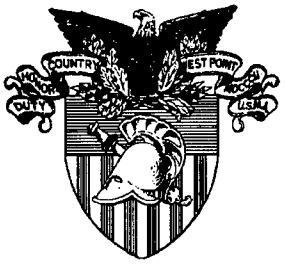

**United States Military Academy**

**West Point, New York 10996**

# PEO Soldier Simulation Roadmap: Continued Efforts in Implementation

**OPERATIONS RESEARCH CENTER OF EXCELLENCE**
**TECHNICAL REPORT #DSE-TR-0610**
**DTIC #: ADA448073**

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**Colonel Michael L. McGinnis, Ph.D.**
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**June 2006**

The Operations Research Center of Excellence is supported by the Assistant Secretary of the Army (Financial Management & Comptroller)

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# Abstract

The Army acquisition community requires high-resolution simulations that represent the dismounted infantry soldier in enough detail to conduct an analysis of alternatives (AOA) for individual weapons and equipment. These models must also be capable of assessing future, proposed capabilities and technologies. Previous work completed in May 2004 proposed the creation of a federation between three different simulation models to achieve this capability. Over the past two years, the Operations Research Center at the United States Military Academy has worked with PEO Soldier to implement this proposed solution. In this report, we discuss second year of the implementation process. We first will describe the process of refining the requirements developed in the first year of implementation into a more useable set of analytical focus-areas for the three combat model developers. We will then address the critical topic of linking the three models. Finally, we will detail the procedure we used to capture the analytical needs and linkage elements into a comprehensive, flexible, and long-term Memorandum of Agreement between PEO Soldier and the proponents for the three combat models. We will conclude with a discussion the current state of the implementation process as we close out the second year and the road ahead for continued implementation efforts.

# About the Author(s)

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# Acknowledgements

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We would like to acknowledge the contribution and support of several individuals. Specifically, key members of PEO Soldier, Mr. Ross Guckert and Mr. Steve Kishok of the Systems Integration division were critical to our continued understanding of PEO Soldier's evolving needs. Additionally, our continued implementation efforts have been directly influenced by the M&S Coordination and Working Group, without which we could not have achieved the implementation milestones we did this past year. This group consists of the following persons from the listed agencies.

| | |
|---|---|
| Mr. Steve Kishok | PEO Soldier |
| COL Greg Hoscheit | TRAC-WSMR (Combat XXI Proponent) |
| Mr. Walt Butler | |
| Mr. Dave Durda | |
| Mr. Imre Ballogh | |
| Dr. Bruce Gafner | |
| Mr. Bob Auer | Natick Soldier Center (IWARS Proponent) |
| Mr. Casey Boardman | |
| Mr. Medhat Korna | |
| Mr. Tom Ruth | AMSAA (IWARS Proponent) |
| Mr. Dean Muscietta | |
| Mr. Brad Bradley | |
| LTC John Surdu | PEO STRI (OneSAF Proponent) |
| Mr. Doug Parsons | |

Our mention of these contributors does not imply their approval of our results. The opinions contained herein are the opinions of the authors and do not necessarily reflect those of PEO Soldier, the United States Military Academy, the United States Army, or the Department of Defense.

# Table of Contents

# List of Figures



# List of Tables

# Chapter 1: Introduction

## *1.1 Background*

The Program Executive Office Soldier (PEO Soldier), the Army program manager for the acquisition of nearly all the items carried or worn by the Infantry soldier, specifically requires high-fidelity models of the Infantry soldier in order to evaluate the effectiveness of its products (Tollefson, et al., 2004). In November 2003, PEO Soldier commissioned the Operations Research Center (ORCEN) at the United States Military Academy to assist them with this growing need. In short, they required the identification of a simulation package that would allow them to quantify the platoon-level operational effectiveness of a new system or component.

Over the course of the ensuing six months, we applied the Systems Engineering and Management Process (SEMP) to develop and analyze alternative solutions and then provide PEO Soldier with a recommended course of action that would best meet their needs. Our Technical Report (Tollefson, et al., 2004) provides a detailed discussion of our methodology and results. In May, 2004, we presented the results of our analysis to PEO Soldier and recommended that they pursue a federation of three developing simulations as the most effective way to achieve the multi-facet aspects of their need. These simulations included: the Infantry Warrior Simulation (IWARS), Objective OneSAF (OOS), and the Combined Arms Too for the 21st Century (COMBAT XXI). PEO Soldier accepted our recommendation and we have since continued our work to implement our recommendation.

This report documents the ORCEN's continued efforts in the implementation process since we recommended our course of action. Although we will discuss the entire implementation effort to date, which we have broken down into Phase I (the first year, June '04-June '05) and Phase II (June '05 to June '06), we will focus primarily on the most recent work in the last year, which has been more of an exercise in management than analytical rigor. Specifically, we will describe our work in coordinating the efforts of PEO Soldier and the proponent agencies of the three simulations to achieve the federation we recommended. This coordination occurred on three parallel tracks: 1) the refinement and articulation of PEO Soldier's near-term analytical needs, 2) starting up the Model & Simulation (M&S) Working

Group to address ways to achieve those needs through model adjustments and hard/soft linkages between the three simulations, and 3) the development and implementation of a Memorandum of Agreement (MOA) between PEO Soldier and the simulation proponents. We will close with a description of the current state of the implementation effort as Phase II draws to an end and then briefly discuss the road ahead for further implementation efforts.

## *1.2 PEO Soldier*

PEO Soldier is the US Army's materiel developer for virtually every item of equipment carried or worn by the infantry soldier. Subordinate to PEO Soldier are three Project Manager Offices: Soldier Warrior, Soldier Equipment and Soldier Weapons. They are responsible for selecting from among candidate systems those new items of equipment which will enhance a soldier's combat effectiveness. To accomplish that assessment and selection of individual pieces of equipment, they rely on combat modeling and simulations. Specifically, it would be necessary to simulate a soldier who was equipped with a particular item, a new helmet for example. Following the required number of runs, the analyst would review the results and then run a similar simulation with a different helmet. With the improved modeling capability and level of detail desired, the statistically significant changes in performance that would most likely be accrued with the improved helmet would be reflected in the results. However, as mentioned above, advances in combat modeling technology have not matched the pace of advances in equipment technology, currently rendering comparisons of such equipment differences not possible (Martin, 2005).

## *1.3 The Simulation Federation*

The simulation federation consists of three simulations currently under development. Each of these models possesses a unique set of capabilities with respect to their primary modeling focus as it pertains to the infantry soldier, but there are considerable overlaps, as well. Table 1 on the following page provides a description of each model.

**Table 1. Table describing each of the three simulation models in the PEO Soldier federation. These descriptions have been adapted from (Martin, 2005).**

| Simulation Model | Description |
|---|---|
| Objective OneSAF | One-Semi-Automated Force (OneSAF) is a combat simulation developed by the Army's Program Executive Office for Simulation, Training, and Instrumentation. It has two components. The first is OneSAF Testbed Baseline (OTB), which is a "high-resolution entity level simulation that represents combined arms tactical operations up to the battalion level." It will be retired in FY 2006. Objective OneSAF (OOS) is the follow-on version of OTB and will have full operational capability in FY 2006. OOS will be able to represent operations up to the brigade level. It is intended for use in the Training, Equipment and Military Operations (TEMO), Advanced Concepts and Requirements (ACR), and Research, Development and Acquisition (RDA) domains. It will replace Brigade/Battalion Battle Simulation (BBS), Janus, Aviation Combined Arms Tactical Trainer / Close Combat Tactical Trainer (AVCATT/CCTT) and Joint Conflict and Tactical Simulation (JCATS) for Military Operation in Urban Terrain (MOUT). It will be able to conduct closed-form analysis of equipment, as well as Soldier in the Loop (SITL) operational testing and training. PEO STRI plans to release Version 1.0 in September 2006, 1.1 in December 2006, and 1.2 in June 2007. |
| COMBAT XXI | The Combined-Arms Analysis Tool for 21st Century (COMBATXXI) is a closed-form combat simulation developed by the TRADOC Analysis Center at White Sands Missile Range (TRAC-WSMR) and Marine Corps Combat Development Command (MCCDC). It is an entity-level analytical simulation that models tactical operations at the brigade-level or lower. It has been constructed for use in support of the ACR and RDA domains, and is intended to replace the Combined Arms and Task Force Evaluation Model (CASTFOREM), which is used in selected Analyses of Alternatives. TRAC-WSMR released Version 5.0 of COMBAT$^{XXI}$ in the summer of 2005. |
| IWARS | The Infantry Warrior Simulation (IWARS) is a closed-form combat simulation developed jointly by the Natick Soldier Center (NSC) and the Army Materiel Systems Analysis Activity (AMSAA). It is designed for use in the RDA and ACR modeling and simulation domains. This model targets "individual and small-unit dismounted combatants and their equipment." IWARS replaced the Integrated Unit Simulation System (IUSS). Natick released Version 1.0 in September 2005. |

## *1.4 The M&S Coordination and Working Group*

The M&S Coordination and Working Group stemmed from our initial recommendation to PEO Soldier in May 2004. It consists of representatives from each of the organizations involved in the simulation federation, including PEO Soldier (Group Chair), PEO STRI, TRAC-WSMR, Natick Soldier Center, and AMSAA. These representatives are essentially the model development teams for their respective organizations and are provided limited decision authority to act within the scope of the federation's goals. Ultimately, the purpose of this group is to

identify and implement the best ways to achieve PEO Soldier's analytical needs. This includes necessary modifications to their respective models, as well as hard and soft linkage requirements between the three, which we will discuss in greater detail later. As part of its charter, the Working Group meets via VTC or teleconference at least once per quarter, or more often as necessary.

