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Civil & Military Operations: Evolutionary Prep Steps to Pass
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ABSTRACT/OVERVIEW

Precision engagement during the last several decades has been an area of much analysis, research and technical application. Yet, those investments, like similar efforts through other research and knowledge application efforts could be considered rather narrow in their application and approach.

When considering the PMESII¹ and DIME¹ environments, along with the broad applications of EBO¹, and the ongoing discussions of 'smart power' applications, there is almost a sense of déjà vu all over again. That is, as if Sun Tzu's points were only just now being considered with respect to the whole, complete spectrum of society. A whole entity which is acting and interacting in a large and almost all encompassing environment where the use of precision engagement is to be employed for short and long term outcomes and objectives.

This paper touches on several past effort chains and the 'resulting' changes with respect to becoming more precise in engagement in the traditional aspects. From that foundation, the paper will attempt to build from the recent PMESII and EBO discussions in light of the near term discussions of 'smart power' applications.

Introduction and Outline

This paper will explore some three example chains of progress within the area of: aviation bombing and targeting; gunnery, artillery, and munitions; and, medical treatments. These are examples of progressive development and improvements to arrive at increased accuracy, precision, and reduction of un-intended effects.

The examples of these streams will demonstrate the progression which is currently emerging to move beyond the classic talk, trade, and fight aspects of governmental diplomacy, commerce and military interactions. The examples offer a framework for discussion of increased emphasis on the normative and literal power available through the international footprint of businesses and organizations (national and international), along with all governmental organizations and entities.

The three example chains, while not detailed in the genealogical or historic chronology, illustrate and demonstrate aspects of precision engagement for influencing and achieving results and outcomes on several time scales.

- Less expenditure of effort or resources to achieve an intended impact or outcome;
- Placing the point of interaction at the correct location and temporal instance;
- Significantly improved targeting discrimination to reduce un-intended consequences; and,
- Going beyond the traditional avenues of interaction for achieving results.

These four aspects are but a limited set of factors for describing the implications which may result from the expansion of precision engagement within the PMESII/DIME/EBO environment when stepping toward the realization of using 'smart power' in the complex and uncertain future. Possibly opening the door to 'winning without having to fight or expend national treasure', whether in the context of small scale scenes or in the large scale grand landscape of interactions and outcomes.

¹ PMESII – Political, Military, Economic, Social, Intelligence, and Infrastructure; DIME – Diplomatic, Intelligence, Military, and Economic; EBO – Effects Based Operations.

The Threads of Innovation – Introduction to the Examples

The opportunity to examine several threads of innovation opens the door to learn some of the factors which cause or influence the attainment of future outcomes, along with understanding aspects of the costs and investment expenses while traveling those paths with those contributing factors for those outcomes.

For the initial thread, fixed wing aviation during World War I (WWI) can arguably be said to have been in its infancy and early exploration of uses and capabilities. Even though balloons for military observation were already employed, airplanes supported the movement for aerial observation to combat, and later to the concepts and applications of air to ground bombing and other engagements. World War II (WWII) saw improvements in navigation for target location, bombing by mass dropping of ordnance, and the use other tools like the Norton bomb site for improvements in delivery accuracy. Increased air speeds and destructive capacity came along after WWII and during the Korean War. There were also changes in aviation targeting accuracy improvements during the Vietnam time period exemplified by the beginnings of laser designation. More recently, the technological application of the global positioning system (GPS) constellation to ordnance delivery and guidance has resulted in changing the ratio of ordnance delivery to target negation toward a one-for-one ratio in some instances.

For the second thread, the advent of guns and gunnery is considered by many as an outcome of the employment of gun powder and oriental firecrackers and rockets, which eventually lead from smooth bore to rifled barrels for virtually all calibers of guns and artillery. Other efforts lead to the technologies of barrel thickness tapering for improved distance and projectile speeds; along with the material for structural strength improvements. Calculations for distance and angle of fire along for aiming have changed through the years as well. The targeting and aiming device improvements from eye sighting and ropes to gun sighting systems and gun fire computers which followed from the older artillery look-up tables represent only part of the sequence of improvements. These steps are all contributing factors to current and future capabilities of self-guiding munitions from large caliber guns and missile systems, to individual weapons as proposed within the Army Future Warrior efforts represent an ongoing stream of improvements and adjustments to apply the correct ordnance (interaction tool) and effect to the correct location (interaction point and time).

As the final mentioned thread, medicine changes from natural herbs, and mystical applications, to the application and extension of cow/small pox discoveries, and moldy bread, all represent an evolving history of medical improvements. Recently, the changes are demonstrated through new drugs and surgery techniques which have come along during almost all war conflicts. Many are the result of the efforts of WWII battlefield techniques, and even more recently, the new reconstructive surgery and artificial replacement limbs for of combat casualty limb amputations, have heralded significant new discoveries and applications. Just as important, there is the need to not forget the medical/chemistry advances which allow chemotherapy to attack only the specific cancer cells with certain surface receptors, thus leaving healthy cells to reproduce, is an example of significant advances in detailed, specific applications for specific outcomes and results.

These threads provide opportunities to discover the interactive effects and insights for cause and effect chains which can become new tools in the kits of actors for moving beyond the tradition talk, trade, and fight of government, commerce, and military organization interactions of the nations as international organizations. They highlight as a starting point four areas:

- Less expenditure of effort or resources to achieve an intended impact or outcome;
- Placing the point of interaction at the correct location and temporal instance;
- Significantly improved targeting discrimination to reduce un-intended consequences; and,
- Going beyond the traditional avenues of interaction for achieving results.

All with the intent of improvements in understanding through insightful and improved understanding and employment of effects based interactions for planned outcomes. In essence, a new all agency and organization 'smart power' tool kit for the whole populous.

