance
- Centers of Gravity



INFORMATIN OPERATIONS

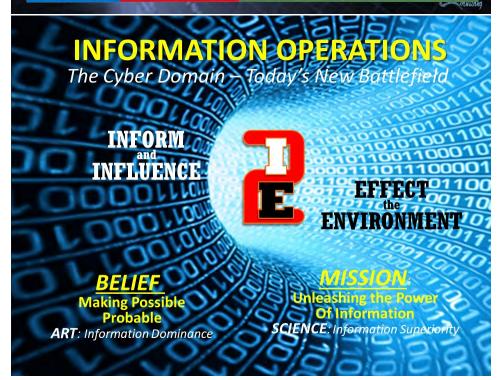
HOW...do we fulfill our objectives? The PURPOSE

- Leverage Technology for Inform Decisions
 - Decisions are made at the Cognitive Layer to ID:
 - Opportunities and threats in order to determine risk
 - Strategic tradeoffs in order to fulfill organizational objectives
 - Knowledge is evolved from the <u>Information Layer</u> to:
 - Organize data by Information Managers to validate its integrity
 - Correlate relationship of information by Knowledge Operators
 - Cyber Domain creates the **Physical Layer** to:
 - Safeguard the confidentiality of Information
 - Ensure the accessibility of Information

Know yourself.....Know your enemy......1,000 Battle you will be Victorious
Understand in order to be Understood.......Live in the Question to Adapt & Overcome
FOR- ORGIN

SA- REFERENCE

EFFECT





INFORMATION OPERATIONS

Transform Hearts/Minds

Control IE (Act-TACT): Cyber Operations (CO)- IMPACT the Info Env (IE)



Cyber Operations (CO): Information Superiority (IS) P3 -EXECUTE: at rest, transit and during processing CAPABILITIES ENGAGE: to fulfill opportunities and overcome risk to influence IE (PHYSICAL)

- Strategic Tradeoffs (Decide-STRAT): Understanding Model (UM) EFFECTS
 - Information Warfare (IW): Information Dominance (ID)



P2 -ENHANCE: Business Analytics coordinate/synchronize (Business Analytics) - TIMING CORRELATE: Knowledge Operators (KO) – supporting supported relationships (COGNITION)

- Characterize IE (Orient-OPS): Situational Awareness (SA)- REFERENCE
- Information Operations (10): Information layer to determine veracity P1 -SUPPORT: Information Analytics: ensure good alignment and allocation of RESOURCES ORGANIZE: Information Managers (IM)- Meta Tag where/when (INFORMATION)
- Background (Observe): Frame of Reference (FOR)-ORGIN
 - Information In War (IIW): Physical Layer (Cyber domain)- data veracity

OPERATIONALIZING INFORMATION

PURPOSE – Enlightened Understanding in order to influence a cognitive endeavor Information Warfare (IW)- Strategic Tradeoffs to shape hearts/minds

Information **Dominance**



FOR + SA = UNDERSTANT		
Past	Present	Future
What Was	As Is	То Ве
Perceptions	Paradigms	Expectations
How	What	Why
Influence	Effect	Act

MISSION – Org data into info, to be correlated into knowledge for Informed Decisions Information In War (IIW)- Evolve understand to identify risks and opportunities

Information **Operations**



- Organized by Meta Tag by IM Information Analytics (IA) to access veracity
 - Business Analytics (BA) to present Strategic Tradeoffs

EXECUTION – Operational effects shaping **physical** environment to desired endstate (Information Operations (IO)- Leverage Technology to shape the battlefield

Information Superiority



- C2 to synchronize operations
- Causality to impact environment Control to enable capability
- Actions to preclude or deny



GIVEN: The Transformative Nature of the Information Environment (IE)

Traditionally Strategy Shaped the Battlefield for Tactical Success...
Today IE is a Strategic Endeavor to Shape Hears and Minds

WHAT: must be done?

- Strategic ACTIONS to leverage the transformative nature of the
- Planning focused on incremental development for success in the
- Adapt to threats while focusing on leveraging opportunities in the
- Reflectively assess and characterize in order to evolve SA in the



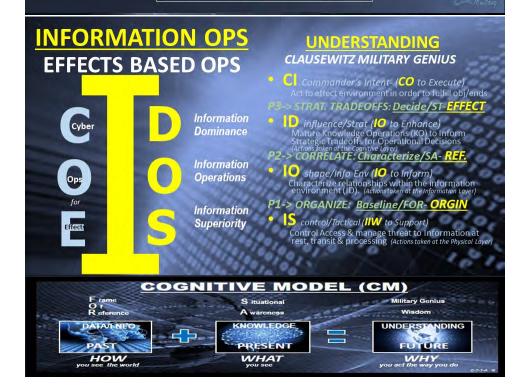
Physical Layer (Cyber Infrastructure

- Defensive: Risk Management
- Offensive: CONTEXTUAL Causality of Result

Cognitive Layer (Decision Process)

<u>Defensive</u>: Combat Perceptions and Paradigms
 <u>Offensive</u>: ADAPTIVE Shape and Motivate

Safeguard Confidentiality of Data Ensure Accessibility of Information Assess Integrity of Knowledge





OBSERVE – CSO (Info Superiority) leverages sensors to monitor/assess

physical access/security, personal protection & operational assurity

- O PHYSICAL Sensors (FOR) what I'm seeing with what I know- lens to see the world
 - Access CONTROL (Information Superiority) CSO looks at vulnerabilities (cohesive- reactionary)
 - Security- accessibility (gates and guards...user id/password/badges) incident response team
 - Personal identity, reputation, non-repudiation/accountability
 - Operations Security (OPSEC) intellectual property CSI – Security disciplines – insider outsider / did they break in / opsec



INFO/CYBER OPERATIONALIZED

OODA Loop

COGNITION Observe rient



CYBEROPS. Collect Organize Characterize

nfluence

- OBSERVER (Characterize)-Collect data to Establish trust and confidence..FOR
- ORIENT (Organize) Organize data in order to Define IT into Information.......SA
- ACT (Influence) FUSE Strategic tradeoffs at cognitive level of understandingST



