Simulation Technologies for a
Globally Accessible Personalized Training Meta-Academy

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Abstract: *This paper advances the need and capability of more fully using simulation technologies to improve training and education. The authors report on and base their assertions on their experience with continentally dispersed simulation and information systems for the DoD. The pressing exigencies of the early twenty-first century mandate a new, more targeted, and individualized practicable approach to training for today's warfighters, at both the individual and the unit levels. There is an immediate need for a system that would understand the individual DoD personnel service personnel's or unit's situation, capabilities, skills, education and training needs. It must provide complete and effective preparation for the DoD personnel's current and next duty stations, including a wide range of skills and knowledge, doing all of that on a real-time basis. This paper examines the goals, challenges, available technologies, and over-all approach to responding to this mandate. While the goals may be virtually unbounded and the situations may be dizzyingly dynamic, the focus will be on how a system could track and monitor the DoD personnel's, service member's personal profile, duty environments, and military objectives. Then it will describe how the system could prioritize needs, evaluate training assets, schedule training, collect or create curricula, execute training, report progress, monitor changing requirements, and evaluate efficacy. The paper will conclude with an analysis of the feasibility and requirements of such a program. The concept's ultimate goals are geo-political awareness, individualized training, global accessibility, mission-oriented curricula, self-paced learning, and engaging interactivity.*

1. Introduction

This paper introduces a novel approach to exploiting simulation technologies to more fully utilize the vast information assets on the World Wide Web. It discusses the need for and the general design of a system to improve the training of not only today's uniformed warfighters but the US government and Department of Defense (DOD) civilians that support deployed warriors on the field. Such a system should rely on proven technologies [1] and tested hardware [2], but will explore emerging technologies [3] and techniques [4. The acceleration of ops-tempos, the reduction of budgets, the escalation of deployments, and the proliferation of asymmetric foes all challenge the warfighter (and DOD civilian personnel) today. This demands a new approach to training and education in the Department of Defense. Much of that new approach can be found in the experiences of the large-scale simulations executed for the U.S. Joint Forces Command (JFCOM) relying heavily upon assets provided by the High Performance Computing Modernization Program (HPCMP). The authors rely most heavily upon the lessons that they learned from a project which they conceived, implemented and tested, the Joint Experimentation on Scalable Parallel Processors (JESPP) project. [5]

The ultimate goal is a more effectively trained DoD member of the DoD, but the more specific objective is a globally accessible training capability that will individualize training based on their respective unit's mission, personal profile, and personnel record. It will continuously:

- assess their current status
- catalog their qualifications
- examine their future orders
- assemble their training needs
- survey germane open web data
- tailor relevant training to match

1.1 System Engineering Insights

These ultimate goals are consistent with DOD Defense Acquisition Guidebook (DAG) that "the ultimate purpose of the System Engineering (SE) processes is to provide a framework that allows the SE team to efficiently and effectively deliver a capability to satisfy a validated operational need," [6]. The DAG utilizes the narrow view of SE that deals with traditional or classical physical systems that support a war fighter goal. There is also a broader Systems Engineer's definition beyond the classical "physical systems" description. Checkland's research reduced the broader concept to the point that a meeting can be engineered [7]. The broader methodology will be used for the remainder of this examination.

The envisioned Globally Accessible Personalized Training Meta-Academy (GAPTMA) will begin by prioritizing individuals' training requirements, taking heed of the global political situation, then compose the most time-effective training, rapidly deliver it wherever the DoD members are. It will continue to monitor progress and to identify emerging requirements, accepting inputs from DoD members and their seniors. Success depends on exploiting recent advances in:

- pedagogy
- computers
- data science
- neural science
- global communications.

