

APPRECIATING COMPLEXITY: THE CHIEF OF STAFF OF THE ARMY GAME

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ABSTRACT

When Army officers are promoted to the rank of Major, they become field grade officers with the responsibility of planning, organizing and leading large unit formations, working on high level staffs and running the Army day to day. The "Future Force" game is an experiential learning simulation designed to introduce them to the complexity of supporting the current force in its world-wide missions while simultaneously designing and shaping the force for all possible mission profiles for the next 20 years. Played early in their change management curriculum, the game provides a common frame of reference for further detailed technical lessons. This paper describes the game design process from conception to application.

INTRODUCTION

Each year, more than 1500 Majors from the United States Army, Navy, Air Force and Marines, along with more than 100 specially selected international officers of equivalent rank, are assigned to attend the United States Army Command & General Staff College (CGSC) at Fort Leavenworth Kansas. In 2010, the vast majority of these officers are combat veterans with an average of 3 combat tours in the last 5 years, with more tours expected in the near future. This extraordinarily high rate of combat experience has been true of the student officer population for several years and is projected to remain constant for the next 5 years. This collection of student officers is more experienced in combat operations characterized by uncertainty, complexity and non-doctrinal solutions as any cohort of officers in the history of CGSC (Long, 2009). These officers attend the year-long Command & General Staff College at Ft Leavenworth, Kansas for education in Leadership, History Strategy, Tactics, and Logistics.

The logistics curriculum includes an 18 hour course in Army Force Management in which they are introduced to the Army's processes for designing, raising, manning, equipping, deploying and sustaining ready field forces. The Army's complex Planning, Programming, Budgeting and Execution System (PPBES) is nested within an even more complex Department of the Defense system. All of which are designed to field the right Army at the right time in the right place to support the nation's defense objectives. This collection of processes are performed by

the Generating Force, which is led by the Army's senior officer, the Chief of Staff of the Army (CSA), who is charged with the leadership, management, design and readiness of all Army forces. In the 10 years following their graduation, CGSC students will have a variety of assignments that require them to become masters of organizational planning and management on a vast scale.

Nothing in their previous experience has prepared them for their future assignments as field grade officers, where they lead and manage large unit formations, work on high level staffs, and run the Army day to day. The complexity and uncertainty they will be asked to appreciate and manage will be of a different nature than the world of direct action combat. They will be asked to plan for multiple missions, manage budgets, design and equip new forms of organizations, assemble mixed task forces of new kinds of units and make them ready for combat in a wide variety of mission profiles in different parts of the world against newly emerging threats.

Traditional technical education, which emphasizes lecture by subject matter experts with knowledge tested by formal examinations, has proven unsuitable and unsatisfying in equipping students with the necessary cognitive skills to survive and thrive in the complex world of force management. Student and faculty surveys had repeatedly described problems with the complex material, citing difficulties in seeing the big picture, understanding the relevance to their future assignments, and seeing how individual technical lessons fit into larger systems and processes.

CGSC faculty in the logistics department developed a pilot program to assess the usefulness of experiential learning, using a small worlds simulation to help students and faculty visualize the complexity of Army force generation and force management. This paper describes the process of developing the Future Force game from design through prototyping to implementation which in six months made significant improvements in all measured areas of education quality and in the satisfaction levels of students and faculty alike.

INITIAL DESIGN REQUIREMENTS

In the initial planning session, key faculty members and subject matter experts described the problem and opportunity space. Force management is hard to do and may even be harder to teach, especially to operations career

field officers who have not directly experienced or been educated in the processes of the Generating Force. The design group focused on top-level educational outcomes that the students must appreciate. Any piece of curriculum must address these issues:

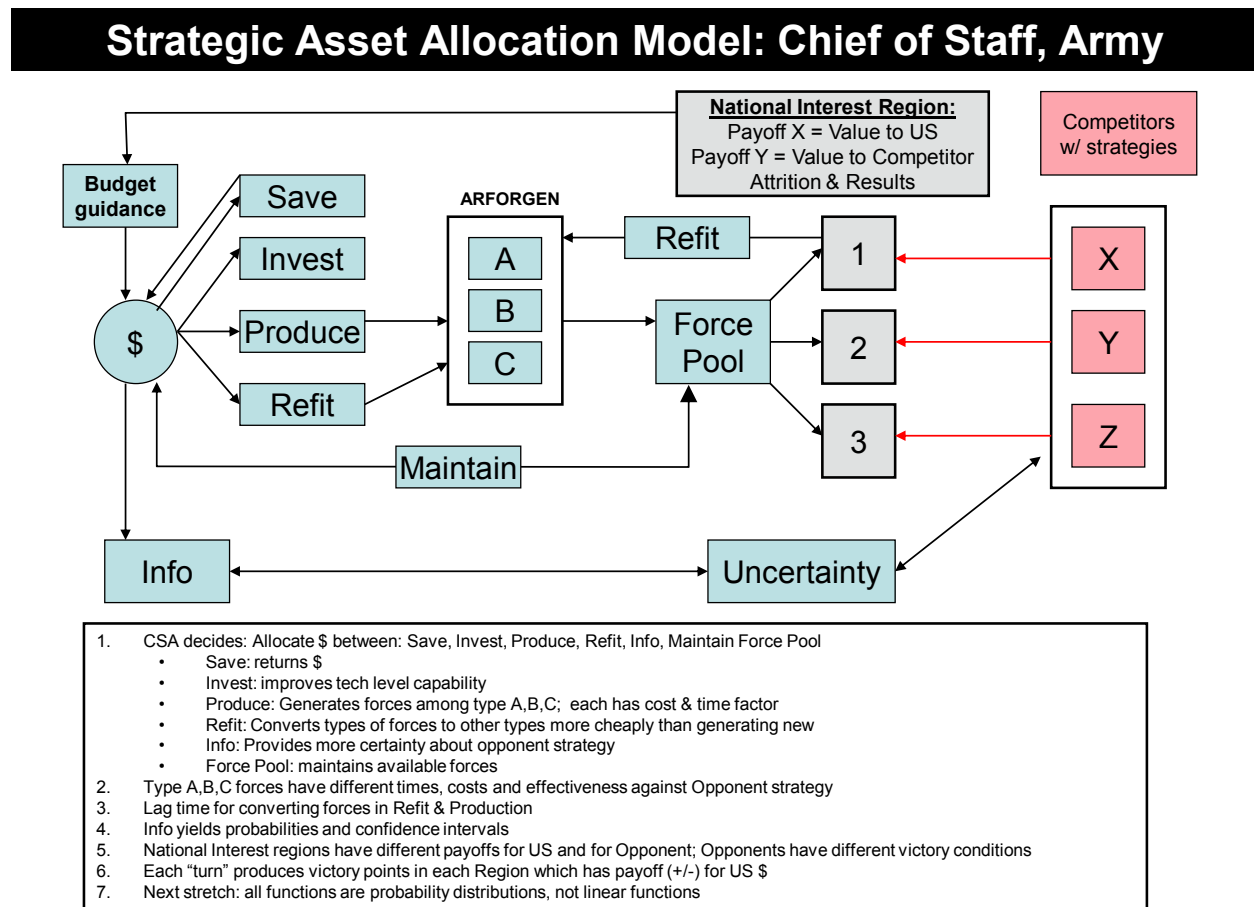
1. How is the Army SUPPOSED run?
2. How DOES it run?
3. How are its processes EVOLVING?
4. How COULD it run better?
5. How SHOULD it run?

One of the most challenging aspects of teaching Force Management is finding the balance between technical terms and detailed processes and a high-level overview of the important professional questions officers must contend with in their career. Operations career field officers are rarely called upon to become experts in broad generating force processes, but their ability to define requirements, establish priorities, allocate resources, manage risk and provide guidance are essential elements of Army Force Management.

The design group incorporated students in the design process from the beginning, to ensure any proposal would be teachable and meaningful from their perspective. In a classroom discussion one day, the team decided to construct on the white board a “systems dynamics” process map of what they imagined the Chief of Staff of the Army’s decision process looked like concerning how to design, equip, sustain and manage an Army. They considered the constraints and conditions of time, money, politics, uncertainty, full spectrum operations, the global information environment, and multiple thinking, adaptive enemies competing with Army forces in the operational environment.

The white board diagramming led to experiential, collaborative learning that students and faculty rated very highly for effectiveness and shared understanding that day. They called it the “Chief of Staff of the Army game” and created a slide to capture the essence of our diagram and discussions. We often referred back to that experience and the slide in later lessons. This is a common experience for organizations that adopt a systems dynamics modeling approach to understand their own processes. These models can often be profitably turned into management simulations

Figure 1



that allow others to experience and explore the rich description of the organization and its environment, and come to a better common understanding.