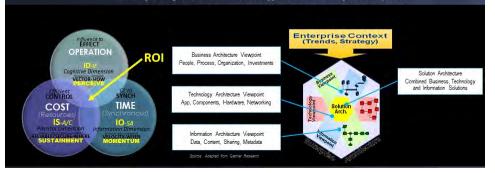
DECIDE - CC provides strategic vision to leverage knowledge operations in a way to fulfill organizational objectives

- Validated/Matrix through Business Analytics technology's facilitation of organizing data, correlated information in a manner that evolve/mature knowledge for strategic decisions.
 - Asymmetric advantage derived within the cognitive process to achieve organizational objectives
 - Act upon current conditions (vector-where they are going and velocity- when they
 will get there) so that they are at the right time at the right place in order
 to take strategic advantage of those opportunities which fulfill
 organizational objectives
- o COGNITIVE Knowledge Operations -



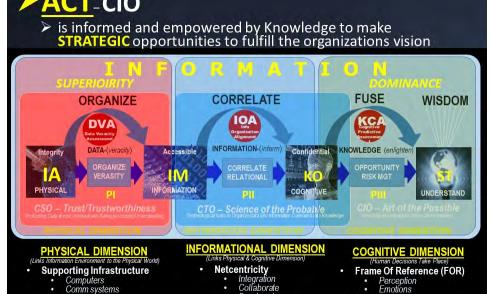
ORIENT – CTO develops technology to leverages capabilities to efficiencies ORGANIZE & CORRELATE information to support business objectives

- o **INFORMATION**
 - CHARACTERIZE (Information Dominance): correlate/reliance (Situational Awareness SA)
 - INFORM/INFLUENCE
 - DF assesses what we know (FOR) & correlates it through the lens of SA so that the relationship to reveal the implications, reliance, and the potential causality of current & future actions
 On Info Mat CTO looks at efficiencies / Info Analytics











Synchronize
Automation

Processed Disseminated

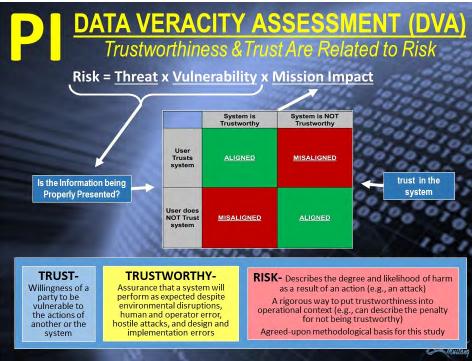
Displayed

Information Medium

Collected

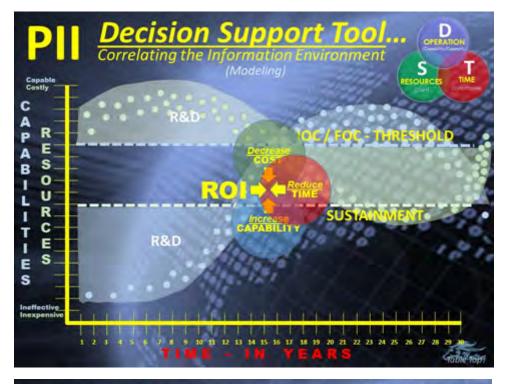
Stored Protected Situational Awareness (SA)

Motivation Public Opinion









PIII CHARACTERIZATION The Information Environment

- The Intelligence Community, Law Enforcement and Private Sector use the same software, hardware and Internet
- The tactics techniques and procedures used by trusted insider or outsiders are the same because the platforms attacked are the same
- Through characterizing the information environment we understand the dynamics, reliance, and expections that we can reasonably place upon it:





TAB 23



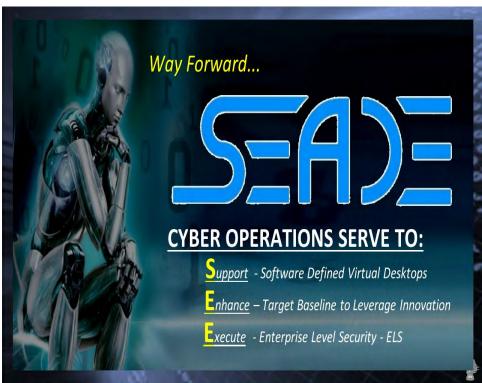
OPERATIONALIZING CYBER

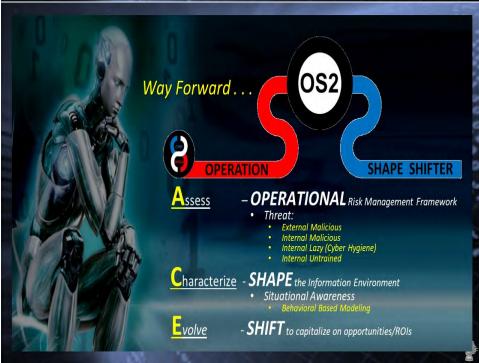










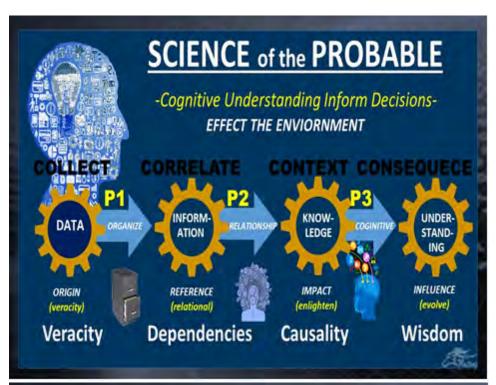






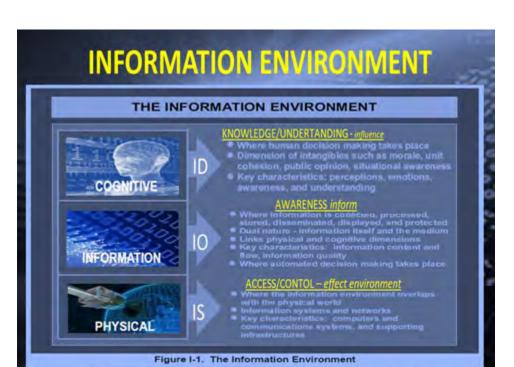


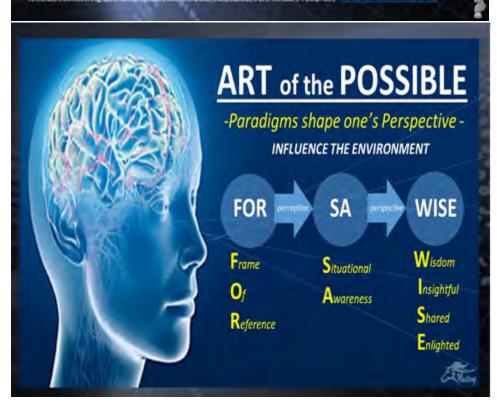




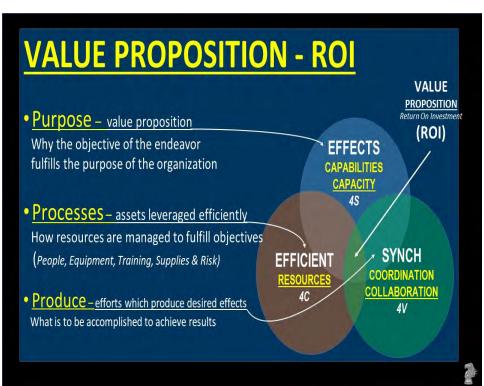


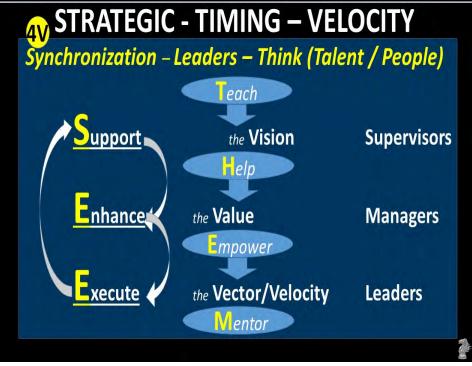






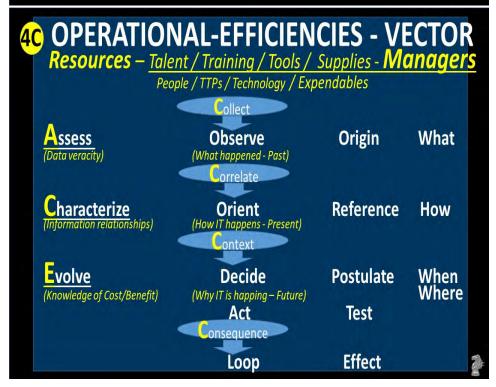








4S TACTICAL - EFFECTS — fulfillment of VISION Capabilities and Capacity – Supervisors Collect **Net Centric** Objective Goal (Autonomous: Integrate / Sustain) (Focus: Technology) Synch Cord Coordinate Info Assurance (Focus: Threat) (Veracity: Restrict / Secure) Structure Mature Correlate Information Mgr. (Focus: Store) (Relationship: Steward / Control) Depend Share Context **Knowledge Ops** (Focus: Explain) (Cost Benefit: Program / Justify) ROI Synthesize



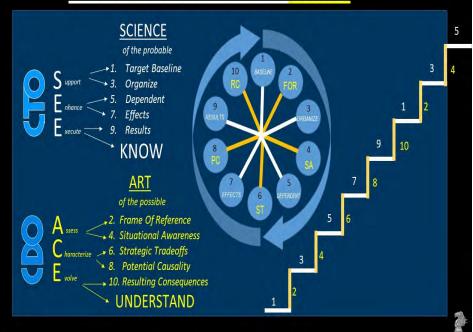


OPERATIONAL-EFFICIENCIES - VECTOR Resources - Talent / Training / Tools / Supplies - Managers People / TTPs / Technology / Expendables Origin Observe What (What happened - Past) P2: Characterize Orient Reference How P3: Evolve When Where Decide **Postulate** (Knowledge of Cost/Benefit) (Why IT is happing - Future) Act Test Loop Effect

TACTICAL — EFFECTS - fulfillment of Vision Capabilities Capacities Put THREE CIRICTL CHARTS HERE Fulfillment of VISION ART of the POSSIBLE (Innovation/Creative) Think -> People Application of TECHNOLOGY SCIENCE of the PROBABLE (Proven/Probable) Things -> Process



SCIENCE . . . ART



OPERATIONALIZING THE INFORMATION ENVIORNMENT

DATA -VALTI

- Vicible
- Accessible
- Understandad
 - III USCWART CHY

WHAT-Frame of Reference (FOR)

INFO VUCA

- wolabili
- Uncertain
- Complex

HOW – Situational Awareness (SA) Matana Unkaga / Dependencies, KO - Comilate & Control

UNDERSTAND VOPIC

- Vision
- Cptions
- Potential
- Innovari
- Consequence

(Knowedge: Understand / Under, ST - Coundity & Consequence)

Assess - Prescriptive

Science of the Probable – As Is Guantitative

Characterize - Descriptive

Art of the Possible - To Be

Gualitative

Evalve - Potential

Analysis of Disportunities
Exploration of the Potential
Options & Opportunities



CYBER OPERATIONS VALUE PROPOSITION -

Three Legs of the Cyber Stool:

- 1. Engage / Cyber Ops Assured
- 2. Think / Cognition Analytics
- 3. Act / Understand Analyze

Support - CYBER OPS

- Assuridty risk to mission

 Assurance data at rest

 Access data in transit

 Application during processing

Enhance - ANALYTICS

- Data Information in War (ITW)
 Information Information Ops (IO)
 Knowledge Information Warfare (IW)

Execute - ANALYZE

- Veracity of data
 Reliance of information
 Resilience of mission



ORIENT - 10: Context - structure

HDW - Situational Awareness (SA)

DECIDE - IW: Correlate - relationship

WHY - Strategic Tradeoffs (ST)

ACT - Consensus - art

WHY - Strategic Tradeoffs (ST)

LOOP - Consequence - results/trends

WHY - Strategic Tradeoffs (ST)





Origin . . .

EFFECT

SYNCH

TIME

CONTROL

COST

Reference . . .

