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# PERSONNEL SERVICE SUPPORT (PSS) IN ARMY MODELS

FINAL REPORT

DEPARTMENT OF THE ARMY
HEADQUARTERS UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND
FORT MONROE, VIRGINIA 23651

TRADOC ANALYSIS COMMAND - FORT BENJAMIN HARRISON





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The purpose of this study was to develop a management plan for including Personnel Service Support (PSS) functions into Army models. The study began with a review of the literature which described existing Army models. We followed this initial screening process with telephone interviews and with on-site visits to key users of Army models. By meeting with PSS subject matter experts (SMEs), the study team determined candidate PSS functions for inclusion into Army models. The study team developed and recommended a methodology for incorporating the strength management function into the SIMNET, ARTBASS, and CBT-SIM training models. The study team also developed a statement of work for a model (WARPAM) which will assist in measuring the overall efficiency of the replacement system in light of its force structure and doctrine, the capability of the medical system to return patients to duty, and the rear area threat. WARPAM results will allow us to improve the replacement system efficiency estimates used in Army analytical models.

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# FINAL REPORT

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# PERSONNEL SERVICE SUPPORT (PSS) IN ARMY MODELS

20 October 1989

U N C L A S S I F I E D

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TABLE OF CONTENTS

## LIST OF APPENDICES

## LIST OF FIGURES

## GLOSSARY OF ACRONYMS

| | |
|---|---|
| ACN | Army Control Number |
| AI | Artificial Intelligence |
| AIDS | Acquired Immune Deficiency Syndrome |
| ALB | Airland Battle |
| AMSAA | Army Materiel Systems Analysis Agency |
| ANSI | American National Standards Institute |
| AR | Army Regulation |
| ARTBASS | Army Training Battle Simulation System |
| BC | Battalion-Corps |
| C2 | Command and Control |
| CAA | Concepts Analysis Agency |
| CASTFOREM | Combined Arms and Support Task Force Evaluation Model |
| CBT-SIM | Combat Simulation |
| CEM | Concepts Evaluation Model |
| CMF | Career Management Field |
| COMMZ | Communications Zone |
| CONUS | Continental United States |
| COR | Contracting Officers Representative |
| CORBAN | Corps Battle Analyzer |
| COSAGE | Combat Sample Generator |
| COTR | Contracting Officers Technical Representative |
| CR | Community Relations |
| CS | Combat Support |
| CSM | Casualty Stratification Model |
| CSS | Combat Service Support |
| CSTD | Concepts, Studies & Threat Division |
| CVS | Commercial Vendor Services |
| DA | Department of the Army |
| DARPA | Defense Advanced Research Projects Agency |
| DCD | Directorate of Combat Developments |
| DG | Defense Guidance |
| DNBI | Disease Non-Battle Injury |
| DoD | Department of Defense |
| EAC | Echelons above Corps |
| EEA | Essential Element of Analysis |
| EMP | Electro-magnetic Pulse |
| FASTALS | Force Analysis Simulation of Theater Administration and Logistics Support |
| FBHN | Fort Benjamin Harrison (refers to TRAC office) |
| FG | Finance Group |
| FLVN | Fort Leavenworth |
| FORCEM | Force Evaluation Model |
| FSC | Finance Support Command |
| HQDA | Headquarters Department of the Army |
| ICBM | Intercontinental Ballistic Missile |

| | |
|---|---|
| IPR | In-progress Review |
| JAGs | Judge Advocate Generals |
| JESS | Joint Exercise Support System |
| KIA | Killed-in-action |
| LEE | Fort Lee |
| MACATAK | Maintenance Capability Attack Model |
| MARC | Manpower Requirements Criteria |
| MASH | Mobile Army Surgical Hospital |
| MATT-HELM | Mixed Attack Helicopter Model |
| MOBMAN | Mobilization Manpower Planning System |
| MOD II | Model II |
| MOPP | Mission Oriented Protective Posture |
| MOS | Military Occupational Specialty |
| MR | Media Relations |
| NBC | Nuclear, Biological, and Chemical |
| NCR | National Capital Region |
| NPS | Naval Postgraduate School |
| OMG | Operational Maneuver Groups |
| OPFOR | Opposing Forces |
| OR | Operations Research |
| PAC | Personnel Administration Center |
| PAO | Public Affairs Officer |
| PASR | Personnel Accounting and Strength Reporting |
| PERSCOM | US Army Total Personnel Support Command |
| PFM | Patient Flow Model |
| PI | Public Information |
| POL | Petroleum, Oil, Lubricants |
| POM | Program Objective Memorandum |
| PSC | Personnel Support Command |
| PSS | Personnel Service Support |
| PSS/BSS | Personnel Service Support/Battlefield Simulation System |
| PSY | Professional Staff Year |
| PSYOPS | Psychological Operations |
| PULHES | P=Pulmonary, U=Upper extremities, L=Lower extremities, H=Hearing, E=Eyesight, S=Psychiatric |
| RC | Replacement Company |
| REC | Radio Electronic Combat |
| RPVs | Remotely Piloted Vehicles |
| RTD | Returns-to-duty |
| SIM | Simulation |
| SIMNET | Simulator Network |
| SME | Subject Matter Expert |
| SOW | Statement of Work |
| SPETSNATZ | Soviet Special Purpose Forces |
| SSC | Soldier Support Center |
| SWA | Southwest Asia |
| TACAIR | Tactical Air |
| TACCS | Tactical Army CSS Computer System |
| TACSIM | Tactical Simulation |
| TDA | Table of Distribution and Allowances |
| TDY | Temporary Duty |
| TFC | Theater Finance Command |

| | |
|---|---|
| TJ | Trial Judiciary |
| TOD | TRAC Operations Directorate |
| TOE | Table of Organization and Equipment |
| TR | Technical Representative |
| TRAC | TRADOC Analysis Command |
| TRADOC | Training and Doctrine Command |
| TRANSACT | Transportation and Supply Activities |
| TRANSMO | Transportation Model |
| UCMJ | Uniform Code of Military Justice |
| UMT | Unit Ministry Team |
| USACAA | U.S. Army Concepts Analysis Agency |
| USALOGCEN | U.S. Army Logistics Center |
| USASSC | U.S. Army Soldier Support Center |
| WARMAPS | Army Wartime Manpower Planning System |
| WARPAM | Wartime Personnel Assessment System |
| WIA | Wounded-in-action |
| WRSS | Wartime Replacement System Study |
| WS | White Sands Missile Range |
| WSMR | White Sands Missile Range |
| VIC | Vector-in-Command |

## ABSTRACT

The purpose of this study was to develop a management plan for including Personnel Service Support (PSS) functions into Army models. The study began with a review of the literature which described existing Army models. We followed this initial screening process with telephone interviews and with on-site visits to key users of Army models. By meeting with PSS subject matter experts (SMEs), the study team determined candidate PSS functions for inclusion into Army models. The study team developed and recommended a methodology for incorporating the strength management function into the SIMNET, ARTBASS, and CBT-SIM training models. The study team also developed a statement of work for a model (WARPAM) which will assist in measuring the overall efficiency of the replacement system in light of its force structure and doctrine, the capability of the medical system to return patients to duty, and the rear area threat. WARPAM results will allow us to improve the replacement system efficiency estimates used in Army analytical models.

## EXECUTIVE SUMMARY

1. INTRODUCTION. Army combat models typically portray weapons systems in great detail, while the modeling of "soldiers" and the infrastructure designed to directly support them on the battlefield (Personnel Service Support (PSS)) receives cursory treatment. This study discusses the importance of PSS in sustaining the soldier and the implications of not adequately including PSS functions in the Family of Army Models. This study identifies the deficiencies which currently exist in portraying Personnel Service Support (PSS) functions in the Family of Army Models and recommends a solution to the problem.

2. PURPOSE. To recommend a management plan to incorporate PSS into Army models.

3. TASKING. We initiated this study in response to the Directorate of Combat Developments (DCD), Soldier Support Center (SSC), desire to determine the effect of improper representations of PSS functions in Army models.

4. SCOPE.

a. With the manpower allocation of .85 professional staff years (PSY) for the entire study, the study team limited the scope of the study so that it could be executed within the manpower constraint. We did not look at manual wargames or joint wargames (the focus is Army models). However, we did investigate potential uses of Air Force and Marine models for PSS type play. Models used currently by Army decision makers were the primary focus of our investigation.

b. We realize that due to the limited manpower resources available for this study, we may find that we have omitted a model which should have been included in our original research. The findings in this report, therefore, are evolutionary and we will update this research as new information becomes available.

5. METHODOLOGY. The study team divided the methodology into three phases.

a. Phase I - Literature Review

(1) During this phase, we sought to collect and research previous documents or studies which addressed PSS issues specifically related to Army modeling. The study team reviewed executive summaries from approximately 279 models.

(2) This review produced a list of 15 models which proclaimed to model Combat Service Support (CSS). The major subcomponents of CSS are logistics, health services, and PSS. Through an in-depth review of these models, the study team determined replacement operations was the only PSS function modeled.

b. Phase II - Analysis

(1) During site visits with the major users of Army models, we discussed PSS representations with model subject matter experts. Through the interview process, the study team determined the current uses and the extent of the PSS representations in the models.

(2) The study team then contacted subject matter experts (SMEs) from the SSC to determine their needs for PSS representations into Army models. The study team compared the SME's desires with the capabilities and ultimate objectives of specific Army models. When considering inclusion of PSS functions, the study team focused on the original intent of the model. For example, replacement operations are extremely important in the outcome of war, but inclusion of a replacement operations module in an AMSAA ballistics model is not consistent with its purpose and, therefore, inclusion of replacement operations would not enhance the model.

c. Phase III - Implementation, Considerations, and Recommendations

(1) We identified the changes that are required to implement critical PSS functions in Army models.

(2) We prepared the final report to implement these changes.

(3) We developed a contractual effort to resolve the major PSS deficiencies that exist in Army models.

6. DISCUSSION AND ANALYSIS. See Essential Elements of Analysis (EEAs) in Appendix A.

7. CONCLUSIONS. The study team concluded that:

a. PSS representation in Army models is inadequate.

b. Of the five functional areas of PSS; Public Affairs, Legal Affairs, Chaplaincy, Finance, and Personnel Administration, the only PSS function which we can model realistically at the present time is a limited portion of Personnel Administration. The specific subfunctions of Personnel Administration which should be modeled are strength management, Personnel Accounting and Strength Reporting, and replacement operations.

c. Army models do not portray the inherent limitations of the doctrinal force structure when modeling the flows of replacements on the simulated battlefield.

d. The Army does not know how many replacements a CONUS Replacement Center (CRC) or a Replacement Company (RC) can process per day, and without a computer simulation, the Army does not have a sound basis for estimating this processing capacity.

e. We can use the Personnel Support/Battlefield System Simulation (PSS/BSS) to derive efficiency curves for the processing times of the replacement system force structure.

f. Army models do not portray returns-to-duty (RTDs) in sufficient detail to determine "choke points" in the demand for specific combat Military Occupational Specialties (MOSs).

g. Several Army training models do not realistically portray the strength management function.

h. We can play the strength management function in training models by post-processing the internally generated casualty streams to produce casualties by name, MOS, and grade. Information of incoming replacements would also be provided.

i. The Army has inadequately modeled the rear area threat, so the PSS community can not realistically measure the threat impact on the effectiveness of its units or doctrine.

j. The US Total Army Personnel Support Command (PERSCOM) shelf-requisition and The Office of the Secretary of Defense (OSD) Wartime Manpower Planning System (WARMAPS) processes will be affected by better estimating the distribution of simulated casualties, their resulting physical profile, and their subsequent utilization by the personnel system.

k. In light of global personnel requirements, the WARPAM model can be used to determine the beginning inventory of the personnel pools in Army models at a specified point in time.

8. RECOMMENDATIONS.

Recommend that:

a. The strength management methodology outlined in this study be implemented in SIMNET, ARTBASS, and CBT-SIM.

b. We continue to pursue the Wakefield Methodology for deriving the distribution of casualties for specific warfighting conditions.

c. We determine processing requirements and capacities of the replacement system (e.g., CONUS Replacement Centers (CRCs) and Replacement Companies (RCs)) in light of its current force structure and doctrine.

d. We interface personnel models with medical simulations which consider the quantities and types of specific wounds and their associated processing times and manpower requirements, number of beds in the hospital, and the evacuation policy.

e. We pursue the JANUS(T) rear area casualty estimation study outline in Appendix F. The results of the study can be used to improve the rear area factors used in Force Analysis Simulation of Theater Administrative and Logistics Support (FASTALS), Vector-in-Command (VIC), and other Army models.

f. We use the PSS/BSS to estimate the degradation to the replacement system from increased workload periods due to peak casualty periods.

g. In light of global personnel requirements, we use the Wartime Personnel Assessment Model (WARPAM) to determine the beginning inventory of available personnel and the projected replacement stream at various points in time for use in Army models.