These must be effectively tapped to train DoD members' service personnel better, faster and at lower cost. From the Systems Engineer's perspective this better and faster goal at a lower cost is at the heart of an "interdisciplinary approach and means to enable the realization of successful systems. Successful systems must satisfy the needs of their customers, users and other stakeholders." [8]

To fully exploit the rapidly evolving technology, *e.g*. the ascendency of Apache Spark over Hadoop, system development requires a team with demonstrated vision, experience, and intellectual flexibility. The phenomenon of disruptive technology displacing existing technologies is well established [9], but the team must be made up of professionals who are capable of understanding and taking best advantage of this process.

Speaking of advances in software approaches and hardware development brings to the fore the necessity of not focusing on a single new advance or relying on just one breakthrough. Properly evaluating new technologies and validating emerging techniques is a necessity to ensure optimal utility. Simply relying on an impressive benchmark result or implementing an improvement in a single module with no benefit to over-all performance is a trap for the unwary and a hallmark of the inexperienced. System Engineering demands that results be validated against baseline metrics. Technology evolves and the envisioned system must keep pace by evolving with it.

The warfighter today is faced with an increasingly complex battlespace and a much more geo-politically unpredictable enemy, but the training and education is too often still constrained by the "school-house" paradigm. the authors hold that this paradigm will not yield critical thinking that the warriors of today will need for tomorrow's warfighting. Instruction is typically administered in classrooms using the lecture method. This has been augmented with a range of game-based training and various simulator devices. The classroom approach mandates teaching to the lowest denominator and by focusing on those issues which are deemed essential for each and every DoD personnel, irrespective of the other DoD personnel's individual levels of mastery of that topic. Some significant part of the classroom training is either misdirected or is redundant, *i.e.* the training may be in skills or for background knowledge that is not required of all the other individuals. Sometimes the lecture is just reiterating topics, training for skills, and conveying knowledge that many of the DoD members have already mastered. This wastes time, saps morale and diminishes the fighting spirit, all of which can lead to poor retention. Similarly, unit training, while very effective now, is often not targeted to the needs of the personnel in the unit or to the specific mission with which the unit is likely to be tasked.

Advances in data science would enable the system to analyze the global political and defense dispositions and determine the impact these may have on the design of optimal training for specific units and individual DoD personnel.

The envisioned system would access a broad range of DoD and open sources in order to:

- evaluate the needs of the DoD member
- utilize technical breakthroughs
- implement new pedagogies
- ensure global availability.
- provide interactivity

It could make the best use possible of the entire range of web resources. The DoD members will not have to spend time looking for important data relating to their next duty station nor will they have to endure the frustration of sitting through lessons they have already mastered. The system can be designed to understand what it is that they need to master, individualize that training to serve them personally, access the data, and interactively teach them the needed information or have them practice needed skills.

It will keep track of all their needs, progress, and achievement. Then, it will analyze this data and issue reports to the DoD member and unit commanders on their readiness for deployment. There already is a body of experience in automated determination of readiness and it has been proven effective in operational use [10], The CAMERA project was fielded and found to be very effective by Marine Aviation. The new system will be designed to notify appropriate authorities if remediation is required. It will be aware of many dynamic aspects of their training, assessing not only the DoD members ' growth, but changes in deployment environments, global trends, and in new assets available to the DoD personnel.

By conducting an iterative cycle of implementation, evaluation and modification, the utility of each module will be assessed and improved. The authors hold that the processes for validation and verification should be rigorously defined so as to reassure the various constituent stake-holders that their needs have been addressed and will be met. The system will keep track of issues that may arise, if they are impacting performance, and will alarm system personnel about the need for pedagogic review.

Under the conceived system, differing visualization techniques could be implemented and careful records kept of the resultant speed of mastery of the skills [11], the quality of academic achievement, and the correlation to operation success [12]. This will facilitate optimizing training for the analyzed units and individuals, as well providing good starting points for units and DoD members with similar profiles and comparable duties.

Care will be taken in all of these activities to convey, most often through visualization, the range of probable futures, not just the most likely one. As an example, in weather forecasting and the presentation of probable conditions for upcoming operations, relative likelihoods of all the important parameters will be presented in ways that the DoD members will quickly comprehend, even when under the stress of a combat situation [13].