These brief summaries do not completely reveal all the available opportunities, tools, and insights which could be drawn from these chains. They also offer the initial general framework from which detailed analysis will enable those opportunities, tools, and insights can be discovered and drawn. Once they are entered into the tool lot of interactions, they become available for further application with new understanding of their employment because of the changes in concepts, doctrine, and organizations which these new concepts and insights offer.

Examination of Threads

Any particular technology, business, or organizational evolution area is worth examining for a thorough review of historical development steps and the path followed to the present state, organizational structure, or business condition. This review can be done as a basic broad brush level as a general summary, it can be done along the technical trail of changes, improvements, and adjustments, or, it can be done along the line of personal assistance, struggles, and influencing interactions, with respect to achievements and decisions aspect. That is, to complete a thorough review framework in a style or the mode similar to that of Graham Allison's models of national security analysis: rational actor, policy/bureaucratic, or personality interactions which provide differing approaches and views, offering the possibility of new insights. The fact that there are a number of differing models for analysis lends credence to the previously mentioned PMESII/DIME/EBO frameworks, for locations of interactions (cause and effect points), as without a close and detailed examination of the interactions of the players, organizations, personalities, and other factors which make up the complete environment, some contributing factors are likely to be overlooked, or underweighted for their influence or contribution, along the path of interactions leading to the observed historical results, and thus tools for potential use for desired results.

This establishes that there are several possible frameworks for establishing the chain of cause and effect – note, these cause and effect frameworks can also be influence nets or acyclic graph components for possible modeling work. Moon, et al., (2008), provides a useful description of an influence net and their suggested automation tool:

“An influence network is a directed graph extensively used for Effects-Based Operation. It contains nodes that represent events and links that encode causal relationships among events. It propagates the likelihood of each event through promotion or inhibition by its parents.” This is done via a proposed ‘automation process of influence network generation with . . . “The resulting influence network is generated from a multi-mode, multi-plex organizational network structure, and the generation scheme is based on assessing event flows and evaluating the factors on task management of the organization.”

This approach is extensible to other organizations and their tasks, as well as, to the inter-organizational tasks, coordination actions, and influences. Further, Armstrong (2010), discusses principles from the Barbary War and irregular warfare, which are also extensible to a much larger international framework of interactions. Namely, that:

Any effort “must be part of a greater naval strategy and be supported by regular forces. Vessels must be suited to the littoral environment, . . . Leadership at a low level in the chain of command . . . will ensure unit on scene effectiveness . . .” by removing encumbering oversight . . . “Finally, local cultural knowledge or partnership will help ensure that the specific expertise required for mission accomplishment is available.”

That: action elements and groups must be appropriate to the environment and context; active leadership must be at the contact point, the lowest level; and, local contextual cultural and demographic information is critical overall success and improvement of conditions. Taken with Moon, et al. (2008), the organization must adapt to the environment and context, be empowered to act at the point of contact, must understand the local and larger culture and its context when acting, and courses of action can be modeled and analyzed for return on investment and outcome results which are for the good of all involved.

The author will return to the introduced three areas of advancement for some limited examination and examples, along with queries. Those areas are: aviation bombing and targeting; gunnery, artillery, and munitions; and, medical treatments.

Aviation Bombing and Targeting

The concept of using the airplane for bombing can be considered as an out growth of using balloons and planes for more than just observation during WWI, i.e., moving on to aerial combat against other planes, and then eventually firing the onboard, mounted machine guns at personnel, equipment, and facilities on the ground. Yet, please reflect on all the factors which had to coalesce to fly and fire machine guns: gasoline/fuel availability, aerodynamics evaluations, internal combustion engines, changes in flight control methods and control surfaces engineering, timing mechanisms between propellers and machine gun firing, etc. The reader is reminded that these threads are related to both the technical improvements and the road to achieving airpower, along with organization and process changes and improvements.

After WWI the concepts and technology improvements in planes and aviation seemed to accelerate. There were the competitions, with prizes for various long distance flights, speed records, etc. The development results of radio communication became a much needed necessity in the civilian and military aviation industry segments, besides their general usage within the other military equipment communities. This transitional movement can be viewed as ultimately fostering the combined arms co-ordination evolution. Further, the opportunities of aviation

employment and use at sea as took place during the interwar years with the initial maturation of naval aviation and the concept of strategic bombing of ships. Radios and transmitters have also helped with aviation navigation improvements for transit to specific target areas, generating improved arrival and delivery of ordnance on targets. Then came the bombsite implementation to further improve 'ordnance delivery' accuracy more for specific targets, to supplement the operational and strategic application of 'carpet bombing' which both have been applied during WWII and later as well.

This progressive chain of technology and personnel interaction is demonstrated via the Schneider Trophy aviation competitions as discussed by Korda (2010) in his biography of T. E. Lawrence, where Lawrence's participation in the British hosting of the September 1929 Schneider Trophy completion held near Southampton England, demonstrated the factors of personal connection and interaction between Lawrence and many of the movers and influential individuals in senior British leadership positions who were in attendance following his contributions during WWI in the middle east, Levant region. As a lowly airman, he inadvertently upstaged the much more Senior British General Officer in charge of hosting the competition. This competition highlights the competition linkage to advances of aviation technology and aircraft design which spawned future designs brought to fruition during WWII listed as listed in Wikipedia (Wikipedia-A), recounting that while the race started after WWI and stopped prior to WWII, then resumed again in the 1981,

"The race was significant in advancing aeroplane design, particularly in the fields of aerodynamics and engine design, and would show its results in the best fighters of WW2. The streamlined shape and low drag, liquid-cooled engine pioneered by the Schneider Trophy design are obvious in the British Spitfire, the American P-51 Mustang, and the Italian Macchi C-202 *Folgore*."