The group published the slide and explanation on the college blog and shared it among select faculty who found it useful, as is, as an educational artifact.

RAPID PROTOTYPING WITH A SIMPLE CARD GAME

Using the systems dynamics diagram as a guide, the design group next modeled a card game that applied a simple ruleset and a half deck of cards to create an interesting game that could be learned and played in a classroom in less than an hour that was very well received by students and faculty who tried it out. The development of the ruleset, much like the slide before it, became a powerful learning artifact above and beyond the direct insights generated during the play of the game.

The card game evolved into several variations of increasing complexity, which led to an increase in accuracy and realism, but which sacrificed playability and enthusiasm for the experience. The insights from these variations of the card game prototype yielded important insights into the next phase of design. The design group refined several versions of the card game that produced positive educational effects at an acceptable level of rigor and playability for some educational environments where access to computer networks and skilled instructors may not be available. They remained valuable contributions to the department's teaching kitbag in their own right.

DESIGNING & DEVELOPING THE COMPUTER SIMULATION

To build on the momentum and insights of the previous phases, the group decided to proceed with the development of a computerized version of the Chief of Staff of the Army game. They developed a computer simulation that could be played:

1. Against a live opponent or in the classroom
2. In an hour
3. With enough complexity to challenge
4. With enough simplicity to allow focus and access to the learning insights
5. With enough fun and competition to make it enjoyable

6. With enough choices to represent complexity but not be overwhelming
7. On a network or a single computer
8. With limited instructions and setup time required
9. With immediate viewable results for feedback
10. With an editable scenario set to allow exploration of student ideas
11. In support of the force management learning objectives
12. With enough realism to be satisfying to professionals
13. With enough strategy choices to suggest themes for further discussion
14. To create a common, memorable experience to support collaborative learning.

The department's design team secured college resourcing for contracted support to develop the game. In a matter of 4 months, a small developmental team of programmers, designers, playtesters, quality assurance, network specialists, faculty and students went from the initial systems dynamics concept model and requirements list to a delivered commercial quality operational game that met all requirements. Keys to the group's success included:

1. Designers with a clear sense of the endstate, with decision authority
2. A small enough group that could remain focused on the deliverable
3. A broad enough group that included representatives from all stakeholders
4. Rapid prototype and development cycles that permitted frequent check-ins and clarifications
5. Distributed, asynchronous development through the network
6. Preventing mission creep and feature creep so that the end-product remained focused and integrated
7. Frequent project updates made available to broader groups of students and faculty through blogs, discussion boards and presentations to gather feedback and build momentum for acceptance of the final product

IMPLEMENTATION OF THE DESIGN MODEL

The Future Force game represents and helps the payer/student visualize the following big ideas:

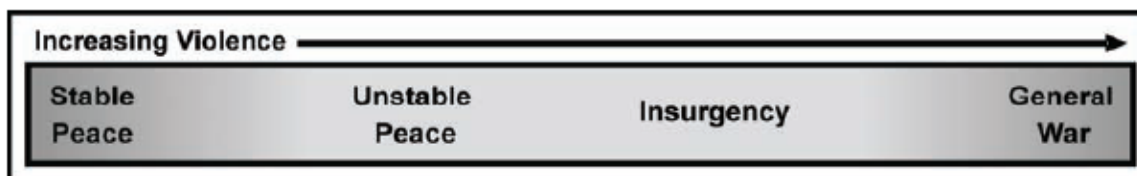


Figure 2-1. The spectrum of conflict

1. The Chief of Staff of the Army (CSA) is a designer and a resource allocator. He makes decisions about the types and mixes of forces the Army needs. He is not a warfighter, and the game reflects a much more technical and administrative tone and feel than typical strategy and first person shooter games.
 2. Congress provides budget guidance from the political process, which in many cases comes with constraints on how that money shall be spent, and the budget guidance is influenced directly by results, but also political processes beyond the scope of the military domain to control or predict.
 3. The Army “competes” in various regions/areas of operations around the world against smart competitors who adapt, and whose “victory conditions” may vary from ours. They seek to learn about our strategies, while masking their own intentions, thus setting the conditions for an information war.
 4. Our forces must be designed, raised, manned, equipped, deployed, sustained, refit, and retired as needed. Life cycle management across many budget and program years is crucial for future preparedness and flexibility.
 5. Many processes make claims on the CSA’s budget: he must make tradeoff decisions concerning: strategic deployment, technological upgrades, strategic and tactical information systems, current operational tempo costs, refit & re-engineering of forces; stationing; responding to opponents’ strategies.
 6. Consistency with current and emerging Army war-fighting doctrine which describe full spectrum operations (FSO) as a set of overlapping mission profiles ranging from Major Combat Operations (MCO) through Stability Operations (SO) to Peacetime Military Engagement (PME).
 7. Mission profiles vary in different regions and in competition with multiple opponents. Not everyone fights us in the way we would want. Mission profiles in a region have patterns but are not completely predictable; regional mission profiles can and do change.
 8. Mission profiles vary by region: simultaneous full spectrum operations will be the norm.
 9. Mission consequences are not linear: the costs, consequences and implications of winning or losing differ dramatically between major combat operations (MCO), stability operations, and peacetime military engagement.
 10. Army Force Generation (ARFORGEN) is a phased process of generating the operational forces needed for current and future operations.
 11. Multiple feedback loops, time delays, uncertainty, incomplete information, mixtures of quantitative and qualitative judgments, adaptive strategies and opponents, funding: these dynamic variables create a network of uncertainty and opportunity which must nevertheless be managed .
- The design team included these insights into the design criteria for the Future Force simulation, so that “players”, in the role of the CSA had real choices to make,

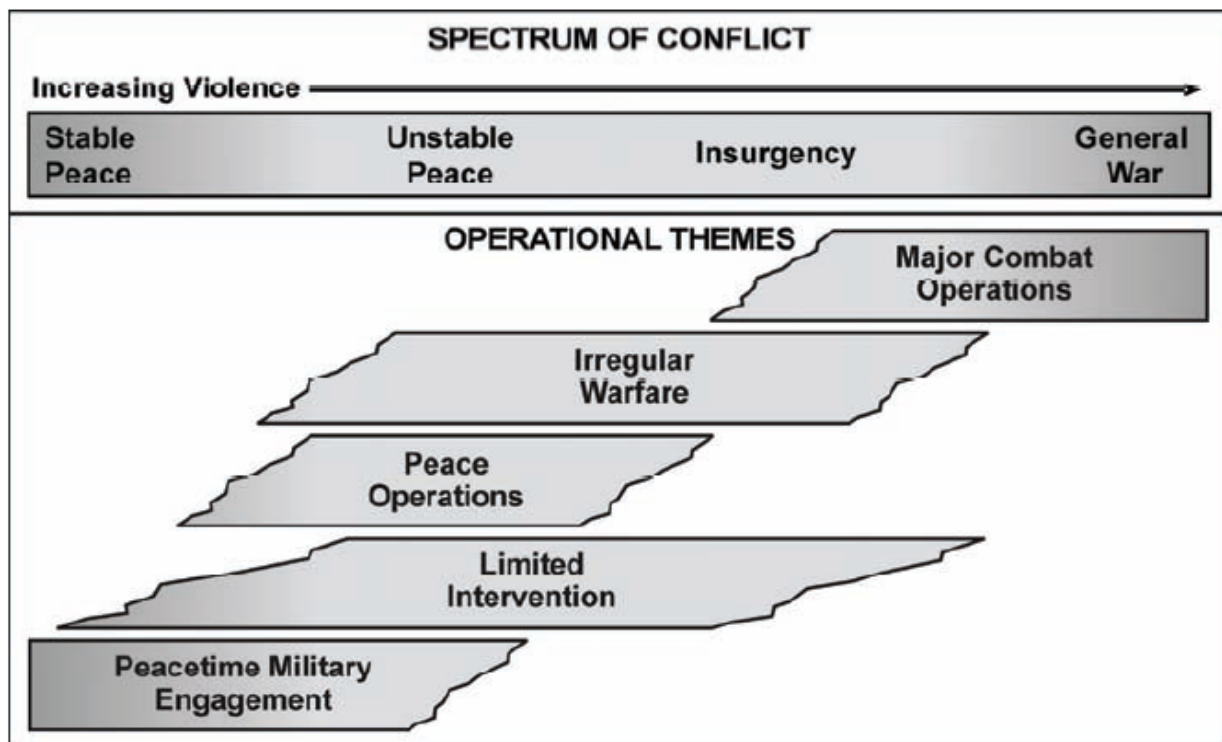


Figure 2-2. The spectrum of conflict and operational themes

with as much reasonable realism in the underlying model as we could design in order to help gain insights into the challenges and tradeoff decisions, while keeping the game playable and meaningful for the time available in the classroom.