# CHAPTER 1

## INTRODUCTION AND BACKGROUND

### 1. STUDY BACKGROUND.

a. The success of the United States Army in a major conflict in the 1980's greatly depends on the premise that superior technology can overcome the Eastern Bloc's tremendous numerical advantages in both personnel and equipment. In addition to the strategic problems caused from these numerical advantages, the nature of modern warfare mandates that changes be made in our conventional approach to military tactics. For example, in a conflict on the Airland Battlefield of Western Europe in the 1980's, contemporary weaponry will cause great chaos, thus requiring rapid change and movement of military units. These factors will greatly affect the classical approach of forward units engaging the enemy, then returning to the rear area for periods during which units will provide reconstitution in the form of "fresh" troops and new equipment. Current Army doctrine predicts that this battlefield will require units to operate 24 hours a day and to anticipate attacks from all directions. Additionally, the chaos of this battlefield will isolate many units, disrupting support operations and communications systems.

b. In addition to the rapidly changing environment of the modern battlefield and its implications on our tactical approaches to warfare, the political system is exerting increased fiscal scrutiny on the Defense Budget. Furthermore, a shrinking population base for military recruits threatens the sustainment of the current levels of military personnel. These pressures mandate the military services become more efficient in all phases of military operations; weapon system development and procurement, tactics and doctrine, personnel management, and training.

c. A key instrument in the military's (particularly the Army's) effort toward greater efficiency is the use of models (includes simulations and wargames). Models provide the means to realistically represent various facets of military operations and, through the use of the computer, the operations can be simulated without the large expenditures of time and money required in actual military exercises.

d. Models are used extensively throughout the Army. They are used to support decisions of force structure, training and doctrine, and to examine the capabilities of the enemy. The trend to use modeling in peacetime to prepare for war will continue.

e. Based on the increasing use of modeling in the Army, efforts are constantly being made to validate model results and improve model representations of combat. One area of modeling that has not been represented well is the individual soldier and the systems designed to sustain him.

f. This study will focus on Personnel Service Support (PSS) in Army models. PSS is defined as the management of all personnel-related matters and includes personnel administration, finance, legal, public affairs, and religious support.

2. PROBLEM. While these PSS functions contribute directly in sustaining the human resource dimension and the general well-being of the combat effectiveness of the Army, the extent to which they are represented or portrayed in Army models has not been studied and documented.

3. OBJECTIVES.

a. To identify and catalog the PSS functions represented in current Army models.

b. To identify and prioritize the PSS functions for inclusion in present and future Army models.

c. To prepare a management plan designed to implement the recommendations of this study.

4. SCOPE. This study will be limited to selected training and analytical models. Model selection will be based on the importance of the models and the extent to which PSS functions influence their outcomes.

5. LIMITATIONS. The study team will accomplish this study within the .85 PSY manpower allocation planned for in this effort.

6. ESSENTIAL ELEMENTS OF ANALYSIS (EEA).

a. What are the Army models that fall within the scope of this study?

b. What PSS functions are included in the Army models that fall within the scope of this study? How and to what level of detail are they portrayed?

c. Which PSS functions are candidates for inclusion in Army models? How and to what level of detail should they be portrayed? What functions lend themselves to post/pre-processing instead of inclusion in the model(s)?

d. Who are the users or user groups which require that PSS be represented in Army models?

e. What products and benefits do the users need?

f. What PSS functions will satisfy the needs of each user or user group?

g. What is the level of resolution that will satisfy the needs of each user or user group?

h. How do PSS functions affect combat capability?

i. What must be done in order to integrate PSS into Army models? What is the priority for this integration?

7. CHAPTER SUMMARY. In this chapter we have established the purpose of this study - determine to what extent PSS is used in Army models, determine which PSS functions should be included in Army models, and develop a management plan to implement the recommendations of the study. With this purpose in mind the reader is now introduced to the key functions which comprise PSS.

## CHAPTER 2

## PERSONNEL SERVICE SUPPORT (PSS)

1. INTRODUCTION.

a. The infrastructure required to support the soldiers on the modern battlefield is complex and immense and consists of the Combat Support (CS) and Combat Service Support (CSS) elements of the Army. CSS is defined as the management of the full range of health, personnel, and logistical service functions and their operations. CSS is delineated into two related parts; manning the force and sustaining the force.

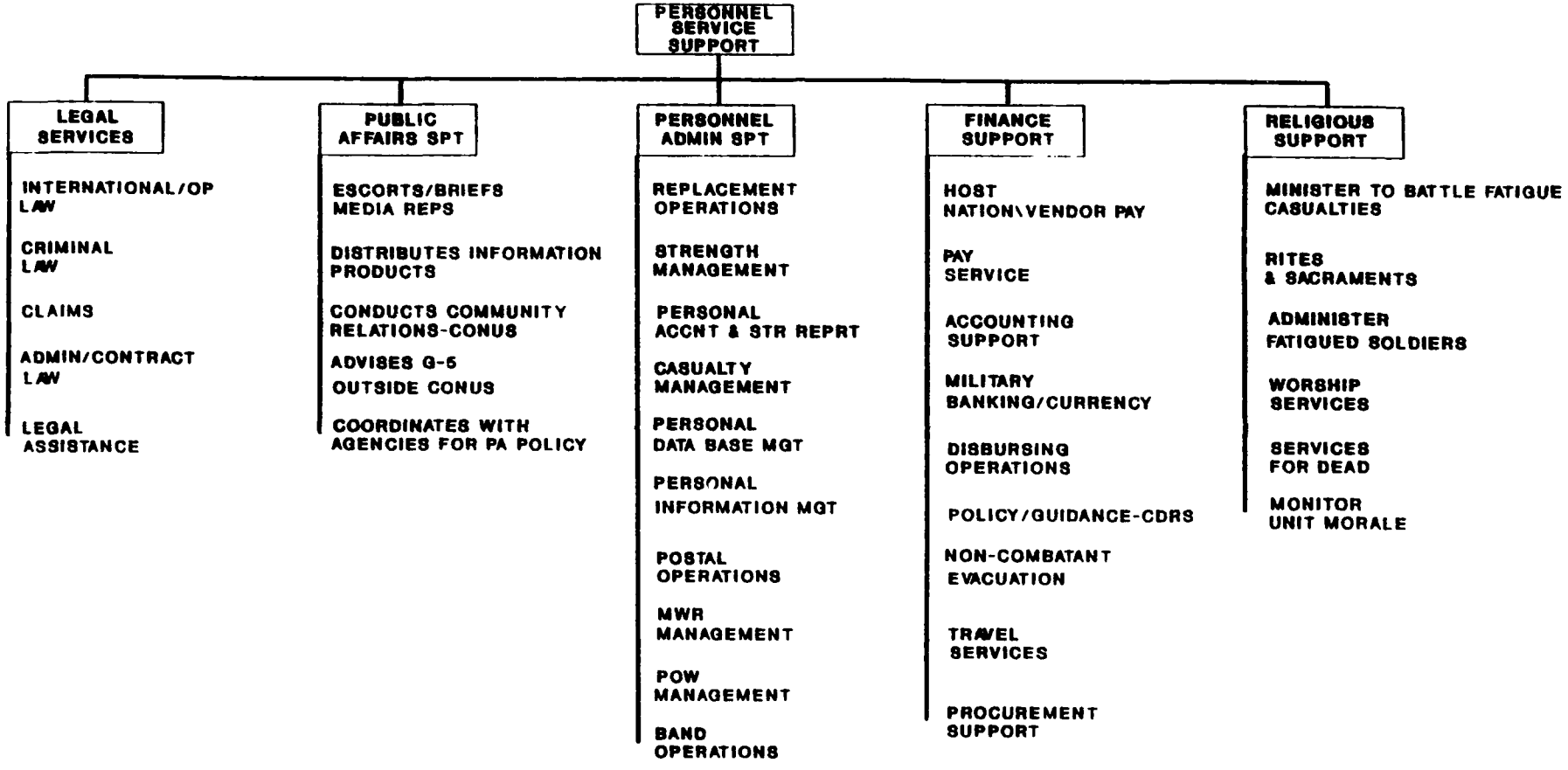
b. Sustaining the force is the maintenance and support of weapons systems and their operations to provide maximum combat power and consists of personnel services support (PSS); health services support; and supply, maintenance, field services, and transportation. PSS is the management of all personnel related matters.

c. To provide the reader with an understanding of PSS, its five functional areas and their major components are now discussed. Figure 1 depicts these functional areas and their major components.

2. PERSONNEL ADMINISTRATION. The most significant elements of the Personnel Administration system consist of critical interconnected military functions. This connectivity is understood best by listing these functions in a hierarchy, as depicted in Figure 2, with the most important function on the top. Every level of the hierarchy is dependent upon the preceding levels for its source of critical personnel information. A brief description of each critical military function follows.

a. The primary goal of replacement operations is to plan for and coordinate the support and delivery of replacements. This system also serves as the conduit for returns-to-duty (RTDs), which include hospital returnees and battlefield stragglers. Replacement operation support includes processing, transportation, logistical support, issuance of orders, and personnel accounting. Successful replacement operations depend heavily on the strength management function to provide the information as to where replacements should be delivered.

b. Through strength management, the personnel system estimates both actual and projected organizational "combat power". Based on this assessment and the commander's plan for future operations, individual soldiers, weapon crews, and small units are assigned to the battlefield to sustain combat power.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RELIGIOUS SUPPORT
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RITES & SACRAMENTS
ADMINISTER FATIGUED SOLDIERS
WORSHIP SERVICES
SERVICES FOR DEAD
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Figure 1
5

# INTERCONNECTED MILITARY PERSONNEL FUNCTIONS ON THE AIRLAND BATTLEFIELD

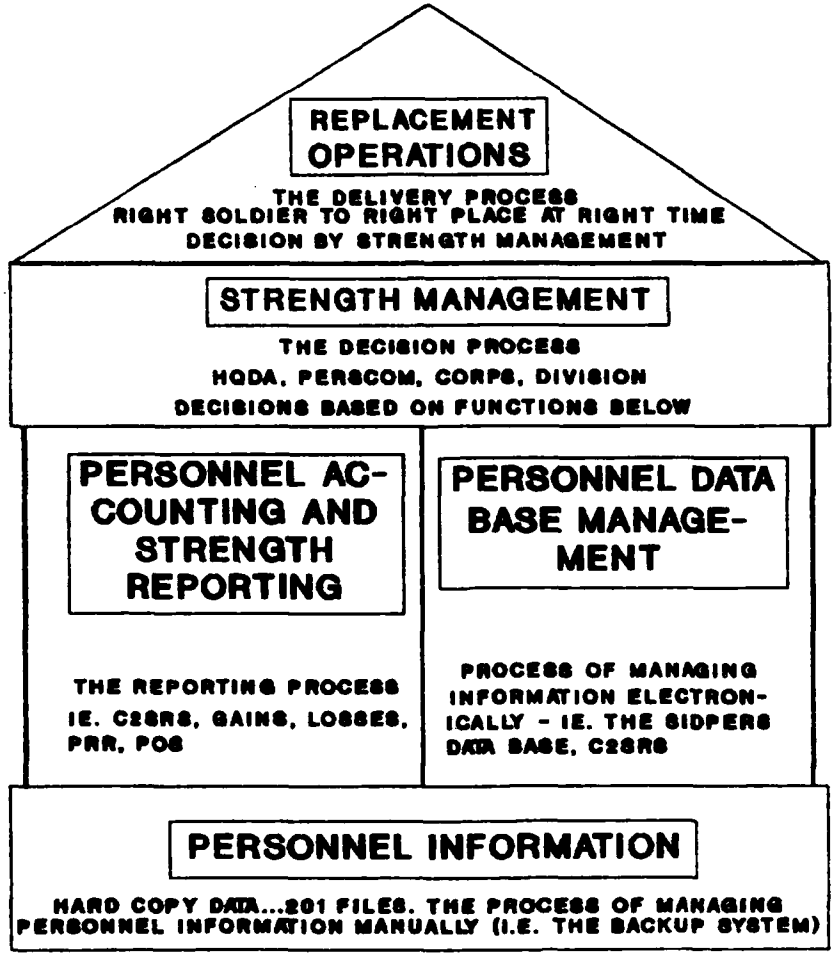



Figure 2

c. The strength management function depends entirely upon the personnel accounting and strength reporting function for the information needed to support the current battle. To support the future battle, the strength management function requires information from the data base management function.

d. Personnel accounting and strength reporting (PASR) is the system for accounting for soldiers on the modern battlefield and reporting their status. This information provides the foundation for many critical battlefield decisions. PASR is divided into two separate accounting systems; deliberate and hasty. Hasty strength reporting is accomplished literally "in the heat of battle" and is designed to provide information only on aggregated numbers of casualties. Alternatively, deliberate personnel accounting concerns "by name" information collection. A primary function of PASR is to reconcile the information obtained in the deliberate and hasty reports, as battlefield conditions provide the opportunity. The PASR operates a command and control strength reporting system (C2SRS) to manage the personnel combat power of the tactical force.

e. Casualty management coordinates the personnel and logistical processes at all levels in the casualty management process. The casualty management function also includes the subfunction of casualty operations. Casualty operations records, reports, and accounts for casualties in an expeditious manner. It notifies and assists the next of kin of casualties, and it supports the PASR function. This function depends upon postal operations to dispose of personal mail of soldiers who become casualties, and on the PASR for the location of evacuated soldiers.

f. The personnel data base management system consolidates all personnel information, both current and projected, for soldiers on the battlefield. This data base is called SIDPERS and is used as the basis for command decisions and projected battlefield requirements.

g. The personnel information management function provides a manual (back-up) record of critical information to support battlefield decisions. Information utilized in this function includes soldiers' grades, numbers, MOSs, and physical profile data.

h. The postal system operates a network to move, deliver, and collect personal and official mail in the combat environment. The Army also uses it to deliver critical spare parts and medical supplies. The postal system provides an alternative delivery system for personnel information on the battlefield. The postal system depends upon the PASR function for locations of soldiers on the battlefield and on the casualty management function for the status of casualties.

i. Due to the nature of the personnel system on the battlefield, success of this system is dependent upon each of the various personnel units (nodes) which comprise the system (network). A breakdown of a key node in the network will cause the system to degenerate. Degeneration of the personnel system could result in an incorrect assessment of a unit's fighting capability or the critical delivery of replacements to the wrong organization. With the tremendous numerical advantages in personnel and equipment enjoyed by our adversaries, the U.S. Army can not afford to make these critical errors.