Effect . . .

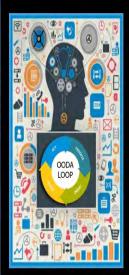
Work with what you've go: Science of the Probable Explore Opportunities: Art of the Possible

Transform	Focus	Task	Role	Responsibility	Reason/Results	Informed by	Purpose
Observe	Origin	Evaluate)	Aware	Accept (what is going on)	Know Data (Probab	le - science)	FR (Frame of Reference)
Orient	Reference	Enlighten)	→ Assure	Relate (who are involved)	Understand In	form (Possible - art)	SA (Situational Aware)
Decide	Influence -	Ensure)	* Adapt	Predict (now to influence) C	ausality Correlate (P	otential - relational)	LD (Link Dependencies
Act	Effect	Engage)	* Action	Do (when/where to inject)	Environment Causa	ality (Predictive – behavior	BD (Behavioral Dynamics
Loop	Feedback /	Evolve)	→ Adjust	Learn (why its behavior)	Effect Wisdom (wh)	-potential)	LE (Learn & Evolve)





Net centric - Operational Approach



THINK BIG

Today many organizations find themselves as high velocity industries, necessitating the launch of new innovative ideas

START SMALL

Through an iterative spiral development approach adapting and evolving to a Volatile, Uncertain, Complex and Ambiguous (VUCA) environment affords the opportunity to be nimble and flexible results in a strategic advantaged derived from their nimble and flexible approach

SCALE QUICKLY

Speed in decisions making is paramount. Fast and roughly right decisions making must replace deliberations that are slow but marginally more precise

Evolving in an Adaptive Environment

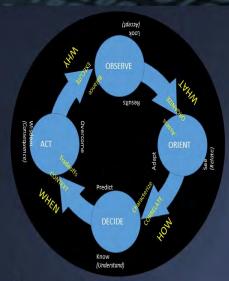
Observe (Assess)

Orient (Characterize)

Decide (Enlighten)

Act

LOOP



Learn Opportunities, Overcome-Risk & Prepare





➤ ORIENT – CTO develops technology to leverages capabilities to efficiencies ORGANIZE & CORRELATE information to support business objectives

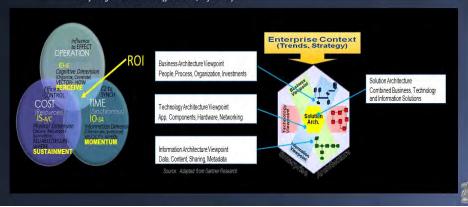
OINFORMATION

■ CHARACTERIZE (Information Dominance):

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INFORM/INFLUENCE- DF assesses what we know (FOR) & correlates it through the lens of SA so
that the relationship to reveal the implications, reliance, and the potential causality of current &
future actions

o Info Mgt-CTO looks at efficiencies / Info Analytics

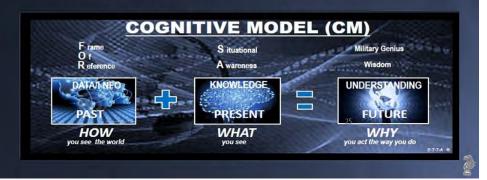




DECIDE CC provides strategic vision to leverage knowledge ops in a way to fulfill organizational objectives

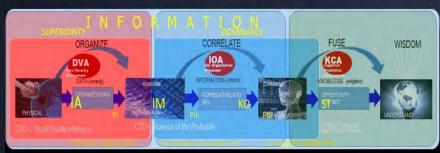
- o Validated/Matrix through Business Analytics technology's facilitation of organizing data, correlated information in a manner that evolve/mature knowledge for strategic decisions.
 - Asymmetric advantage derived within the cognitive process to achieve organizational objectives
 - Act upon current conditions (vector-where they are going and velocity- when they will get there) so that they are at the right time at the right place in order to take strategic advantage of those opportunities which fulfill organizational objectives

○ COGNITIVE - Knowledge Operations -



>ACT_CIO

is informed and empowered by Knowledge to make STRATEGIC opportunities to fulfill the organizations vision



PHYSICAL DIMENSION

- Supporting Infrastructure

 - ComputersComm systems
- Information Medium
 - Collected

 - · Protected

INFORMATIONAL DIMENSION

- Netcentricity

 - Automation
 - Processed

 - Displayed

COGNITIVE DIMENSION

- Frame Of Reference (FOR)
 - Perception Emotions
- Situational Awareness (SA)

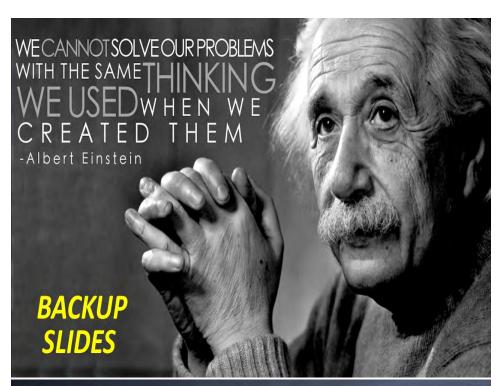
 - Public Opinion

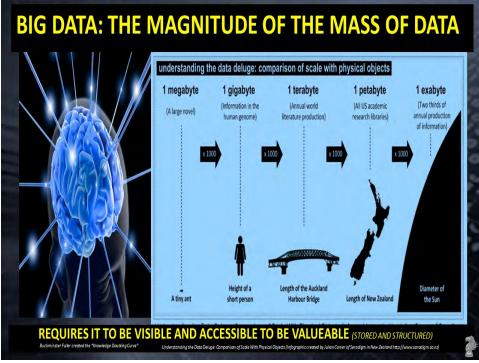


OPERATIONALIZING CYBER to unlock the POWER of INFORMATION **OBSERVE PROBABILITY** SCIENCE OBL 1C. Collect WHAT DATA Store INFO 2C. Catalogue Structure WHERE **OREINT** OB.I 3C. Correlate Relate FOR HOW 4C. Context Understand SA WHEN DECIDE POTENTIAL 5C. Cost/Benefit Assess 6C. Characterize KO Know PFRFORM ENGAGE ACT WHO 7C. C2 Synch C2 CTO 8C. Communicate Disseminate LOOP **PERTUBATION EFFECT** OBJ 9C. Causality Dependencies Feedback Results 10C. Consequence Trend Evolving living process that grows, evolves upon itself and is perpetual and integrative to do it all over again...1C