TRADEOFFS AND SIMPLIFICATIONS

To be useful in a time-constrained school environment, educational models must find simplifications that allow games to be learned and played for significant effect. Simplified models must not be mistaken for reality, and neither can they be shunned for their lack of perfect accuracy. Expressing this idea in the classroom was part of a larger lesson on the nature of uncertainty and the use of models for understanding and managing it. The department elected to make this an explicit part of the faculty train-up, the teaching note, and the classroom discussions that followed the playing of the game. This allowed the faculty to connect the logistics and change management curriculum to the broader theme of critical thinking and management of uncertainty which ties the year-long curriculum together.

These are things the design team simplified in order to have a playable game and just enough complexity to represent the dynamics of the environment. Simplification is a tradeoff between realism and playability/usefulness. They made every effort to blend both to create a tool that stimulates thoughts about the nature of force management and strategic decision-making for officers coming from an operational force, tactical orientation.

Mission profiles: The categories and sub-categories of mission profiles (types of missions) get more numerous every year, as the Army is called upon to undertake a wider

set of operations. Army Field Manual 3.0 “Operations”, (FM 3.0 , 2008), figure 2-1 describes full spectrum operations as a spectrum of conflict

FM 3.0 (2008) then arrays operational themes across the spectrum of conflict to represent the complexity

FM 3.0 (2008), Table 2-1 illustrates a representative sample of the many operational types defined under a subset of just some of the operational themes

The design team made a playability and visualization decision to simplify into 3 broad categories:

1. Major Combat Operations (MCO): conventional high intensity combat involving a significant number of large formations of regular forces.
2. Stability Operations(SO): a catch-all category to contain missions as varied as COIN, peace-keeping, peace-making, insurgency and counterinsurgency
3. Peacetime military engagement(PME): everything less than a force-on-force direct engagement and including forward presence, foreign internal defense, partnership training, coalition and partner readiness exercises

Army units are numerous and varied with an almost infinite set of capabilities and performance characteristics in different mission profiles. They vary by design and by proficiency of individual units. We made a playability and visualization decision to use 6 “type” brigades to represent the variety of choices available to the CSA. This is how we described them to reflect their use, play, costs and consequences within the game. Our intent was to remain as true

Table 2-1. Examples of joint military operations conducted within operational themes

<i>Peacetime military engagement</i>	<i>Limited intervention</i>	<i>Peace operations</i>	<i>Irregular warfare</i>
<ul style="list-style-type: none"> • Multinational training events and exercises • Security assistance • Joint combined exchange training • Recovery operations • Arms control • Counterdrug activities 	<ul style="list-style-type: none"> • Noncombatant evacuation operations • Strike • Raid • Show of force • Foreign humanitarian assistance • Consequence management • Sanction enforcement • Elimination of weapons of mass destruction 	<ul style="list-style-type: none"> • Peacekeeping • Peace building • Peacemaking • Peace enforcement • Conflict prevention 	<ul style="list-style-type: none"> • Foreign internal defense • Support to insurgency • Counterinsurgency • Combating terrorism • Unconventional warfare
<p><i>Note:</i> Major combat operations usually involve a series of named major operations, such as Operation Desert Storm, each involving significant offensive and defensive operations and supporting air, land, sea, and special operations.</p>			

to the professional understanding of what these units “really” are:

1. Heavy BCTs (HBCT): large, self-sufficient, conventional combined arms formations of tanks, Bradley fighting vehicles, howitzers, optimized for MCO, and whose forward presence demonstrates national political resolve and pre-emptive force, with a high OPTEMPO cost and high deployment costs
2. Stryker BCTs (SBCT): large, self-sufficient, conventional combined arms formations of Stryker medium weight vehicles, howitzers, proficient in MCO and SO, and whose forward presence demonstrates national political resolve and pre-emptive force, but with a medium OPTEMPO cost and medium deployment cost
3. Infantry BCTs (IBCT): large, self-sufficient, conventional, tailorable combined arms formations of light-weight vehicles, towed howitzers, proficient in MCO, and SO, adaptable in PME, and whose forward presence demonstrates national political resolve and pre-emptive force, with a relatively low OPTEMPO cost and low deployment cost
4. Special Forces Groups(SOF): small, self-sufficient, unconventional, tailorable, special operations formations of small, highly trained, specialized soldiers, proficient in MCO, and SO, adaptable in PME, and whose forward presence demonstrates national political resolve, a commitment to developing partnership capacity and the ability to engage in direct action on short notice in SO and PME, with a relatively low OPTEMPO cost and low deployment cost
5. Aviation Brigades (AVN): large, self-sufficient, conventional combined arms formations of helicopters and support vehicles, optimized for MCO and proficient and adaptable for use in SO and PME; whose forward presence demonstrates national political resolve and pre-emptive force, with a high OPTEMPO cost and high deployment costs
6. Maneuver Enhancement Brigades (MEB): medium size formations, reflecting multi-capable, highly adaptable general purpose forces that can be tailored for a variety of missions across MCO, SO and PME with medium OPTEMPO costs and medium deployment costs.