An additional enhancement of the DoD personnel's ability to properly analyze the complexities of operations in the 21st Century would be enabled by the insights from research into analysis of complex data sets. New approaches have shown that it is possible to discover meaningful structure of data from diverse sources [14]. This will respond to the Warfighters' constant complaint of the "fire hose of data" to which they are subjected.

As it seems likely the new training utilities and visualizations of this system will find favor with the users in operational settings, as well as in training mode, care should be taken to understand possible program extensions and to design a system that will not, *ab initio,* preclude other uses. It would be natural to have the users want to rely on it to support the real-time demands of impending mission rehearsal and preparation [15]. It is similarly conceivable to see pressures developing to extend GAPTMA's projected service life and to expand its function modules to reach years farther into the future. At that time, it might be called upon to support an education component, as well as training and operations.

GAPTMA can and should make optimal use of new computing capabilities, *e.g.* artificial intelligence [16], advanced visualization, interactivity, natural language [17], *etc*. It should also utilize creative pedagogies, *e.g.* meta-cognition [18], self-organized learning, teamwork training (via video-conferencing), and learning modalities. The learning modality modules should follow both the LSI [19 & 20] and the VARK [21 & 22] models.

Such a system would greatly enhance training, readiness, retention, and operational effectiveness for the unit and the DoD personnel. It will additionally aid the DoD personnel's, unit and officers, in that it will follow core SE principles and lead to:

- relieve the commanders of the bureaucratic duties forced on them by school-house training
- inform them of the DoD members ' readiness in a more comprehensive manner
- warn them of critical deficiencies prior to deployment
- reduce travel, labor and associated time costs
- assure continued training during deployments, to hone critical skills
- deliver updated training in theater to meet changing threats.

Global communications would allow globally-dispersed DoD members, who will serve in units together later, to virtually assemble to train together now. This will improve training and instill team spirit. Teamwork-skill characteristics could then be identified, quantified and improved.

Another opportunity that should not be overlooked is that of augmented reality. Recent advances have taken this concept out of the theoretical realm and advanced it into the arena of real-world operations [23]. This area holds great promise for shoring up the beleaguered warfighter, who has been issued the finest weapons that can be provided, but still operates with inherent human limitations, like their abilities to perceive the impact of terrains and dispositions during the stress of the evolving battlefield.

2. System Vision

Experience has shown that large systems are both possible but potentially problematic [24]. Effective implementation depends on well-defined objectives, unwavering commitment to the ultimate goal (better training the warfighter), rigorous periodic re-evaluations of progress, and well articulated program scope or direction and management. Underperformances in SE management will "lead to either cancellation of already expensive systems or even more expensive systems in terms of total cost of ownership or loss of human life." [25]

Driven by the parameters already discussed, the system will need to meet several conflicting requirements, *e.g.* it will need to be easily accessible from globally scattered locations, but it will contain information that is so sensitive that it needs to be secure at several different levels. One DoD member on his way to Japan may want to brush up on a few Japanese phrases while studying in public areas and using low security civilian networks, while his service compatriot may need study Urdu very securely, as he is headed for a clandestine operation in the Mideast. The former needs just standard net security, while the latter may need code-word compartmented secure communications.

There is a plethora of wide-ranging, rapidly changing, and independently-owned data that is already globally distributed. Centralizing and freezing that immense amount of data would be impractical and self-defeating [26]. Based on his experience in the JESPP project [27], Dr. Yao has established a series of data management techniques that were invaluable in that project and could be easily adapted and adopted into the envisioned system here.

In the future, this system may morph into something more operational, in the same way that America's Army morphed from a recruiting tool into a training system [28]. The desire to have a lookahead capability [29] would be one candidate for DoD members' wanting to use the system to assess their current operational situations, having gotten used to using it during their training.

