Enhancing Army Training Support Management Using a Visual-Analytic Model

David A. Dryer
Virginia Modeling, Analysis and Simulation Center
Norfolk VA 23529
ddryer@odu.edu

Randall Chalkley
U.S. Army Training Support Center
Ft. Eustis, VA 23604
randall.chalkley@us.army.mil

ABSTRACT

This paper describes a training analysis solution for the Army's Training Support System (TSS) that enables managers and analysts to conduct decision support activities through a combination of visualization and analysis techniques. The Army TSS is an emerging system of systems that, when fully mature, will provide the networked, integrated, interoperable training support and mission rehearsal capabilities necessary to enable an operationally relevant training environment for warfighters. In short, it is an integrated training support enterprise that is flexible and tailorable to meet dynamic training strategies. It is comprised of product lines, architectures and standards, and management, evaluation, and resource processes that enhance training effectiveness. The complexity of training support overwhelms traditional management and decision support tools such as spreadsheets and databases. Program managers and analysts need to look across TSS product lines to integrate enablers such as live, virtual, constructive (LVC) simulation architectures, ranges, and training ammunition to better synchronize training support. What is needed is a new capability that provides senior leaders and action officers a tool that enables them to iteratively observe, orient, decide and act based on a total vision of the TSS. The proposed solution is a visual-analytic model of the TSS that displays interdependencies among training enablers in ways not now possible. The paper will include a description of a prototype model that will focus on visualization and resource impact analysis of Urban Operations (UO) training. The model will provide a means to assess not just the immediate impact of the training solution, but also second and third order effects, as well as to identify redundancies, gaps, seams, and reuse opportunities. By applying visualization and analysis modeling techniques to map TSS enabling capabilities, leadership will have a more complete picture of the implications of current decisions on future training support.

ABOUT THE AUTHORS

Dr. David A. Dryer is a Senior Research Scientist at VMASC. He received his B.S. from the United States Military Academy in 1980, M.S. in Operations Research from the Naval Postgraduate School in 1989, and Ph.D. in Industrial Engineering from the University of Central Florida in 1996. Dr. Dryer has over 16 years of combined industry and U.S. Army experience in systems engineering, modeling, simulation, and human-computer interaction specializing in simulation analysis, combat modeling, virtual environments and information visualization design. Recent projects include; Joint National Training Capability (JNTC) advanced training technology certification development, front-end enterprise architecture analysis for the Army Training Support System (TSS), and life cycle lead for the Joint Rapid Distributed Database Development System (JRD3S).

Mr. Randall Chalkley currently works for the Concepts and Plans Office of the US Army Training Support Center, Fort Eustis, VA. His primary area of research and planning is in the area of training support concepts related to Joint and Training Transformation initiatives. His background is in training evaluation and policy, and he has over 30 years of government service. He obtained his BA from the College of William and Mary, and his MBA from the Florida Institute of Technology.

Enhancing Army Training Support Management Using a Visual-Analytic Model

David A. Dryer
Virginia Modeling, Analysis and Simulation Center
Norfolk VA 23529
ddryer@odu.edu

Randall Chalkley
U.S. Army Training Support Center
Ft. Eustis, VA
randall.chalkley@us.army.mil

OVERVIEW

Ultimately, our ability to rapidly adapt our doctrine, organizations, training, materiel, leadership and education, personnel and facilities (DOTMLPF) will be the measure of our institutionally agility—and clear proof of a culture of innovation (Fastabend & Simpson, 2004).

Change in the Army is taking place at an unprecedented rate. From innovative tactics and strategies of Operation Enduring Freedom in Afghanistan, to the spiraling of new capabilities into the current force based on new technologies, to the need for agile and adaptive forces to cope with the Iraqi insurgency, the Army is adapting in a myriad of ways. Every aspect of Army processes as reflected in the DOTMLPF model must integrate new capabilities and processes. Preparing soldiers and units to perform in this changing environment is a major challenge for the Army training community. Every new weapon system, communication device, organizational realignment or tactic/technique/procedure sends a huge ripple of change requirements for individual, small unit, and headquarters and staff training. Although current methods for forecasting, planning, and implementing change have successfully produced an Army which has been victorious on past battlefields, it is clear that this success cannot continue without modernizing our capability to prepare units and soldiers. The crucial question is, *can these Cold War, Industrial Age processes continue to produce a trained and ready Army in this era of increasingly rapid change and turmoil?*