OPERATIONALIZING DOMINANCE- Cognitive SUPERIORITY- Physical Pillar I: FOR/Origin- Information In War (IIW) TACTICAL - Assess - Access Control - Associate- Correlate/Relate - Assuredly - Reliability - Account - Non-Repudiation - Asynchronous - cord/synch Pillar II: SA/Ref- Information Operations OPERATIONAL - Goals Virus - Objectives - Scada - Ends Pillar III: ST/Effect- Information Warfare (IW) STRATEGIC - World Opinion - Vulnerabilities - Wisdom - Reliance - Motivation - Centers of Gravity



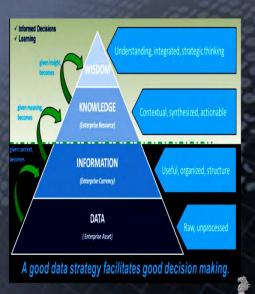






DATA STRATEGY

- Vision
- Guiding Principles
- Goals and Objectives
- Roles/Responsibilities
- Implementation







What Analytics Is better decision making in a complex world Executives in every kind of organization are using analytics to unlock the value in their data, model complex systems, and make better decisions with less risk

Whether analytics is used to inform high-level strategy or improve day-to-day operations, the results speak for themselves



- . Superior ROI
- . Higher quality
- . Faster payback
- More & better options
- **Breakthrough efficiencies**
- . Insight into difficult problems
- Better utilization of resources
- . Millions in savings & increased revenues
- . Accurate predictions, plans, and forecasts
- Improved processes, productivity & performance



The Analytics Value Proposition

Analytics consistently delivers significant value – strategic to tactical, top-line to bottom-line – to the organizations and executives who use it. Organizations worldwide in business, the military, health care, and the public sector are realizing powerful benefits from Analytics, including:

- Big data: Finding hidden clues to improve customer service and improve sales
- Business insight: Providing quantitative and business insight into complex problems
- Business performance: Improving business performance by embedding intelligence into an organization's information systems to improve decision making
- . Cost reduction: Finding new opportunities to decrease cost or investment
- Decision making: Assessing the likely outcomes of decision alternatives and uncovering better alternatives
- Forecasting: Providing a better basis for more accurate forecasting and planning
- Improved scheduling: Efficiently scheduling staff, equipment, events, and more
- Planning: Applying quantitative techniques to support operations, tactical planning, and strategic planning
- Pricing: Dynamically pricing products and services
- Productivity: Helping organizations find ways to make processes and people more productive
- Profits: Increasing revenue or return on investment; increasing market share
- Quality: Improving quality as well as quantifying and balancing qualitative considerations
- Resources: Gaining greater utilization from limited equipment, facilities, money, and personnel
- Risk: Measuring risk quantitatively and uncovering factors critical to managing and reducing risk
- Throughput: Increasing speed or throughput and decreasing delays



Answering the challenges you face today organizations and the world in which they operate continue to become more complex. Extensive choices and relentless time pressures and margin pressures make the decisions you face more daunting and more difficult. Meanwhile, new enterprise applications and software are generating massive amounts of data – and it can seem like an overwhelming task to turn that data into insight and answers. Analytics can help today's executives with many of the specific challenges they face, such as:





- . Deciding where to invest to evolve and grow
- Getting more value out of existing resources
- Figuring out the best way to run a call center
- Locating a warehouse or depot to deliver materials
- Forecasting need for a new missions
- . Solving complex scheduling problems
- . Planning for a potential risk and impact to mission
- . Deciding when to reprioritize and synch operations
- . Ensuring more cycles/increasing efficiency
- Optimizing a portfolio of investments

CHARACTERIZE OBSERVE (see life and it see and you and its her INFORM) Software of the Possible Operator and programs around managed and viral annual and seed and you and its her INFORM) PARTY INFO: PARTY OF THE Possible Operator (NO) - Pile 3 Malus Internation in War (NW)-statisch understanding CORGIN PT PREFERENCE PROSPERSE (NO) - Pile 3 Malus Internation in War (NW)-statisch understanding WHAT- "Science of the Probabile" E - EXECUTE DECIDE Neurop inherica is ACI Involume the environment (ligger with the end in man) EFECT Collaborative Endewors to Evolve Capabilities -> Leverage Capabilities to ensure Capacity -> to overcome threats & fulfill objectives WHEN - Evolve to Overcome*



INFORMATIN OPERATIONS HOW...do we fulfill our objectives? The PURPOSE

- Leverage Technology for Inform Decisions
 - Decisions are made at the Cognitive Layer to ID:

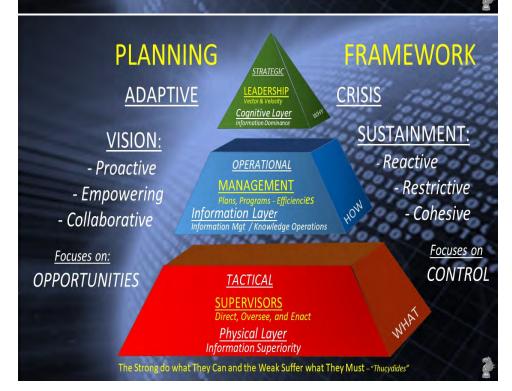
 - Opportunities and threats in order to determine riskStrategic tradeoffs in order to fulfill organizational objectives
 - Knowledge is evolved from the Information Layer to:
 - Organize data by Information Managers to validate its integrity
 Correlate relationship of information by Knowledge Operators
 - Cyber Domain creates the Physical Layer to:
 - Safeguard the confidentiality of Information
 Ensure the accessibility of Information

FOR- ORGIN

SA- REFERENCE

Know yourself......Know your enemy......1,000 Battle you will be Victorious Understand in order to be Understood.....Live in the Question to Adapt & Overcome

FFFFCT





CYBER OPERATIONS

- Information a <u>STRATEGIC</u> resource vital to US national security
- Military operations are dependent upon C2 to <u>SYNCHRONIZE</u> operations to afford greater flexibility and synergistic collaboration in order to derive an asymmetric advantage
- <u>INFORMATION SUPERIOIRTY</u> leverages Air/Space/Cyber ensure accessibility to the information environment at a time & place of their choosing



• INFORMATION DOMINANCE unleashes the power of information at the cognitive level to influence and inform the decisionary process in order to effect the environment

Transformative Nature of the Information Environment

WHAT: must be done?