3. FINANCE SUPPORT. A common misperception is that military pay is the primary function of finance units in the Airland battle. However, with the tremendous demands that will be placed on the US transportation network during mobilization, a large percentage of the finance units' wartime efforts will be directed toward satisfying the logistical shortfalls inherent in the next war. This support to the logistical system is considered absolutely critical. The finance support of the procurement process is divided into two primary areas; contract operations and commercial vendor services operations (imprest fund operations).

a. Contract operations are conducted at corps level by the Finance Group (FG) and at the theater by the Theater Finance Command (TFC). These contracts may include such items as laundry operations, bath operations, construction materials, Class 1 supplements, supply parts, maintenance, and transportation. Additionally, commercial vendor services (CVS) are for the direct daily needs of the force which can not be satisfied by the standard support systems. CVS are cash unforeseen disbursements from imprest funds and are used for such items as pay for day laborers, solatium (grievance) payments, and Class I (e.g., food) supplements and construction materials not otherwise on contract.

b. In support of the procurement process and other battlefield functions, the Finance Corps also provides banking and currency support functions as outlined in the principles of service and standards of support in reference 10. Banking and currency support functions include the responsibility for supplying US currency, foreign currencies, US Treasury checks, foreign military script, and military payment certificates to US forces in the theater. These payments to US soldiers are on an emergency basis (and limited to $100 per month per soldier) only for the first 90 days of combat, with regular military pay support scheduled to occur during combat stand downs and/or after the first 90 days of combat.

c. Other miscellaneous functions provided by finance units in wartime include essential pay support for DA civilian workforce, essential travel support, non-US pay support, financial advice and guidance, and liaison support (is a TDA function) for accounting operations.

4. CHAPLAIN SUPPORT. The primary mission of the chaplain is providing pastoral ministry to soldiers on the modern battlefield. To soldiers experiencing uncertainty, shock, chaos, isolation, stress, and fear of death, the chaplain offers spiritual comfort, moral support, and encouragement. In the words of George C. Marshall, General of the Army, "The soldier's heart, the soldier's spirit, the soldier's soul, are everything. Unless the soldier's soul sustains him he cannot be relied on and will fail himself and his commander and his country in the end." To sustain the soldier's soul, the chaplaincy, primarily through unit ministry teams (UMT), conducts services, administers rites, visits, comforts, and encourages soldiers.

a. The mission of the UMT can be grouped into three categories; nurture the living, care for the casualties, and honor the dead. The importance of the UMT and its mission area responsibilities can not be overemphasized. By nurturing the living, the UMT brings hope in the midst of severe hardship. By caring for casualties, the UMT contributes directly to the total well-being of the soldier, which may be essential to the soldier's quick return to health. Honoring the dead has always been a deep seeded tradition of our nation. William Gladstone, Former Prime Minister of Great Britian, once said, "Show me the manner in which a nation or a community cares for its dead, and I will measure exactly the sympathies of its people, their respect for the laws of the land, and their loyalty to the high ideals."

b. Under the Airland Battle (ALB) operational concept, the doctrinal concept of Forward Thrust places religious support forward to the smallest, most advanced elements of the battle-field. UMTs move frequently among the forward elements, ministering to soldiers before, during, and after contact with the enemy. Additionally, chaplains and chaplain's assistants provide religious support to soldiers located in the rear area.

c. Although the religious support mission of the chaplains is widely known, several aspects of this mission are not. For example, the chaplain/UMT is actively involved with the unit drug and alcohol abuse program and involved in alleviating the problems caused by racism and immorality. Furthermore, the chaplains are involved in various personnel actions, including discharges, Article 15's, conscientious objectors, compassionate reassignments, and courts-martial. They also fulfill the important function of communicating with soldiers' families in the event of injury or death.

5. PUBLIC AFFAIRS. The primary mission of Army public affairs personnel is to provide for the free flow of information and news to and from commanders and staff, soldiers and other internal audiences, and to the American people through the Congress, the news media, and personal contact. From this mission statement, public affairs is divided into three functional areas; Command Information (CI), Public Information (PI), and Community Relations (CR). During combat the Community Relations function is performed in OCONUS theaters of operation and communications zones by the G-5 (Civil Affairs Officer). Within CONUS, Alaska, and Hawaii, community relations is always performed by the Public Affairs Officer (PAO).

a. CI is the acquisition, analysis, production, and dissemination of information to soldiers, DoD and DA civilians, and their respective family members. It is a fundamental function of command. By keeping soldiers informed about their purpose on the battlefield and the expectations of them from both the command and the nation, CI has historically proven to be a combat multiplier. This in fact was shown as recently as the US troop deployment in Honduras. Reports from these soldiers reinforced the need for news coverage from home.

b. PI is the acquisition and dissemination of information directed toward national and international audiences through the civilian news media. This function includes coordinating news media coverage of operations; responding to news media queries; releasing news stories, photos and tapes; and supervising the Hometown Release Program. The importance of this function to the sustainment of the national will to fight and to provide personnel and material resources can not be overstated.

c. In fulfilling the PI function, the PAO exercises an important role, that of avoiding the release of classified information. The PAO must constantly weigh the commander's responsibility of "maximum disclosure with minimum delay" to news media inquiries with the release of classified information.

d. Public affairs personnel are organic to EAC, corps, corps support command, division, and separate brigade staffs. To support the PAO at these various organizational levels, there are four types of Public Affairs Units; the Public Affairs Team, the Mobile Public Affairs Detachment, the Press Camp Headquarters, and the Broadcast Public Affairs Detachment.

e. Public affairs personnel will operate across the battlefield and will be found down to squad level in providing command (internal) information support and in escorting news media representatives.

6. LEGAL SERVICES. There are five functional areas, or legal disciplines, in which judge advocates provide legal services on the AirLand Battlefield: administrative/contract law, claims, criminal law, international/operational law, and legal assistance. Professional advice is provided to the commander for command and control matters, disciplinary matters, and disposition of the commander's executive function, to the command group and staff for sustainment of the organization and sustainment of operations, and to the soldier for personal matters that affect duty performance and provide for the welfare of the family.

a. Administrative/contract law. The administrative law function includes advice to commanders and staffs in the interpretation of law, regulation, and policy related to the operation of the organization. Included in this function are the legal relationships between and with nonmilitary organizations and governments. Contract law covers the statutory and regulatory guidance in all phases of the acquisition process, funding military operations, foreign military sales, and acquisition of goods and services for the Army.

b. Claims. The claims function covers the receipt, review, investigation,and adjudication of claims against the United States and for the United States. Claims cognizable under statute, international agreement, or custom are approved for payment by judge advocates. Claims cognizable under Article 139, UCMJ are forwarded to the Commander authorized to approve or disapprove these claims. The purpose of the claims function is to protect the command and soldier against unwarranted suit and interference from the performance of duties as a result of the soldier's assigned duties.

c. Criminal law. The criminal law function covers the administration of the Uniform Code of Military Justice and violations of another penal code that impact on morale, welfare, and good order and discipline of the command. The staff judge advocate communicates directly with the commander. Judge advocates advise subordinate commanders and, in their capacity as a defense counsel, advise soldiers of the rights provided under the Constitution and the UCMJ. Military judges preside at trial by courts-martial and provide magisterial services concerning confinement and authorities to search persons and possessions. Judge advocates provide required training under Article 137, UCMJ.

d. International/operational law. The international/ operational law function provides to the commander and the command group and staff the impact of U.S. policy, established international protocols agreed to or not agreed to by allied forces, potential hostile forces, and countries in the contingency area. This includes required training during deployment under AR 350-216.

e. Legal assistance. This function provides for professional legal advice to soldiers, their family members, and other eligible personnel, for their personal legal problems. This advice includes

appropriate relief as provided under the Soldier's and Sailors' Civil Relief Act as a result of military duties. Commanders are provided advice to assist soldiers in the disposition of paternity, support, and indebtedness claims.

f. Legal support. Legal specialists at battalions, brigades, and equivalent organization provide legal support to the commander and the organization.

7. PSS BATTLEFIELD LOCATIONS. Although PSS units are normally deployed only as far forward as the Corps Support Group area (sometimes the division rear area), PSS functions are performed at various organizational levels on the Airland Battlefield. For example, chaplain activities are performed by UMT (unit ministry teams), which are assigned to each battalion. However, in providing religious services, UMTs are found as far forward as company level. Separate brigade is the lowest level of assignment, but PA personnel will go forward and will be found at company, platoon and squad levels in providing command (internal) information support, and in escorting news media representatives to at least forward company level.

a. Three of the PSS functions, chaplain activities, public affairs, and legal services, are represented on the commander's personal staff. The commander of a separate brigade, division, corps, and theater uses these officers to ensure that he and his command operate lawfully; that the rights of soldiers are protected; that the morale and welfare of soldiers is considered; and that the command fulfills its obligations to inform internal and external audiences. As part of the commander's personal staff, these staff officers are located on the battlefield in close proximity to the commander.

b. The PSS functions of personnel management, finance services, and legal services begin with the battalion Personnel Administration Center (PAC). The PAC is organizationally subdivided into the PAC Main and the S-1/PAC Forward. The S-1/PAC Forward is located in the battalion area and supports the battalion commander in all personnel related matters. The PAC Main is located in the brigade support area and is designed to be a "one stop" servicing center for administrative support of soldiers on the battlefield. The services provided by the PAC are shown in Figure 3.

c. The Personnel Service Company (PSC) is the basic direct military personnel support unit on the battlefield. It is structured to provide direct military personnel support to all Army units within its designated area of support. It operates 24 hours-a-day, using two shifts. The PSC manages combat-essential personnel information on the battlefield and provides direct military personnel support to strength managers and commanders on the battlefield. It is located in the Corps Support Group Area, the Communications Zone (COMMZ), or in the division rear area.

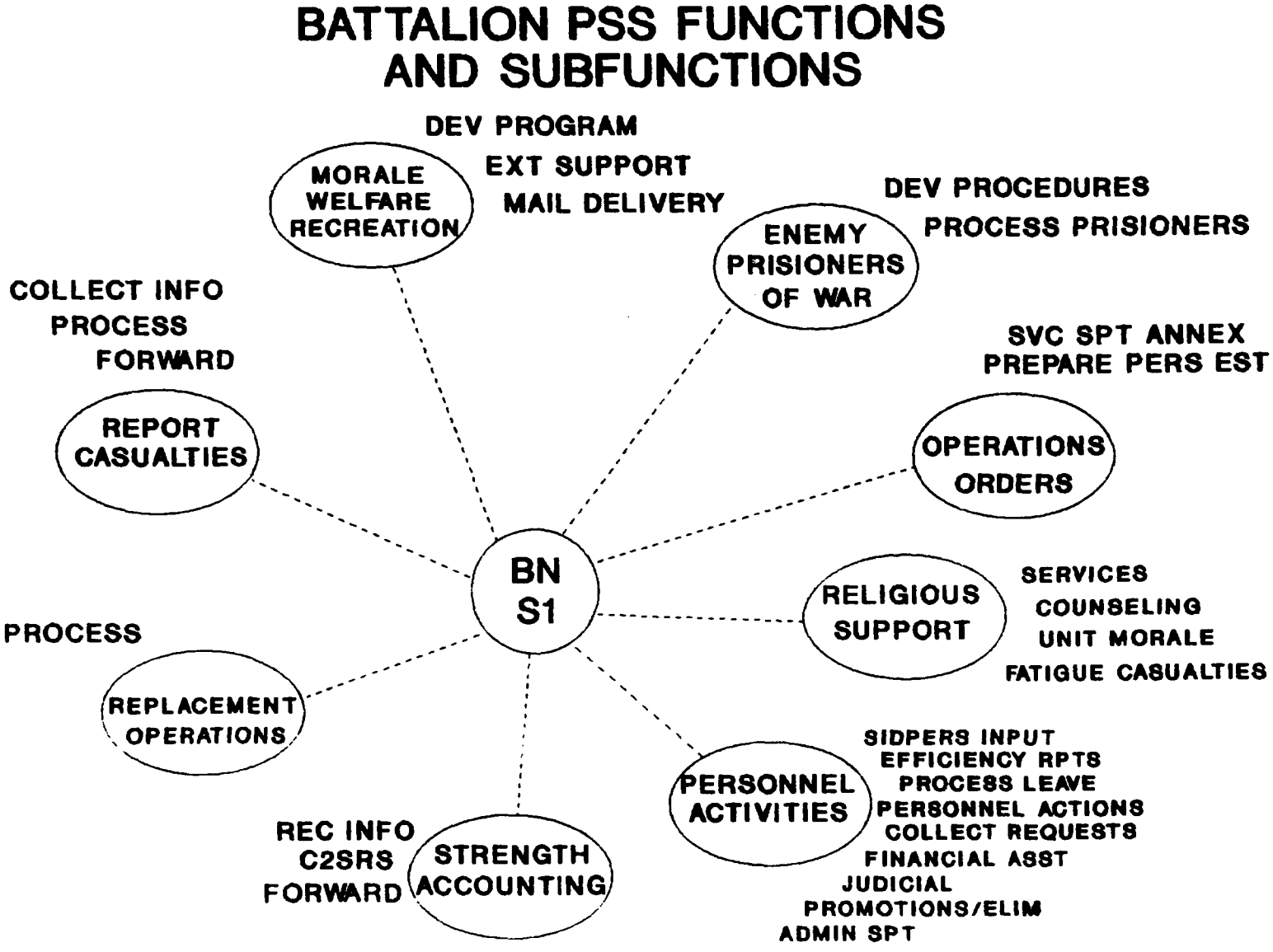

BATTALION PSS FUNCTIONS
AND SUBFUNCTIONS
DEV PROGRAM
EXT SUPPORT
MAIL DELIVERY
MORALE
WELFARE
RECREATION
DEV PROCEDURES
PROCESS PRISIONERS
ENEMY
PRISIONERS
OF WAR
COLLECT INFO
PROCESS
FORWARD
SVC SPT ANNEX
PREPARE PERS EST
REPORT
CASUALTIES
OPERATIONS
ORDERS
BN
S1
RELIGIOUS
SUPPORT
SERVICES
COUNSELING
UNIT MORALE
FATIGUE CASUALTIES
PROCESS
REPLACEMENT
OPERATIONS
SIDPERS INPUT
EFFICIENCY RPTS
PROCESS LEAVE
PERSONNEL ACTIONS
COLLECT REQUESTS
FINANCIAL ASST
JUDICIAL
PROMOTIONS/ELIM
ADMIN SPT
PERSONNEL
ACTIVITIES
REC INFO
C2SRS
FORWARD
STRENGTH
ACCOUNTING

Figure 3

d. The Finance Service Command (FSC) is the basic finance support unit on the battlefield. FSC battlefield locations are similar to those of the PSC.

e. Figure 4 depicts the PSS flow of information, mail, and replacements on the battlefield from the battalion through echelons above corps (EAC).