STATEMENT OF THE PROBLEM

The current processes that the training community uses to produce solutions to changing operational threats and challenges cannot cope with the rapidly changing environment and threat posed in the current operating environment. The training community must be able to develop the training enablers to prepare soldiers and leaders who arrive at the unit ready to face and conquer these challenges. The training community must forecast new training capabilities and design effective solution sets that adapt to new adversary capabilities. Training must also recognize how changes in Army organizations and operations, new materiel capabilities, improvements in leader development, revised personnel requirements and skill sets, or changes in land and facilities affect the training enterprise. It must be able to analyze DOTMLPF impacts on training strategies, plans, and resources as well as understanding the current situational awareness and visualizing future actions needed to training solutions in a rapid, agile and responsive way.

This paper describes one approach to improving Army training by applying modeling and simulation (M&S) concepts to enhance training support analysis, just as M&S has shown benefits in building new weapons systems and emerging capabilities. In addition, the paper describes how fusing analytical tools with visualization capability as part of the M&S capability results in a powerful capacity to be able to describe and visualize the current state of training enablers, as well as providing a decision support tool that can help improve future Army training. Without a new method of analyzing and implementing change in training, the Army risks lowered readiness of its combat capability through not having soldiers and units prepared to operate and sustain new systems and equipment.

To demonstrate how the application of the analytical-visualization capability can improve training, the paper uses the example of Urban Operations (UO) training. The use of this concrete example helps illustrate how an analytical-visualization model can be used to plan, integrate, and implement changes in Army training.

INTEGRATING ARMY TRAINING THROUGH THE TRAINING SUPPORT SYSTEM

In order to model any complex activity, the components and interactions within the activity must be defined. A model can be defined as an abstract logical and mathematical representation of a system that describes the relationship among objects in a system (Fishman, 2001). A system model relevant to training support analysis is the Training Support System (TSS), which the U.S. Army uses as the description of the training enablers that are needed for training to occur.

Training support enables the implementation of training and education strategies. The TSS is the mechanism by which training support enablers are organized. It provides the means for the development, delivery, management, and resource decision making necessary for integrated Armywide training support capabilities. (Department of the Army, 2005)

A visual illustration of how the TSS is organized is provided in Figure 1. This structure allows the development, fielding, and evaluation of TSS enablers as a related enterprise, versus the traditional process of building stand-alone training solutions. The three top level components of the TSS focus on integration (Architectures and Standards), business processes (Management, Evaluation, and Resources), and training products and services that are organized by characteristics (Product Lines). Using the organization of Product Lines, training enablers can be grouped within a "family" product line that shares common features and functionality. This description is crucial to the ability to identify relationships within and across product lines which is at the heart of the ability to model the training enterprise.

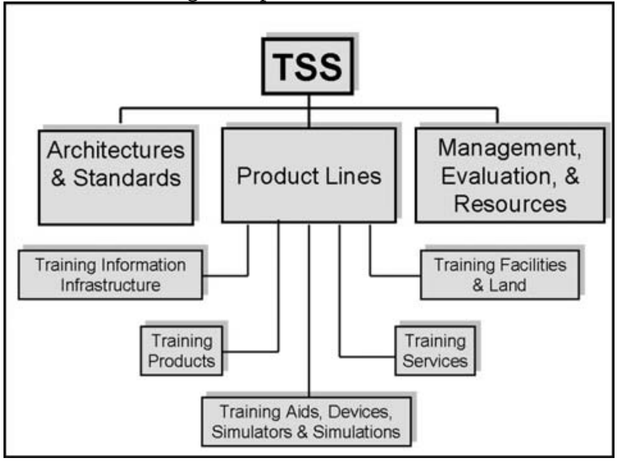

Figure 1. Composition of the Training Support System

Decomposition of the Product Lines

Each of these products lines is in turn composed of categories of products based on shared characteristics. As shown in Figure 2, this process of decomposing the categories at each level into its component pieces is continued until the elemental level of individual training products and services is reached. With the *Training Facilities and Land* product line as the illustration, the decomposition of categories into its constituent parts is continued through the various sub-component levels until specific products and services in each subcategory are identified. The value of this analysis includes the "situational awareness" of the current training enterprise, and an ability to forecast how new capabilities and product would be integrated into the current structure. This capability would be critical for the Army to manage support, thereby improving readiness and performance of the current and future force.