Following WWII there were additional aviation competitions for improvements, along with Defense development contracts, which drove technological improvements as well. Those innovations and improvements have not diminished, nor slowed down, within the aviation community or its related supporting arenas. WWII also saw the emergence of jet aviation and guided missiles, both of which 'matured' in later conflicts. In fact, during the Vietnam conflict some of these technological developments continued their cross pollination, increasing the accuracy of targeting via laser designation and bomb guidance coordination to improve the probabilities of successfully hitting the target for effect. The same reductions in miss probabilities were also applied to inter continental missiles for targeting improvements, along with the precision improvements for initial positioning and travel tracking, which have been supported by the rocket launched global positioning systems employed by the military and commercial communities.

These multiple layers, threads, and component improvements have also supported the realization of: 'be seen – be targeted – be hit – one shot, one hit' opportunities and occasional reality. This targeting and effect chain is only as good as the information, data, knowledge, and understanding which culminates in the decision to act, the choice of method to act, timing to act, and the area to be acted upon within the DIME or PEMSII framework, to have an impact effect for, or toward, an immediate, intermediate, or ultimate outcome or future condition within the EBO framework.

As an example see the 'Nano Hummingbird' of AeroEnvironment articles by: Hennigan (2011) discussing

“A pocket-size drone dubbed the Nano Hummingbird for the way it flaps its tiny robotic wings . . . results of a five-year effort . . . by the company and the Pentagon's Defense Advanced Research Projects Agency. . . . With a wingspan of 6.5 inches, the mini-drone weighs 19 grams . . .” and is “Equipped with a camera . . . can fly up to 11 miles per hour . . . hover and fly sideways, backward and forward, as well as go clockwise and counter clockwise, by remote control for about eight minutes.”;

and, Iannotta (2011) which demonstrates the Department of Defense (DOD) involvement in research and development efforts. This product could also have been used for remote viewing and sensing of dangerous environments like the inside of the Japanese reactor plant equipment buildings following the recent earthquake for real-time information and assessment imagery without directly hazarding personnel.

The overall flow of improvements and uses can be tracked by basic technology, organizations, society pressures, or some other framework, which lends itself to cause and effect chains – influence nets. The opportunities are present directly and indirectly through analysis and application of interaction means via the chains found within those frameworks, to gain an understanding of what caused which steps of improvements to occur along which paths. Whether via private individuals, industry opportunities, government policy or funding, private sponsorship, personal interactions, fortuitous accident, intense study, chance meetings, mentoring, sponsorship, patronage, or even defeat and recovery. The depth of analysis can expose those factors which fit into the DIME, EBO, and PMESII frameworks for helping understand how the communities of interest within the population interact and realize progress. They are not isolated items or events, but are well and truly interconnected, as the reader may discover with the other examples within the following two sections.

Gunnery, Artillery, and Munitions

The history of gunpowder, firecrackers and rockets has its roots in China, with significant technology improvements occurring within European society, kingdoms, churches, and nations as advantages were sought over various adversaries. These advances eventually overcame archers and individual light body armor of knights, along with their swords and hand held shields.

History is replete with stories and accounts of the employment of the evolving guns, ammunition, and powders as European explorers and military employed early guns and cannons to defeat those without them. These encounters can be considered the early manifestation of the arms race of the period, which have not stopped. Whether due to social, trade, territory, tribute, or the various paths of science and technology improvements, the guns, cannons, and artillery advances moved from smooth bore, brute force devices with limited precision into improvements in distance and accuracy.

Rifling in barrels eventually supersedes smooth bores for increased projectile stability and distance. Casting and production of cannons and arms slowly shifted from kingdom/sovereign control to individual and later, company production. Mountings in guns and cannon bases added

to aiming improvements, as did the efforts to calculate range tables for cannons, which can be seen as the beginnings of the prediction and correction mechanisms for environmental conditions. These environmental conditions are not limited to wind, temperature, target or shooting platform motion, though they have been and continue to be studied for correction and mitigation solutions which can increase the efficiency of hitting the desired target in the appropriate method and appropriate time.

Targeting improvements have shifted from fixed sites, to adjustable sites for varying distances; variable powder loads for distance and projectile speed; atmospheric monitoring of wind for in-flight adjustments, to name a few areas from which improvements have emerged. Changes in gun powder composition, structure, burn rate, etc. have taken place, along with almost countless changes in the projectiles themselves.

These have been influenced via shared learning, social pressures for survival, general commerce, and intelligence gathering efforts. In a nutshell, all the framework factors are present in the PMESSI and DIME frameworks which support analysis of historical causes and effects, and assist/improve future planning. These frameworks are in anticipation of finding those interaction paths and projecting them toward the selection of courses of action and interaction to achieve a desired future state or condition, i.e., an outcome of the action or interaction.

These efforts have demonstrated progress in efficacy and efficiency according to some and absolute degeneracy of human nature at the same time. Maybe some will agree that the efforts have demonstrated styles of return on investment for improvements, generally accepted as being for the common good for some larger group, or section, of society. Those have not been without their losses, yet not all losses have been in-vane. There has been, in the larger sense, the over-all advancement in knowledge and understanding, though not always immediately available to all the population. The paths of cause and effect for development and implementation can be analyzed by straight technology, education, social contact, organizational bureaucracy, economic exchanges, or national trade for that matter. Some of those patterns of interaction may be clear and apparent, others may be indirect, and some may not be there except via 2nd or 3rd level interactions or effects. Yet the investment in teasing out the knowledge and understanding has the return on investment for assistance in planning, monitoring, and hopefully realizing the attainment of a desired future state via in-direct or direct means or methods for some larger common good.