This possibility further emphasizes an issue that is of central research interest to one of the authors (Hunt), who has observed the disruptive effects of poorly implemented software in systems designed to administer standardized test over continentally distributed networks. This is the bane of SE worldwide and can lead to excessive costs and possible program cancellation. He has observed the problems encountered when server or network inefficiencies leave the user at the remote client terminal unable to complete the tasks assigned. He posits and has demonstrated techniques to ameliorate this troubling defect.

The subject scenario had relatively tiny amounts of information that were almost certainly downloaded to the machine instantly. The lockup was almost certainly caused by someone doing Input/Output (IO) work in a User Interface (UI) thread (because the app IO was unresponsive). The two likely scenarios I was able to generate were that the test machines were doing something someone thought was safe like write to a log file whenever the mouse moved after a 5+ second delay, and in this case it turned out the test machines were Virtual Machines (VMs) sitting on an ESX (Electric Sky X) server with some sort of network issue between it and it's networked data storage device - or that someone was doing some sort of network IO under similar criteria, in the UI thread.

Further research would be facilitated by such a large and well provided system. “Systems are made up of objects” and all objects have boundaries. [30]. One object of the boundary research could be the identification, characterization and eradication of the previously observed disruptions. Several techniques could be applied to keep the user engaged and attentive, *e.g.* monitoring for anticipated delivery constraints and providing buffers, content modification or warning messages as found appropriate or required.

On the software side, such a system should be designed to:

- present training using curricula developed by other training entities
- collect information from open sources
- convey background and battlespace data validated as trustworthy
- evaluate training progress and achievement using automated processes.

The system would house and analyze all of the personnel records of potential trainees, as well as storing information on them that has been determined by the embedded A/I functions. These data would be gleaned during interactive sessions [31].

It would also have access to the entire World Wide Web to keep track of changes in alliances, mew threats, active combat, social instability, and environmental changes. The students’ background data would be augmented by diagnostic tests administered on-line, *e.g.* a test to ascertain an individual’s optimal learning modalities [32]: visual, reading-writing, auditory, or kinesthetic [33].

Also housed and maintained locally could be the data, programs, and hardware to provide a high resolution three dimensional representations of any area of the world with demographically correct populations and infrastructures, all distributed globally with very low latency [34]. Even though the output information of these simulations might not be of particularly high classification, some of the intelligence on which they may be based is extremely sensitive and, as history has repeatedly shown, any distribution of sensitive data runs increasing the risk of compromise.

3. Specific Subsystem Issues

It would be prudent now to review some of the more critical subsystem issues and look quickly at goals, challenges, and practicable approaches, as well as the likelihoods for all of them.

3.1 The Role of Systems Engineering

The International Council on Systems Engineering (INCOSE) delineates systems engineering as “an interdisciplinary approach and means to enable the realization of successful systems.” (INCOSE Handbook) Shortfalls in a cohesive SE approach will lead to either cancellation of already expensive systems or even more expensive systems in terms of total cost of ownership or loss of human life.

“The Systems Engineer should possess the skills, instincts, and critical thinking ability to identify and focus efforts on the activities needed to enhance the overall system effectiveness, suitability, survivability and sustainability [35].” Previously the DOD has relied on traditional brick and mortar schoolhouses like the service academies, war colleges, and Armed Forces Industrial

Staff College among others. A Globally Accessible Personalized Training system will lead to improvements in critical thinking that simply have not been available to the DOD.

This is neither an exhaustive list nor a deep treatment of the topics, but is instead a survey of issues already becoming evident. This new era of globalization and computing technology requires the military to transform to fight in this daunting cyber age. The basic subsystem remains the DoD member who will be enabled by improved simulations and allow for an enhanced scheme of maneuver in cyber space. [36]

3.2 Individual Issues and Analysis

3.2.1 DoD Members Personal Profile

Goals

By analyzing the training and evaluation records of each DoD personnel, the system should be able to establish past training, current skill levels, pending assignments and other characteristics. The system will administer additional tests to assess current skills, aptitudes, attitudes, and progress [37].