Developing a TSS Model

When applied across all product lines, this process results in a relational inventory of all training enablers. This information can then be used to build a detailed model of the training support system. Modeling the interrelationships of all training enablers provides a powerful tool for analyzing the impact of any new training mission or capability on the enterprise as a whole. The model provides a means of visualizing the current state of training enablers as well as being able to perform "what if" predictions of how changes in training enablers or new training capabilities will affect the overall enterprise. The state-of-the-art capability to do this at present is dependent on the tacit expertise of the individual or organization, but no expert has the knowledge of all of the complex interactions across the training enterprise. At best, an experienced trainer can identify the most important direct relationships and interdependencies among a limited number of training systems.

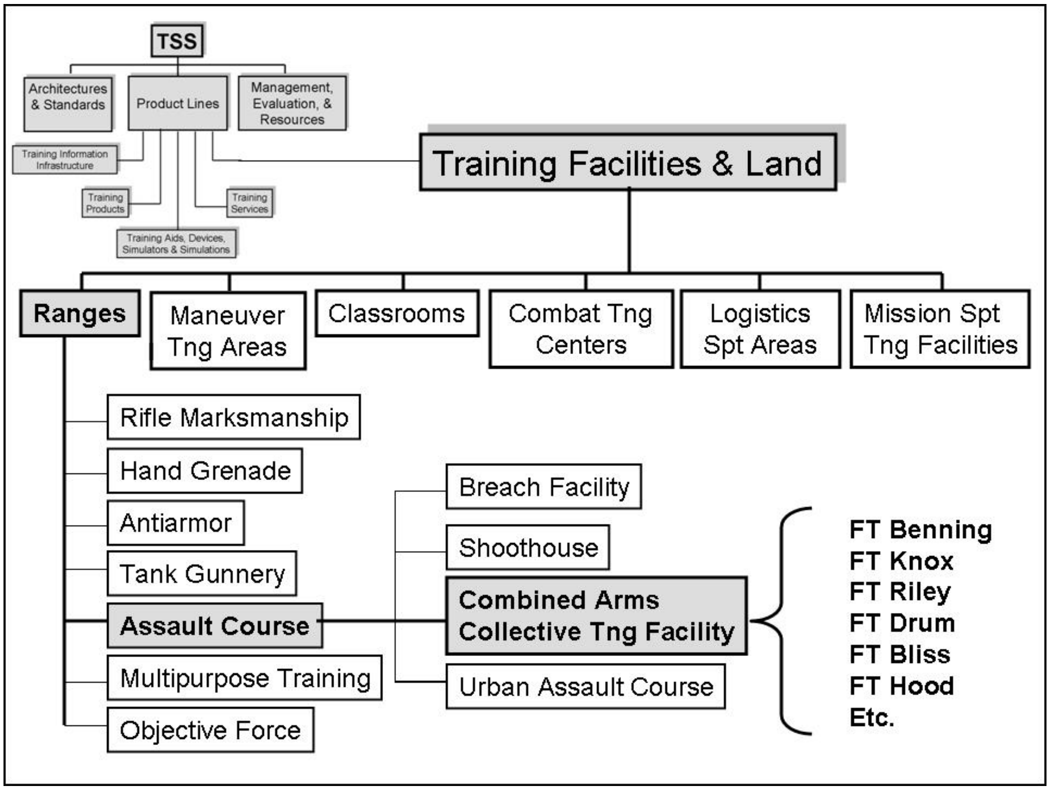

Figure 2. Decomposition of a TSS Product Line

The model will enable complex interrelationships among training enablers to be made explicit and allow even non-experts to observe and predict second and third order effects of potential decisions. By adding stochastic inputs, the model can provide iterative simulation of different effects on the training support system.

The complexity of the model will expand as more capability is added. It starts with a categorized inventory of all training enablers that captures shared characteristics and commonalities and describes relationships among the training enablers. With the addition of a visualization capability, the multifarious network of training enablers can be organized in a way that can be understood and acted upon. Without this visualization capability, the data would be overwhelming and impossible to comprehend as an integrated system. Adding analytical and simulation tools results in a capability to provide a decision support tool for decision makers and trainers that can model current training support capability and also provide an ability to forecast implications of any category of change on the training support enterprise. The value of this ability would be profound for the Army in managing training support to improve readiness and performance of the current and future force.