# Chapter 2: Implementation Efforts

## *2.1 Phase I Overview: June '04 – June '05*

The period spanning June 2004 through June 2005 comprises what we call Phase I of the implementation effort. During this period, the ORCEN's primary focus was 1) developing and completing a Memorandum of Agreement (MOA) between PEO Soldier and the model proponents and 2) providing explicit descriptions of the modeling requirements. Although much work was done pursuant to the former, the ORCEN was unable to complete the MOA in Phase I, thus we move MOA coordination to the next phase of implementation discussed in the following section. Work on the latter area yielded a comprehensive set of analytical needs delineated by specific products or capabilities, both current and future. This functionality set began with a list of 450 different products or capabilities either in use or under development. The analysts streamlined the list by culling out unnecessary items and grouping them into families of systems. Using these needs, the analysts applied a combination of effects-based, analysis-based, and universal modeling language approaches to translate the needs into more explicitly defined simulation requirements. This resulted in a prioritized set of modeling requirements that reflected PEO Soldier's analytical needs and served as the starting point for the next phase of implementation. A complete explanation of the work accomplished during this phase is found in (Martin, 2005).

## *2.2 Phase II: June '05 – June '06*

### 2.2.1. Overview.

Phase II began in June 2005 and ends with the completion of this report in June 2006. From the outset, one of our primary objectives was to complete the MOA between PEO Soldier and the simulation proponents. With a solid, detailed agreement in place, PEO Soldier could apply funding toward achieving analytical needs and linkages between the three models and thereby begin to realize the anticipated results of the federation. However, in order to develop a useful MOA, we first needed to determine a) PEO Soldier's analytical needs for the year and b) the modifications to and linkages between the models that would be necessary to fill those needs.

These two critical steps would essentially allow us to define the MOA in terms of which simulation development team would perform what work to what end.

### 2.2.2. Analytical Areas of Endeavor

The results from Phase I provided a detailed listing and modeling description of over 400 PEO Soldier products. Since we could in no way achieve the modeling needs for all of these products, we narrowed this list to a prioritized manageable modeling load for the year. Accordingly, we worked with PEO Soldier to extract a prioritized list of products or STMS (soldier tactical mission system) components/capabilities from the Phase I results. We defined "manageable load" as what the model developers could reasonably accomplish in a year. Our process began with determining what that load should be from the modelers' perspectives.

Based on feedback from the three model proponents, we (PEO Soldier and the ORCEN) agreed that a manageable load would consist of five products or component capabilities. We then identified the five capabilities to be implemented from the list of PEO Soldier products discussed above. Table 2 lists the five capabilities selected for implementation. Next, we began coordination with the M&S Working Group to determine the best way to integrate these items into the modeling process.

**Table 2. Prioritzed list of five products or STMS components/ capabilities that model developers would focus on for FY06.**

| |
|---|
| 1) Advanced Combat Helmet |
| 2) Interceptor body armor and integrated head, neck, and face protection |
| 3) Direct fire weapons |
| 4) Sensors (optics, sights, aiming devices, etc.) |
| 5) Communications equipment (analog and digital) |

These five items were inadequate from the combat modelers' perspectives. The list failed to articulate one critical aspect of the modeling process in terms of what PEO Soldier wanted to achieve with respect to each of these items. As each of the model proponents stated, incorporating these items into their respective models would be a relatively easy task. However, what they really needed to know was what analytical questions PEO Soldier needed addressed as

a result of the items' incorporation. From their perspective this is the more important (and complicated) issue.

Pursuant to providing the modelers with analytical focus points for each of the five items, we rephrased them in terms of five analytical areas of endeavor. This required us to ascertain and articulate the broader context in which PEO Soldier needed STMS components evaluated. Figure 1 serves to capture this context. The figure attempts to capture, conceptually, what PEO Soldier requires in terms of analysis. Following this concept, we strived to articulate the initial set of analytical needs as clearly and concisely as possible. We structured these analytical needs around the five specific system components, categories, or configurations as described earlier.

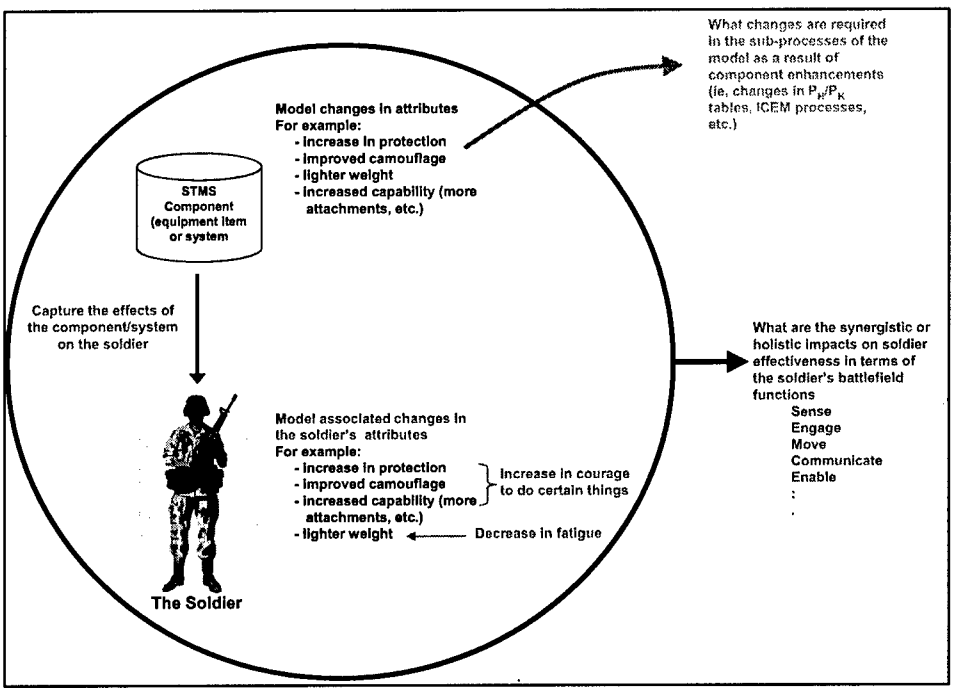


**Figure 1. Concept sketch articulating the broader context of PEO Soldier's analytical objectives as they pertain to the modeling of STMS components or capabilities.**

## 2.2.3. Linkage Framework

The goal of linking the three models is to utilize the strengths of all three simulations to support analysis. These linkages ultimately provide PEO Soldier with the flexibility to use any one of the three simulations independently to support specific analytical needs, while at the same time enabling the use of the other two to supplement those needs or other needs. In order to

effect the linkages between them, we worked with the model developers to identify the critical areas and challenges that the M&S Working Group would need to address: 1) the development of a linkage framework or outline and 2) the partitioning of the framework into either "hard" or "soft" linkage categories.

The linkage framework, located in Appendix C, delineates the critical areas and challenges the model developers must address. It essentially represents the bridges between the models that facilitate the transfer of data. Table 3 below shows an abbreviated rendition of the framework.

**Table 3. Upper tier of the linkage framework between the three simulation models, which identifies the critical linkage areas that must be addressed.**

| |
|---|
| 1. Equivalent terrain representations for specific areas of common interest |
| 2. Equivalent environments, as appropriate |
| 3. Equivalent methodologies or utilization of the preferred methodology from one of the simulations, as appropriate |
| 4. Equivalent algorithms, as appropriate |
| 5. Equivalent data, as appropriate |
| 6. Ghosting and / or proxies of entities |
| 7. Time / Event management |
| 8. Development of behaviors sets |
| 9. Method to obtain appropriate behavior interactions between the COMBAT$^{XXI}$ and IWARS entities |
| 10. The best way to keep proxy elements in complimentary model updated |
| 11. Use of simulation specific capabilities / constructs |
| 12. Usability of the combined simulation |
| 13. Data output and analysis |

While the development of the framework was a critical step towards realizing the linkages across the federation, equally critical is how the model developers address its implementation. This is primarily due to the fact that, although they will each address the framework from their perspective, certain aspects must be executed in concert with the other models.

To better facilitate this synchronized execution of the framework, we divided the linkage efforts into two categories: hard and soft linkages. Hard linkages represent the actual coded implementations within the models that enable the transfer of data between them (i.e., running sub-processes between models). Soft linkages simply involve running one model to obtain data elements (results) and then using those elements as inputs into one or both of the other models.

The key difference between the two types of linkages is the amount of time required to implement coding solutions. Hard linkages will require much more time to develop and implement coding solutions because of the complexities associated with recoding models to "talk" to one another. Likewise, some of the elements listed in the framework must be completed in their entirety before others can be addressed. Soft linkages, on the other hand, will certainly normally occur more quickly and are designed to provide data partial bridges for current technology gaps.

### 2.2.4. M&S Coordination and Working Group Meetings

The M&S Working Group (M&S WG) convened via VTC/teleconference four times since October 2005. These meetings provided the pretext for discussing the analytical and linkage issues within the federation. Moreover, they enabled the M&S WG to determine 1) who would take responsibility for what work, 2) associated timelines, and 3) what levels of work each participating organization and the M&S WG as a whole could expect to reasonably accomplish during the year. The first meeting on 13 October 2005 set the conditions for the subsequent meetings in December, February, and May. Three key results stemmed from the October meeting. The first of these was an alignment of the efforts within the federation against the analytical areas of endeavor. The second and third results concerned implementation and/or execution timelines and what could be accomplished within the fiscal year.

To achieve the first result, we aligned the five analytical areas of endeavor against each of the models, identifying which model developer would assume the lead for each area. We based the assignment process on the attributes and current direction of a particular model. For example, IWARS will have the highest fidelity with respect to the individual soldier and was already developing various aspects associated with the combat helmet and body armor. As such, IWARS assumed the role as the lead for these two areas. Similarly, COMBAT$^{XXI}$ will address more of the aggregated effects of groups of soldiers or units in a combined arms setting, therefore it assumed the lead for communications equipment. What this means is the "Lead" for a particular analytical area coordinates the federation's efforts to address the areas and associated issues. The following table reflects the resulting Area Leads.