Army units have different capabilities in the different mission profiles. The design team used a Delphi technique to establish the relative effectiveness of the 6 “type brigades in each of the 3 mission profiles. This is necessarily a qualitative judgment, informed by professional expertise. The group normalized the relative effectiveness that emerged from the consensus of over 50 field grade officers and faculty, in order to create meaningful choices in the game. The group used a simple form to capture individual opinions and discovered that this form can be used as a great “concrete experience” to generate interest and “buy in” from students, because it gets them into discussing their

own experiences, judgment, and decision criteria. The scenario editor lets the adventurous faculty member to use their consensus estimates for the basis for the game decision-model.

Playing and winning the game connected directly to the students’ competitive instincts. The group used the following concepts to connect to playability considerations:

1. Regions/Areas of operations: the game establishes 5 regions/areas of operations to represent areas around the world in which military forces (and the other elements of national power as well) engage other “players. At times we thought of these as geographical combatant command areas of responsibility, and at other times as definable Joint Operational Areas of strategic interest to the nation
2. Victory points: represent the strategic value of the 5 regions/Areas of operations to the nation, determined by the political strategic process.
3. Variability and trends: the game described each region/AO in terms of the relative stability of the current “state of nature” to represent how volatile, or subject to change each region is considered to be by competent experts. This represents a range of geo-political uncertainty with which the CSA must contend as he develops his design and mixture of forces for future contingencies. We described a probability for each of the 3 mission profiles for each region, as a way to estimate the set of likely future missions. These fuzzy qualitative judgments approximate the strategic uncertainty, somewhere between random and deterministic, that the CSA is working with.

INSIGHTS AND TRADEOFFS ENCOUNTERED THROUGH GAMEPLAY

The Future Force game helps officers consider the following strategies and tradeoffs, at a minimum. Here are 8 kinds of questions/dilemmas/tradeoffs that the players will encounter, and which they will continue to encounter as field grade officers throughout their career.

1. Stationing: forward deployment at increased operational tempo (OPTEMPO) cost vs. continental United States (CONUS) stationing. Stationing in CONUS represents a requirement for more strategic movement capability, but less OPTEMPO costs. Forward deployment requires the Army to be strong in many places; CONUS stationing allows the Army to be strategically strong but increases the transportation costs. Consider the costs of the assumption about how many regions can be covered simultaneously
2. Research & Development: what percentage of the operating budget? Should the Army remain focused on 1 program consistently or regularly rotated to improve all forces? Do R&D dollars always pay off? What’s the risk of going down the wrong path?

3. Mixture of forces: here are a variety of force mix strategies that are feasible
 - a. A balanced force mix of equal parts of each type brigade
 - b. Mostly general purpose forces that are reasonable good at a lot of things in PME (the “normal” state of the regions), and a few specialized forces (HBCT and SOF) to be ready for MCO and SO
 - c. A split between HBCTs and SOF to be ready for seizing the opportunity to win the 2 kinds of shooting war, and a few general purpose forces
 - d. Very effective but expensive general purpose forces (AVN) vs. moderately effective inexpensive, general purpose forces (EGR)
4. Specialization of forces: What does it cost the Army to specialize? For how much value? What’s the conversion cost if the Army gets it wrong? How much specialization is enough? Specializing for what?
5. Forecasting future mission sets: How adaptive to strategic surprise is the Army? Should the Army maintain a budgetary reserve? How much money should be spent to improve the accuracy of the estimate of the future requirements? CAN the estimate accuracy be improved?
6. Information vs. force structure: If the Army spends more on information (strategic and/or tactical) can it reduce the cost of equipping and maintaining force structure? How reliable is the information? How well protected are the Army’s own plans? How much should it spend to mask friendly force intentions compared to buying armored forces?
7. Tactical vs. strategic information: Is it more important to see what the opponent has in the region where the Army is engaging him, in order to optimize the deployed force or to stay in touch with his longer term acquisition and force structure strategy (looking at his capabilities in the future across all regions)
8. Reset vs. re-engineer: is it better to reconstitute damaged forces or convert them to different types of units, since the Army must pay a refit cost anyway? Should the Army stand down unneeded units and build new or should the Army retrain existing units for new missions?