Stated differently, the analysis and discovery of historical cause and effect chains can potentially deliver or develop the capacity to not only truly be aware of the environment and its changing conditions, but interact with it successfully to ride it efficiently and eventually even steer it toward improvements, delivery of common goods, and improvements in conditions for the population as a whole. All these results require not only the information associated with the cause and effect patterns, but also the knowledge and understanding associated with that direct and indirect data to arrive at understanding what truly results in better outcomes vice worse outcomes, for the cause and effect chains – influence nets – are very complex problems.

Medical Treatments

The prior section closed with the common good, and it can be argued that medicine fits within the regime of a common good, as it is considered something to receive and has value.

Medicine is yet another regime where advances have continually taken place – independently, collectively, and adaptively. These advances have continued to stretch the bounds of understanding and knowledge; pushing back frontiers of surgery, treatments, and the shadows of unexplored areas; all areas which, through the ages, have all had their controversies and changes. Yet while shifting those shadows and boundaries older techniques, practices and sources have not been discarded and tossed onto the debris pile of the past. For through that past can new understandings for the future yet arise, evolve, and influence the current practices. Some aspects of this are recounted in articles by Pellerin (2010) recounting the progress and successful results of the 779th Medical Group's acupuncture clinic, where Dr. Richard Niemtow and Dr. Stephen Burns, train military doctors and treat patients using a technique called battlefield acupuncture; and, Svan (2010) reporting that . . .

“The military is finding that Western medicine alone doesn't always work in relieving the suffering of troops dealing with a complex range of injuries after nine years of war, from multiple concussions to backs strained under heavy packs and body armor. . . . the Army surgeon general released a report [June 2010] addressing the lack of a comprehensive pain-management strategy, suggesting alternative treatments including meditation and yoga. . . . “The whole idea of the battlefield concept was trying to develop an acupuncture technique that would be generic for all pain and that would be very rapid in terms of its effectiveness,” said Dr. Richard Niemtow.”

The reader is encouraged to review and research the long and varied history of herbal medicine, mystical treatments, and natural medicines. Some aspects of this medical investigation is likely to point out the parallel difference in education and thinking development pointed out by Levin (2010) regarding Asian versus non-Asian education, namely the:

“Students pick a discipline or a profession at age 18 and study little else thereafter. And unlike in elite European and U.S. universities, pedagogy in China, Japan, and South Korea relies heavily on rote learning; students are passive listeners, and they rarely challenge one another or their professors in class. Learning focuses on the mastery of content, not on the development of the capacity for independent critical thinking. . . . In today's knowledge economy . . . when the philosophy of liberal education was articulated by Cardinal John Henry Newman, it is not subject-specific knowledge but the ability to assimilate new information and solve problems that is the most important characteristic of a well educated person. . . . Students who aspire to be leaders in business, medicine, law, government, or academia need “the discipline” of mind – the ability to adapt to constantly changing circumstances, confront new facts, and find creative ways to solve problems.”

This points out the importance of critical thinking beyond the obvious visible and easily discovered information, and getting into the deeper understanding of the complete, complex and interconnected environment and context of the international and national events and actions.

Take for example finding treatments for upset stomachs from jungle plants and herbs, malaria treatments from tree bark extract, infection cleaning with leeches, as a few examples. Yes, there are many others which have not been successful, such as: progressive bleeding to remove ‘bad humors’², repeated dunkings to remove the ‘psychoses of witchcraft or mental affliction’; that

² Bad humors is a medical term from helenic times into the 1800s related to the medical description of body functions being out of balance, and that restoration of balance could be restored by bleeding the patient. See

there is no positive use in acupuncture – that it is quackery, fake; or, that it is not necessary to clean or sterilize before or after medical surgery procedures. If nothing else these historical positions show how much the medical regime has adjusted, adapted, and moved with the times. Brown (2010) in his article about medics in combat, recounts the history of medical discoveries and rediscoveries through various combat periods of history, addressing using silk thread for tying off blood vessels vice cauterizing them, prevention of hemorrhage (massive bleeding), types and blood content and age considerations for transfusions, the use of tourniquets which have all contributed to fewer battlefield fatalities. Similarly, the previously introduced articles by Pellerin (2010) and Svan (2010), point out the changed opinion about and actual application of acupuncture for treatment. Thus demonstrating the ability and willingness to go back to already known practices and beyond the local cultural framework to find solutions.

Through the ages herbs have historically been used as treatments for many ailments and become part of cultural, community knowledge, and folk remedies. With the advances in chemistry and biology supporting medical advances, the active and mitigating agents and 'drug' have been identified, isolated, and eventually moved to production for the population's benefit. When it became clear that milk maids did not contract the more virulent small pox after contracting the milder cow pox, some understanding of treatment course and preventative inoculation emerged. When soldiers with significant wounds were treated with some 'moldy bread', and recovered, eventually the advanced family of penicillin started its emergence, use, and evolutionary adaptation for strength, varied specific, and general employments. (Yes, and the bacteria have adapted as well with their own mutations, varieties, and lethality.) Add to this, the example of evolved sulfa-drugs; the linkage between mosquitoes and malaria, which with the removal of stagnant water and the use of netting, significantly improved the rate of work on the Panama Canal thorough improved worker health. In fact, wars and surgery have been the source of many advances within medicine and reconstructive surgery. Open heart surgery techniques of today can be traced back to their antecedents of heart shrapnel surgery during WWII. This is when Dr. Dwight Harkin, a young U.S Army surgeon during WWII, developed the first successful procedure for removing shrapnel and bullet fragments from still beating hearts to save soldiers lives; and which eventually through later advancements we now have the heart and lung machines, regular open heart surgery and other procedures, along with heart transplants. (NOVA) (Coulson and Hanlon, 1997) The reconstructive surgery, artificial limbs, and rapid treatments have all flowed from early military development, for very specific and targeted employments, to more general applications to greatly improve the quality of life of all recipients within the population at large.