**Table 4. Alignment of efforts within the federation as they pertain to achieving the analytical areas of endeavor.**

| Analytical Area | Lead |
|---|---|
| Advanced Combat Helmet | IWARS |
| Body Armor, et al. | IWARS |
| Direct Fire Weapons | Collaborative Lead |
| Sensors | Collaborative Lead |
| Communications Equipment | COMBAT$^{XXI}$ |

The second result evolved from the recognition that the group could not productively address all five areas of endeavor in one year. Before each model began to address the specifics of a particular area independently, we had to determine how those efforts would fit into the larger system of systems, or the federation. Accordingly, the group collectively agreed that, for this year, it would be better to focus on one of these areas vice multiple areas. This would enable all models to go into considerable depth for the designated area to learn about the level of complexity in store for this effort. Moreover, we felt the resulting learning process would facilitate taking on the remaining areas the following year. Pursuant to this, the group selected the Body Armor area as the most appropriate place to begin, primarily because of the current high demand for analysis pertaining to this topic.

The third result dealt with implementing the linkage framework. Early on, the M&S Working Group recognized the need to start both hard and soft linkages simultaneously in order to expedite the process and thereby more quickly realize the objectives of the effort. However, the simultaneous effort would have to be tempered with what could reasonably be accomplished. Since hard linkages require more time, we decided that the integration should begin in manageable steps. Thus, rather than attacking the hard aspects of the framework in total, we would work on each of the 13 areas to varying degrees, striving to maintain a balance between the areas and recognizing that some would have to occur completely before others could begin. In contrast, the soft linkages require no-prerequisites. Although they may require some minor modifications to the models, nothing has to be fully completed prior to working on another part. Moreover, just as with the second result above, pursuing soft linkages initially would generate a learning process that would allow all parties to learn about the existing and required connections between the models and what they would entail. Based on these observations, the group agreed the primary linkage focus for Phase II would fall on the soft linkages, particularly as they relate to the selected analytical area of endeavor.

### 2.2.5. Memorandum of Agreement (MOA) with the Model Proponents

The purpose of this MOA is to establish a collaborative effort between PEO Soldier and the organizations affiliated with the three simulation models. The overarching goal of the effort: to facilitate the development of a complementary and, where possible, linked set of simulation models that will enable high-fidelity representations of the individual Soldier within varied operational environments and across the spectrum of missions. One of the key objectives of the resulting models and linkages is to support quantitative analyses that address PEO Soldier requirements.

To achieve the purpose of the agreement, we developed a two-tiered approach. The upper tier consists of the base MOA, which established the broader context of the roles, responsibilities, and agreements within the federation. It outlines the process by which PEO Soldier will identify and prioritize its analysis requirements, coordinate the fulfillment of those requirements with selected Soldier Modeling & Simulation (M&S) development programs, determine which analysis requirements can be met within the M&S programs currently funded, and identify additional PEO Soldier M&S development funding required to address supplementary analysis needs. Within the scope of this tier, PEO Soldier, PEO STRI, Natick, TRAC, and AMSAA agree to collaborate in the planning, development, management, funding, linkage, and fielding of M&S capabilities aimed at addressing PEO Soldier analysis requirements. Pursuant to that end is the development of a process to coordinate PEO Soldier analysis requirements and resources with existing M&S programs in order to maximize the Army's M&S investments in bridging current gaps in Soldier system analysis. Appendix D contains the complete base MOA (minus signatures).

The second tier consists of a series of sub-MOAs between PEO Soldier and each of the individual model developer groups. For administrative purposes, we constructed these as annexes to the base MOA, as they act as specific extensions of the understandings and agreements delineated therein. We discuss these annexes in greater detail in the next section.

### 2.2.6. Annexes to the MOA

The M&S Working Group developed the sub-MOAs or annexes to the base MOA in full collaboration with each other. This was particularly important for reasons previously discussed

concerning the interdependent nature of the analytical and linkage efforts. These annexes serve to capture the following information:

- The work that each respective model proponent agrees to undertake for the year toward addressing specified, and agreed-upon PEO Soldier analytical needs and model linkages; and
- The funding level that PEO Soldier will provide to accomplish the work for the year.

In total, there are four annexes to the base MOA. Annex A consists of the analytical areas of endeavor discussed in section 2.2.2. Annexes B, C, and D comprise the set of sub-agreements between PEO Soldier and PEO STRI, Natick/AMSAA, and TRAC-WSMR respectively. Appendices E, F, and G contain these annexes, minus signatures.

The purposes of the annexes are two-fold. First, they articulate the unique aspects of specific agreements between PEO Soldier and the respective model proponents, as described above. This is important, as each model had, to some degree, already endeavored to achieve various aspects of the analytical areas PEO Soldier deemed important. Moreover, given the different objectives with respect to levels of fidelity in representing the individual soldier, each of the model developers would need (and want) to pursue this work in the particular way best suited for their model.

Second, they provide a degree of flexibility within the scope of the MOA. In and of itself, the base MOA is intended as a long-term agreement between the signatories that will, in general, not change over time. However, as work and linkages get accomplished and new analytical needs arise, the agreements and responsibilities therein will have to change. Since the signatories to the base MOA consist of the senior-most individuals in their respective organizations, a single MOA with no annexes would require a re-staffing and re-signing process with each change, consuming considerable amounts of time. The use of annexes mitigates these impacts by providing flexibility in the decision and funding processes. The following three points taken from paragraph 4(b) of the base MOA capture the essence of this flexibility:

(1) These annexes represent individual agreements between PEO Soldier and the respective model developers that fall within the scope of this MOA. While the base MOA remains unchanged, the annexes will be revised at the start of each fiscal year in order to update analytical and linkage objectives, as well as funding allocations. It is understood by all that these annual revisions will not require a resigning of the MOA.

(2) The decision authority for the annex development will be delegated to the respective representatives in the M&S Working Group. This authority extends only to deciding what objectives are deemed feasible for the year, the level of commitment (i.e., the amount of work each proponent agrees to perform for the year), and developing funding estimates. Final funding decisions will remain with the PEO Soldier.

(3) The funding levels apportioned to each M&S effort at the outset of the fiscal year will remain set for the year. In the event that a particular objective supported by PEO Soldier funds is attained through some other means, those PEO Soldier funds will be reallocated within the respective annex to achieve other linkage or analytical requirements.

As with most projects, the single greatest variable concerns funding. This project is no different. Further indicative of the flexibility in these annexes is the inclusion of a matrix that aligns certain levels of work with funding levels for each proponent. This provides a quick-reference starting point to correlate work levels with available funding. Moreover, if certain aspects of work require less time/money than originally expected, we can potentially bring feasible aspects from other parts of the matrix into the fold.

# Chapter 3: Current Progress & Conclusion

## *3.1 Where the Effort Currently Stands*

As of 31 May 2006, the annexes to the base MOA have been signed and are with PEO Soldier, awaiting the base MOA, which is in the signing process. Ultimately, this process took far longer than originally anticipated, due to unforeseen administrative delays and fiscal constraints beyond PEO Soldier's control. As it stands, although the Working Group's initial estimates for funding FY06 objectives exceeded $1.2 million, budget reductions and unexpected shifts in priorities reduced the actual allocation to $1.0 million, approximately 80% of the original request. Accordingly, we have elected to partition the $1.0 million by funding the model developers at 80% of their original estimates. Using the matrices mentioned in 2.2.6, we worked with the members of the M&S Working Group to delineate precisely what each proponent would strive to perform and the period of performance.

As of 9 June 2006, all three model groups have received funding from PEO Soldier, and they have begun their work in earnest. Although the release of funds occurred late in the fiscal year (May 2006), the work will still span a 12-month period ending in June 2007. This date is tied to the release of OOS Version 1.2.

## *3.2 The Road Ahead*

In mid-July, members of the Working Group will convene to conduct a Technical Interchange Meeting (TIM) to discuss several of the details involved with the linkages and analytical efforts. In particular, the meeting will cover the integration of the OOS synthetic natural environment (SNE) into IWARS and COMBATXXI, the integration of the Integrated Casualty Estimation Model (ICEM) into OOS and COMBATXXI, and the development of scenarios to drive analytical efforts. The first two are critical with respect to linking the models and feed directly into the third. Ultimately, the integration of the SNE and the ICEM across the three models will mitigate compatibility issues between the models and essentially assist them with "talking" to one another using a common frame of reference. The scenarios themselves are important because they must be common between the models to facilitate standardized entity processing and logic. Incompatibility issues herein would render any data virtually useless.

Over the next year, the Working Group will continue to meet to review the year's objectives, discuss progress, and look to the year beyond. Based on progress or other events, the group will decide on modifications to the work load and funding, as necessary. As an example, if the integration of the SNE requires less time and money than originally anticipated, then the excess funds earmarked for that purpose will either be reallocated among the current set of objectives for the year or, if time and resources allow it, applied to an additional objective (one of the secondary efforts mentioned in Annexes B, C, and D). The group will also continue to conduct TIMs as necessary to facilitate the exchange of data and technical information required to stimulate the linkages and analytical efforts, as well as to ensure each of the three models are on parallel courses from a technical standpoint.

From the ORCEN's perspective, we will need to work with PEO Soldier in the August-September 2006 to refine the next set of analytical areas of endeavor that the federation will begin to address at the end of FY07 and throughout FY08. These areas will need to account for PEO Soldier priorities with respect to equipment/component development, fielding, and data collection, as well as any critical events (i.e., analyses of alternatives (AoAs)). As with the set of priorities developed for this year, next year's will also have to be a manageable load that we can adjust as necessary based on time, funding, etc.

## *3.3 Conclusion*

The work the ORCEN accomplished for PEO Soldier this year has served to further implement our Simulation Roadmap recommendation from May 2004. Although this work has been more managerial in nature vice analytical, it has served a critical purpose. Foremost, we have achieved our primary objective of completing the MOA between PEO Soldier and the model proponents. As a result, we have a vetted and signed, long-term agreement between these organizations that will facilitate the development and use of one of the most beneficial analytical packages the Army acquisition community has to support the development, acquisition, and fielding of Infantry soldier systems. Beyond this, we have worked diligently with the M&S Working Group to develop a comprehensive linkage framework and a set of analytical focus areas that will drive the work efforts for the next year. In the end, work has begun and progress is being made toward a viable and fully linked simulation federation.

# Bibliography

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Tollefson, Eric S., Boylan, Greg L., Foote, Bobbie L., West, Paul D., Kwinn, Michael J. 2004. *Simulation Roadmap for Program Executive Office (PEO) Soldier.* Operations Research Center of Excellence Technical Report No. DSE-TR-0421, DTIC #ADA425648.