MAPPING TSS AND DOTMLPF

Although the value of the visual-analytic model for TSS is obvious, the application of this information in a DOTMLPF analysis provides a new dimension of utility. According to the U.S. Army's Training and Doctrine Command (TRADOC, 2004), "DOTMLPF analysis is a qualitative analysis that identifies and analyzes potential DOTMLPF solutions…and produces a recommended integrated DOTMLPF solution set." The DOTMLPF construct provides a holistic approach to analyzing impacts of new materiel and non-materiel solutions on the appropriate domain, of which training is only one. However, since training is the primary means of preparing soldiers and units to perform, any change in one or more of the other categories will impact the training domain. Therefore, a mapping of DOTMLPF to the TSS provides valuable information on training impacts as a result of DOTMLPF changes. For example, content experts are asked in the DOTMLPF analysis "Does a new materiel capability being analyzed drive a change in any of the other domains? What is the significance of that change? Any significant DOTMLPF changes should be considered in the affordability, supportability and technical risk assessments" (TRADOC, 2004). The depth of this analysis depends on the expertise of each of the individuals analyzing the impact for their domain. Further, the analysis only requires a "yes/no" level of impact:

- Yes, major changes are needed in the DOTMLPF domain in order to implement this solution.
- No, current DOTMLPF are adequate and supports the capability. (TRADOC, 2004)

The visual-analytic model provides a means of identifying DOTMLPF implications in the training domain in a more detailed and exhaustive way, even to the level of second and third order effects of these impacts. It also provides an explicit knowledge system that is objective and comprehensive and does not depend on the experience of the individual analyst.

Training solutions based on new policy, capabilities, or technologies also should also be vetted through the DOTMLPF analysis. The TSS approach provides a set of product lines that are very similar to many of the DOTMLPF domains as shown in Figure 3. This congruence assists in mapping training enabler product lines against the DOTMLPF to obtain new insight into changes that the Army must consider in other domains when implementing training initiatives.

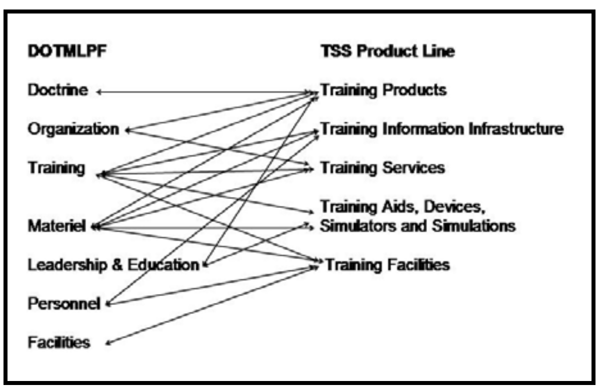

Figure 3. Mapping Across DOTMLPF and the TSS Product Lines

USE-CASE: URBAN OPERATIONS (UO) TRAINING

To demonstrate the concept of the visual-analytic model on a practical, real-world example, we have chosen the very relevant example of how changes in UO strategy and direction, based on experiences in Iraq, can be illustrated using the current capability of the model. The visual-analytic model described in this paper is a research effort undertaken for the Army Training Support Center by the Virginia Modeling and Simulation Center. This is anticipated to be a multi-year effort based on current resources. The model will expand its capability over time with the expectation that it will eventually reach the full capability described in this paper. However, the current prototype does not provide the forecasting and stochastic capability described in the paper as a full operational capability.

Introduction to UO

Forces facing a much stronger opponent may choose to fight in a city; that was true in the past and it is equally true today. Because we are the dominant force in the world, lesser opponents typically seek combat in urban terrain to offset our advantage. For that reason, that the U.S. military elevated the study of urban operations as a training priority. (Center for Army Lessons Learned, 2003)

Historically, the U.S. Army has focused on training for combat operations in large, open landscape that allows the employment of armor, air power, and maneuver in which the Army excels. The success of this approach was demonstrated in the first Gulf War when Iraqi units were outmaneuvered and outgunned, resulting in a clear, quick victory. However, recent experiences in Iraq have identified an enemy with a much different strategy for opposing U.S. ground power. This adversary uses many different modalities for attacking U.S. forces, from pitched battles in the streets of Fallujah to the employment of remotely detonated improvised explosive devices. The tactics of this agile adversary highlights the need for changes in the way that soldiers and units prepare and operate in this changing threat environment. One facet of this change is an approach that focuses on the ability to close with and defeat an enemy entrenched in an urban landscape. The enemy realizes that the complexity and limited access of a city minimizes the superiority of maneuver and firepower and turns every street into a potential battlefield. The Army accepted the challenge of this strategy and is now emphasizing UO training as a cornerstone of its training strategy.