INTEGRATION INTO THE BROADER CURRICULUM

The department implemented the use of the newly named Future Force game in a series of faculty development sessions that featured full documentation of the game and a robust teaching note, demonstrating not only how the game was played, but how it could support a variety of teaching styles and scenarios in the classroom. Student reports of their own learning insights in small focus groups became an important part of this teaching note, as they pro-

vided actual evidence of learning in a positive acceptable and believable manner.

Pilot programs using the game in one classroom while more traditional methods were taught by the same faculty were used to compare and contrast educational outcomes. Post-instructional exposure to the game by students who had received the traditional instruction confirmed the faculty opinion that the game offered much more variety enjoyment and practicality in achieving lesson intended outcomes.

The game was introduced into a force management elective course, where students interested in Army change management can go deeper into their studies of this technical domain. They found the game very helpful in providing “scaffolding” for placing their deeper research inquiries into a broader theoretical context.

The students and faculty in the elective found that conducting another round of “game design” allowed them to quickly and graphically describe additional insights into Army change management and force management in a language and with concepts that they already had in common. This is consistent with the systems dynamics models in general: they not only allow participants to try out ideas, they also become the basis of a shared mental model that facilitates communication and mutual understanding. This has broader applicability beyond the military gaming community. Experiential games that allow for iterative development between domain experts and game designers can quickly generate new models for understanding and education.

Some faculty reported observing their students playing the game before class, during lunch, and after classes were released for the day. Many students and faculty are avid gamers and their interest in playing a competitive level of the game against each other produced some memorable encounters and provided additional deep-level insights into the power of small worlds games to achieve a positive and energetic classroom environment.

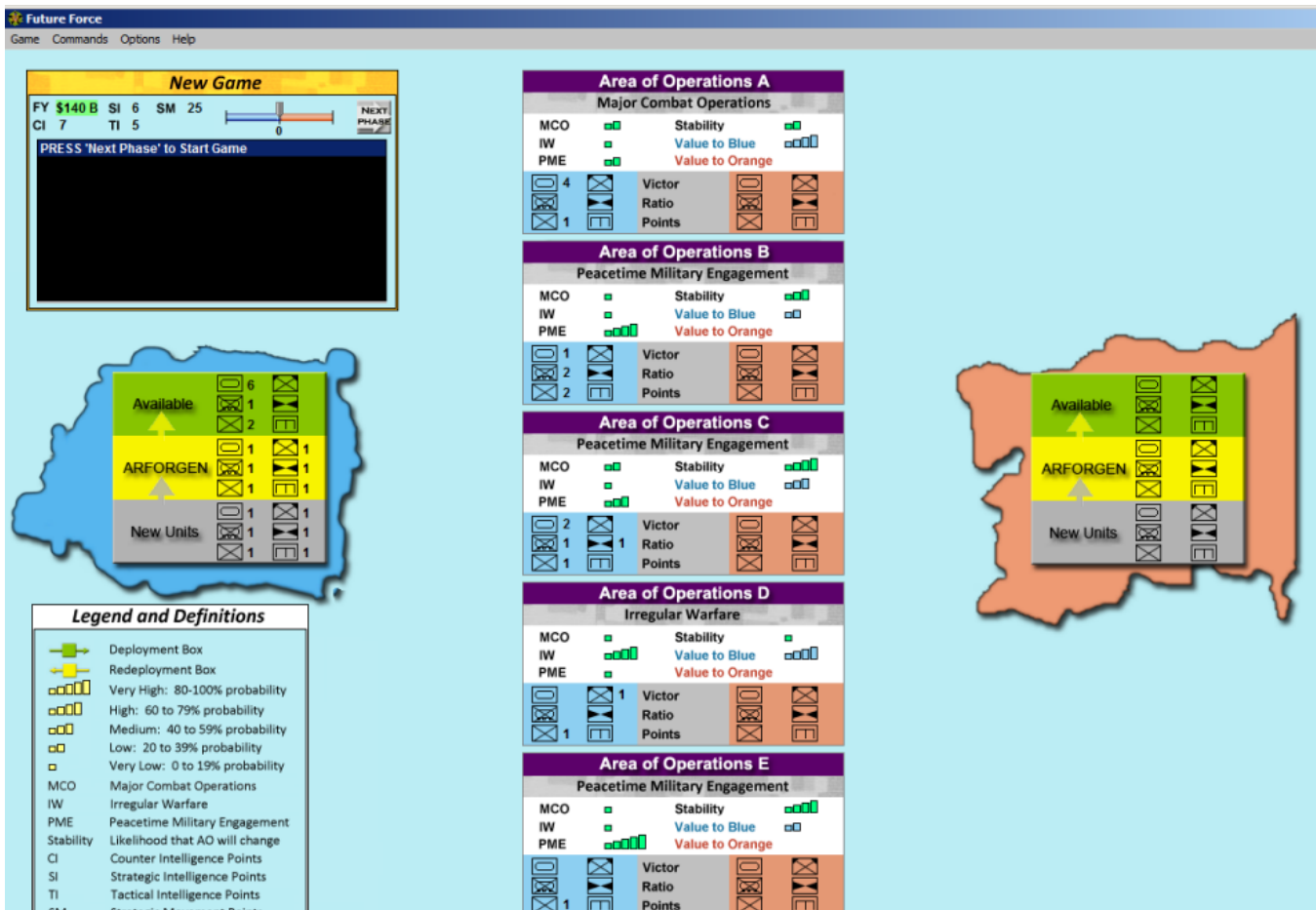
Here is a screenshot of the simple yet subtle screen where Future Force: The Chief of Staff of the Army Game” is played