8. PSS THREAT. Threat strategy plans for deep penetration into the rear area to disrupt lines of communication, logistical support, command and control, reinforcement of frontline/enveloped units, and to negate the nuclear delivery systems capability. Although PSS units themselves may not be targets, they will frequently collocate with units that are priority targets. A more detailed discussion of the rear area threat is at Appendix B.

9. CHAPTER SUMMARY. In this chapter we outlined the important functions which PSS units perform on the battlefield. It is clear that PSS functions directly support both the timely delivery of qualified replacements on the battlefield and the sustenance of the soldiers' will to fight. While the threat does not directly target our PSS units, many times PSS units will co-locate with units which are prime threat targets. Now that the reader is familiar with PSS and its contribution to the force, we now turn to a discussion of how we selected the models which were examined in this study.

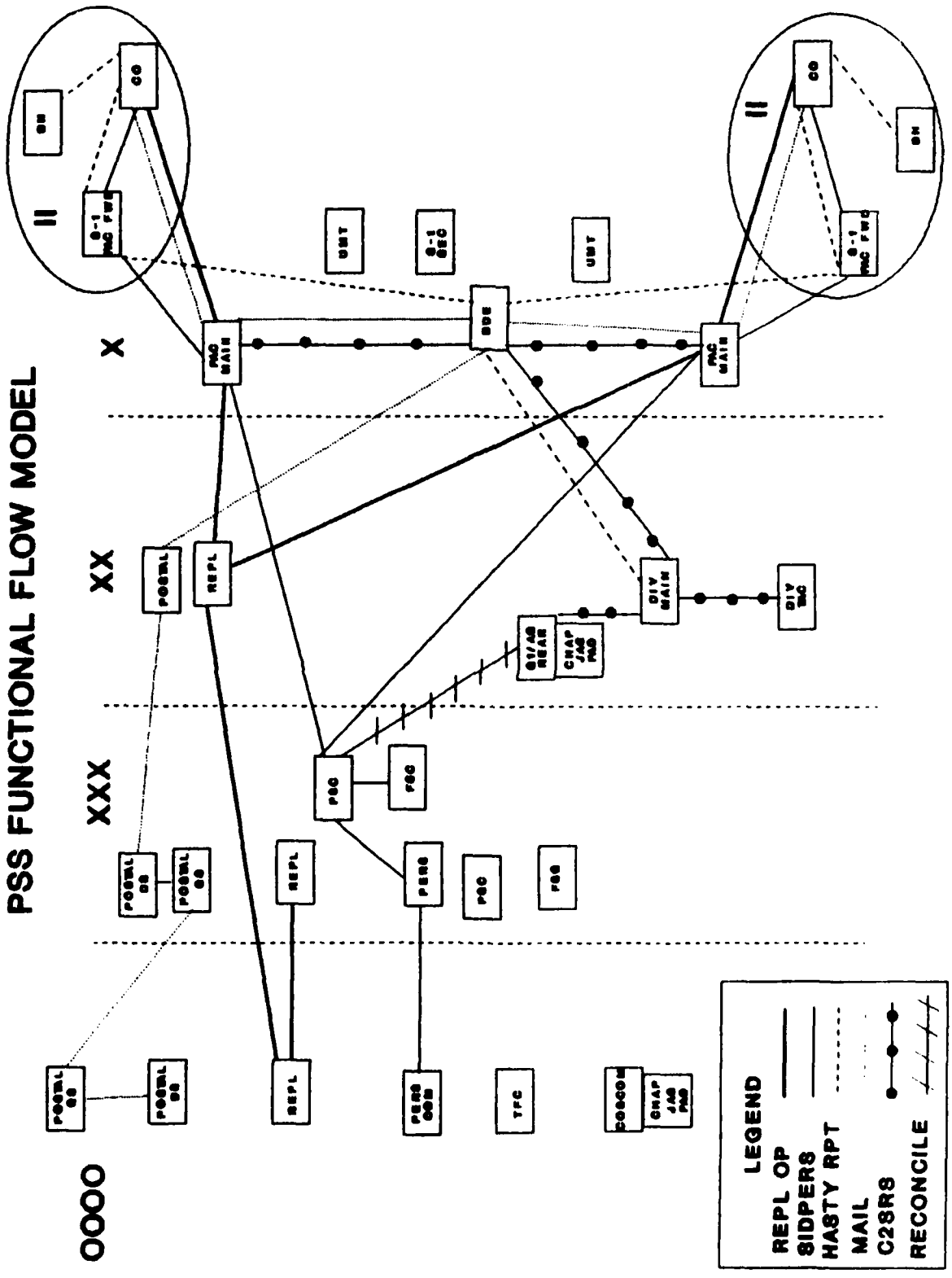

PSS FUNCTIONAL FLOW MODEL
X
XX
XXX
0000
LEGEND
REPL OP
SIDPERS
HASTY RPT
MAIL
C2SRS
RECONCILE

Figure 4

## CHAPTER 3

## LITERATURE REVIEW AND MODEL SELECTION

### 1. LITERATURE SEARCH METHODOLOGY

a. With over 279 models in the Army inventory, the study team sought to adequately review the maximum number of models representing PSS functions subject to the .85 PSY manpower limitation for the entire study. In accordance with the scope of the study as stated in the study plan (Appendix C), "Model selection will be based on importance of the models and the extent to which PSS functions influence their outcomes". The plan for accomplishing this initial search was a sequential three step process;

(1) Review the Catalog of Simulation Models and Wargames Used for Unit and Leadership Training, dated January 1987.

(2) Review the Inventory of TRADOC Models, dated January 1988.

(3) Visit the Army organizations that currently use models to support Army decision makers.

b. We reviewed all models (under 1 and 2 above) which proclaimed to play CSS. This review included phone interviews and the collection and review of model documentation/executive summaries. The study team quickly ascertained that in Army combat modeling, CSS is "logistics", and that in the very few instances that PSS is represented, PSS is "replacement" of personnel.

c. Site visits were conducted with key personnel in the organizations shown in Figure 5 to determine the important models being used in the Army. A complete list of key individuals contacted is at Appendix D.

| STUDY TEAM SITE VISITS |
| --- |
| CONCEPTS ANALYSIS AGENCY |
| TOTAL ARMY PERSONNEL COMMAND |
| TRADOC ANALYSIS COMMAND - FORT LEAVENWORTH |
| COMBINED ARMS TRAINING AGENCY |
| TRADOC ANALYSIS COMMAND - WHITE SANDS |
| TRADOC ANALYSIS COMMAND - MONTEREY |
| TRADOC ANALYSIS COMMAND - FT LEE (LOG MEETING) |
| NAVAL POSTGRADUATE SCHOOL |
| GEORGIA INSTITUTE OF TECHNOLOGY |

Figure 5

This review process leads to the study team's conclusion of which training and analytical models fell within the scope of this study. The selected models are shown in Figure 6. In making this determination, an extremely important selection criteria was "don't try to make the model do something it wasn't designed to do".

| SELECTED MODELS |
| --- |
| CONCEPTS ANALYSIS AGENCY MODELS |
| SIMNET |
| ARTBASS |
| COMBAT-SIM |
| PSS/BSS |
| *PERSCOM MODELS* |
| JESS |
| JANUS-T |
| VIC |

Figure 6

## 2. DESCRIPTION OF SELECTED MODELS

a. Department of the Army Models. Definitions of key modeling terms used in this section is included in Appendix H.

(1) CAA MODELS

(a) The Office of the Secretary of Defense is required to submit annually, in conjunction with the Program Objective Memorandum (POM), military manpower data for the Army Wartime Manpower Planning System (WARMAPS). The Concept Analysis Agency conducts major force structure studies in support of the WARMAPS process. WARMAPS depicts time-phased personnel requirements, supply, and shortfalls for a specific theater within the Defense Guidance (DG) scenario. In general, the CAA models primarily incorporate CSS constraints into the outcome of the warfight.

(b) The analytic support required for the CAA mission is immense. The total process now includes about ten models and hundreds of thousands of data items. Figure 7 depicts the major CAA models and their interrelationships. A brief discussion of CAA modeling and processes follow. Most of the model descriptions were extracted from the "Report of the Model Input Data Process Subcommittee of the Casualty Estimation Steering Committee". This discussion is not intended to give a "stand-alone" description of the models. Virtually all of them are adequately described in their individual reference manuals. The intent of the discussion is to provide a general understanding of the CAA modeling process.

# U.S. ARMY CASUALTY ESTIMATION PROCESS

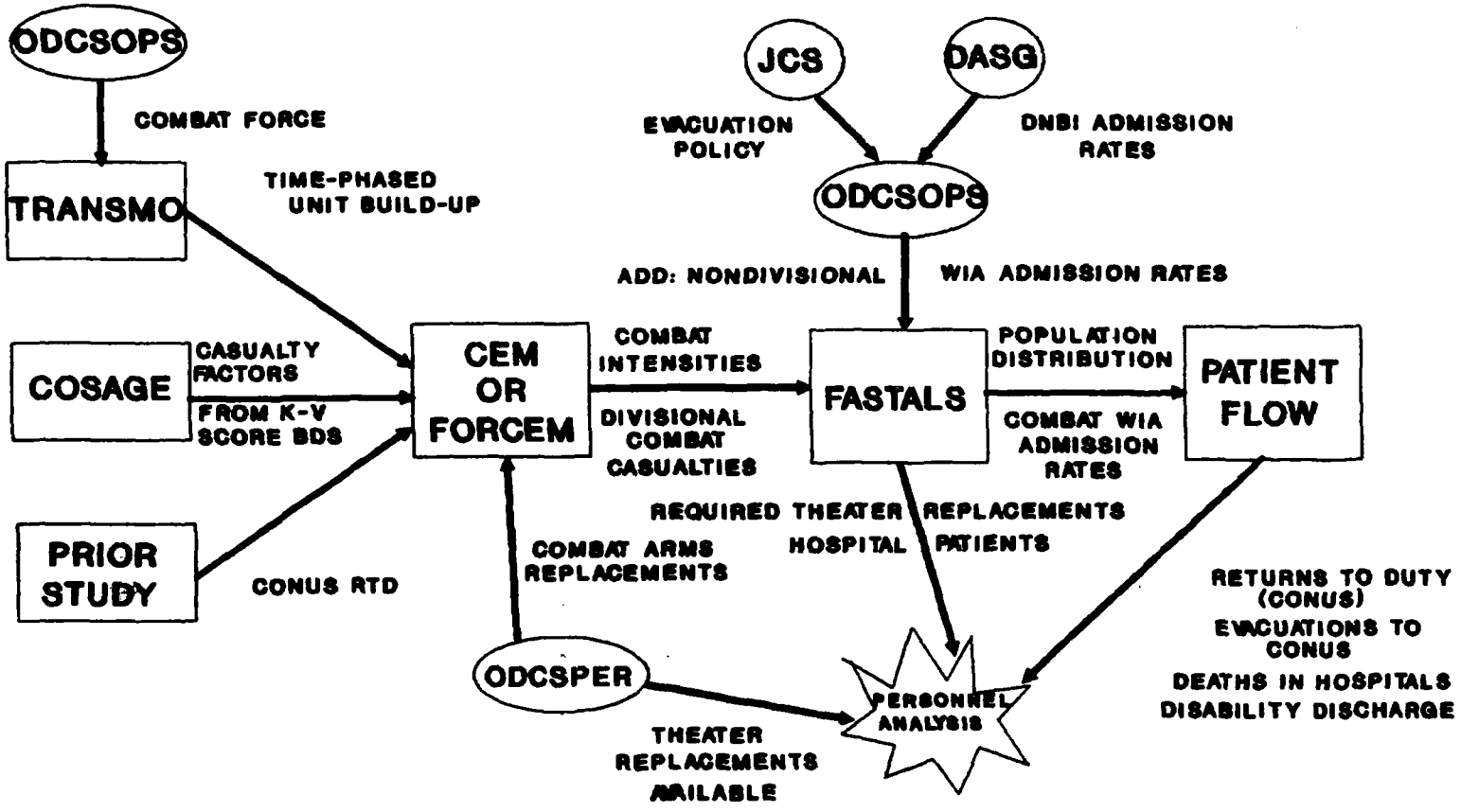



Figure 7

(c) Transportation Model (TRANSMO). The critical function this model performs in the CAA modeling process is in the time estimation of the build-up of the required theater force structure. The red force air threat imposes losses on the blue force airlift assets. TRANSMO calculates the time of arrival of troops and cargo to the theater over time.

(d) Combat Sample Generator (COSAGE). This model simulates 24 hours of combat between a blue division and an appropriate sized red force. The model allows blue force representation in the attack, defense, delay, and static posture. The COSAGE function in the CAA modeling process is to provide the theater model high-resolution weapon kill and ammunition usage rates. Other models contribute to the final COSAGE output and include the Tactical Air (TACAIR) and the Mixed Attack Helicopter Model (MATT-HELM).