This movement to treatment for the population at large is demonstrated with the military training and experience assisting with quick treatment, as demonstrated through the treatment received by Representative Giffords and the other victims of the January 2011 shooting in Tucson. Mehta's article (2011) reports that

"Rep. Gabrielle Giffords, gunshot wound through her brain, was fortunate enough to be wheeled into the emergency room of a uniquely qualified surgeon: Dr. Peter Rhee, a 24-year military surgeon who has treated "hundred and hundreds" of battlefield injuries during stints in Iraq and Afghanistan. . . . Rhee, 49,

chief of trauma at University Medical Center in Tucson, said his work in the Navy tending to injured soldiers and Marines and teaching the next generation of battlefield medical personnel unquestionably played a role in his ability to treat Giffords and direct care for the 10 other victims who began arriving in his unit Sunday morning. . . . Rhee said he handled . . . battlefield injuries in two war deployments beginning in 2001. He was one of the first battlefield surgeons to be deployed to Camp Rhino, the first U.S. land base in Afghanistan, located in the remote desert about 100 miles southwest of Kandahar. In 2005, he served in Iraq.”

Additionally, Coughlin’s article (2011), through a similar discussion recounts the almost unique opportunity for critical care during the ‘golden’ time for initial treatment following traumatic injury, because of the prior training and experience of the attending team of personnel following that shooting. Both of these discussions point out the appropriate skills and personnel being available at the correct time and place. The events may be considered the serendipity result of complex interactions chains leading to the application of those skills to someone in need of them.

The biology and chemistry advances associated with medicine have been opening doors to the promise of much targeted drug treatments as evidenced by the cell surface receptor identifications and cancer treatment regimens using those receptors to specifically target cancerous and not healthy cells. That is, to reduce the collateral damage and effects of less specific treatments which attacked nearly all the cells – healthy along with cancerous – endangering the patients’ health to significant other problems. This seems very much like the earlier military improvements in weapons targeting.

For years the use of acupuncture was available within only certain sections of society and the population, is changing as mentioned previously regarding application and more general acceptance of acupuncture treatment regimens. Similarly, there was resistance to the idea that positive outlooks could influence the course of recovery in conjunction with other regimens of treatment. Yet, currently acupuncture is regularly available to all, and the field of psycho-immunology is accepted and recognized. Just as other treatments have emerged from unlikely sources: digitalis originally from flowers, malaria quinine treatment from tree bark; cancer treatment from yew trees; these ‘drug’ outcomes with their sources illustrate that linking of knowledge and information areas does provide benefits in other areas and regimens. This has the parallel mentioned earlier of analysis of context, actions, and chains of cause and effect through the PMESII and DIME frameworks, as with the intent of producing specific results in an enlarged EBO framework, for unexpected, innovative paths to solutions and outcomes through other agencies, organizations, and mechanisms. As cross-cutting area examples, consider Senior (2011) discussing a shift from isolated medical specialist treatment and prescriptive medicines to an integrated patient and specialist team approach to limit drug interaction; Zetter (2011) and Economist (2010) articles on the development and progress of printing organs and replace body parts by methods paralleling the powder metallurgy technique of three dimension construction of machine parts; and Christenson’s (2011) article discussing the application of flatbed scanner and printing technology to spray apply/print the patients’ replace skin medium on the burn area with cells grown from the patient’s own cells. These represent the melding of medicine and manufacturing communities for providing new solutions, as well as treating the patient as a complete individual, like addressing the whole of an organization in its many facets of demographics and imbedded communities of interest.

In closing these sub-sections, while these three areas above can be considered in isolation; they also have numerous interactions and interconnections which can make analysis and understanding very challenging, yet offer potentially great rewards. Such as medical advances assisting physiological solutions for pilots while aviation platforms increased speed and expanded their performance envelopes. (Remember, the X-15 was technically the first aircraft/spacecraft to deliver an astronaut to space, and protect him environmentally, after previous high altitude jets.) The related fields of chemistry, metallurgy, and general technology providing new, stronger metals and materials, more energetic explosives, the development of newer, smaller components for controls, activation, and control circuits and devices; as well as the seemingly ever more dense computer processors and capable handheld devices. (Superglue, very high performance ceramic materials, semi-conductors and hand held computing devices received great boosts from the space program.) Yet none of these changes can truly be considered as isolated or absolutely independent results or products, they all result from other efforts and interactions of many types. We tend to disaggregate the interactions to attempt to analyze and understand them, yet they are complex and probably should even be considered 'wicked problems' in the mathematical sense. (in mathematics a 'wicked problem' is one where the parameters and the solution set are so intertwined and interconnected that a 'final' solution is developed by repetitive solutions, with incremental variations of the parameter initial conditions, such that the solution converges and does not 'blow up'.³) This can also be framed in several other factors, as discussed by Rittel and Webber (1973), in their article "Dilemmas in a General Theory of Planning", that planning is not an actual linear process, that it is indeed complex, interconnected, and can have many orders of effects and interactions, which is a general description of a wicked problem. The authors provide ten (10) descriptive characteristics, of which several are regularly discussed within CCRP policy papers are:

"a) Solutions to wicked problems are not true-or-false, but good-or-bad; b) Every wicked problem can be considered to be a symptom of another problem; c) There is no immediate and no ultimate test of a solution to a wicked problem; and, d) Every solution to a wicked problem is a "one-shot-operation", because there is no opportunity to learn by trial-and-error, every attempt counts significantly."

These factors point to a solution set which has similar points and characteristics to chaos theory initial conditions, and fractal representations – namely that small changes in initial conditions can yield disproportionate changes in results, and that whether one moves the scale in or out for examination of evidence, the patterns are repeated – wicked problems beget wicked problems. Yet, with sufficient information and knowledge, the understanding of the scope of interactions may be improved, and the results can be better and not worse, with acceptable return on investment for the course of interaction implemented.