Now, the Army must identify and address the implications in many areas such as resource allocation, availability of training land and facilities, training location, throughput capacity, and many other issues that are crucial to successful preparation of soldiers and units. Complicating the design and implementation of UO training are additional policies, processes, and training demands such as:

- Every soldier must be prepared, even on their first assignment, to be able to perform basic UO tasks.
- Installations must have the facilities and capability to train UO at the appropriate level, from individual soldier tasks up to Brigade-level tasks.
- For Brigade-level tasks, the training environment must provide realistic emulation of combat operations such as Joint "wraparounds" to practice calling for close air support and synchronizing ground operations with Marine and Special Forces units.
- The availability and throughput of UO training to certify units before deployment reinforces the need to define "how much" and "where" for new UO capability based on modularity and stationing decisions.
- Finally, the Army is expanding by 30,000 new soldiers which will also add to this training requirement.

How will the Army meet this sudden surge in urban operations training? How can the training implications and requirements be defined, integrated, and implemented in a timely fashion? How can the capabilities, locations, and resources be identified and managed to accomplish the expanded capacity? What implications will these changes have for other areas of Army training?

These questions are crucial to designing and managing a solution set to the problem of training UO, but as important as this issue is, it is only one of many similar programs and capabilities that the Army must identify, diagnose, and improve. This illustration of improving UO will be a "use case" in this paper to demonstrate a proposed solution. From this specific example, we intend to illustrate how the visual-analytic model can be used to help improve the delivery of all aspects of Army training.

MODELING AN "AS IS" UO TRAINING MIX

The challenge of defining "how much" and "where" for new UO training capabilities can be assisted by the task-based modeling of training capability configurations. In-depth UO training support analysis is done using Mission Essential Task List (METL) guidance from existing or proposed training support packages (TSPs) and subject matter experts (SMEs). This assessment involves determination of which tasks should be trained at each echelon, task sequencing and timing, and task mappings to existing or proposed DOTMLPF training capabilities. Current UO training guidance is found in TC 90-1, Training for Urban Operations. TC 90-1 is a TSP containing UO METL task lists by echelon and battlefield operating system (BOS) mapped to UO training facilities. Such METL information needs to span the full spectrum of urban operations including combat, stability, and support operations.

An example of such guidance is shown in Figure 4, which lists brigade echelon combat tasks under the "Protect the Force" and "Deploy/Conduct Maneuver" BOSs and maps them to training capabilities with recommended training frequencies (Department of the Army, 2002). The range of UO training enablers in this matrix include the Shoot House, Breach Facility, Urban Assault Course (UAC), Combined Arms Collective Training Facility (CA/CTF), Combat Training Center (CTC), and Constructive Simulation. The assignment of one or more training capabilities necessary to fully train each METL task provides a task – capability incident matrix, useful as a foundation to model UO training capability mixes.

BRIGADE TASKS	SHOOT HOUSE Semi-Annual	BREACH HOUSE Semi-Annual	UAC Quarterly	CA/CTF Semi-Annual	CTC *As Scheduled	SIMULATION Annual
Protect the Force						
Perform Mobility/Survivability Operations					X	X
Provide Engineer Support					X	X
Coordinate NBC Operations					X	X
Conduct Operations Security					X	X
Deploy/Conduct Maneuver						
Attack of a Built-Up Area				X	X	X
Plan for Urban Operation				X	X	X
Defend an Urban Area				X	X	X
Conduct an Infiltration /Exfiltration				X	X	X
Perform Cordon and Search Operations in an Urban Area				X	X	X
Plan for Urban Operations				X	X	X
Conduct Tactical Movement				X	X	X
Conduct Presence Operation in a Stability Environment				X	X	X