(e) Concepts Evaluation Model (CEM). CEM simulates combat between friendly brigades and enemy divisions on each side of the FEBA. It determines what blue units engage what red units each day, and with what weapons, in what postures, and with what ammunition. It tracks repair of certain types of damaged vehicles and the treatment of personnel to see how many can return to their units, and when. The CEM model does not represent any CSS units.

(f) Force Evaluation Model (FORCEM). As depicted in Figure 7, the lead model in the CAA family of models is CEM or FORCEM. During this study investigation, FORCEM was inoperable. The model was under total review. When FORCEM is operational, it has several advantages over CEM. Enhancements include full depth of theater, command and control decisions at each echelon, full range of air interactions, and explicitly modeled CSS effects (not all) to the division level.

(g) Force Analysis Simulation of Theater Administrative and Logistics Support (FASTALS). The purpose of the FASTALS model is to compute administrative and logistical workloads which generate the theater level support force structure requirements necessary to round out a combat force in a postulated confrontation. FASTALS supplements the casualty estimation process by calculating losses in echelons above division and non-combat losses in the division area. FASTALS applies historical wounded-in-action (WIA) and disease non battle injury (DNBI) rates. FASTALS combines these estimates with the hospital admissions from CEM (or FORCEM) to estimate RTDs and those remaining in hospitals.

(h) Patient Flow Model (PFM). The patient flow model determines the disposition of casualties among treatment facilities and the results of that treatment; returned to duty, died in hospital, evacuated, and hospitalized. Although CEM and FASTALS

have medical modules, PFM is needed to determine supportable evacuation policies. The evacuation policy is the number of days of hospitalization estimated to be required by a patient beyond which a decision would be made to evacuate the patient out of theater to CONUS.

(i) Casualty Stratification Model (CSM). CSM uses the total casualty figures generated by CEM and FASTALS and determines who suffered the casualties. Based on the density of the force, casualties are stratified by officer, NCO, and enlisted. These groups are further divided by the vulnerability of each branch or functional area. Finally, casualties are then distributed by MOS within each functional area based upon battlefield location, susceptibility of that location to enemy fire, and particular MOS job risk factors.

(2) US Total Army Personnel Support Command (PERSCOM) - U.S. Army Mobilization Manpower Planning System (MOBMAN)

(a) In addition to the aggregated data required for submission to OSD's WARMAPS system, PERSCOM uses MOBMAN to operate at a level of detail (MOS/AOC) that reveals serious shortages or surpluses which are often masked by the aggregate data.

(b) MOBMAN is based on the Defense Guidance (DG) scenario and all the data is time phased in 10 day/30 day increments. MOBMAN can analyze MOS requirements for all levels of mobilization (except total) with variable force structures. The results of this process are used for the Mobilization Army Program for Individual Training (MOBARPRINT) and for establishing Army Manpower Policy.

b. TRADOC MODELS. The study team extracted the following model descriptions (except PSS/BSS) from the Inventory of TRADOC Models, dated 8 April 1988, or the Catalog of Simulations Models and Wargames Used for Unit and Leader Training, dated January 1987.

(1) VECTOR-IN-COMMAND (VIC)

(a) VIC is a computerized, analytical, mid-intensity model developed for use in estimating net assessments, performing force deployment studies, and generating information for performing trade-offs among weapon systems. The outcome of force interactions is determined in terms of the ground gained or lost and the attritions of personnel and weapons systems.

(b) The VIC Model is a two-sided, deterministic simulation of integrated land and air combat. The level of aggregation is the maneuver battalion or its equivalent. It employs forces up to the level of a US Corps facing an enemy of strength determined by scenario and theater in which the simulation takes place. VIC is an event-stepped model which also employs time

steps for scheduling some actions. It uses modified differential equations for combat outcomes based upon the Vector-2 Model. Tactical decisions and force employments are determined by tactical decision tables supplied by the user to provide flexibility in controlling model processes. Each side may employ maneuver unit weapon systems and weapons to tactical aircraft, as well as artillery, mines, helicopters, air defense systems, and other means of conducting combat at the US Corps level.

(c) The primary purpose of the VIC CSS module is to incorporate CSS constraints into the outcome of the warfight. This module models the replacement system by using hospitals as RCs. All new replacements and RTDs are "issued" by the hospitals. VIC-CSS associates personnel with weapons systems. For a more detailed discussion of VIC-CSS see Chapter 5.

(2) JANUS(T)

(a) JANUS(T) is a computerized, interactive, ground combat simulation model using dynamic graphics representation. The JANUS(T) code provides a neutral battlefield environment with detailed treatment of conventional military systems and digitized terrain. Players, in a competitive near real time simulated battle, make tactical and system employment decisions using interactive graphics based on continuous presentation of map-like display and on-call status reports. The model is used to evaluate the interaction of the principal maneuver elements under conventional/chemical conditions. The model provides insights useful in analysis or training.

(b) JANUS(T) is a two-sided, stochastic, ground force model designed for conflict at up to BLUE brigade versus RED division force levels. The model focuses on individual fighting system engagements and assessments with aggregation capability up to company size elements. The JANUS(T) code is event-sequenced, runs in near real time, and uses probabilistic solution techniques.

(3) JESS - JOINT EXERCISE SUPPORT SYSTEM

(a) JESS is a computerized battle simulation system. It is designed to drive a Joint Readiness Exercise (JRX), which is a joint task force command post exercise (CPX). The heart of the system is an interactive computer model of field operations. Simulated battle results from JESS are used in real time to provide realistic data to train commanders and their staffs in JRXs. The system replaces manual battle boards used previously.

(b) A CPX using JESS includes three interacting groups: Blue force controllers, command post personnel undergoing training, and opposing force (OPFOR) controllers. The Blue force controllers operate the Blue workstations, interfacing with the

combat simulation via the workstation input devices, printers and graphics. The controllers also interface with the command post via organic communications. The controllers act as subordinate unit commanders, translate (when necessary) and enter command post orders into the combat simulation, and interpret and communicate combat simulation outcomes back to the command post. The ability of the controller to portray a combat environment through his reports and responses to orders provides a key element in the realism perceived by the command post.

(c) The command post units staff their respective tactical operations centers, execute operations plans, and respond to contingencies by communicating with Blue force controllers, who represent their subordinate units.

(d) Under direction of the Senior Controller, the OPFOR controllers also interact with the combat simulation. They maneuver and control Red forces to provide active opposition Blue forces in a way that contributes to the training objectives of the exercise.

(e) The entire exercise is coordinated by the Senior Controller, who monitors and controls the flow of battle so that exercise objectives are met. He is supported by technical controllers who have direct access to the combat simulation software that allows them a measure of intervention over simulation outcomes. Further control over the simulation depends on controller discipline and role-playing ability.

(4) Army Training Battle System (ARTBASS)

(a) Through use of a real-time battle simulation and a computer graphics display system, a battalion commander and staff may be exercised in the command and control realities that will be encountered on the modern integrated battlefield. ARTBASS permits a battalion commander to observe the units in a tactical situation. It allows for alternate courses of action to be exercised and evaluated for effectiveness.

(b) Lanchester theory is used to drive weapons effects and unit attrition, expected values used to determine unit movement and equipment performance curve fit for determining levels of suppression, probability theory in line-of-sight, maintenance functions, etc.

(5) Combat-Simulator (CBT-SIM)

(a) CBT-SIM provides battalion and brigade commanders and their staffs an environment to train in the execution of Airland Battle Doctrine at the tactical level of war.

(b) CBT-SIM is a system of computers networked together to provide the driver for CPX or command and staff training. The simulation operates as a two-sided, free play, real-time training environment.

(6) Simulator-Network (SIMNET)

(a) SIMNET is an advanced research project aimed at developing the DoD technology base for large scale networks of interactive combat simulators. When completed, this technology will dramatically increase the opportunity for units to practice collective, combined arms, and joint war fighting skills in fully crewed, fully interactive, high quality simulators which cost 1/100th of today's simulators and which can be operated at a fraction of the O&S costs of a combat vehicle used for training.

(b) While simulators have been shown to be effective for training selected military skills, it is often impossible to build enough to fully train the force because of high cost. Further, because of the absence of a technology to network simulators, they have not been a factor in collective, combined arms or joint training.

(c) SIMNET addresses both of these problems. Its high risk research is aimed at four high payoff areas which are achievable because of recent breakthroughs in several core techniques. These technologies are combined in SIMNET to allow force-on-force, man-in-the-loop, free play combat exercises in simulation which require the same troop leading and command and control skills as in field exercises but which can be run on any terrain location in the world modeled in the simulation. The focus is to give all members of the combat team a massive dose of practice, from platoon/unit to the battalion/task force levels, and possibly higher.

(d) SIMNET components have been designed to be self contained and modular. The lowest common denominator is the single simulator which can be operated completely by itself or be networked with up to 82 more simulators.

(7) Personnel Service Support - Battlefield Simulation System (PSS-BSS)

(a) The PSS-BSS is designed to provide the necessary inputs and outputs (I/O) to simulate PSS actions (using the TRADOC Common Teaching Scenario (TCTS)) and activities which are expected to occur at levels above and below the level being simulated (BN through corps). The PSS activities modeled are the three critical battlefield functions of Strength Accounting, Casualty Reporting, and Replacement Operations.

(b) PSS-BSS has the capability to replicate the 21 day war fought in the simulation. Additionally, the simulation has the ability to vary some events (e.g., casualties or replacements) within preset limits to provide a different range of priority/ management decisions.

(c) PSS-BSS can be run varying the simulated-to-real time ratio as desired. For example, 1 day of real time may equal [illegible] days of simulated time in one exercise. However, for another exercise, 1 day of real time may equal 4 days of simulated time.

(d) The model has a limited capability to compare the responses of exercising staffs with doctrinally correct responses. Consequently, it can be used as a valuable research tool in determining and evaluating proposed changes in procedures, systems, doctrine, and/or organizational change in the Army.

3. CHAPTER SUMMARY. In this chapter we outlined our methodology for selecting the models examined in this study. We realize that there may be other models which perhaps we should have included. However, due to our very limited manpower resources for the entire study (.85 PSY), we feel the methodology used to derive the subset (of the 279 potential models) of models which we selected for examination in this study, was both efficient and effective. In the next chapter we will discuss PSS applications in our selected Army training models.

# CHAPTER 4

## PSS IN TRAINING MODELS

### 1. Introduction.

The question of which personnel functions to represent in Army training models is dependent upon both the ability of the simulation to accurately portray the function, as well as the contribution this portrayal adds to the realism of the training. From the perspective of the integrating center for personnel related issues, potential functions for inclusion in training models are those performed by the five major areas of PSS; Public Affairs, Chaplaincy, Finance Services, Legal Support, and Personnel Administrative Management. Although Health Services is no longer considered part of PSS and does not fall under the responsibility of SSC, it completes the set of possible functions that could be included in "playing personnel."

### 2. PSS Functions in Training Models.

a. Battalion Level Training Models

(1) Since SIMNET, ARTBASS, and CBT-SIM simulate combat of battalion sized units (or smaller), we should consider including only PSS functions found at this organizational level. Public Affairs officers are found at separate brigade, division, and higher echelons. While the battalion PAC performs limited legal and financial services, these functions would not contribute to training realism. Though Unit Ministry Teams are extremely important in alleviating shock, stress, and fear at the battalion level, it is difficult to test their contribution in these training models. The set of PSS functions (or other functions related to the sustainment of personnel) for possible inclusion into battalion-sized simulations is quickly reduced to Personnel Administrative Management and Health Services Support.

(2) During our site visit to SIMNET facilities at Fort Knox, it was pointed out that medical teams have been used during SIMNET simulations. Soldiers were evacuated from the individual simulators by stretcher and removed to a "MASH" tent outside the facility. Soldiers acting as if they are injured while medics "play doctor" is at best a very minor contribution to training realism.

(3) The final PSS function which could be modeled in these battalion level models is Personnel Administration. Critical Personnel Administration functions include replacement operations, strength management, personnel accounting and strength reporting, casualty management, personnel data base management, personnel

information management, and postal operations. Of these functions, strength management, replacement operations, and personnel accounting and strength reporting are the most important functions of Personnel Administration that could be modeled at battalion level and contribute to effective training.

(4) It is through the strength management function that the personnel system estimates both actual and projected organizational "combat power." Based on this assessment and the commander's plan for future operations, the replacement operations function assigns individual soldiers, weapon crews, and small units to the battlefield to sustain combat power.

(5) The strength management function depends entirely upon the personnel accounting and strength reporting function for the information needed to support the current battle. More specifically, both hasty and deliberate strength reports are needed. A hasty strength report is produced in "the heat of battle" and is designed to provide information on the aggregate numbers of casualties. Alternatively, deliberate personnel accounting concerns "by name" accounting and is used to identify more specifically replacement needs, to provide for timely casualty management, as well as to reflect accurately the combat power of the unit.

b. Corps Training Models. JESS is the only Corps training model which fell within the scope of this study. At Corps level, units from each of the five functional PSS areas are found. Therefore, the question of which training functions to portray in this model depends only on the training realism gained by including the specific PSS function. The study team concluded that the modeling of Chaplaincy, Finance, Public Affairs, and Legal Affairs would not contribute to the realism of JESS training. The only PSS function for representation in JESS is personnel administration, specifically, the strength management function.

3. Strength Management Implementation Plan

a. SIMNET

(1) During the study team's visit (we accompanied the CG, U.S. Army Soldier Support Center (SSC)) to the SIMNET facilities at Fort Knox, the CG expressed a keen interest in incorporating "personnel" into the SIMNET model. He stated, "The next war will be decided by personnel. We have got to play personnel in the model." He then asked, "What will it cost me to play personnel in SIMNET?" Defense Advanced Research Projects Agency (DARPA) representatives responded by saying that it would cost approximately $500,000. The major cost would be to load an Army Materiel Systems Analysis Agency (AMSAA) data base, which would be used to determine the distribution of casualties in a combat vehicle given that a hit occurred, its impact point, type of munitions, and the type of threat weapon system that made the hit.