Challenges

Personnel records frequently do not adequately reflect aptitudes and achievements, so the system will have to be given the latitude to assess skill levels and aptitudes on its own. Security, especially as it applies to future duties, would have to be constantly monitored and effectively insured.

Practicable Approach

Using proven techniques of assessment, quantify current capabilities and compare these with requirements solicited from outside of the formal performance evaluation process. The authors have noted that evaluation reports all too often suffer from the "halo effect" bias. To get value out of the great mass of data contained in these reports will require sophisticated natural language analysis [38] to produce a realistic evaluation of the subject DoD member. A realistic and unbiased evaluation is required so that any system can train the individual to their best advantage and to raise their skills to the highest possible level.

3.2.2 Duty environment

Goals

The intent should be to design the training by taking into account the past, present and future duty stations of each DoD Member. That background knowledge should be wide and capable of going deep, *e.g.* all previous TDYs, past living accommodations, operational requirements, on- and off-duty activities, impacts on DoD members noted or anticipated from their duties while they were there.

Challenges

A major hurdle here is making sure the system can comprehend the various characteristics of the duty station, the observed or predicted impacts, potential changes and relationship to training needs and effects. Astute members of the military can usually predict the impact duty at particular stations will have.

Practicable Approach

Ensure access to the oceans of data that is available online and from the vast range of DoD sources. Cross-check data from third-party sources and develop feedback mechanisms to "learn" how to best incorporate data into the curricula so as to inculcate critical skills and knowledge. Implement advances in natural language processing to fully grasp implications of written material. [39].

3.2.3 Military objectives

Goals

While maintaining security, the system should identify and understand the assigned military objectives, unit missions, and how they are related to the individual DoD member, as well as how they will guide, constrain, and alter training. Unit composition and previous training must be taken into account.

Challenges

Care must be taken to mask releasing any training choices that would otherwise reveal classified objectives. It will be critical to automatically select training to correspond to operational imperatives, and to focus training on unit mission success.

Practicable Approach

Much of this area will require that it be isolated on classified machines and made available to the DoD member in the last possible moments. This is analogous to combat-loading of amphibious vessels. In this case, the *mantra* should be: teach last that which is the most critical and the most sensitive, to make sure it is safe and freshest [40].

3.2.4 Prioritize needs

Goals

Eschewing the “one size fits all” approach to training prioritization, this system will look at all relevant factors and create priorities driven by unit requirements, and individual DoD member’s needs, current skills, aptitudes, time available, and mission imperatives, all securely provided.

Challenges

It will be daunting to do this in an automatic and rapid way, establishing a reliable human-like analysis, so “human” as to engage and motivate the DoD members. It must also be amenable to external guidance and able to focus on critical skills.

Practicable Approach

Assemble and enable a multi-disciplinary team to include computer scientists, developmental psychologists, pedagogy analysts, human factors designers, and visualization programmers. Focus on results, discard the less-effective and strive to create the optimally effective. This should be an on-going process for the life of the system. Analysis of large scale, multi-factor prioritizations may be resolved best by emerging quantum computing techniques. [41]

3.2.5 Evaluate training assets

Goals

Wherever possible, the use of existing instructional materials and methods would be prudent. Such a system should both accept inputs from training consultants and from users. The system would need to identify, analyze and rate appropriate training materials, but rely largely on those identified by military trainers. Using prescribed and extant learning goals, a system could build up a history of how effectively the individual achieved them and how effectively the performance correlated with the achievement ratings.

Challenges

Some materials will turn out to be ineffective and need replacement. A balance must be struck between the benefits of incorporating potentially superior new materials and the detriments of wasting precious training time. Those benefits or wastes may prove to be the difference that would lead either to mission success or to the death of the trainee. Selecting the proper and most useable materials will not be trivial. Comparing the various materials’ efficacies against training successes of DoD members with the differing learning modalities will be important, but must not interfere with the training

Practicable Approach

Using a combination of machine analysis, A/I, and human monitoring, personalize training and show the benefit from that. Install a series of control overrides to allow human intervention of machine analysis and options.