Figure 4. Army UO Training Table Excerpt from TC 90-1

Implications of the Training Cycle

The concept of a modular brigade unit of action (UA) three year reset cycle is shown in Figure 5. A two month reset of personnel is followed by an intense four month training period, culminating in a training readiness certification. This readiness is then sustained within a band of excellence during the following 30 months by a combination of multi-echelon training and personnel stability. The "P" or personnel rating of the UA is high (1) during the entire cycle, due to the personnel rotating into the unit during the two month reset. The "T" or training rating of the UA is low (4) during reset, improving to T1 by certification. By factoring in the recommended frequency of UO training capabilities from TC 90-1, a matrix can be developed (see Table 1), which gives an indication of the fraction of task repetitions (reps) using an assigned capability over a UA three year cycle. An assumption is made that CTC training frequency is 18 months. For example, the "Attack of a Built-Up Area" task fractional breakdown is Shoot House: 0, Breach House: 0, UAC: 0, CA/CTF: (6 reps ÷ 11 Total reps), CTC: (2 reps ÷ 11 Total reps), and Simulation: (3 reps ÷ 11 Total reps). It is anticipated to use probability distributions for these fractional values in future modeling to capture normal variation in UO task – training capability execution as commanders tailor specific training plans for their units.

Repetition fractions are then summed across all UO training tasks and normalized against the total number of tasks, resulting in a fractional mix of training capabilities for cumulative METL tasks up to each echelon level, as shown in Table 2. These calculations provide a method of identifying an optimal mix of UO training capabilities needed for an identified echelon unit, from individual to the identified echelon. This mix calculation is driven by TSP-based task-capability assignments and guidance on the use frequency of these capabilities.

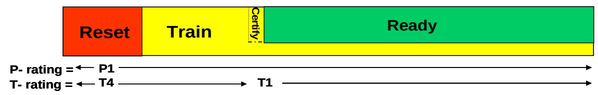

Figure 5. Modular Brigade Unit of Action (UA) Three Year Cycle

Table 1. Fraction of UO Task Repetitions to Assigned Capabilities

BRIGADE TASKS	SHOOT HOUSE Semi-Annual	BREACH HOUSE Semi-Annual	UAC Quarterly	CA/CTF Semi-Annual	CTC Assume 18 Months	SIMULATION Annual	TOTAL
Protect the Force							
Perform Mobility/Survivability Operations					0.4	0.6	1
Provide Engineer Support					0.4	0.6	1
Coordinate NBC Operations					0.4	0.6	1
Conduct Operations Security					0.4	0.6	1
Deploy/Conduct Maneuver							
Attack of a Built-Up Area				0.55	0.18	0.27	1
Plan for Urban Operation				0.55	0.18	0.27	1
Defend an Urban Area				0.55	0.18	0.27	1
Conduct an Infiltration /Exfiltration				0.55	0.18	0.27	1
Perform Cordon and Search Operations in an Urban Area				0.55	0.18	0.27	1
Plan for Urban Operations				0.55	0.18	0.27	1
Conduct Tactical Movement				0.55	0.18	0.27	1
Conduct Presence Operation in a Stability Environment				0.55	0.18	0.27	1

Table 2. UO Fractional Mix of Training Capabilities

	SHOOT HOUSE (L) Semi-Annual	BREACH HOUSE (L) Semi-Annual	UAC (L) Quarterly	CA/CTF (L) Semi-Annual	CTC (L) *As Scheduled - assume 18 months	SIMULATION (C) Annual	TOTAL
UP TO BRIGADE TASKS	0.038	0.012	0.063	0.517	0.214	0.155	1.000
UP TO BATTALION TASKS	0.058	0.018	0.094	0.688	0.116	0.026	1.000
UP TO COMPANY TASKS	0.076	0.024	0.124	0.697	0.079	0.000	1.000
UP TO PLATOON/SQUAD TASKS	0.150	0.047	0.246	0.501	0.057	0.000	1.000
INDIVIDUAL TASKS/TECHNIQUES	0.210	0.210	0.395	0.185	0.000	0.000	1.000

Visualization Aspects

Once the analytics of the model have been calculated, the visualization aspect of the visual-analytic model is necessary to achieve enhanced training support analysis. An intuitive way of visualizing training capability mixes is by using a radar plot, as shown in Figures 6 to 8. The "spokes" of the plot represent the different training capability solutions, with the magnitude of the fraction of tasks supported by that solution being plotted from 0 to 1. Connecting the points results in an integrated shape representing a training support solution package mix for a designated unit echelon. With a quick glance, analysts and decision makers can understand various training support mix configurations and differences between echelon levels. The individual mix in Figure 6 shows the dominance of UAC and Shoot House capabilities. As the echelon level increases toward company level, the CA/CTF increases in importance. The brigade level mix of Figure 10 reflects the increased use of CTCs and constructive simulation for brigade-level UO training.