# Appendix A: List of Abbreviations

| | |
|---|---|
| ACR | Advanced Concepts and Requirements |
| AMSAA | U.S. Army Materiel Systems Analysis Activity |
| AoA | Analysis of Alternatives |
| AVCATT | Aviation Combined Arms Tactical Trainer |
| BBS | Brigade / Battalion Battle Simulation |
| CASTFOREM | Combined Arms and Task Force Evaluation Model |
| CCTT | Close Combat Tactical Trainer |
| COMBAT$^{XXI}$ | Combined Arms Analysis Tool for the 21$^{st}$ Century (affiliated with TRAC-WSMR and MCCDC) |
| DTIC | Defense Technical Information Center |
| ERC | Environmental Runtime Component |
| FFW | Future Force Warrior Program |
| FY | Fiscal Year |
| ICEM | Integrated Casualty Estimation Model |
| IWARS | Infantry Warrior Simulation (affiliated with AMSAA and NSC) |
| JCATS | Joint Conflict and Tactical Simulation |
| MCCDC | Marine Corps Combat Development Command |
| M&S | Modeling and Simulation |
| MOA | Memorandum of Agreement |
| MOUT | Military Operations in Urban Terrain |
| NSC | Natick Soldier Center |
| OneSAF | One-Semi-Automated Force (affiliated with PEO-STRI) |
| OOS | Objective One-SAF |
| ORCEN | Operations Research Center |
| OTB | OneSAF Testbed Baseline |
| PEO | Program Executive Office |
| PEO-STRI | PEO Simulation, Training and Instrumentation |
| RDA | Research, Development, and Acquisition |
| SITL | Soldier in the Loop |
| SMART | Simulation and Modeling for Acquisition, Requirements and Training |
| SEMP | Systems Engineering and Management Process |
| SNE | Synthetic Natural Environment |
| STMS | Soldier Tactical Mission System |
| TEMO | Training, Equipment, and Military Operations |
| TIM | Technical Interchange Meeting |
| TRAC | TRADOC Analysis Center |
| TRAC-WSMR | TRAC at White Sands Missile Range |
| TRADOC | Training and Doctrine Command |
| USMA | United States Military Academy |
| VTC | Video Teleconference |

# Appendix B: PEO Soldier's Analytical Areas of Endeavor.

As stated in the report, Figure 1 attempts to capture, conceptually, what PEO Soldier requires in terms of analysis. Following this concept, this appendix articulates the initial set of analytical needs as clearly and concisely as possible. We have structured these analytical needs around specific system components, categories, or configurations and have tied them back to the original soldier functions developed in (Tollefson, et al., 2004).

## 1) ADVANCED COMBAT HELMET

Equipment specifics & components (what needs to be modeled):

- Weight:
- Field of view:
- Ballistic properties:
- Subcomponents: Integrated commo (?), Camo pattern, Improved chinstrap, Improved internal webbing, Night vision mount, HUD w/ targeting & commo (future)

**Analytical Needs:**

How does the Advanced Combat Helmet affect soldier effectiveness with respect to the following soldier functions?

***MAKE SENSING DECISIONS, SENSE***

Effects of reduced weight, increased peripheral vision and increased protection on a soldier's ability or inclination to:

- Select sensing equipment (effects of having more robust subcomponent capabilities w/ IR and/or thermal capabilities)
- Search for targets
- Track targets
- Acquire targets

***MAKE ENGAGEMENT DECISIONS, ENGAGE***

Effects of reduced weight, increased peripheral vision and increased protection on a soldier's ability and inclination to:

- Engage targets with direct fire weapon
- Engage targets with CQC

*MOVE*

Effects of reduced weight on a soldier's ability to:

- Change physical location (physiological effects, such as fatigue and rate of movement)
- Change postures

*MAKE COMMUNICATION DECISIONS, COMMUNICATE*

Effects of increased peripheral vision, increased protection and subcomponent capabilities on a soldier's ability and inclination to:

- Receive visual, verbal or radio communications
- Transmit

## 2) INTERCEPTOR BODY ARMOR & INTEGRATED HEAD, NECK, AND FACE PROTECTION

Equipment specifics & components (what needs to be modeled):

Weight (total system): 16.4 lbs [9 lbs. lighter than previous system]

Ballistic properties: TBD

Level of protection (body areas protected):

**Analytical Needs:**

How do the Interceptor Body Armor & Integrated head, neck, and face protection affect soldier effectiveness with respect to the following soldier functions?

*MAKE SENSING DECISIONS, SENSE*

Effects of increased protection on a soldier's ability or inclination to sense, et al.

*MAKE ENGAGEMENT DECISIONS, ENGAGE*

Effects of increased protection on a soldier's ability or inclination to engage targets, et al.

*MAKE MOVEMENT DECISIONS, MOVE*

Effects of reduced weight on a soldier's ability to:

- Change physical location (physiological effects, such as fatigue and rate of movement)
- Change postures

*MAKE ENABLING DECISIONS, ENABLE*

Effects of reduced weight, physical construct (impacts on range of motion of arms, legs, head, torso) on a soldier's ability to:

- Alter surroundings
- Manipulate load (carry extra equipment (pouches), or physically able)
- Operate (administer first aid, operate equipment)

## 3) DIRECT FIRE WEAPONS

Equipment specifics & components (what needs to be modeled):

Dimensions of system

Weight (total system): of the weapon itself, and with specific component configurations

Ballistic properties: both the effects on the enemy AND the effects on the firer (ie, recoil effects, concussion effects, etc.)

Component capabilities: combat optics, IR/Thermal sights, aiming devices, reduced exposure sights, etc.

**Analytical Needs:**

1. How do the changes in physiological attributes resulting from weapon specifics (above) impact soldier effectiveness?
2. What is the impact of weapon attributes on soldier effectiveness (i.e., changes to $P_H/P_I/P_K$ measures, detect-ability due to audible and visual signatures of weapon, etc.)
3. How do specific weapon systems (rifle, grenade launcher, SAW, MG, etc.) impact soldier effectiveness with respect to the following soldier functions:

***MAKE SENSING DECISIONS, SENSE***

Effects of system capabilities and attributes on the soldier's ability to

- Search for targets (i.e., due to optics, reduced exposure sights, etc.)
- Acquire targets
- Track and designate targets

***MAKE ENGAGEMENT DECISIONS, ENGAGE***

Effects of system capabilities and attributes on the soldier's ability to

- Select a method of engagement (i.e., timeliness; sensor capabilities of sights, aiming devices, etc.)
- Engage targets (individual, multiple, in rapid succession; obviously, this must be in conjunction with the SENSE function, because we are interested in whether the weapon enhances effectiveness by 1) enabling the soldier to more quickly identify targets, 2) allowing the soldier to place well-aimed shots against that target (or multiple), and then 3) facilitating a rapid acquisition and engagement of additional targets)

***MAKE MOVEMENT DECISIONS, MOVE***

Effects of weapon weight and dimensions on a soldier's ability to:

- Change physical location
  - physiological effects, such as fatigue and rate of movement
  - other effects on attributes such as detect-ability (i.e., a longer weapon might catch on vegetation or branches more, a molded plastic or composite material might absorb sound better, etc.)
- Change postures

*MAKE ENABLING DECISIONS, ENABLE*

Effects of weight, physical construct, and components on a soldier's ability to:

Alter surroundings (i.e., one hand free or two hands free capability afforded by sling or other component(s))

Manipulate load (carry other things)

Operate (administer first aid, operate other equipment)

## 4) SENSORS (TO INCLUDE OPTICS, SIGHTS, VIEWERS, AIMING DEVICES, ETC.)

Equipment specifics & components (what needs to be modeled):

Dimensions of system

Weight (total system): of individual components (to include batteries/power supply) and the aggregate weights of system configurations

Power properties: type of power, duration, number of batteries/power cells, power draw tied to usage of devices (individual components and aggregate draw on the system)

Component capabilities: combat optics, IR/Thermal sights, aiming devices, reduced exposure sights, operational effects of weather, etc.

**Analytical Needs:**

1. What impact does the power usage/draw of the equipment have on the soldier's effectiveness (i.e., does it require him to stop more often to change batteries or recharge; does it require him to carry a greater load of battery replacements, etc.)
2. What impact(s) do various sensor capabilities have on the soldier's effectiveness with respect to the following soldier functions?

*MAKE SENSING DECISIONS, SENSE*

Effects of system capabilities and attributes on the soldier's ability to

- Search for targets
- Acquire targets
- Track and designate targets

*MAKE ENGAGEMENT DECISIONS, ENGAGE*

Effects of system capabilities and attributes on the soldier's ability to

- Select a method of engagement (i.e., timeliness; sensor capabilities of sights, aiming devices, etc.)
- Engage targets (individual, multiple, in rapid succession; obviously, this must be in conjunction with the SENSE function, because we are interested in whether the weapon enhances effectiveness by 1) enabling

the soldier to more quickly identify targets, 2) allowing the soldier to place well-aimed shots against that target (or multiple), and then 3) facilitating a rapid acquisition and engagement of additional targets)

***MAKE MOVEMENT DECISIONS, MOVE***

Effects of equipment weight and dimensions on a soldier's ability to:

- Change physical location
  - physiological effects, such as fatigue and rate of movement
  - other effects on attributes such as detect-ability (i.e., helmet mounted optics might catch on vegetation or branches more, a molded plastic or composite material might absorb sound better, etc.)
- Change postures

***MAKE ENABLING DECISIONS, ENABLE***

Effects of weight, physical construct, and components on a soldier's ability to:

Alter surroundings (i.e., one hand free or two hands free capability afforded by weapon/helmet mount, sling or other component(s))

Manipulate load (carry other things; i.e., does the equipment require so much space/weight that it forces the soldier to give up other capabilities)

Operate (administer first aid, operate other equipment)

## 5) COMMUNICATIONS EQUIPMENT (DIGITAL AND ANALOG SYSTEMS)

Equipment specifics & components (what needs to be modeled):

Dimensions of system

Weight (total system): of individual components (to include batteries/power supply, antennae, handsets, etc.) and the aggregate weights of system configurations

Power properties: type of power, duration, number of batteries/power cells, power draw tied to usage of devices (individual components and aggregate draw on the system)

Component capabilities: operational range, bandwidth, memory, security, operational effects of weather, etc.