. . . . Insert Future Force Screen Shot about here

A 15 minute movie/voice over that describes the play of 1 turn in the game, and which is used as a part of the class preparation phase and homework can be found at the following link: <http://www.youtube.com/watch?v=W5fw8Ry3kvM>

RESULTS

The faculty has been overwhelming in favor of using the game in the mainstream curriculum and after 2 cycles of use, their judgment has been supported by the measured feedback from the college’s quality assurance office, re-



sponsible for rigorous quantitative and qualitative measurements of student learning outcomes. The year over year measured student satisfaction levels shown a significant increase in overall satisfaction with the difficult force management materials when taught using the Future Force game. Students have chosen to highlight the game experience in their open-ended narrative comments.

Faculty after action reviews have been very positive in describing the use of the game in their classrooms. The game has embedded many technical considerations into the system, which many new faculty often find to be challenging when preparing for their first delivery of the lessons. The game serves as a useful education tool for the faculty as well as students.

The department has shared the game with other partner schools in the Army Education System and with high level operational field commands who are concerned with raising the proficiency of their staffs in appreciating the complexity of Army force management.

The success of this strategic force management educational game spawned the rapid development of 2 additional small worlds games, which have both been completed using the same developmental model and strategy described in this paper. Both games are on schedule to be added to the curriculum using the same basic approach to implementation described in this paper

The second game is an operational level deployment model that simulates the flow of forces and supplies into a theater of war from a CONUS base against a determined and capable enemy whose aim is to disrupt the flow and create catastrophes at the initial ports of debarkation. The third game models the tactical distribution of bulk fuel throughout an area of operations against an elusive, determined and capable enemy, in order to support offensive operations over a wide area. The look and feel of all 3 games are similar, by design, and collectively represent a suite of educational experiences that are well positioned to meet the college's needs for experiential games into the future.

CONCLUSIONS

The Army Command & General Staff College's (CGSC) mission to educate newly promoted field grade officers on the variety of complex management and leadership challenges their students will face in the future is significantly enhanced by the appropriate use of experiential learning in the form of small worlds management games.

Using a design and implementation strategy that featured a diverse development team of subject matter experts, faculty, students and programmers, the logistics department

at CGSC was able to define, develop, test, field and apply a strategic level Army Force Management game. The Future Force game significantly enhanced the student and faculty ability to visualize, understand and manage the complexity inherent in the requirement to field an Army now and in the future that is ready to adapt to and win in a dynamic operational environment against adversaries across the spectrum of conflict.

Fully documenting the design and development process became an important part of the educational process contained within the lesson package for the game, since the project itself was directly concerned with managing and learning about uncertainty.

Successful completion of this project points the way ahead for more ways to apply the techniques of experiential learning to other areas of the curriculum, and allows the CGSC to continue to develop partnerships with other schools and organizations working in this area of educating leaders for uncertainty.

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