- Strategic actions to leverage the transformative nature of the
- Planning focused on incremental development for success in the
- Adapt to threats while focusing on leveraging opportunities in the
- Reflectively assess and characterize in order to evolve SA in the

Physical Layer (Cyber Infrastructure)

<u>- Defensive</u>: Risk Management / Mission Assurance - Offensive: CONTEXTUAL Causality of Result

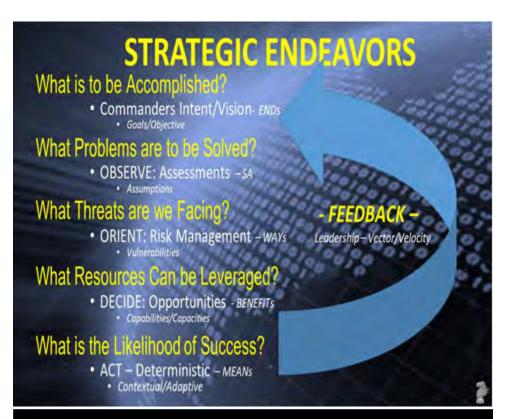
Cognitive Layer (Decision Process,

<u>Defensive</u>: Combat Perceptions and Paradigms
 <u>Offensive</u>: ADAPTIVE Shape and Motivate

Safeguard Confidentiality of Data Ensure Accessibility of Information Assess Integrity of Knowledge











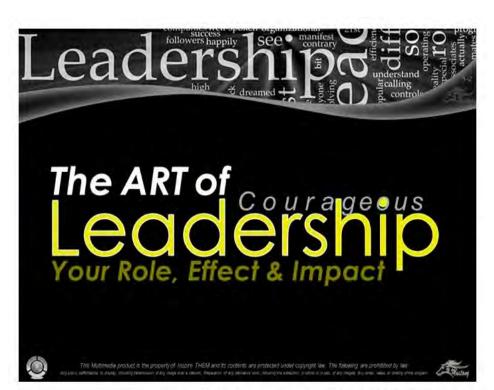


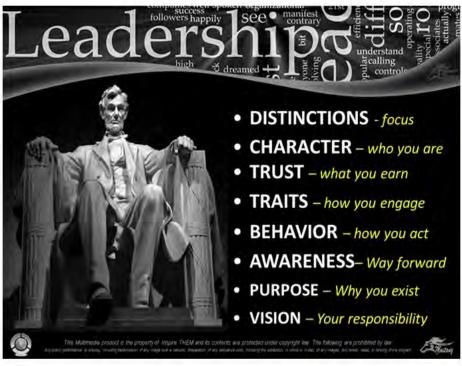
TAB 24



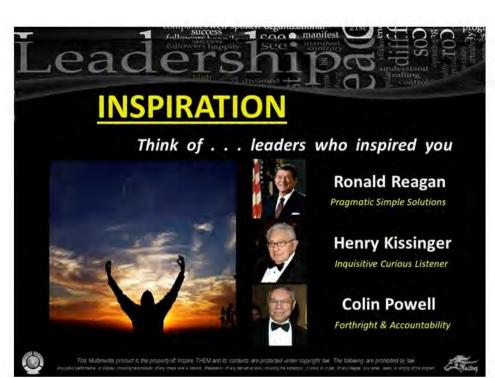
LEADERSHIP PRESENTATION



















Leaders **TRAITS** What makes a good colleague

2.



1. Responsible

Dependable

3. **Positive**

Selfless 4. 5. Innovative

6. Professional

7. Collaborative

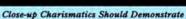
8. **Transparent**

9. Inspiring

10. Trustworthy

accountable reliable encouraging self aware creative respectful team oriented forthright motivational honest





- Sociability
- Expertise
- Humor
- · Dynamism, activity
- · Physical appearance · Intelligence
- · High standards
- · Originality

Distant Charismatics Should Demonstrate

- Persistence
- · Rhetorical skills
- · Courage
- · An emphasis on social courage (expressing opinions, not conforming to pressure)
- Ideological orientation

Both Distant and Close-up Charismatics Should Demonstrate

- Self-confidence
- · Honesty
- Authoritativeness
- · Sacrifice





- Natural born leaders.
- · Arouse emotions within group.
- · High energy, physical appearance, independence, verbal

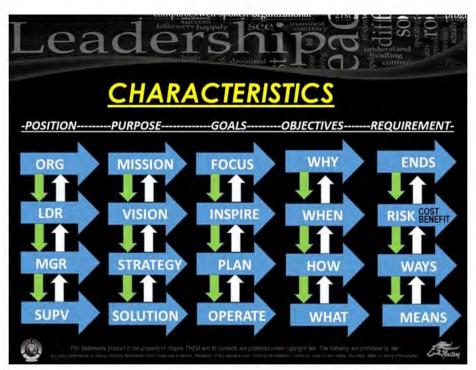
Challenge Thinking



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BEHAVIOR



- isten- Don't assume; ask question be curious
- nthusiastic Be positive and optimistic
- $oldsymbol{\mathsf{A}}$ **ction** Be creative and willing to take risks
- ependability ethical/best interest at heart
- ducated Be aware and get informed
- $oldsymbol{\mathsf{R}}$ esults Getting positive things accomplished





- Actions to erode trust:
 - Micro ManagementLack of:



- Trust hard to get & easy to loose
- Reliable must follow through
- Integrity honest in all things
- Responsible standard of excellence
- Accountable to self and others
- Forthright transparent and real