(2) The SIMNET model presently identifies the weapon system when it is hit by a threat weapon system. What we don't know is, given the hit, what is the distribution of casualties within the tank? The AMSAA data would presumably tell us that at 3000 meters a T-72 frontal hit on an M-1 with a HEAT round would cause the deaths of the driver and tank commander, a head wound to the loader, and no wounds to the gunner. The AMSAA data would also provide a probability of this occurrence (e.g., 40% of the time this happens, 60% of the time it doesn't).

(3) Since SIMNET is a training model and a goal of the SSC is to properly represent personnel functions in the model, our first priority is to play the strength management function. The second priority should be to obtain the most accurate data base. To play strength management, we don't need to know if the hypothetical distribution of casualties outlined above happens 40% or 80% of the time or that the tank driver is killed instead of the tank loader. What we need to realistically play "personnel" is a generated casualty stream which will cause the trainees (commander and his staff) to consider personnel constraints during the training exercise. (If we were analyzing force structure in an analytic model, we would obviously care about the distribution of casualties by MOS and grade.)

(4) When the simulation identifies a tank as being hit, this information becomes known to the game players (e.g., commander, S-1, and S-3). A random number generator, which is found on virtually all computers including the TACCS (Tactical Army Combat Service Support Computer System), could be used to determine which individuals are KIA or WIA (with specific injuries if desired) and the status of the weapon system hit (usable or destroyed). If a TACCS is used at the S-1 player station, it would contain the battle roster of the units in the exercise. Given the data from the random number generation process, we would obtain the name, MOS, grade, and casualty status of hit crews. This information can be used to prepare a hasty and deliberate strength report for the commander and staff. Since, in actual combat, the hasty report will precede the deliberate report, a predetermined time delay could be used between their release.

(5) To complete the data set required for representing strength management in SIMNET, the commander and his staff would be provided information of incoming replacements. Given the relatively short duration of the SIMNET simulation, it is probably more realistic to have the staff plan for where replacements would be assigned as the battle develops, rather than actually inserting new soldiers in the simulation. However, if desired, new replacements could enter the simulation in either a previously disabled weapon system which was repaired (with a time delay) or in a new weapon system.

(6) Although we have outlined an effective methodology to quickly include the strength management function into SIMNET, the Army should pursue funding to incorporate AMSAA data base into SIMNET. This is certainly consistent with TRADOC Commanders goal of a single set of Army Models.

b. ARTBASS and CBT-SIM

(1) During our site visit to the ARTBASS and CBT-SIM facilities at Fort Leavenworth, the project managers for both training models expressed desires to improve the personnel play in their models. The personnel play in both models is essentially limited to the personnel station (S-1) relaying the message to the Commander that "I have five casualties in unit X." The project managers both stated that the improvement in the personnel play in their models was contingent upon the models identifying casualties by unit, grade, and MOS. The ARTBASS project manager stated that it would perhaps be possible to obtain money in 1992 for the contractor to program the changes in the model required to identify the needed casualties. The CBT-SIM project manager expressed a similar need, but he had the more immediate problem of exporting his model to selected field sites.

(2) As we outlined in the SIMNET discussion, what we need to realistically play "personnel" is a generated casualty stream which will cause the trainees (commander and his staff) to consider personnel constraints during the training exercise. When the simulation identifies a weapon system or soldier as being hit, this information becomes known to the game players (e.g., commander, S-3, and S-1). The random number generation process using the TACCS computer as outlined in the SIMNET discussion above could be used. Given the data from the random number generation process, we would obtain the name, MOS, grade, and casualty status of hit weapon system crews or individual soldiers. This information can be used to prepare a hasty and deliberate strength report for the commander and staff. If information is provided on incoming replacement streams to the S-1, then he can make strength management recommendations to the commander.

c. JESS

(1) The JESS methodology allows for the creation of a fictitious unit which serves as a replacement pool in the simulation. Casualties are grouped in CMF categories and further delineated by the rank categories; E1-E4, E5-E6, E7-E9, WO, and officer.

(2) Although the simulation treats personnel as a supply item, it does require the game players to make strength management allocation decisions in distributing replacements within the Corps (e.g., to the divisions). Since the model tracks soldiers by CMF it has the added capability of preventing the use of weapon systems if qualified (CMF) personnel are not available.

(3) The study team concluded the JESS personnel play is adequate. It requires the commander and his staff to make strength management allocation decisions with given personnel constraints during the simulation.

d. Personnel Service Support - Battlefield System Simulation (PSS-BSS)

(1) The PSS-BSS is designed to provide the necessary inputs and outputs (I/O) to simulate PSS actions and activities which are expected to occur at levels above and below the level being simulated (BN through corps). The PSS activities modeled are the three critical battlefield functions of Strength Accounting, Casualty Reporting, and Replacement Operations.

(2) Although PSS-BSS is a training simulation, the study team found that it could provide us with estimates of parameters needed in modeling replacement operations in the analytical models. Therefore, we defer discussion of this model until Chapter 5.

4. Chapter Summary. The implementation of the strength management methodology described in this chapter into SIMNET, ARTBASS, and CBT-SIM would not require a major change to the current simulations. Additionally, this methodology can be implemented rather quickly. Once we implement this methodology, the commanders and their staffs will consider personnel constraints during the training exercise.

# CHAPTER 5

## PSS IN ANALYTICAL MODELS

1. Introduction.

a. PSS functions which we can include into Army analytical models are chaplaincy, finance, public affairs, legal, and personnel management. Although chaplaincy, finance, public affairs, and legal services provide vital services in support of the warfighting effort, quantification of the benefits from these services to the combat effectiveness of the force do not exist. While there are multivariate procedures available to perhaps estimate these relationships, the study team concluded that the results from these techniques would be highly situational (scenario dependent) and open to intense academic scrutiny. Furthermore, assuming that the contributions of these PSS functions to the blue force can be estimated, similar estimates must be made of the contribution of red force units. We did not pursue these multivariate methods, but a discussion of a methodology is in Appendix E and may be a topic for further study and analysis.

b. There are presently several research initiatives which are attempting to quantify the effects of human factors on combat effectiveness. Once these methodologies are established, we may be able to quantify the effects (using the methodology at Appendix E) of these PSS functions in sustaining the combat effectiveness of our soldiers.

2. Lack of Doctrinal Force Structure in Replacement Operations Modeling.

a. All of the models which simulate replacement operations treat personnel replacements as if they are an item of supply, issued from depots or hospitals. Failure to represent the doctrinal force structure's inherent capabilities in the flow of replacements is a serious flaw in the Army Family of Models.

(1) According to personnel doctrine, when replacements arrive in a theater, they receive processing at the theater TOE replacement company (RC). The RC is the basic replacement delivery unit on the battlefield. Replacement personnel are defined as; personnel arriving in the theater; personnel going to or from another unit within the theater; medical and straggler RTDs; personnel returned from confinement facilities; and personnel in transit to or from rest and recreational areas.

(2) The RC commands, controls, and is responsible for providing the following functions:

(a) Arranging for food service, billeting, limited supply, and a battlefield orientation.

(b) Coordinating the transportation of the replacements to their assigned units.

(c) Coordinating the re-equipping of RTDs.

(d) Providing soldier accountability, making assignments against fill plans, and issuing orders.

(3) Due to the AIDS epidemic and its potential for tainting the battlefield blood supply, personnel doctrine now requires the RC to coordinate HIV testing.

(4) The processing capability of the TOE RC (or CRC) has not been analytically estimated. Doctrine states that the RC can process 400 personnel per day. The RC is further divided into four platoons which supposedly are able to process 100 personnel per day. The Army leadership is currently very interested in validating the capability of the RC.

(5) The logistical requirements in support of the replacement system are substantial. The most critical element of this support is transportation. There are no organic transportation assets in the replacement system. This support must be obtained through the movements control system where it competes with other battlefield needs (e.g., ammo and POL). The transportation requirements of the replacement system over time must be provided to the logistics community. LOGCEN can then obtain a better measure of transportation shortfalls. The personnel units which comprise the replacement system can design for optimal processing of the replacements, but if the replacements wait days for transportation assets, the system is obviously not optimally constructed.

b. There has been little work done in the area of estimating the effects of threat forces on CSS units, particularly PSS units. During our examination of Army models, we developed a methodology using the JANUS(T) model which could be used to quantify the degradation of PSS performance from threat forces, and to obtain better casualty estimates in the rear area. CAA and PERSCOM are jointly involved in an AR 5-5 study to determine how to better estimate rear area casualties. We discussed our methodology with both parties, whom both expressed a keen interest. A discussion of this methodology is at Appendix F.

3. Inadequate Modeling of Returns-to-duty

a. Complicating the modeling problems caused by omitting the doctrinal force structure, the Wartime Replacement System Study (WRSS) estimates 40-50% of all replacements in the first 90 days of warfare will be returns to duty (RTDs) from the medical system.

RTDs are grouped into two primary categories; wounded in action (WIAs) and disease non battle injury (DNBIs). The current methodology for estimating RTDs in Army modeling assumes that within each category the distribution of patient conditions is equal and, as a result, RTDs per category have the same probability of recovery.

b. Furthermore, the methodology assumes that remaining physical disabilities never limit the reassignment of the returning soldier. We suspect, however, that MOS may affect the distribution of patient conditions which an injured soldier may experience and that many soldiers will incur serious injuries which will mandate MOS reclassification. Since a unique probability of recovery is associated with most patient conditions, different MOSs would not have the same probability of returning to duty. This phenomenon may change the number of RTDs available in critical MOSs.

c. Current computer simulations of theater combat define casualties in terms of combat or noncombat. There are no provisions during or after the simulation to consider the correlation between any of the multiple patient classification databases, the expected presentation of casualties resulting from a combat engagement, or the effect the patient reclassifications have on the personnel system's ability to provide the right man to the right job at the right time.

d. The medical and personnel communities have developed post-processing methods to disaggregate reported casualties from Army combat simulations into categories for treatment analysis (patient classification) and/or replacement estimation (MOS category/grouping). These methods do not draw upon the vast information contained in the combat simulation to ascertain the patient treatment classifications or MOS fitness for the return to duty patient in the replacement system. MAJ Bill Wakefield from CAA is currently researching a methodology using AMSAA ballistics data to determine the distribution of casualties based upon specific warfighting conditions. For example, we would expect a different mix of casualties from an armor battle than we would expect from an infantry battle.

e. Assuming we have specific distributions of casualties from the Wakefield methodology, we can group them into one of the 319 patient classifications defined by the medical system. From the patient classification we know the type of medical care needed (e.g., treated in division, corps, theater, or evacuated to CONUS). If we determine the medical resources required to treat each patient condition (e.g., condition 5 - 1 hour surgery, three days bed rest), we can simulate RTD times given the medical system force structure, number of beds in the hospital, and the evacuation policy.

f. Undoubtedly, the personnel system will reclassify large numbers of the RTDs which require evacuation to CONUS. Army doctrine has not established a force structure or outlined the procedures by which this reclassification process will be executed. Presumably, a medical panel will consider individual cases and make a determination of the wounded soldier's physical profile. Then the personnel community would reclassify the soldier into a suitable MOS. Considering reclassifications on an individual basis will consume considerable medical and personnel resources and result in potentially long delays in returning RTDs to the replacement system.

g. What is needed from a modeling, as well as an operational perspective, is the expected medical profile (PULHES) from each patient condition. We can accomplish this objective by convening a panel of subject matter experts (SMEs) from the medical community. These would primarily be doctors who served in combat. This panel would determine the most probable PULHES profile for each of the 319 medical conditions (or at least the conditions which would warrant a reclassification). The personnel community would then determine the soldier's MOS reclassification. Although personnel doctrine states there will be no utilization or classification restrictions in wartime, we know, for example, that individuals with severe leg injuries will be unable to serve in the infantry.

h. The medical SME panel could also determine medical system service times for each of the 319 medical conditions. Service times would include the direct medical care (e.g., surgery), indirect care (time recuperating in a hospital bed), and ambulatory care (released from hospital but requires periodic medical treatment and is still not fit for duty). An average service time and range (longest service time minus shortest service time) for each of these three types of care categories would also be obtained from the panel. These service time statistics will enable us to better simulate the medical system.

i. The large numbers of RTDs processed by the system will create immense pressures on the replacement system. For example, there will be many ambulatory patients with medical injuries (e.g., broken limbs) that will be released by the medical system but unable to perform in combat MOSs. These soldiers require billeting, feeding, and re-equipping. The medical doctrine eliminated medical holding facilities several years ago. Therefore, the burden for providing these services to the "walking wounded" will fall right on the RCs. We have not considered the impact of this action on the replacement system's processing capability. More importantly, we have not estimated the effect of these "walking wounded" on the strength levels of critical combat MOSs.

4. Specific Analytical Models

a. Vector-in-Command (VIC)

(1) In spite of the inclusion of a CSS module, VIC remains primarily a warfight model. Its primary purpose is to incorporate CSS constraints into the outcome of the warfight, not to provide data for the study of CSS (PSS) issues. As a result, it is not an especially useful vehicle for the study of PSS functions.

(2) Replacement operations is the only PSS function that is included in VIC-CSS. The model uses a network of personnel pools, one associated with each medical entity being gamed, to provide a mechanism for returning RTDs to units. Replacements are inserted into the network to be assigned to units as if they were RTDs. Although the RTD pools do parallel the replacement force structure, their performance is not reduced by casualties, they do not impose processing delays, and they allow soldiers to be accumulated at locations other than where doctrine would allow.