**Analytical Needs:**

1. What is the aggregate impact on the level of situational awareness afforded by the equipment and how does this affect the soldier's effectiveness?
2. What impact does the power usage/draw of the equipment have on the soldier's effectiveness (i.e., does it require him to stop more often to change batteries or recharge; does it require him to carry a greater load of battery replacements, etc.)
3. What impact(s) do various communications capabilities have on the soldier's effectiveness with respect to the following soldier functions?

*MAKE SENSING DECISIONS, SENSE*

Effects of system capabilities and attributes on the soldier's ability to

- Search for targets
- Acquire targets
- Track and designate targets

*MAKE ENGAGEMENT DECISIONS, ENGAGE*

Effects of system capabilities and attributes on the soldier's ability to

- Select a method of engagement (i.e., does having more/less knowledge affect the soldier's ability/decision to select methods, etc.)
- Engage targets (similar to weapons and sensors, how does this equipment contribute to the soldier's effectiveness in terms of engaging direct or indirect fire targets, etc.)

*MAKE MOVEMENT DECISIONS, MOVE*

Effects of system weight and dimensions on a soldier's ability to:

- Change physical location
    - physiological effects, such as fatigue and rate of movement
    - other effects on attributes such as detect-ability (i.e., enemy ability to triangulate signals, audible signature, etc.)
- Change postures

*MAKE COMMUNICATION DECISIONS, COMMUNICATE*

Effects of system attributes/capabilities on a soldier's ability to:

- Receive and transmit information (how much information traffic can the system handle at a time, what are the effects of higher-level net control stations, etc.)
- Operate (here, we are interested in the effects of large amounts of information on the soldier's ability to operate; in short, effect of "information overload" on the soldier)

*MAKE ENABLING DECISIONS, ENABLE*

Effects of weight, physical construct, and components on a soldier's ability to:

Alter surroundings (i.e., one hand free or two hands free capability afforded by weapon/helmet mount, LBE attachment, backpack, or other component(s))

Manipulate load (carry other things; i.e., does the equipment require so much space/weight that it forces the soldier to give up other capabilities)

Operate (administer first aid, operate other equipment)

# Appendix C: Model Linkage Framework

The goal of linking IWARS, OOS, and COMBAT XXI is to utilize the strength of both simulations to support analysis. While we are working to be able to link the two models, we will also keep the ability to run each model independently.

Identified challenges that need to be addressed, with examples and/or sub-issues:

14. Equivalent terrain representations for specific areas of common interest
    a. Terrain representations must match exactly, e.g. building must be in the same location in both of the simulations
15. Equivalent environments, as appropriate
    a. Weather and lighting information and affects on simulation processes
16. Equivalent methodologies or utilization of the preferred methodology from one of the simulations, as appropriate
    a. Line of sight
    b. Radio frequency propagation
    c. Acquire based search and target acquisition
    d. Casualty assessment
    e. Smoke
    f. Flares
    g. Stochastic shielding
17. Equivalent algorithms, as appropriate
    a. Java vs. C++ implementations
    b. Interaction with the simulation architecture
18. Equivalent data, as appropriate
    a. Soldier postures, presented area, location
19. Ghosting and / or proxies of entities
20. Time / Event management
    a. Both simulations are event-queue based
    b. Scheduling and control
21. Development of behaviors sets
    a. Development of Soldier behaviors for appropriate interaction with vehicles
    b. Development of vehicle behaviors for interaction with Soldiers
22. Method to obtain appropriate behavior interactions between the COMBAT$^{XXI}$ and IWARS entities
    a. Commonality or compatibility of the scenarios defined in each of the simulations
    b. Commonality or compatibility of the behaviors defined in each of the simulations
23. The best way to keep proxy elements in complimentary model updated
    a. HLA or an HLA-like method

b. Definition of which data elements are to be exchanged
c. Control of the exchange

24. Use of simulation specific capabilities / constructs
    a. Terrain databases augmented with additional "semantic" information to support agent decision making, e.g. phase line
25. Usability of the combined simulation
    a. Interfaces and simulation control
26. Data output and analysis

# Appendix D: Base MOA between PEO Soldier and Model Developers

MEMORANDUM OF AGREEMENT
BETWEEN
THE PROGRAM EXECUTIVE OFFICER SOLDIER (PEO Soldier)
AND
THE PROGRAM EXECUTIVE OFFICER FOR SIMULATION,
TRAINING AND INSTRUMENTATION (PEO STRI)
AND
THE NATICK SOLDIER CENTER (NSC)
AND
THE TRADOC ANALYSIS CENTER - WHITE SANDS MISSILE RANGE (TRAC-WSMR)
AND
THE ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY (AMSAA)

SUBJECT: Memorandum of Agreement to Establish a Collaborative Modeling, Simulation, and Analysis Effort between PEO Soldier, PEO STRI, TRAC, the Natick Soldier Center, and AMSAA

1. References.

a. Tollefson, E. S., Boylan, G. L., Kwinn, M. J., Jr.; Foote, B. L., West, P. D., 2004, Simulation Roadmap for Program Executive Office (PEO) Soldier, Operations Research Center of Excellence Technical Report [DSE-R-0421], DTIC #: ADA425648, United States Military Academy, West Point, NY.

b. Tollefson, Eric S. and Gregory L. Boylan, "Final Decision Briefing to Mr. Charles Rash, Deputy PEO, Soldier," 14 May 2004.

2. Purpose: The purpose of this MOA is to establish a collaborative effort between the above-listed agencies to facilitate the development of a complementary and, where possible, linked set of simulation models that will enable high-fidelity representations of the individual Soldier within varied operational environments and across the spectrum of missions. One of the key objectives of the resulting models and linkages is to support quantitative analyses that address PEO Soldier requirements. This MOA will outline the process by which PEO Soldier will identify and prioritize its analysis requirements, coordinate the fulfillment of those requirements with selected Soldier Modeling & Simulation (M&S) development programs, determine which analysis requirements can be met within the currently funded M&S programs, and identify additional PEO Soldier M&S development funding required to address supplementary analysis needs.

3. Scope.

a. PEO Soldier, PEO STRI, Natick, TRAC-WSMR, and AMSAA agree to collaborate in the planning, development, management, funding, linkage, and fielding of M&S capabilities aimed at addressing PEO Soldier analysis requirements. Pursuant to that end is the development of a process to coordinate PEO Soldier analysis requirements and resources with existing M&S

programs in order to maximize the Army's M&S investments in bridging current gaps in Soldier system analysis. This MOA coordinates the following three Army M&S development efforts to support PEO Soldier analysis requirements:

(1) One Semi-Automated Force (OneSAF) – Product Manager OneSAF

(2) Combined Arms Analysis Tool for 21st Century (COMBAT$^{XXI}$) – TRAC- WSMR

(3) Infantry Warrior Simulation (IWARS) – Natick Soldier Center (NSC)/AMSAA

b. Furthermore, this MOA details the roles and responsibilities of all signatories to resource, develop, and field an M&S toolset that will meet PEO Soldier analysis requirements.

4. Understandings, agreements, support and resources.

a. General. All signatories to this memorandum agree and bear responsibility to meet, collaborate, and work together to facilitate achievement of the group's established goals. With respect to the M&S program proponents, PM OneSAF, NSC/AMSAA, and TRAC-WSMR are responsible for supporting the cost, schedule, technical performance, and life cycle management of their respective M&S programs. Each M&S program, while an independent effort, will work in a collaborative manner to address PEO Soldier analysis issues wherever common interests are identified. Additionally, each M&S program agrees to provide a member to participate in the PEO Soldier-chaired M&S Coordination Group, which will meet according to a schedule to be determined. This group will meet prior to the beginning of each fiscal year in order to identify, agree upon, and delineate the analytical and modeling requirements and linkage issues for the upcoming year; and then meet routinely throughout the year in order to assess progress, address issues, and revalidate requirements. The specific objectives of the M&S Coordination Group are to:

(2) Outline and discuss PEO Soldier analysis requirements;

(3) Determine a suitable and achievable M&S proponent-to-requirement crosswalk that clearly delineates which proponent will assume responsibility for particular modeling requirements, as well as cost and timeline estimates for implementation;

(4) Identify the necessary elements and required methodologies to facilitate both soft and hard linkages between simulation models, to include cost estimates and expected timelines;

(5) Apprise PEO Soldier on the planned development cycle of each M&S program;

(6) Assist in prioritization of PEO Soldier M&S requirements not met by current M&S development plans; and

(7) Discuss annual funding considerations that relate to modeling and linkage requirements for the simulation models.

b. MOA Annexes (sub-MOAs) between PEO Soldier and each M&S program proponent.

(1) The M&S Working Group will develop sub-MOAs in the form of annexes to this parent MOA. These annexes will serve to capture the following information:

i. The work that each respective M&S proponent agrees to undertake for the year toward addressing specified and agreed upon PEO Soldier analytical needs and model linkages.

ii. The funding level that PEO Soldier will provide to accomplish the work for the year.

(2) These annexes between PEO Soldier and the respective M&S proponents will be developed in full collaboration among M&S Working Group participants. This will ensure that all members of the team understand the direction and levels of effort of all parties involved in achieving the year's objectives.

(3) The decision authority for the annex development will be delegated to the respective representatives in the M&S Working Group. This authority extends only to deciding what objectives are deemed feasible for the year, the level of commitment (i.e., the amount of work each proponent agrees to perform for the year), and developing funding estimates. Final funding decisions will remain with the PEO Soldier.

(4) The funding levels apportioned to each M&S effort at the outset of the fiscal year will remain set for the year. In the event that a particular objective supported by PEO Soldier funds is attained through some other means, those PEO Soldier funds will be reallocated within the respective annex to achieve other linkage or analytical requirements.

(5) These annexes represent individual agreements between PEO Soldier and the respective model developers that fall within the scope of this MOA. While the base MOA remains unchanged, the annexes will be revised at the start of each fiscal year in order to update analytical and linkage objectives, as well as funding allocations. It is understood by all that these annual revisions will not require a resigning of the MOA.

c. PEO Soldier Responsibilities.