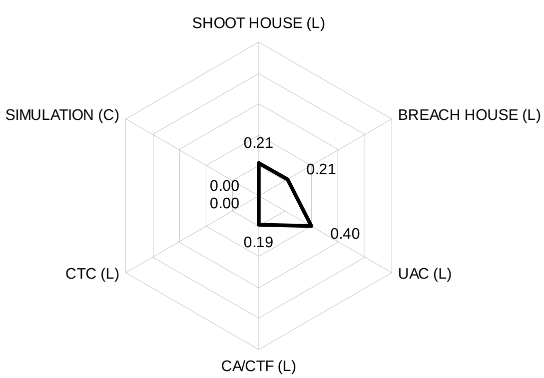

Figure 6. UO "As Is" Individual Task/Technique Training Mix

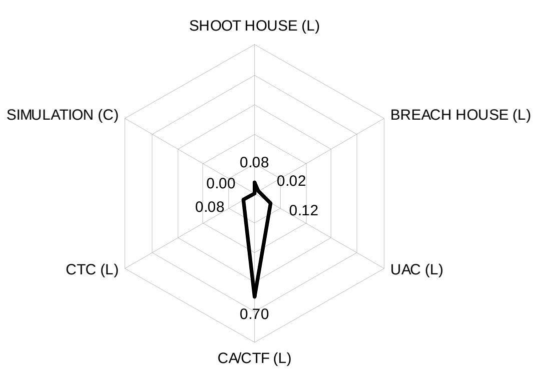

Figure 7. UO "As Is" Up To Company Training Mix

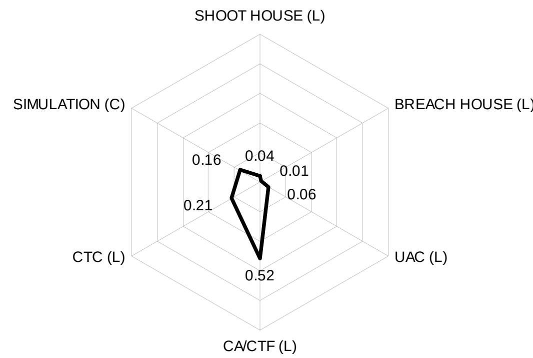

Figure 8. UO "As Is" Up To Brigade Training Mix

Mapping to DOTMLPF Domains

After a task to capability training mix is modeled, the UO capability can be mapped to the various DOTMLPF domains. Some of these mappings are at the individual solution level and others will map at the aggregate training capability level, depending on the nature of the DOTMLPF domain and the aggregation level of the domain's resourcing. Figure 9 shows some selected UO mappings, which have been developed as part of a prototype demonstration use case. The materiel and facility domains have linkages to individual solution enablers, such as a Military Construction Army (MCA)- funded Shoot House facility and associated Other Procurement Army (OPA) - funded Shoot House instrumentation materiel. Other aspects of DOTMLPF map to the overall UO training capability, such as the UO TSP development mapping to doctrine, as well as overall UO range support mappings to organization and personnel. This DOTMLPF construct is also being used to identify and model interrelationships between training capability enablers, such as the dependence between a CA/CTF building (facility) and its targetry instrumentation (materiel).