Trust begets trust - say what you mean and do what you say















LEADER/MANAGER/SUPERVIOR



- Planter: "Strategic Visionary"
 - Creates innovation



- Cultivator: "Operationalizes Idea"
 - Nurtures & Sustains



- Harvester: "Tactically Applies"
 - Applies & cashes in



PATH-GOAL

- Directive behaviors:
 - set goals, assign tasks, show how to do things
- Supportive behavior:
 - look out for the worker's best interest
- Participative behavior:
 - give subordinates a say in matters
- Achievement-oriented behavior:
 Setting challenging goals/believe in worker
- Behaviors are dependent upon subordinates and their work











and beyond the plan. Serves to change the status quo. This Multimedia product is the property of Inspire THEM and its contents are protected under copyright law. The following are prohibited by law

Influence

Leadership Comment of the local particular of the loca

Who they are -

They talk about

what's important
where we're headed
what we stand for
overcoming risk

And they **inspire** people

M entor

Orient

Trust

nformed

V ision

A Iternatives

alent

E nthusiasm

S ynergy



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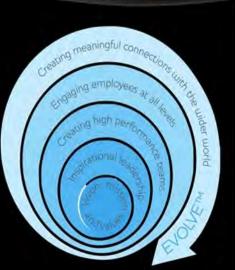


Leadership

Lifelong endeavor

study, practical application, field experience, insights

- · Technical eclecticism
- Theoretical integration
- Common factor
- Leadership as an art





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Leaders ask THEMselves do 1?

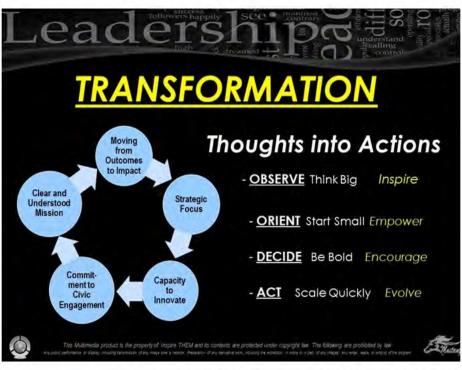
- Create authentic professional relationships?
- Generate and sustain trust?
- Give people a sense of investing in their future?
- Provide direction and a sense of meaning to others by reminding them of what's important?
- Convey a feeling of hope?
- Cultivate the motivation in others?



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BIOGRAPHY







ABOUT THE AUTHOR



NEVIN "Mustang" TAYLOR











Colonel Nevin "Mustang" Taylor is a decorated combat veteran with a distinguished 32-year military career that includes leading one of the nation's largest logistical activities following the initial cessation

of hostilities in Irag. An Air Force Senior Officer with a decade of command time. he has served as the Sr. IMA to the Deputy Under Secretary Policy Integration and Chief of Staff, Military Advisor to both the Under Secretary of Defense Policy and Under Secretary of Defense for Acquisition, Technology and Logistics in the Office of the Secretary of Defense. During his tenure, he has chaired the Strategic Advisory Board for USAF Task Force Cyber and led the DoD CIO's Enterprise Services and Data Panel Tiger Team Enterprise Search and Catalog.

A Harvard University National and International Security and Senior Executive fellow as well as a Cyber Policy credentialed professional he is one of MIT's Big Data and Social Analytics credentialed expert and technology anti-tamper professional. A National Defense University Credentialed Chief Information Officer and lecturer of "The Power of Information." This Georgetown University's Transformational Leadership alumni serves as the State Department's Foreign Service Institute orator lecturing on "Leaders Inspire T.H.E.M." This credentialed Stanford University's Strategic Decisions Management and Oxford University Planning Foresight, Innovation, Knowledge, and Change Management certified professional has served as the White House international visionary on Artificial Intelligence and Machine Learning and national lead for the Camp David Summit on developing a data driven organization.

An innovative leader and seasoned data, cyber, and space professional in corporate, public and military service, he has relocated two Air Wings, built an air base, and oversaw the standup of the first space communications squadron coupled with the nation's only Joint Space Operations Center. He has served as the Deputy Regional Director Liaison Officer Air Force Academy, Honor Guard Commander for President Ronald Reagan at his Presidential Library, Naval Destroyer modernization technologist, Cyber Subject Matter Expert underway onboard the USS Carl Vinson and Deputy Director Warfighter Integration Senior Executive Service bridge.

He is currently the Co-Chair of the United States Data Cabinet and the four working groups; Policy, Governance, Talent, Analytics and the NSTC's Data Science Interagency Working Group, Colonel Taylor also serves on the Air Staff as the Air Force Deputy Chief Data Officer, Deputy Chief Technology Officer for Special Programs, and Cyberspace Strategy and Policy IMA. A published author, he is currently working to support the development of a strategic framework to operationalize a data driven organization. Additionally, he is one of the founders of the Secretary of the Air Force's AFWERX innovative initiative to transform and modernize their ability to Fly, Fight and Win our Nation's Wars.



































PAST PROGRAMS









1981 – Developed, coded and tested an educational program on a Texas Instrument TI994A to teach and test students on reading and speaking German

1982 – Programed an Apple Series II basic math curriculum with quizzes, tests, to assess and adapt teaching styles to tutor students from initial math skills culminating in completion of college algebra

1985 – Operationalized TTC-39 from IOC to FOC for combat tactical communications environment

1985 – AF modernization program backward compatible Zenith 100 5MNz Intel 8088 processor transition to a Z-248 12MHz Intel 80C286 processor workforce integrating automation systems

1986 – Developed hydrogen accumulator from Tesla's HHOs brown gas extraction system utilizing an electrolysis catalytic process to produce hydrogen and oxygen on demand from tap water

1988 – Created a Loran-C Khz long range navigation interface to provide autonomous steerage for a 50-foot sail vessel featured on the front page of the Yachting World Magazine

1989 – Initial electromagnetic parking sensors to include eventual Ultrasonic Transducers providing short/long range spatial orientation. Reduced latency evolved an initial autonomous CEED vehicle

1990 – Overseeing split operations of Air Force technology model installation integrating a digital switch, developing Network Control Center, and operationalizing a Banyan Vines token ring LAN

1991 – Integrated CPU overdrive from a P54C to doubling performance through application of FPU