(1) Identify the general analysis applications required from the M&S toolset.

(2) Identify and prioritize the specific functionality requirements needed from each model proponent in the M&S toolset to address the analysis applications.

(3) Support the three respective M&S developments & linkages by providing data, methodology, and funding to address model development and linkage requirements, especially those unique to PEO Soldier analyses.

(4) Chair the M&S Coordination Group to support the collaborative development of the PEO Soldier M&S toolset.

(5) Identify a prioritized set of M&S development funding requirements to support PEO Soldier analysis.

(6) Maintain this MOA, ensure that it is current, and provide all signatories progress reports regarding implementation of all documented agreements.

d. PEO STRI Responsibilities.

(1) Execute the work agreed to in the sub-agreement with PEO Soldier (Annex B) that addresses specified and agreed upon PEO Soldier analytical needs and model linkages.

(2) Maintain development, execution, and lifecycle management responsibility for the OneSAF modeling effort.

(3) Provide status updates on OneSAF development, especially as it relates to addressing the analysis requirements identified by PEO Soldier.

(4) Identify resource requirements not currently part of the OneSAF development program necessary to address PEO Soldier analysis requirements.

(5) Identify areas in which the other M&S efforts in this MOA can leverage existing work from the OneSAF program to maximize reuse and minimize costs.

(6) Identify areas in which OneSAF can leverage from the other two M&S developments in this MOA to maximize reuse and minimize costs to OneSAF.

(7) Where feasible, and when resourced by PEO Soldier, align OneSAF development efforts to address PEO Soldier analysis requirements and participate in other activities such as algorithm transition, technical interchange meetings, analysis activities, etc., to support development of overall PEO Soldier analytic capability.

e. Natick and AMSAA Responsibilities.

(1) Execute the work agreed to in the sub-agreement with PEO Soldier (Annex C) that addresses specified and agreed upon PEO Soldier analytical needs and model linkages.

(2) Maintain development, execution, and lifecycle management responsibility for the IWARS model.

(3) Provide status updates of IWARS development, especially as it relates to addressing the analysis requirements identified by PEO Soldier.

(4) Identify resource requirements not currently part of the IWARS development or any other development program necessary to address PEO Soldier analysis requirements.

(5) Identify areas in which the other M&S efforts in this MOA can leverage existing work from the IWARS program to maximize reuse and minimize costs.

(6) Identify areas in which IWARS can leverage from the other M&S developments in this MOA to maximize reuse and minimize costs to IWARS.

(7) Where feasible, and when resourced by PEO Soldier, align IWARS development efforts to address PEO Soldier analysis requirements and participate in other activities such as algorithm transition, technical interchange meetings, analysis activities, etc., to support development of overall PEO Soldier analytic capability.

f. TRAC-WSMR Responsibilities.

(1) Execute the work agreed to in the sub-agreement with PEO Soldier (Annex D) that addresses specified and agreed upon PEO Soldier analytical needs and model linkages.

(2) Maintain development, execution, and lifecycle management responsibility for the COMBAT$^{XXI}$ model.

(3) Provide status updates of COMBAT$^{XXI}$ development, especially as it relates to addressing the analysis requirements identified by PEO Soldier.

(4) Identify resource requirements not currently part of the COMBAT$^{XXI}$ development program or any other development necessary to address PEO Soldier analysis requirements.

(5) Identify areas in which the other M&S efforts in this MOA can leverage existing work from the COMBAT$^{XXI}$ program to maximize reuse and minimize costs.

(6) Identify areas in which COMBAT$^{XXI}$ can leverage from the other M&S developments in this MOA to maximize reuse and minimize costs to COMBAT$^{XXI}$.

(7) Where feasible, and when resourced by PEO Soldier, align COMBAT$^{XXI}$ development efforts to address PEO Soldier analysis requirements and participate in other activities such as algorithm transition, technical interchange meetings, analysis activities, etc., to support development of overall PEO Soldier analytic capability.

5. Execution:

a. PEO Soldier, as chair of the M&S Coordination Group, will monitor and facilitate coordination of the applicable M&S developments identified within this MOA, to include development strategies, schedules, program costs, and issues.

b. For each identified M&S program, PEO Soldier, PEO STRI, Natick, AMSAA, and TRAC-WSMR will identify a responsible M&S development manager for coordination and management of their M&S development. The M&S development manager will identify appropriate M&S Coordination Group representation.

c. MOA participants will attempt to resolve conflicts through the M&S Coordination Group. Unresolved conflicts will be elevated through the chain of command to be resolved at the signatory level.

6. Effective/Termination Date. This MOA and associated annexes are effective as of the date of the last signature below, and will remain in effect until amended, superseded, or terminated.

a. This agreement will be reviewed annually on its anniversary date, or when deemed necessary, to identify the need for additions or modifications.

b. This MOA may be reviewed for modifications at any time at the request of any signatory.

c. The annexes will be revised at the outset of every fiscal year for the life of this MOA.

| | | |
|---|---|---|
| R. MARK BROWN<br>Brigadier General, USA<br>Program Executive Officer, Soldier | JAMES T. BLAKE<br>Program Executive Officer for Simulation, Training and Instrumentation | PAMELA I. BLECHINGER<br>Director, TRADOC Analysis Center – White Sands Missile Range |
| (Date) | (Date) | (Date) |

| | |
|---|---|
| PHILIP BRANDLER<br>Director, Natick Soldier Center | DAVID SHAFFER<br>Director, Army Materiel Systems Analysis Activity |
| (Date) | (Date) |

Annexes:

A – PEO Soldier's Analytical Areas of Endeavor for FY06
B – Sub-agreements between PEO Soldier and PEO STRI
C – Sub-agreements between PEO Soldier and NSC/AMSAA
D – Sub-agreements between PEO Soldier and TRAC-WSMR

# Appendix E: Annex B to the Base MOA – Objective OneSAF (PEO STRI)

1. Purpose. To delineate the specific understandings and agreements between PEO Soldier and PEO STRI pursuant to addressing analytical areas of endeavor reflected in Annex A and linkages with the other two modeling groups for FY06. This annex will annotate the efforts PEO STRI agrees to undertake to achieve the analytical and soft/hard linkage objectives determined by the M&S Working Group.
2. Understandings, agreements, support, and resources.
    a. General. As determined by the M&S Working Group, the federation's efforts for FY06 will focus on soft/hard linkage issues and the five analytical areas of endeavor (Annex A). Soft linkage efforts will focus on passing the results of sub-processes between the models to support analytical objectives. Hard linkage efforts will proceed simultaneously and will encompass manageable levels of all elements identified by the M&S Working Group. Within the five areas of endeavor, the primary FY06 analytical focus between the three models is the Interceptor Body Armor and integrated head, neck, and face protection. While the group will continue to address the other four areas as feasible and necessary, these areas are secondary efforts for FY06.
    b. PEO Soldier agrees to:
        1) Provide PEO STRI with $306,000 in funding in order to achieve analytical and linkage objectives for FY06.
        2) Provide guidance and input with respect to the analytical needs for the year. Continue to revalidate these needs and provide updates/modifications as necessary throughout the year.
        3) Provide model developers with information (e.g. test and experimentation schedules and plans) that would support the collection of data needed for analysis.
        4) Provide modelers with available data for all items of equipment addressed for the year. Data provided should include the following:
            a) Equipment specifications/attributes.
            b) Estimated/known enhancements to equipment performance.
            c) Expected/known changes in soldier behavior.
            d) Expected/known impacts to soldier attributes.
    c. PEO STRI agrees to:
        1) Provide PEO Soldier with a detailed statement of work (SOW) that specifies how it plans to achieve its portions of the analytical and linkage

objectives over the course of FY06 and how the funds provided by PEO Soldier correspond to those efforts.

2) Perform the level of work articulated in the following table. This level will be determined by the funding level provided by PEO Soldier. Any changes to the funding level over the course of the year will be addressed in M&S Working Group meetings to determine the adjustments to the level of work performed.

| | **Associated Level of Work by Funding Level** | | |
|---|---|---|---|
| **Level of Funding** | **Analytical Areas** | **Soft Linkages** | **Hard Linkages** |
| **$306,000** | • Complete conceptual modeling and KA/KE<br>• Create Individual Combatant with unique ACH physical model(s) – high fidelity.<br>• Data collection to support Advanced Combat Helmet analytical requirements.<br>• Delivery and training | • Lead integration of common SNE across OOS, Combat XXI, and IWARS.<br>• Support unique DIS and HLA requirements, depending upon hard linkage requirements. | • Investigate hard linkage of IWARS and Combat XXI via OOS SORD |
| **$206,000** | • Complete conceptual modeling and KA/KE<br>• Create Individual Combatant with unique ACH physical model(s) – high fidelity.<br>• Additional data collection for ACH. | • Unique DIS PDUs and/or FOM to support IWARS and Combat XXI. | • No hard linkage. |
| **$106,000** | • Complete conceptual modeling and KA/KE<br>• Create Individual Combatant with ACH data in existing OOS models. | • DIS and HLA as currently defined in OOS. | • No hard linkage. |
| **$50,000** | • Cannot execute | | |
| **$25,000** | • Cannot execute | | |

3. Decision authorities.

   a. PEO Soldier. The PEO Soldier representative(s) to the M&S Working Group shall have the authority to act on behalf of PEO Soldier in the development and implementation of this annex as it relates to the base MOA. They may decide

on issues pertaining to linkage efforts as they impact PEO Soldier objectives, PEO Soldier analytical thrusts for the current year and beyond, revalidation of and/or modifications to the analytical objectives for the year, and to agree to funding estimates with respective model groups. It is understood that all final funding decisions in the contexts of this MOA and annex are reserved for the PEO Soldier.

b. PEO STRI. The PEO STRI representative(s) to the M&S Working Group shall have the authority to act on behalf of PEO STRI in the development and implementation of this annex as it relates to the base MOA. They may decide on and agree to the level of commitment to address soft/hard linkage and analytical objectives for the year, as well as provide funding level estimates necessary to achieve those objectives. It is understood that this level of commitment may fluctuate based on PEO Soldier's revalidation of or modifications to analytical objectives; any necessary fluctuations would be determined and agreed upon during the monthly M&S Working Group meetings.