CONNECTIONS –TEASING THE FUTURE PATH

To offer an example of tracking changes and results, consider how James Bourke through his BBC produce Connections TV series (Wikipedia-C) provided a non-linear tracking of change behind pieces of the modern world, as very interconnected and complex manner.

³ See Wikipedia information on wicked problems at http://en.wikipedia.org/wiki/Wicked_problem, for more discussion of 'wicked problems'; a brief summary is: "a problem that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognize. Moreover, because of complex interdependencies, the effort to solve one aspect of a wicked problem may reveal or create other problems."

“the entire gestalt of the modern world is the result of a web of interconnected events, each one consisting of a person or a group acting for reasons of their own motivations (e.g., profit, curiosity, religious) with no concept of the final, modern result of what their or their contemporaries actions finally led to. The interplay of the results of these isolated events is what drives history and innovation . . .”.

This points out that the interplay of seemingly unrelated events may indeed contribute the pattern of data which can ultimately result in understanding and improvements.

An area of several past papers presented at the Command and Control Research Program (CCRP) symposia – i.e., the area of Maritime Domain Awareness (MDA) – offers some degree of insight into the interconnectedness. A particular example, CDR S. C. Boraz's (2009) article in the Naval War College Review – “Maritime Domain Awareness – Myths and Realities” provides such a vehicle. While discussing the MDA targeting issue and challenges (via the cited quote below) he points out a somewhat clear view onto larger opportunities within a larger setting of interacting personnel and organizations:

““Targeting,” in this sense, does not always involve “kinetic effect” (a weapon striking an object). It may mean pointing out to a boarding team a merchant vessel that it should strike up a conversation with; identifying a cargo carrier as suspect so it can be held offshore for inspection; understanding the flows of personnel and cargo at a shore facility; or, when a kinetic targeting solution is required, picking out the wheat from the chaff.”

This points out the importance and opportunities of the interconnection between components of the PMESII and DIME frameworks for influencing the outcomes through the choices among the available actions within a process related effects chain and producing likely expected outcomes or results which are better.

The examples cited immediately above by Boraz, and earlier in this paper show what can be considered areas for follow-on research for discoveries in support of and potentially envisioned to ultimately realize the ‘full spectrum/dimension protection’ of Joint Vision 2010 and 2020. Further, this research could likewise be the initial complement of results toward another dimension of ‘precision engagement’ discussed by Johnson in ‘Forward . . . From the Sea: Naval Operational Concept’ (1997⁴). Both can be considered in some respects relatively contemporary versions from the DoD community for the much more recent commentary, journal articles, and press reports regarding ‘smart power’: the all agency/organization, collaborative solution approach. This could include the intermediate concept of integrated response to what was called ‘complex contingency operations’ (CCOs)⁵, as well as the now very familiar humanitarian assistance/disaster response (HA/DR) style planning and response actions.

They can be said to have shortcoming in that they all are predicated on working at relieving the results of already existing problems and conditions, while only occasionally addressing correctable root causes, which are the precursors to these problems and conditions. Root causes

⁴ <http://www.navy.mil/navydata/policy/fromsea/ffseanoc.html>. Note this document was actually released as a speech during the annual Sea, Air, Space Symposium sponsored by the Navy League.

⁵ Complex Contingency Operations (CCOs), have been discussed within the CCRP in the category of humanitarian assistance and disaster assistance (HA/DA). The initial Presidential direction for CCOs was provided via Presidential Decision Directive (PDD) 53, copy available at: <http://www.fas.org/irp/offdocs/pdd56.htm>.

which take multi-discipline analysis and understanding to determine the complex causal chains for action points, methods, and times to mitigate, address, correct, prevent the generation of the root cause conditions or mitigate and remove the problem preconditions which exist. By acting on the preconditions, then the need to execute reactive intervention after the fact could be realized through the proactive interventions. This is where a deeper understanding of the information and data is required. It the point that Bill James attempted to communicate to his baseball loving audience, that to help baseball teams perform better it took improved understanding. Lewis (2003) noted “What James’s wider audience had failed to understand was that the statistics were besides the point. The point was understanding; the point was to make life on earth just a bit more intelligible; and that point, somehow, was lost.” This aspect is regularly addressed through testing, and test planning, and examination of evidence and results discussed during many of the papers and presentations at this continuing series of symposia.

The paper sections above offer synopses of program steps and events which are but small teasers for the readers. The purpose has been to shine some illumination on the complex and wicked PEMSII/DIME frameworks of factors which are available for reflective analysis and development of understanding. By using both frameworks for thorough discovery and understanding of the past, the chance for tools, capabilities, and opportunities for influencing the future outcomes, to make improvements for the common good via improved planning, implementation, research, mentoring, feedback, intervention; and yes, literally smart targeting not only of the wheat grain within the chaff, but also the important straw which could make the crucial brick. (Remember the story regarding the nail for horse shoe for the horse for the general . . . and the lost battle.) Essentially, pointing out that some of the small things may actually be the important links in the chain which bring about significant future results and changes.