(3) Replacement flows are left to the discretion of the team performing each study. No attempt is made to provide realistic replacement data in relation to expected supplies and global demands. Corps replacement operations should occur in a global framework in terms of the number of soldiers made available as replacements. There is no mechanism in VIC-CSS to ensure that this is followed. Additionally, weapon systems can fight without crews, so that repaired and replacement systems can be returned to the battle even if crews would not actually be available. Conversely, crew replacements can be assumed to be infinite as was done in the Armored Family of Vehicles Study. The total effect may be to greatly inflate the effective replacement flow available to the model, resulting in an overstatement of combat capability.

(4) PSS units have no explicit role in VIC-CSS, but can be included at the gamer's option in order to fully work load the medical system. If this is done, they are staffed with a single soldier type that is used to man all such dummy units.

b. PERSCOM Modeling. The Mobilization and Operations Directorate, PERSCOM, provides analytical support for various Army force structure issues. This support is now discussed.

(1) This directorate is the Army POC for WARMAPS. WARMPAPS is a standardized, DoD-wide procedure for computing time-phased wartime manpower demand and supply. It provides a wartime shortfall calculation that is standard among the services. These official DoD shortfall results are used in congressional testimony and reports.

(2) WARMAPS is prepared biennially in conjunction with the POM. It is calculated for first and last years of the POM. The deployment of forces and the warfight are based on Defense Guidance Scenario. The CAA family of models are used to derive broad manpower casualty categories; close combat, combat support, medical, other combat, maintenance, and others. Each of these occupational categories is further divided. Each of these occupational categories contain groupings of Standard Army Occupational arenas.

(3) Since the WARMAPS methodology produces an aggregate shortfall analysis, this output does not depict specific MOS battlefield deficiencies. PERSCOM uses the Army Mobilization Manpower Planning System (MOBMAN) to operate at a level of detail that reveals serious shortages or surpluses which are often masked by the aggregate shortfall analysis produced by WARMAPS.

(4) MOBMAN is based on the Defense Guidance (DG) scenario and all the data is time phased in 10 day/30 day increments. MOBMAN can analyze MOS requirements for all levels of mobilization (except total) with variable force structures. The results of this process are used for providing training requirements to the Mobilization Army Program for Individual Training (MOBARPRINT) and for establishing Army Manpower Policy.

(5) Since this entire process is driven by the CAA simulated casualties, the RTDs problem discussed previously impacts significantly upon the results. We have initiated a contractual effort which will develop a methodology to more accurately reflect the true impact of the RTDs on the capabilities of the medical and personnel systems. The statement of work (SOW) is in Appendix G.

5. Strength Management in Analytic Models.

a. Through strength management, the personnel system estimates both actual and projected organizational "combat power". Based on this assessment and the commander's plan for future operations, individual soldiers, weapon crews, and small units are assigned to the battlefield to sustain combat power. The strength management function depends entirely upon the personnel accounting and strength reporting function for the information needed to support the current battle. To support the future battle, the strength management function requires information from the data base management function.

b. A key aspect of the strength management function is that it requires the commander's continual assessment of the battlefield. As new tactical information becomes available during the battle, the commander will adjust his concept of the operation. This may change initial replacement priorities. Therefore, we need a methodology which will allow for the insertion of a man-in-the-loop or computer emulation of this decision making process.

c. VIC has the capability of stopping the simulation at various time intervals for analysis. A decision maker could analyze the warfight at selected time intervals and adjust the predetermined fill priorities. The study team lacks detailed knowledge of VIC model architecture and so we included examination of this potential methodology in the SOW.

d. Without the man-in-the-loop, artificial intelligence (AI) would appear to be a potential solution to the strength management play. This will also be examined in the SOW.

6. Degradation of PSS System Performance. The personnel replacement system's performance will be degraded by two key factors. First of all, PSS unit performance will be directly effected by the threat in the rear area. The threat will cause casualties in PSS units, require PSS units to perform their secondary mission of defense, require PSS units to relocate on the battlefield, and operate in an NBC environment. Secondly, the replacement system's performance will be degraded by the increased workload generated by large numbers of casualties. Given the doctrinal force structure, the replacement system has inherent manpower driven capacity constraints. As the demands on the system increase we would expect to observe both delays in processing and deviations from the optimal assignment of replacements. All of these factors effect the overall efficiency of replacement operations. A discussion of methodologies for incorporating these degrading factors into Army models follows.

a. Personnel Service Support - Battlefield Simulation System (PSS-BSS)

(1) The PSS-BSS is designed to provide the necessary inputs and outputs (I/O) to simulate PSS actions and activities which are expected to occur at levels above and below the level being simulated (BN through corps). The PSS activities modeled are the three critical battlefield functions of Strength Accounting, Casualty Reporting, and Replacement Operations.

(2) PSS-BSS has the capability to replicate the 21 day war fought in the simulation. Additionally, the simulation has the ability to vary some events (e.g., casualties or replacements) within preset limits to provide a different range of priority/ management decisions. The baseline casualties generated in a Corps is 27,000 in a 21 day war. Simulation controllers can decrement this by any desired percentage. PSS-BSS also simulates the assignment of 17,000 replacements (including 3000 RTDs).

(3) We can also require game players to simulate most of the personnel functions required at a replacement company (RC). These processing functions include soldier accountability, assignments, and issuing orders. We can vary the replacement streams to gain an analytical estimate of the capacities and the inherent efficiencies of the RC.

(4) The study team also observed that PSS-BSS would be an ideal setting to test the degradation in performance of the replacement personnel functions from an NBC environment. We could statistically compare the responses of two test groups; one in mission oriented protective posture (MOPP), and one without MOPP.

(5) We could obtain a measure of the replacement system's ability to function with casualties in the PSS units themselves. For example, we can compare the performance of a fully staffed PSC with a PSC that has experienced 25% attrition. This information would be particularly valuable when used in concert with information obtained in the aforementioned JANUS(T) rear area casualty estimation study.

(6) By comparing these various experimental cases of the exercising staffs with doctrinally correct responses, PSS-BSS can be used as a valuable research tool in determining a set of personnel replacement efficiency curves for use in Army models.

b. JANUS(T) Rear Area Casualty Estimation Study

(1) As mentioned in the discussion above, we can use PSS-BSS to experimentally determine the efficiencies of the doctrinal replacement force structure given attrition parameters. The JANUS(T) study discussed at Appendix F has several goals. First of all, using a slice of a Corps Support Group we simulate the effects of the rear area threat on our rear area forces. This provides us with a measure of what will happen to our PSS units given attacks by particular mixes of threat forces. As discussed in the appendix, we need to determine, perhaps using Bayesian statistical methods, the probability that PSS units will be attacked by the various threat forces.

7. Wartime Personnel Assessment Model (WARPAM). In Figure 8 we depict the various inter-related components of the personnel system. This system is complex and its efficiency is dependent upon the ability of the replacement flows (supplies) to traverse across the replacement network and fill requirements (demands) in a timely manner. The WARPAM methodology is the first to consider the entire system; from determining the fitness of RTDs to be used in critical MOSs to the personnel system's ability to handle the work-load requirements of requisitioning and processing replacements, so that the system gets the right man to the right job at the right time.

8. Chapter Summary. A major problem in modeling replacement operations in analytical models is that we do not properly portray the capabilities of the replacement force structure. This problem is exacerbated by the fact that many RTDs will be unable to perform in combat MOSs for a specified period of time, and these RTDs will inevitably become burdens on the replacement system for billeting and feeding. We must attempt to model the entire replacement system, including all of its constituent parts, personnel and medical systems capabilities, threat effects, and the logistical systems ability to support the replacement system.

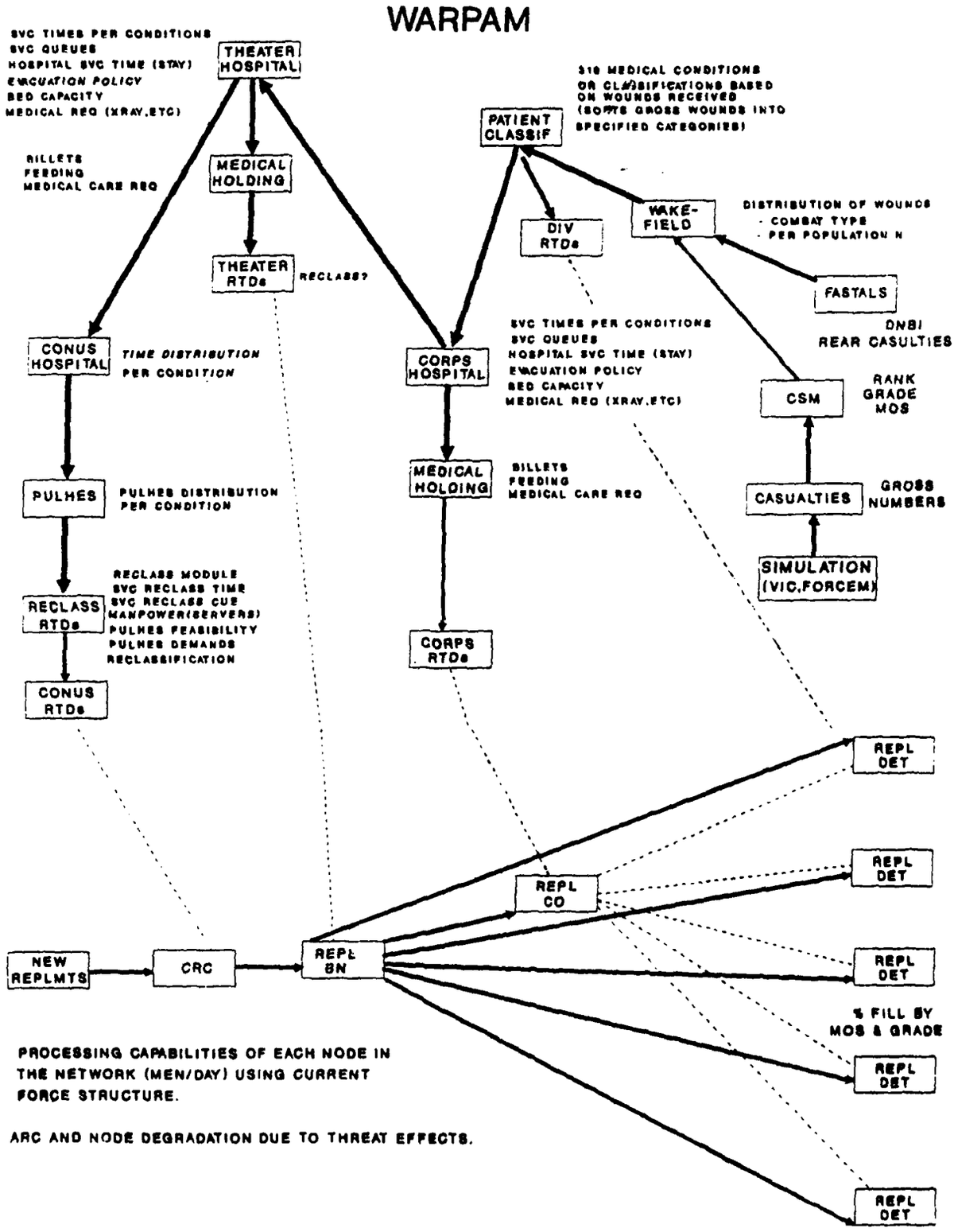

WARPAM
SVC TIMES PER CONDITIONS
SVC QUEUES
HOSPITAL SVC TIME (STAY)
EVACUATION POLICY
BED CAPACITY
MEDICAL REQ (XRAY,ETC)
THEATER HOSPITAL
BILLETS
FEEDING
MEDICAL CARE REQ
MEDICAL HOLDING
THEATER RTDs
RECLASS?
CONUS HOSPITAL
TIME DISTRIBUTION PER CONDITION
PULHES
PULHES DISTRIBUTION PER CONDITION
RECLASS RTDs
RECLASS MODULE
SVC RECLASS TIME
SVC RECLASS CUE
MANPOWER(SERVERS)
PULHES FEASIBILITY
PULHES DEMANDS
RECLASSIFICATION
CONUS RTDs
$10 MEDICAL CONDITIONS OR CLASSIFICATIONS BASED ON WOUNDS RECEIVED (SORTS GROSS WOUNDS INTO SPECIFIED CATEGORIES)
PATIENT CLASSIF
DIV RTDs
WAKE-FIELD
DISTRIBUTION OF WOUNDS
- COMBAT TYPE
- PER POPULATION N
FASTALS
DNBI
REAR CASULTIES
SVC TIMES PER CONDITIONS
SVC QUEUES
HOSPITAL SVC TIME (STAY)
EVACUATION POLICY
BED CAPACITY
MEDICAL REQ (XRAY,ETC)
CORPS HOSPITAL
CSM
RANK
GRADE
MOS
MEDICAL HOLDING
BILLETS
FEEDING
MEDICAL CARE REQ
CASUALTIES
GROSS NUMBERS
CORPS RTDs
SIMULATION (VIC,FORCEM)
REPL DET
REPL DET
REPL CO
REPL DET
% FILL BY MOS & GRADE
REPL DET
REPL DET
NEW REPLMTS
CRC
REPL BN
PROCESSING CAPABILITIES OF EACH NODE IN THE NETWORK (MEN/DAY) USING CURRENT FORCE STRUCTURE.
ARC AND NODE DEGRADATION DUE TO THREAT EFFECTS.

Figure 8

# CHAPTER 6

## CONCLUSIONS

(1) PSS representations in Army models are inadequate.

(2) Of the five functional areas of PSS; Public Affairs, Legal Services, Chaplaincy, Finance, and Personnel Administration, the only PSS function which we can model realistically at the present time is a limited portion of Personnel Administration. The specific subfunctions of Personnel Administration which should be modeled are strength management, Personnel Accounting and Strength Reporting, and replacement operations.