4. Effective period for this Annex. This annex shall take effect with the signing of the base MOA and shall remain in effect through FY06. Subsequent annexes (for FY07 and beyond) shall take effect at the start of the fiscal year (1 October 20XX) and shall replace the annex for the previous year (i.e., annex for FY07 will replace that for FY06). It is understood that, while the annexes will change from year to year, the base MOA remains unchanged and will not require a resigning each year.

5. Annex termination date. This annex shall expire on 1 October 2006 and shall be replaced by the annex developed for FY07.

| | |
|---|---|
| JOHN SURDU<br>LTC, USA<br>Program Manager, OneSAF | ROSS R. GUCKERT<br>Director, Systems Integration<br>Program Executive Office, Soldier |
| Date: _____ | Date: _____ |

# Appendix F: Annex C to the Base MOA – IWARS (Natick Soldier Center and AMSAA)

1. Purpose. To delineate the specific understandings and agreements between PEO Soldier and the IWARS Modeling Group (defined as NSC and AMSAA) pursuant to addressing analytical areas of endeavor reflected in Annex A and linkages with the other two modeling groups for FY06. This annex will annotate the efforts that NSC and AMSAA agree to undertake to achieve the analytical and soft/hard linkage objectives as determined by the M&S Working Group for this fiscal year (2006).

2. Understandings, agreements, support, and resources.

a. General. As determined by the M&S Working Group, the federation's efforts for FY06 will focus on soft/hard linkage issues and the five analytical areas of endeavor (Annex A). Soft linkage efforts will focus on passing the results of sub-processes between the models to support analytical objectives. Hard linkage efforts will proceed simultaneously and will encompass manageable levels of all elements identified by the M&S Working Group. Within the five areas of endeavor, the primary FY06 analytical focus between the three models is the Interceptor Body Armor and integrated head, neck, and face protection. While the group will continue to address the other four areas as feasible and necessary, these areas are secondary efforts for FY06.

b. PEO Soldier agrees to:

1) Provide the IWARS Modeling Group with $550,000 in funding in order to achieve analytical and linkage objectives for FY06.

2) Provide guidance and input with respect to the analytical needs for the year. Continue to revalidate these needs and provide updates/modifications as necessary throughout the year.

3) Provide model developers with information (e.g. test and experimentation schedules and plans) that would support the collection of data needed for analysis.

4) Provide modelers with available data for all items of equipment addressed for the year. Data provided should include the following:

a) Equipment specifications/attributes.

b) Estimated/known enhancements to equipment performance.

c) Expected/known changes in soldier behavior.

d) Expected/known impacts to soldier attributes.

c. NSC and AMSAA agree to:

1) Provide PEO Soldier with a detailed joint statement of work (SOW) that specifies how they collectively plan to achieve their portions of the analytical and linkage objectives over the course of FY06 and how the funds provided by PEO Soldier correspond to those efforts.

2) Perform the level of work articulated in the table on the following pages. This level will be determined by the funding level provided by PEO Soldier. Any changes to the funding level over the course of the year will be addressed in M&S Working Group meetings to determine the adjustments to the level of work performed.

| | Associated Level of Work by Funding Level | | |
|---|---|---|---|
| **Level of Funding** | **Analytical Areas** | **Soft Linkages** | **Hard Linkages** |
| **$550,000** | • As the primary analytical effort for this year, serve as the "Lead" to achieve the analytical objectives involving the Interceptor Body Armor and integrated head, neck, and face protection area of endeavor. Collaborate with the other two modeling groups to ensure that efforts are aligned and mutually supportive.<br>• Secondary efforts for FY06.<br>– Serve as the "Lead" in addressing the Advanced Combat Helmet area of endeavor.<br>– Serve as a "Collaborative Lead" in addressing the analytical needs associated with the 'Direct Fire Weapons' and 'Sensor' areas of endeavor.<br>– Work with the OOS and COMBAT$^{XXI}$ (Lead) groups in addressing the analytical needs associated with the 'Communications Equipment' area of endeavor<br>– As appropriate and as opportunities exist, participate in the set-up, conduct, and reduction of experiments that support the collection of data needed for analysis.<br>– Work with PEO Soldier and other agencies, as required and as opportunities arise, for the conduct of analysis pertaining to issues of importance to the PEO Soldier. | • Collaborate with other members of the M&S Working Group to facilitate soft and hard linkages between OOS, IWARS, and COMBAT$^{XXI}$, working to utilize the OOS Environmental Runtime Component (ERC) and the Synthetic Natural Environment (SNE). Collaborate with these modeling groups to facilitate the integration of these OOS features/methodologies into your model as part of establishing a common operating environment within the federation.<br>• Collaborate with the OOS and COMBAT$^{XXI}$ groups to facilitate all necessary soft linkages associated with the five areas of endeavor (Annex A) for FY06, focusing on linkage elements consistent with the analytical guidance and input provided by PEO Soldier (referring to paragraph 2.b.2) above). | Continue to address necessary hard-linkage elements in conjunction with the OOS and COMBAT$^{XXI}$ groups. |
| $450,000 | Conduct work within the Analytical Areas needed to enhance Soldier and small unit representations, with a focus on body armor. Work issues related to linkage with the Integrated Casualty Estimation Model (ICEM). Conduct work within the secondary areas based upon need, opportunities and resources permit. Provide limited analysis support and leveraging of data collection opportunities. | • Collaborate with other members of the M&S Working Group to facilitate soft and hard linkages between OOS, IWARS, and COMBAT$^{XXI}$, working to utilize the OOS Environmental Runtime Component (ERC) and the Synthetic Natural Environment (SNE). Collaborate with these modeling groups to facilitate the integration of these OOS features/methodologies into your model as part of establishing a common operating environment within the federation.<br>• Collaborate with the OOS and COMBAT$^{XXI}$ groups to facilitate soft linkages associated with the five areas of endeavor (Annex A) for FY06, focusing on linkage | Continue to address necessary hard-linkage elements in conjunction with the OOS and COMBAT$^{XXI}$ groups. |

| | | | |
|---|---|---|---|
| | | elements consistent with the analytical guidance and input provided by PEO Soldier (referring to paragraph 2.b.2) above). | |
| **$350,000** | Conduct limited work within the Analytical Areas needed to enhance Soldier and small unit representations, with a focus on body armor. Work issues related to linkage with the Integrated Casualty Estimation Model (ICEM). Conduct work within the secondary areas based upon need, opportunities and resources permit. Provide limited analysis support and leveraging of data collection opportunities. | • Collaborate with other members of the M&S Working Group to facilitate soft and hard linkages between OOS, IWARS, and COMBAT$^{XXI}$, working to utilize the OOS Environmental Runtime Component (ERC) and the Synthetic Natural Environment (SNE). Collaborate with these modeling groups to facilitate the integration of these OOS features/methodologies into your model as part of establishing a common operating environment within the federation.<br>• Collaborate with the OOS and COMBAT$^{XXI}$ groups to facilitate soft linkages associated with the five areas of endeavor (Annex A) for FY06, focusing on linkage elements consistent with the analytical guidance and input provided by PEO Soldier (referring to paragraph 2.b.2) above). | Continue to address critical hard-linkage elements in conjunction with the OOS and COMBAT$^{XXI}$ groups. |
| **$250,000** | Conduct limited work within the Analytical Areas needed to enhance Soldier and small unit representations, with a focus on body armor. Conduct work within the secondary areas based upon need, opportunities and resources permit. Provide limited analysis support and leveraging of data collection opportunities. | Continue to focus on the soft linkage, addressing a range of issues. Collaborate with other members of the M&S Working Group and conduct technical interchange meetings to work to address M&S issues of importance to PEO Soldier and to foster linkage of the M&S tools. | Address critical elements of hard linkage |
| **$150,000** | Conduct limited work within the Analytical Areas. Limited analysis support and leveraging of data collection opportunities. | Continue to focus on the soft linkage. Collaborate with other members of the M&S Working Group and conduct technical interchange meetings to work to address M&S issues of importance to PEO Soldier and to foster linkage of the M&S tools. | Address critical elements of hard linkage |
| **$50,000** | Identify and consider PEO Soldier M&S requirements in the development of IWARS. | Focus on soft linkage. Collaborate with other members of the M&S Working Group and conduct technical interchange meetings to work to address M&S issues of importance to PEO Soldier and to foster linkage of the M&S tools. | Limited work addressing hard linkage. |
| **$25,000** | Identify and consider PEO Soldier M&S requirements in the development of IWARS. | Focus on soft linkage. Collaborate with other members of the M&S Working Group and conduct technical interchange meetings to work to address M&S issues of importance to PEO Soldier. | Limited work addressing hard linkage. |

3. Decision authorities.

   d. PEO Soldier. The PEO Soldier representative(s) to the M&S Working Group shall have the authority to act on behalf of PEO Soldier in the development and implementation of this annex as it relates to the base MOA. They may decide on issues pertaining to linkage efforts as they impact PEO Soldier objectives, PEO Soldier analytical thrusts for the current year and beyond, revalidation of and/or modifications to the analytical objectives for the year, and to agree to funding estimates with respective model groups. It is understood that all final funding decisions in the contexts of this MOA and annex are reserved for the PEO Soldier.

   e. NSC & AMSAA. The NSC and AMSAA representatives to the M&S Working Group shall have the authority to act on behalf of their respective organizations in the development and implementation of this annex as it relates to the base MOA. They may decide on and agree to the level of commitment to address soft/hard linkage and analytical objectives for the year, as well as provide funding level estimates necessary to achieve those objectives. It is understood that this level of commitment may fluctuate based on PEO Soldier's revalidation of or modifications to analytical objectives; any necessary fluctuations would be determined and agreed upon during the monthly M&S Working Group meetings.