A PATH TO SMART POWER – Weaving, Warping, and Splicing – Integration and Leverage

The author has attempted to provide a sampling of potential sources toward understanding interaction facts and their cause-and-effect chains for future improved understanding and application toward desired outcomes. Future individuals within these networks of causes-and-effects have the potential for exercising capabilities to influence the application and targeting of non-kinetic, as well as, kinetic effects to influence future results, effects, and outcomes. These kinetic effects are quite well known, however, the current discussions and comments about ‘smart power’ are the newest manifestation of non-kinetic effects and outcomes which truly need to go beyond the initial, primary efforts of Defense and State Department’s coordination currently seeing some improved favor. It must go to the other agencies and branches more extensively, and, more collaboratively. Several examples which demonstrate aspects of these changes are: Parrish (2011), reviewing “a shift from Industrial Age military force to Information Age force. “. . . we’re great at strike warfare – dropping bombs. It’s now time for the Navy, and frankly the U.S. joint forces, to step up and start dealing with information in a much more sophisticated manner than they have in the past,” [Vice Admiral D. J.] Dorset said.”; Censer (2011), in discussing teamwork development noted that “The Defense Department is launching a pilot program that will send information technology employees to industry in an effort to I prove the government’s IT expertise, particularly in cybersecurity.” This shows the initiative to go beyond the immediate organization to gain experience and potential solutions, as well as to develop teamwork relationships to draw upon in the future; and, Stamm, (2009), reporting “The

provincial reconstruction team in Afghanistan's Panjshir province serves as a model for the continued integration of civilian assets into military operations to achieve a unified strategic goal." This parallels the embassy coordination between all the Executive Departments present at the embassies. These demonstrate the desire to move beyond the traditional to the innovative and adaptive approach to solutions.

As intimated by the synoptic development areas and the progression of high level doctrine concepts for protection and precision targeting/engagement, finding the best interaction point for near and long term effects and results, is not an easily realized analysis, distillation, or fusion result . . . the implementation and form are critically important. Having the nail for the horse's shoe could still leave the horse unavailable for its rider, if the smith is not available to attach the shoe. Thus not maintaining the chain of causes can result in the lack of success in battle. The other pieces of the chain must be available for implementation, or there must be replacements, alternatives, or completely different causal chains used for the desired result. Some of those alternatives may actually be less expensive in some way, delivery the desired result on an alternative schedule, and yet still fulfill the desired result or outcome. The journey starts with the first step, and there are several paths which are available for selection to arrive at the result.

Closure and 'So What?' – A Bigger Picture Landscape

The 'so what' here is that besides the tools which assist in making and determining the cause-and-effect linkages for desired results, the chain success returns ultimately to the human factors in many dimensions of interaction to achieve any results.

Some of the individuals who were involved in the examples and synopsis event sequences in this paper had, and displayed, natural abilities which generated results, while others overcame different factors to produce and generate results. They, and we, are all members of multiple communities with complex interactions, which generate results and outcomes. The analysis and learning of the ways and whys of those results and outcomes from the actions of those multiple communities can provide understanding, as well as, potential tools and capabilities for the future. A immediate future now being experienced, as well as the more distant future will continue to unfold in very surprising directions occasionally, because the needed degree of understanding of those causes-and-effects along that path to the future is not currently available. Some of the understanding must be quite specific, while other sections of that understanding are rather generalized, until they can be distilled down to finer, precision items and details. The wisdom may well be in knowing which specifics to act upon, or not act upon: which grain or piece of chaff to pay attention to; and which over-arching general principles to maintain for far longer and larger concepts and perceptions. These are the potentially the parallel components within the international community which Bill James (Lewis, 2003) in discussing baseball statistics arrived at several points which can be extended to other uses:

- look beyond the immediately visible – while Bill James was expressing "his outrage about fielding statistics: the naked eye was an inadequate tool for learning what you needed to know to evaluate baseball players and baseball games." (p. 68)
- to look for new knowledge on the subject being examined – Bill James had the "ability to light a torch in a dark chamber and throw a new light on a dusty problem. He made you think." His "cause was the systematic search for new baseball knowledge" based on the appropriate data and information in context to the circumstances and sequences of events, which is part of the CCRP objective. (p. 69)

- the team, teamwork, and circumstances are important for understanding – “The problem,” wrote James “is that baseball statistics are not pure accomplishments of men against other men, which is what we are in the habit of seeing them as. They are accomplishments of men in combination with their circumstances.” (p. 71)
- improved understanding – “What James’s wider audience had failed to understand was that the statistics were besides the point. The point was understanding; the point was to make life on earth just a bit more intelligible; and that point, somehow, was lost.” (p. 95) As regularly addressed through testing, and test planning, and examination of evidence and results discussed during many CCRP papers and presentations.

If successfully applied these points would likely result in a balanced art and a science approach, and thus a gain in the depth of perspective when they are integrated together. That is, a potential improvement over an un-integrated, isolated perspective where the balance is unable to shift as discussed in the *NATO NEC C2 Maturity Model* (Alberts, et al., 2010), from one to the other. Like successfully applying the improvements to influence net automation discussed in Moon, et al., (2008) paper, which discusses Influence networks’ aspects of complicated interconnections and interactions between different groups and organizations which allows for cultural characteristic groups, communities of interest, and organizational sub-groups as the frameworks for analysis and potential application areas for planning and courses of action analysis. Worked and woven together, the mixture will hopefully be stronger than the actions of individuals by themselves, and allow for seamless shifting and balancing between the component individuals, organizations, and entities, all for the common good. This may be an approach to assist in improving solution assessment of wicked problems. The end result could actually be the manifestation regarding intelligence and action, Fromkin, noted that “F. Scott Fitzgerald remarked that “the test of a first-rate intelligence in the ability to hold two opposed ideas in the mind at the same time, and still retain the ability to function.” By this he meant, he explained, “for example [to] be able to see that things are hopeless and yet be determined to make them otherwise.”” (Quote from F. Scott Fitzgerald. *The Crack-Up*.) (Fromkin, 1996)

Returning to the four points in the Abstract and Introduction of this paper:

- Less expenditure of effort or resources to achieve an intended impact or outcome – the points by Bill James and the piracy context provide examples supporting the efforts to get further into the indirect data and more complete context of the conditions and circumstances;
- Placing the point of interaction at the correct location and temporal instance – The aspect of being aware of and utilizing the cultural and demographic contexts, as well as technological opportunities and solutions, which may provide more robust and bettered returns on investment via the chosen courses of action;
- Significantly improved targeting discrimination to reduce un-intended consequences – Like the networked improvements in performance, with a better understanding and depth of interaction knowledge there is the opportunity to gain improved results vice poor results; and,
- Going beyond the traditional avenues of interaction for achieving results – That sometimes it is not the obvious which is to be examined, remember to look beyond the obvious, draw upon the available spectrum of specialists and generalists to prevent tunnel vision for other paths to better results may be found.