1993 – Establish one of five national regional Air Force Data Centers while concurrently modernizing mainframes to a server based operational component of mini computers

1994 – Developed deployable secure communication center leveraging Sahara LTE/STU-III/Z184-97

1995 - Preliminary test/implemented a commercial voice mail system for the USAF Academy

1998 – Designed/deployed a weapons integration server for USS destroyer modernization program

1999 – Deployed on USS Carl Vinson for a C2 technological assessment to integrate capabilities

2001 – Technologist for Nintendo to deploy Dolphin, the next evolution platform/console

2003 – Created the Computer Transportation Assisted Secure Network (*CTASN*) nodal acquisition wireless/cellular interfacing system for monitoring and navigation of autonomous operations

2004 – Integrated CTASN into Universal Transport's CEED R&D to produce an automatous vehicle

2004 – Transition the US Space Fence from the Navy to the Air Force to detect/track orbital objects

2005 – CONOP development establishing/integrating the Joint Space Operations Center (JSPOC)

2006 – Est self-evolving system to provide a common operational user definable space ops picture

2007 – Stood up 614SCC which consolidate operational C2 of Joint Space Forces to evolve Space SA



















2007 - Consolidated all space operations into JSPOC under the operational control of USSTRATCOM

2008 – Established a framework for data driven organization to leverage SA to evolve knowledge into understanding to operationalize data as a vital strategic asset for competitive advantage

2009 - Facilitated establishing the Cyber and Space offices for the DoD Policy Undersecretary

2010 – Oversaw establishment of DoD AT&L Asst Secretary of Energy/Installations/Environment

2011 – Director of Staff overseeing redeployment of forces from Iraq culminating combat in Iraq drawing Operations New Dawn culmination of the largest logistical movement in military history

2012 – Created \$2.5M Decision Support Tool, to align AF Program Elements to Resource allocation analyzing temporal analytics to optimize effectiveness maximizing efficiencies saving DoD \$14B

2013 – Created doctrine to leverage information dominance cyber ops modernization for the POM

2014 - Catalyzed PBR integrating C4 for 35 net centric sys saving \$850M in FY and \$3.5B over FYDP

2015 – Aided development of a Security Encapsulated Application Data Enclave (SEADE) framework

2015 – Est ops ability (*Chess Match*) to assess predictive model, characterize prescriptive modeling against an RMF framework to identify options/opportunity to adapt/overcome threats

2016 – Created an adaptive tool (*OS2*) to leverage a flexible virtual Application Data Center (*VADC*) to realign an Enterprise-Level Security (*ELS*) approach to characterize, protect and assure DoD data

2016 – Est/Co-Chair White House Data Cabinet in EOP/OSTP to leverage CDO to leverage data ops

2016 – Camp David Data Collaboration Summit Co-Chair; established the National DRM, DMM, and CDORR for the USDC, USDSC, and DSIWG

2016 – White House SME on Al and ML to 50 UK CEOs, Google London, Royal Society, US Secretary of Small Business Administration and his Royal Highness Prince Andrew, Duke of York

2016 – Ops Lab Rat identifying quantifiable measure/characterization of cyber domain certified by the Air Force Research Laboratory

2016 - Constructed a system to identify Behavior Base Network Modeling (BBNM) to mgt ops risk

2017 – Chartered Sr. Fed. CDOs for NSTC to identify collective data challenges and best practices

2017 - DoD ESDP Tiger Team Lead/est Ent Search and Catalog framework to operationalize data

2017 – US Data Cabinet Co-Chair and Exec Director/NSTC Data Secretariat/Data Steering Committee

2017 – Established the AF Data Office and AF Data Laboratory to optimize and evolve mission ops

2017 – SG pioneer; stood up AFWERX on bequest of the SECAF, CSAF, VCSAF and A5/8 to drive innovation recognized by the Vice President of the United States

2017 - National Security Council Cyber SME integrating a whole of government approach to sec ops

2017 - Est innovative prgs: Electric Parameter Wall, JCN cognitive systems, C2abit, CAWS, and MSC







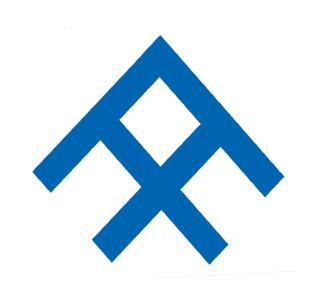








FUTURE PROGRAMS





CONSIDERATIONS

CAUSALITY

CONSEQUENCES

OPTIONS OPPORTUNITIES OUTCOMES

> PRESCRIBE PREDICT POTENTIAL

DISTINCTIONS DIFFERENCES DIFFERNENTIALS **EVOLVE**

EMPOWER

ENLIGHTEN

NLIGHTEN













THINK - POTENTIAL TRY - PRODUCTION TEST - PLATFORMS













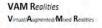




















EXCELLENCE



ENLIGHTEN









SIMULATE







FUTURE PUBLICATIONS





OBSERVE ORIENT DECIDE ACT LOOP

THINK TRY TEST TRUST

IDEATE INNOVATE INTEGRATE IMPLEMENT

CREATE CULTIVATE CALLABORATE CULMINATE

STRATEGIC

HELP

OBSERVE ORIENT DECIDE ACT LOOP

HUMBLE HONEST HEAR HONOR

ENLIGHTEN

EVOLVE

ENGAGE

ENACT

Who you are? Have you engaged? What you say? Why you said it?

REAL RELIABE REPOIRE REACT

OPERATIONS FACTS

RELATIONSHIPS

OBSERVE ORIENT DECIDE ACT LOOP

OBSERVE

ORIENT

DECIDE

ACT

LOOP

MEASURE MOTIVATE

PURPOSE POTENTIAL PRIOIRITY **PROGRAMTICS**

OBJECTIVES OPPORTUNITIES **OPTIONS** OUTCOMES

STRATEGIC

OPERATIONS

RELATIONSHIPS

MENTOR

MOMENTUM MATRICULATE

How are we doing? ASSOCIATE Where are we going? ADVISE Why is this important? ASSIST How do we align it? ALLOCATE

FACTS

THIS