4. Effective period for this Annex. This annex shall take effect with the signing of the base MOA and shall remain in effect through FY06. Subsequent annexes (for FY07 and beyond) shall take effect at the start of the fiscal year (1 October 20XX) and shall replace the annex for the previous year (i.e., annex for FY07 will replace that for FY06). It is understood that, while the annexes will change from year to year, the base MOA remains unchanged and will not require a resigning each year.

5. Annex termination date. This annex shall expire on 1 October 2006 and shall be replaced by the annex developed for FY07.

ROBERT J. AUER
Manager, IWARS ATO Modeling and
Analysis Team
Natick Soldier Center

Date: _____

TOM RUTH
Infantry Warrior Team Leader
Armor Infantry Branch
AMSAA

Date: _____

ROSS R. GUCKERT
Director, Systems Integration
Program Executive Office, Soldier

Date: _____

# Appendix G: Annex D to the Base MOA – COMBAT$^{XXI}$ (TRAC-WSMR)

6. Purpose. To delineate the specific understandings and agreements between PEO Soldier and the TRAC-WSMR pursuant to addressing analytical areas of endeavor reflected in Annex A and linkages with the other two modeling groups for FY06. This annex will annotate the efforts that TRAC-WSMR agrees to undertake to achieve the analytical and soft/hard linkage objectives as determined by the M&S Working Group for this fiscal year (2006).

7. Understandings, agreements, support, and resources.

a. General. As determined by the M&S Working Group, the federation's efforts for FY06 will focus on soft/hard linkage issues and the five analytical areas of endeavor (Annex A). Soft linkage efforts will focus on passing the results of sub-processes between the models to support analytical objectives. Hard linkage efforts will proceed simultaneously and will encompass manageable levels of all elements identified by the M&S Working Group. Within the five areas of endeavor, the primary FY06 analytical focus between the three models is the Interceptor Body Armor and integrated head, neck, and face protection. While the group will continue to address the other four areas as feasible and necessary, these areas are secondary efforts for FY06.

b. PEO Soldier agrees to:

1) Provide TRAC-WSMR with $405,000 in funding in order to achieve analytical and linkage objectives for FY06.

2) Provide guidance and input with respect to the analytical needs for the year. Continue to revalidate these needs and provide updates/modifications as necessary throughout the year.

3) Provide model developers with information (e.g. test and experimentation schedules and plans) that would support the collection of data needed for analysis.

4) Provide modelers with available data for all items of equipment addressed for the year. Data provided should include the following:

a) Equipment specifications/attributes.

b) Estimated/known enhancements to equipment performance.

c) Expected/known changes in soldier behavior.

d) Expected/known impacts to soldier attributes.

c. TRAC-WSMR agrees to:

1) Provide PEO Soldier with a detailed statement of work (SOW) that specifies how the organization plans to achieve their portions of the analytical and linkage objectives over the course of FY06 and how the funds provided by PEO Soldier correspond to those efforts.

2) Perform the level of work articulated in the table on the following pages. This level will be determined by the funding level provided by PEO Soldier. Any changes to the funding level over the course of the year will be addressed in M&S Working Group meetings to determine the adjustments to the level of work performed.

| Level of Funding | Associated Level of Work by Funding Level | | |
|---|---|---|---|
| | **Analytical Areas** | **Soft Linkages** | **Hard Linkages** |
| **$405,000** | a) As the primary analytical effort for FY06, work with the IWARS (Lead) and OOS groups to achieve the analytical objectives involving the Interceptor Body Armor and integrated head, neck, and face protection area of endeavor.<br>b) Secondary analytical efforts for FY06.<br>– Work with the IWARS (Lead) and OOS groups in addressing Advanced Combat Helmet area of endeavor.<br>– Serve as a "Collaborative Lead" with the IWARS and OOS groups in addressing the analytical needs associated with the 'Direct Fire Weapons' and 'Sensor' areas of endeavor.<br>– Serve as the "Lead" to achieve other secondary efforts involving the Communications Equipment area of endeavor. Collaborate with the other two modeling groups to ensure that these efforts are aligned and mutually supportive.<br>– As appropriate and as opportunities exist, participate in the set-up, conduct, and reduction of experiments that support the collection of data needed for analysis.<br>– Work with PEO Soldier and other agencies, as required and as opportunities arise, for the conduct of analysis pertaining to issues of importance to the PEO Soldier. | c) Collaborate with other members of the M&S Working Group to facilitate soft and hard linkages between OOS, IWARS, and COMBAT$^{XXI}$, working to utilize the OOS Environmental Runtime Component (ERC) and the Synthetic Natural Environment (SNE). Collaborate with these modeling groups to facilitate the integration of these OOS features/methodologies into your model as part of establishing a common operating environment within the federation.<br>• Collaborate with the OOS and IWARS groups to facilitate all necessary soft linkages associated with the five areas of endeavor (Annex A to draft MOA) for FY06, focusing on linkage elements consistent with the analytical guidance and input provided by PEO Soldier. | Continue to address necessary hard-linkage elements in conjunction with the IWARS and OOS groups. |
| **$305,000** | d) As the primary analytical effort for FY06, work with the IWARS (Lead) and OOS groups to achieve the analytical objectives involving the Interceptor Body Armor and integrated head, neck, and face protection area of endeavor.<br>e) Secondary analytical efforts for FY06: support IWARS and/or OOS group(s) in addressing one other analysis effort. | • Collaborate with other members of the M&S Working Group to facilitate soft linkages between OOS, IWARS, and COMBAT$^{XXI}$, working to utilize the OOS Environmental Runtime Component (ERC) and the Synthetic Natural Environment (SNE). Collaborate with these modeling groups to facilitate the integration of these OOS features/methodologies into your model as part of establishing a common operating environment within the federation.<br>• Collaborate with the OOS and IWARS groups to facilitate all necessary soft linkages associated with selected areas of endeavor from Annex A of the draft MOA for FY06, focusing on linkage elements consistent with the analytical guidance and input provided by PEO Soldier. | Participate in technical discussions with IWARS and OOS groups to define software architecture, data table structure, and other areas associated with establishing hard linkages. |

| | | | |
|---|---|---|---|
| **$205,000** | f) As the primary analytical effort for FY06, work with the IWARS (Lead) and OOS groups to achieve the analytical objectives involving the Interceptor Body Armor and integrated head, neck, and face protection area of endeavor. | Collaborate with other members of the M&S Working Group to facilitate soft linkages between OOS, IWARS, and COMBAT[XXI], working to utilize the OOS Environmental Runtime Component (ERC) and the Synthetic Natural Environment (SNE). Collaborate with these modeling groups to facilitate the integration of these OOS features/methodologies into your model as part of establishing a common operating environment within the federation.<br><br>Collaborate with the OOS and IWARS groups to facilitate all necessary soft linkages associated with the Interceptor Body Armor area of endeavor from Annex A of the draft MOA for FY06, focusing on linkage elements consistent with the analytical guidance and input provided by PEO Soldier. | Participate in technical discussions with IWARS and OOS groups to define software architecture, data table structure, and other areas associated with establishing hard linkages. |
| **$105,000** | Cannot execute. | Participate in technical discussions with IWARS and OOS groups to define software architecture, data table structure, and other areas associated with establishing soft linkages. | Participate in technical discussions with IWARS and OOS groups to define software architecture, data table structure, and other areas associated with establishing hard linkages. |
| **$50,000** | Cannot execute. | Cannot execute. | Cannot execute. |
| **$25,000** | Cannot execute. | Cannot execute. | Cannot execute. |

8. Decision authorities.

   a. PEO Soldier. The PEO Soldier representative to the M&S Working Group shall have the authority to act on behalf of PEO Soldier in the development and implementation of this annex as it relates to the base MOA. He/she may decide on issues pertaining to linkage efforts as they impact PEO Soldier objectives, PEO Soldier analytical thrusts for the current year and beyond, revalidation of and/or modifications to the analytical objectives for the year, and to agree to funding estimates with respective model groups. It is understood that all final funding decisions in the contexts of this MOA and annex are reserved for the PEO Soldier.

   b. TRAC-WSMR. The TRAC-WSMR representative(s) to the M&S Working Group shall have the authority to act on behalf of TRAC-WSMR in the development and implementation of this annex as it relates to the base MOA. They may decide on and agree to the level of commitment to address soft/hard linkage and analytical objectives for the year, as well as provide funding level estimates necessary to achieve those objectives. It is understood that this level of commitment may fluctuate based on PEO Soldier's revalidation of or modifications to analytical objectives; any necessary fluctuations would be determined and agreed upon during the monthly M&S Working Group meetings.

9. Effective period for this Annex. This annex shall take effect with the signing of the base MOA and shall remain in effect through FY06. Subsequent annexes (for FY07 and beyond) shall take effect at the start of the fiscal year (1 October 20XX) and shall replace the annex for the previous year (i.e., annex for FY07 will replace that for FY06). It is understood that, while the annexes will change from year to year, the base MOA remains unchanged and will not require a resigning each year.

10. Annex termination date. This annex shall expire on 1 October 2006 and shall be replaced by the annex developed for FY07.

| | |
|---|---|
| GREGORY C. HOSCHEIT<br>COL, FA<br>Interim Director, Models and Simulations | ROSS R. GUCKERT<br>Director, Systems Integration<br>Program Executive Office, Soldier |
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# Chapter 4: REPORT DOCUMENTATION PAGE – SF298

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**14. ABSTRACT**

The Army acquisition community requires high-resolution simulations to provide quantitative analytical support to acquisition decision-making. These models must be able to assess future, proposed capabilities and technologies. Previous work completed in May 2004 proposed the creation of a federation between three different simulation models to achieve this capability. Over the past two years, the ORCEN at West Point has worked with PEO Soldier to implement this proposal. In this report, we discuss the second year of the implementation process. We first will describe the process of refining the requirements developed in the first year into a more useable set of analytical focus-areas for the three model developers. We will then address the critical topic of linking the three models. Finally, we will explain how we captured the analytical needs and linkage elements into a comprehensive, MOA between PEO Soldier and the proponents for the three simulation models. We will conclude with a discussion the current state of the implementation process as we close out the second year and the road ahead for continued implementation efforts.

**15. SUBJECT TERMS**

Combat simulations, requirement definition, Infantry Soldier Systems

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