See the following sampling of papers from a prior symposium for potential implications of their topics light of these points.

“Adding Culture to Command Decisions” – Woodley, et al., 2008 – This paper presents an application process for assessing world view demographic style information to predict ‘group’ response to types of actions styles for selection potential courses of action. It addresses providing more context for cultural and well as historic influences on population groups when making planning and influence assessments related to courses of actions and likely outcomes of those actions.

“Research Model of Cultural Influences on Information Sharing via C2 Systems” – van den Heuval, et al., 2008 – Authors present in this paper a discussion of information transfer and the cultural factors to be discovered, analyzed, and understood in or to facilitate information transfer and development of knowledge and understanding between members and groups. Like the prior paper, this offers additional contextual inputs when assessing plans and courses of action for the results and the return on investment for choosing a better course of action among those available.

“Identification of Adversarial Activities: Profiling Latent Uses of Facilities from Structural Data and Real-time Intelligence” – Grande, et al., 2008 – This paper presents its authors’ suggested new a framework for filling in the gaps of an information trail or string, by deduction and inference logic methods, which link buildings, activities, people, and their related factors and interactions to establish collective opportunities for actions and interaction to influence the course of events and activities. Through this method the structures and personnel are related for providing likely relationships which can assist in additional data collection, as well as providing input knowledge to plan and course of action evaluation.

“Holonc scheduling concepts for C2 organization design for MHQ and MOC” – Park, et al., 2008 – This paper provides a great discussion of the mechanics of asset/unit/task management and allocation of loading efforts and support of the execution of the outcome chain associated with the loading efforts in support of successful strategic, operational, and tactical perspective. The paper opens the door to interagency, organizational, and joint/allied coordination planning of efforts for results and outcome. Further, it provides implications for possible with the interagency, organizational, and joint/allied adaptive task shifts while executing courses of action.

“Designing ‘Killer Applications’ of NCW – A process to support creation and innovation” – Kingston and Hew, 2008 – Gina Kingston and Patrick Hew – 13th ICCRTS – 2008. The discussion of a ‘killer application’ is used to parallel the cause-effect chains for events and results across an all of government model. This approach is extensible to agencies, non-governmental organizations, private volunteer organizations, as well as industry and the population at large in its respective demographic characteristics groups. As a caution this aspect of an application must connect with the users, receive their buy-in, and demonstrate an improved return on investment which can result in early adopters as well and the larger community of general users providing the critical mass for acceptance.

“A Useful Methodology for Cost-Benefit Evaluations of Cognitive Process Improvements in Complex C2 Endeavors” – Acosta, et al., 2008 – The authors of this paper present a mechanism or process for converting soft return-on-investment to \$s return-on-investment, within an organization performing process improvement (such as DOD), which can be extended to other

organizations, agencies, and groups of all types. This has this potential to assist with the factor of wicked problems, where they are considered to not provide true quantitative results but rather an assessment of good-versus-bad for possible solutions paths.

“Using NATO Human View Products to improve Defense Support to Civil Authority (DSCA)” – Stevens and Heacox, 2008 – This paper provides a introduction and discussion of an additional proposed human view family of interaction diagrams/views, which would be added to the Department of Defense Architecture Framework (DODAF) in support of humanitarian assistance/disaster response (HA/DR) all-of-government all-of-nation coordination efforts. This would be similar to the cultural or demographic characteristics of the personnel within the organization systems setting up the influence and interaction networks for possible cause and effect interaction planning and anticipation. Further it can open the door to potential coding of the structure through universal modeling language and influence nets, for potential assessment of courses of action and return on investment.

In closing, while the foregoing points offer some linkages for perspective when considering improvements for understanding and planning, ADM Stavridis and LCDR LeBron (2010), while discussing potential solution paths for the piracy of the Horn of Africa area offer a perspective which also applies to the larger arena of interactions with international groups and entities,

“If piracy in those strategic waterways is ever to be eradicated, it will take the coming together of governments, nongovernmental organizations, international organizations, and the private sector in the partnerships necessary to deliver security, stability, sustained economic development, and prosperity in Somalia. Harder military and law-enforcement activities are necessary but not enough. Pompey understood the need for this balance in the Mediterranean more than two thousand years ago; it is a fact that must not be overlooked in the Horn of Africa.”

That it takes a larger team approach, addressing a more rounded solution, like the integrated medical treatment by all the specialists treating the complete patient as opposed to only their specific specialty symptoms, much like the recent coordination of funding requests and supporting statements between the Department of Defense and Department of State.

This approach must also be balanced with the consequences of the actions, their intent and costs. Card (2006), provides a rather appropriate longer term view of those consequences within his book “Shadow of the Giant” of his Ender Series of warfare and future of humanity. “The route of war might succeed for a time – and the operative word in “might,” since nothing is certain in war – but the cost in blood, economic losses, and ill will for generations to come will be steep.” A timely thought for reflecting on which path to take when choosing how to interact with any organization, that all decisions have costs, and the path to assessing good-versus-bad assessments must be places into the complete context of the population, organizations and the future.

‘Disclaimer’ Opinions, conclusions, and recommendations, expressed or implied are those of the author. They do not reflect the views of the Command and Control Research Program, DoD, U.S. Navy, Naval Sea Systems Command, or Program Executive Office for Integrated Warfare Systems. The author likewise assumes responsibility for any errors in this work.

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