3.2.6 Schedule training

Goals

A system should be so constructed as to schedule training in light of a number of well known and often unavoidable criteria: time available, criticality of skill, costs, security and expectations. The system will also be responsive to the individual in ways that classroom instructions cannot be, *e.g.* recognizing trainee’s circadian rhythms and their impact on learning.

Challenges

The optimization of learning has a number of different dimensions that must be considered. Some of these dimensions are very susceptible to both external and trainee variability, not to speak of the emergence of new training assets and shifting operational requirements.

Practicable Approach

Implement the most effective machine generated schedules, so as to provide the best schedule. In addition, implement recent advances in linear programming optimization and assess them. Evaluate emerging optimization of schedules by using the heuristic outputs from simulated and quantum annealing.

3.2.7 Collect course materials

Goals

Taking heed of the analysis of materials previously described, the system should then be able to collect, collate, and configure material for delivery to the students. These materials must be available virtually instantaneously and must be reasonably immune to human disruption or corruption. They must be configured so as not to be de-motivating.

Challenges

Much of the material will not be the property of the DoD, but will be open-source materials from the World Wide Web (Web). As such, it will be particularly susceptible to malicious interference. Preparation will have to be automated and much cannot be made available for human review prior to delivery to the trainee, *e.g.* current weather forecasts for the duty station.

Practicable Approach

Leave the vast majority of the stored information in-place and use advanced distributed data management algorithms to identify, organize and make the data available when needed. Use newer tools such as Apache Spark, to manage this distributed data. Spark's proponents claim it can do data manipulation from ten to one hundred times faster than Hadoop [42]. Develop automated systems to cross-check the information for validity that is subject to tampering and issue appropriate caveats to users [43].

3.2.8 Create curriculum

Goals

The curricula developed must be standardized as to its ability to achieve the needed training for the student, as well as variable as to the methods, teaching modalities and scheduling. This is required in order to best serve the needs of the individual and still serve the needs of the mission. Criteria for success include efficacy, cost, speed, and student motivation/morale.

Challenges

Balancing the needs of standardization with those of cost, pedagogical malleability, and mission requirements will not be trivial. Assessing optimal training materials will be difficult. Time constraints and cost pressures which may lead to sub-optimal training will be inevitable.

Practicable Approach

Encourage the use of "plug and play" teaching modules, but maintain an awareness of the desirability of making them responsive to various learning styles. Substitute A/I for human analysis and adaptation of raw instructional materials when feasible, with a concomitant review by educators and subject matter experts (SMEs). Enhance education by identifying and adopting that which is already known [44]

3.2.9 Conduct training

Goals

Project goals for this activity would be to assess speed, efficacy, and morale impact of training on a wide variety of troops. Longer-term goals will be to assess its impact on subsequent duty, operational performance and retention.

Challenges

The users do not represent a homogeneous collection of research subject. They vary greatly in experience, intelligence, motivation, and commitment. Units vary in many of the same ways. Establishing and quantifying outcome expectations for each learner is difficult under any circumstance, but will be especially difficult considering the varying pressure to which toady's DoD members are subjected and the disparate backgrounds from which they come.

Practicable Approach

Relying on previous successes in trans-continental simulation events, supply training to a global audience of DoD members [45], both on and off-duty. Using the data collection, analysis, optimization and evaluation strengths of HPC, track both efficacy measurements implemented by the system and those evaluation reports which have been input from external sources.

3.2.10 Report progress

Goals

Aside from assessing student progress for evaluation of system efficacy, a more important evaluation, the one for operational readiness, will be provided. DoD members must be aware of their own needs and how rapidly and effectively they are training to meet those needs. Commanders need to know who is approaching operational readiness and who needs reassignment, remotivation or remediation.

Challenges

Operational readiness is a function of many disparate evaluations: operational needs, situation immediacy, pressures to relieve those DoD members who are on station now, impact of premature deployment on personnel and situation, and many other factors. Simple linear programming algorithms may do an insufficient job of identifying optimal use of human and logistic resources.