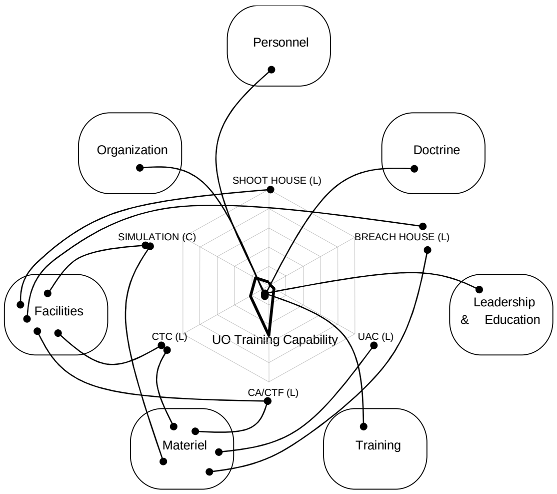

Figure 9. UO Brigade Training Capability Mappings to DOTMLPF

TOWARDS THE MODELING OF "TO BE" TRAINING MIXES

The training support visual-analytic model is envisioned for use in the planning evolution of "to be" training support solution packages. In the case of UO, there are identified deficiencies in the available solutions and task allocation of these solutions. TC 90-1 uses the graphic in Figure 10 to identify some of the deficiencies in the available solution set, which can help drive "to be" development priorities. Figure 10 portrays status indicators for live, virtual, and constructive UO training capabilities. Virtual simulators are shown with a red status and are not currently assigned to any tasks in TC 90-1's METL lists. Problems with current virtual simulators and, to a lesser extent constructive simulations, include the lack of adequate replication of urban scenarios, terrain, and weapons effects. For echelons above battalion, it becomes difficult to use virtual simulators or *live* capabilities to train. As shown in TC 90-1's lists, at brigade level, many training tasks currently are conducted with a constructive simulation or infrequently at a CTC rotation.

Figure 10. Live, Virtual, Constructive UO Training Support

There are ongoing planning and execution activities to improve UO training capabilities, which can benefit from the training support visual-analytic model. As "to be" task to capability assignment lists are developed in future urban operation TSPs, the model can serve to analyze various mix courses of action as well as their subsequent decomposition and resourcing using DOTMLPF. Figure 11 portrays a hypothetical "to be" UO brigade capability mix which emphasizes the emerging concept of a Mega MOUT live facility serving as a multi-echelon, distributed, linked training capability focusing on live brigade and below UO tasks. Also, the gap in virtual simulator capability is addressed by increased emphasis on virtual simulators, including assigning UO task repetitions to an infantry Soldier Combined Arms Tactical Trainer (CATT) and an urban engagement skill trainer (EST).

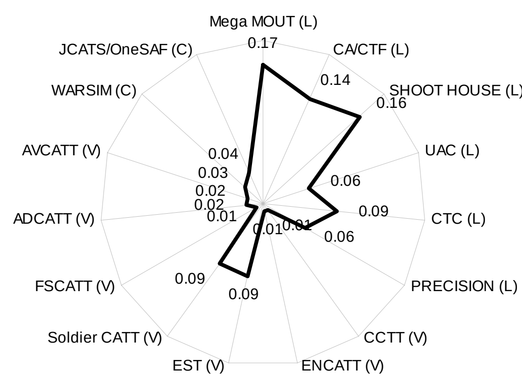

Figure 11. Hypothetical UO "To Be" Up To Brigade Training Mix

CONCLUSION

Training enterprises can benefit from the application of M&S concepts to enhance training support analysis. This paper has described a visual-analytic modeling approach to such analysis using an example use case of UO training. UO training challenges include the future planning and execution of training support capabilities to provide the availability and throughput of realistic UO training at multiple echelons, especially brigade level. The approach includes the modeling and visualization of task-to-training capability mixes and the use of a DOTMLPF construct for training support capability and interdependency analysis. The TSS enterprise can benefit from this integrated model, which links the business practice of training support management to the efficient delivery of TSS product lines.

REFERENCES

Center for Army Lessons Learned, (2003). Small Unit Leader's Guide to Urban Operations: Tactics, Techniques, and Procedures, *CALL Newsletter, No. 03-4*, Ft. Leavenworth, KS: Author.

Department of the Army. (2005). *Department of the Army Pamphlet 350–XX (Draft), 23 February 2005*, Washington, D.C.: Author.

Department of the Army. (2002) *Training Circular 90-1 Training for Urban Operations, 1 April 2002*, Washington, D.C.: Author.

Fastabend, D. A. and Simpson, R. H. (2004). The Imperative for a Culture of Innovation in the U.S. Army: Adapt or Die, Army Magazine. Retrieved June 16, 2005, from http://www.ausa.org/www/armymag.nsf/(all)/EB5252A9404F977685256E220059F541?OpenDocument

Fishman, G. S. (2001). *Discrete-Event Simulation*, New York: Springer.

Training and Doctrine Command (TRADOC). (2004). *Action Officer's Guide to the Functional Solutions Analysis*, Ft. Monroe, VA: Author.