Practicable Approach

Implement a coordinated analysis by using both human reviews and the very best optimization programs. Explore the advantages of quantum annealing [46], with its ability to produce histograms of the various maxima and their relationship to the various minima. Monitor progress and issue alarms to unit leadership personnel if progress is insufficient to support deployment schedules and operations. The key criterion will be operational readiness.

3.2.11 Monitor changing requirements

Goals

As well as the current status of the DoD member, a system needs to be able to constantly monitor and take heed of changes to the operational environment into which the DoD member is going, not to slight those areas of their likely assignments in the near future. Keeping track of changes in political situations, disposition of friendly and adversary forces, infrastructure [47] and weather conditions will be necessary to ensure the training does not fail to anticipate and prepare the DoD member for situations in which they may find themselves Stochastic simulations may produce a range of possible futures in the battlespace [48].

Challenges

The DoD member may not have the capacity for, nor can the system effectively train for, all situations and every contingency. A rational analysis and prioritization will be very difficult. Studies have shown that humans tend to do poorly if asked to optimize any situation in which five or more factors are germane.

Practicable Approach

Take heed of the direction selected by human-generated orders. Focus the training first on the duty immediately at hand. Nevertheless, survey training needs for DoD members within their specific specialties and prioritize additional training to reflect the potential of the needs that will almost certainly arise. Accomplish this prioritization with the optimization techniques already discussed.

3.2.12 Evaluate efficacy

Goals

Such a system should effectively provide both complete data for external evaluation by experienced military trainers and perform its own internal evaluation, conducted automatically and in real time. This evaluative process could be used internally to adjust training and justify readiness analyses. Both specific training modules and over-all system efficacy could be evaluated.

Challenges

Automating system self-evaluation runs the risk of suffering an algorithmic pathology that misreads the progress and alters the training in an incorrect direction. Valuable training time and student motivation may be lost be such a failure. Operational readiness goals, generated by humans, are subject to error and can lead the entire system awry.

Practicable Approach

Implement a series of cross-checking algorithms will to recognize any anomalous trends in progress and alarm training personnel of the need for a review of the data.

Further reduce the likelihood of the system's making inappropriate choices by scheduling spot reviews by experienced military trainers. For the most part, the normal evaluative process will succeed and sufficient data will be provided to the DoD personnel, supervising trainers, and commanders to reassure them that the training is on-schedule and on-target.

IV. Conclusion

A globally available training system could greatly enhance training, readiness, retention, and operational effectiveness for units and DoD members . Such a system could be implemented using proven technical capabilities. Further, it would present an opportunity to provide many refinements and improvements that are now available via emerging and innovative technologies and approaches. Pedagogies like meta-computing and learning modalities can now be applied and their impacts studied and extended. Technologies such as secure communications, high-performance computing and quantum computing are already at the point of enabling the solution of heretofore intractable problems and barriers [49].

Characteristics of an SE view revert simply to management technology. Technology is the result of and represents the totality of the organization, application and the delivery of scientific knowledge for the intended enhancement of society.” [50]

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5. Authors' Biographies

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Daniel P. Burns is a life-long Systems Engineer first with the Active Duty Navy, then with a Fortune 250 Company and small business as well as in Academia**. He** formerly served as the Naval Chair and a Professor of Practice in the Department of Systems Engineering at the Naval Postgraduate School (NPS) in Monterey California. He is a Captain in the United States Navy and has served as the as the Military Associate Dean and as acting Dean of the Graduate School of Engineering and Applied Sciences at NPS. For eight years he directed research as a senior executive at SAIC. His research interests center on analyses of both human and resource utilization in defense efforts. Captain Burns received a BS degree from the U.S. Naval Academy and an MS from the Naval Postgraduate School. He is currently finishing his dissertation for a PhD in Systems Engineering from Southern Methodist University.