(3) Returns-to-duty (RTDs) from the medical system are a major source of replacements (40-50% in the first 90 days of war), but Army models overestimate the RTD capabilities when returned to combat.

(4) Army models do not portray the inherent limitations of the doctrinal force structure when modeling the flows of replacements on the simulated battlefield.

(5) Army models do not portray RTDs in sufficient detail to determine "choke points" in the demand for specific combat MOSs.

(6) Army training models (SIMNET, ARTBASS, and CBT-SIM) do not realistically portray the strength management function.

(7) The Army does not know how many replacements CONUS Replacement Center (CRC) or a RC can process per day and, without a computer simulation, the Army does not have a sound basis for estimating this processing capacity.

(8) Since most Army models allow all WIAs (except a few who die in the hospital or receive disability discharges) to return to duty after a time delay, we are systematically overestimating the combat effectiveness of the blue force. A more detailed simulation of the medical system is needed.

(9) Since Army models do not analytically estimate the numbers and types of casualties from the simulation, we are unable to realistically predict the workload on the medical system or the estimated impact the resulting patient conditions will have on both the personnel systems ability to reclassify the soldiers and their resulting utilization on the strength levels of critical combat MOSs.

(10) Army models don't portray the effects that MOS reclassification would have on personnel levels of critical combat MOSs. Nor do we have any estimates of the impact of the time delay to return large numbers of reclassified soldiers to battle. Additionally, the force structure for reclassifying large numbers of RTDs does not exist in the Army.

(11) The medical community has identified 319 patient classifications which would result on the battlefield, but the resulting PULHES profile from each patient condition has not be n determined.

(12) To allow for the modeling of the personnel flows from the medical system, PULHES profiles should be established as limits for wartime utilization in specific MOSs.

(13) The Army has inadequately modeled the rear area threat, so the PSS community can not realistically measure the threat impact on the effectiveness of its units or doctrine.

(14) The lack of the ability to model the rear area threat results in the use of outdated historically derived rear area casualty estimates in Army models (e.g., FASTALS, VIC).

(15) Since Army models do not accurately portray the flows of replacements through RCs, we have not adequately provided realistic demands on the logistical system for transportation and other essential support provided to the replacement system.

(16) We can improve the strength management function play in training models by post-processing the internally generated casualty streams to produce casualties by name, MOS, and grade. Information of incoming replacements would also be provided.

(17) The PERSCOM shelf-requisition and MOBMAN processes will be affected by better estimating the distribution of simulated casualties, their resulting physical profile, and their subsequent utilization by the personnel system.

(18) In light of global personnel requirements, the WARPAM model can be used to determine the beginning inventory of the personnel pools in Army models (e.g., VIC) at a point in time.

(19) We can use the PSS/BSS simulation to derive efficiency curves for the processing times of the replacement system force structure.

(20) WARMAP submissions to Congress will be affected by improvements in the modeling of the medical and personnel replacement systems.

(21) The Departments of the Navy (includes the Marine Corps) and Air Force do not have models which portray PSS functions.

# CHAPTER 7

## RECOMMENDATIONS

Recommend that:

(1) The strength management methodology outlined in this study be implemented in SIMNET, ARTBASS, and CBT-SIM.

(2) As additional monies become available, incorporate the AMSAA ballistics data into SIMNET so that the simulation generates the casualties internally.

(3) We continue to pursue the Wakefield Methodology for deriving the distribution of casualties for specific warfighting conditions.

(4) We use the casualties derived from the Wakefield Methodology to assign each casualty to one of the 319 patient classifications from the medical community.

(5) A panel of medical SMEs to determine the most probable PULHES profile and the treatment requirements and times for each of the 319 patient classifications.

(6) The personnel system develop PULHES wartime reclassification limits for critical MOSs (e.g., combat arms and combat engineers).

(7) We simulate the processing requirements and capacities of the replacement system (e.g., CONUS Replacement Centers and Replacement Companies) in light of current force structure and doctrine.

(8) The Department of the Army provide guidance to the personnel and medical communities to determine and obtain the force structure required to reclassify the large numbers of soldiers.

(9) We pursue the JANUS-T rear area casualty estimation study outline in Appendix F. The results of the study can be used to improve the rear area factors used in FASTALS, VIC, and other Army models.

(10) We use the PSS/BSS to estimate the degradation to the replacement system (including PASR) from increased workload periods due to peak casualty periods.

(11) We use the results in (10) for parameter estimates of the efficiency (e.g., delays) of the replacement system's force structure for use in Army models (e.g., VIC).

(12) We use the WARPAM model to determine the beginning inventory of the personnel pools in the VIC model at a point in time in light of global personnel requirements.

## Essential Elements of Analysis (EEA).

1. What are the Army models that fall within the scope of this study?

With over 279 models in the Army inventory, the study team sought to adequately review the maximum number of models representing PSS functions subject to the .85 PSY manpower limitation for the entire study. In accordance with the scope of the study as stated in the study plan (Appendix A), "Model selection will be based on importance of the models and the extent to which PSS functions influence their outcomes". The selected models are;

VIC
JANUS-T
CAA Models
JESS
ARTBASS
CBT-SIM
PERSCOM Models
PSS/BSS
SIMNET

2. What PSS functions are included in the Army models that fall within the scope of this study? How and to what level of detail are they portrayed?

a. VIC

(1) Replacement operations is the only PSS function that is included in VIC-CSS. The model uses a network of personnel pools, one associated with each medical entity being gamed, to provide a mechanism for returning RTDs to units. Replacements are inserted into the network to be assigned to units as if they were RTDs.

(2) Replacement flows are left to the discretion of the team performing each study.

(3) PSS units have no explicit role in VIC-CSS, but can be included at the gamer's option in order to fully work load the medical system. If this is done, they are staffed with a single soldier type that is used to man all such dummy units.

(4) VIC associates personnel and MOSs with weapons systems.

b. JANUS-T

There are no PSS functions represented in JANUS-T.

c. CAA Models

The CAA models do not portray any PSS functions directly. However, CAA models determine casualties used in major Army studies. These casualties are used in the shelf requisitioning process and in determining the numbers of soldiers needed in the Army. Both of these ultimately effect replacement operations.

d. JESS

(1) The JESS methodology allows for the creation of a fictitious unit which serves as a replacement pool in the simulation. Casualties are grouped in CMF categories and further delineated by the rank categories; E1-E4, E5-E6, E7-E9, WO, and officer.

(2) Although the simulation treats personnel as a supply item, it does require the game players to make strength management allocation decisions in distributing replacements within the CORPS (e.g., to the divisions). Since the model tracks soldiers by CMF it has the added capability of preventing the use of weapon systems if qualified (CMF) personnel are not available.

e. ARTBASS

The simulation generates gross unit casualties. These casualties are not identified by grade or MOS. The S-1 play is essentially limited to "I've got 4 casualties in A-1". Incoming replacement streams are not provided in the exercise.

f. CBT-SIM

CBT-SIM personnel play is identical to ARTBASS.

g. PERSCOM Models

These models do not play PSS functions. However, they provide the replacement streams for use in simulations and manpower planning.

h. PSS/BSS

The PSS-BSS is designed to provide the necessary inputs and outputs (I/O) to simulate PSS actions and activities which are expected to occur at levels above and below the level being simulated (BN through corps). The PSS activities modeled are the three critical battlefield functions of Strength Accounting, Casualty Reporting, and Replacement Operations.

i. SIMNET

The SIMNET model presently identifies a weapon system when it is hit by a threat weapon system. What we don't know is, given the hit, what is the distribution of casualties within the tank. The absence of the identification of casualties by grade and MOS limits the PASR play of the model. Additionally, the simulation does not provide information on incoming replacement streams. Therefore, the strength management play is very limited.

3. a. Which PSS functions are candidates for inclusion in Army models?

(1) PSS functional areas which could be included into Army models are chaplaincy, finance, public affairs, legal, and personnel management. Although chaplaincy, finance, public affairs, and legal services provide vital services in support of the warfighting effort, quantification of the benefits from these services to the combat effectiveness of the force do not exist. Until we develop analytical relationships between these PSS functions and their contribution to force effectiveness, these functions should not be included in Army models. Furthermore, even after we develop these relationships, we must also estimate them for the red force if we are to use them in analytic models.

(2) Within personnel management, strength management, replacement operations, and personnel accounting and strength reporting are the most important functions of Personnel Administration that could and should be modeled.

b. How and to what level of detail should they be portrayed?

(1) The training models (SIMNET, ARTBASS, and CBT-SIM) are designed for training at the battalion level and below. At this organizational level, the PASR system must report unit casualties by grade and MOS. Since these simulations run at real time, a time delay must be imposed between the release of the hasty and deliberate strength report. The battalion S-1 should be provided incoming data on replacements, by MOS and grade, so that he and the commander are required to decide replacement priorities and assignments (although they don't physically receive replacements during the simulation).

(2) In the VIC model, replacement operations is the only PSS function which is modeled in VIC-CSS. The model uses a network of personnel pools, one associated with each medical entity being gamed, to provide a mechanism for returning RTDs to units. Replacements are inserted into the network to be assigned to units as if they were RTDs. When the RTDs and replacements are processed by these personnel pools, the performance of these processing centers is not reduced by casualties that may occur in the processing unit. Additionally, there are no processing delays as a function of workload, and in the VIC model, it allows soldiers to be accumulated at locations other than where doctrine would allow.

(3) In VIC replacement flows are left to the discretion of the team performing each study. No attempt is made to provide realistic replacement data in relation to expected supplies and global demands. Corps replacement operations should occur in a global framework in terms of the number of soldiers made available as replacements. There is no mechanism in VIC-CSS to ensure that this is followed. Additionally, weapon systems can fight without crews, so that repaired and replacement systems can be returned to the battle even if crews would not actually be available. Conversely, crew replacements can be assumed to be infinite as was done in the Armored Family of Vehicles Study.

(4) VIC associates personnel with weapons systems, so that MOS 19k becomes M1 tank crewmen. Other soldiers are classified as riflemen, resulting in the loss of MOS differentiation. An additional problem occurs with systems such as the Bradley, for which a single MOS (11M) is both crew and passenger. Part of the MOS is considered to be crew, while the rest of it is included with the generic category of riflemen. This arrangement may result in the overstatement of combat capability, by allowing combat arms soldiers to be substituted by other MOSs.

c. What functions lend themselves to post/pre-processing instead of inclusion in the model(s)?

(1) Doctrinal Force Structure Constraints. On the battlefield the replacement system will face many constraints. First of all, the workload of the replacement system will be a function of casualties. During periods of intense warfare, the system will be required to process the large numbers of casualties and replacements. Additionally, the threat in the rear area will inflict casualties on personnel in the replacement units, require replacement personnel to relocate on the battlefield, and to defend the base cluster to which they are assigned. The cumulative effect of all these factors will be to degrade the effectiveness of the replacement system.

(2) Using the PSS/BSS model, we can develop efficiency curves of the ability of the system to process replacements. WARPAM will use these curves and other derived data as a post-processor for replacement streams generated by other models (e.g., MOBMAN) and will be used to determine the percent fill over time. The same efficiency curves, however, can be included in VIC and other models as delay parameters in the replacement processing algorithms.

4. Who are the users or user groups which require that PSS be represented in Army models? See Figure 9.

5. What products and benefits do the users need? See Figure 9.

6. What PSS functions will satisfy the needs of each user or user group? See Figure 9.

7. What is the level of resolution that will satisfy the needs of each user or user group? See figure 9.

8. How do PSS functions affect combat capability?

a. In Chapter 2 we describe in detail the PSS functions. We point out that the primary mission of Chaplaincy, Public Affairs, and Legal Services is to sustain the soldiers "will to fight". The chaplains accomplish this through their ministry, the public affairs officers through the dissemination of public information, and the judge advocates by providing professional legal advice to commanders, command groups and staffs, and soldiers. These three functions directly affect the morale of our soldiers, and ultimately, our combat effectiveness and capability. However, the extent of their impact on sustaining morale has not been quantified. A discussion of a methodology to estimate the effects of these functions is at Appendix E.

b. The finance function will affect combat capability in several ways. With the tremendous demands that will be placed on the US transportation network during mobilization, a large percentage of the finance units' wartime efforts will be directed toward satisfying the logistical shortfalls inherent in the next war through local contracting. These contracts may include such items as laundry operations, bath operations, construction materials, Class 1 supplements, supply parts, maintenance, transportation, pay for day laborers, and solatium (grievance) payments.

(1) In support of the procurement process and other battlefield functions the Finance Corps also provides banking and currency support functions. This requirement includes the responsibility for supplying US currency, foreign currencies, US Treasury checks, foreign military script, and military payment certificates to US forces in the theater. These payments to US soldiers are on an emergency basis (and limited to $100 per month per soldier) only for the first 90 days of combat.

(2) Therefore, we can say that finance function affects soldier combat capability directly by eliminating the inherent logistical shortfalls in food, laundry and bath operations, and personal finance support. The finance function also affects combat capability by providing the banking infrastructure and procurement actions for such items as transportation and spare parts.

(3) Obviously, this support to the logistical system is absolutely critical to success in the next battle. However, the quantification of these benefits is difficult and they have not been quantitatively estimated.

c. The Personnel Administration function affects combat capability in many ways.

# ESSENTIAL ELEMENTS OF ANALYSIS (4-7)

| USERS(4) | PRODUCTS(5) | PSS FUNCTIONS(6) | RESOLUTION(7) |
|---|---|---|---|
| **TRAINING MODELS** | | | |
| S-1 | CASUALTY STREAMS TO PRODUCE<br>- HASTY STRENGTH REPORTS (PS)<br>-DELIBERATE STRENGTH REPORTS (PRR)<br>- UPDATE C2SRS | PASR<br>PASR | GROSS NUMBERS<br>MOS & GRADE |
| | REPLACEMENT STREAMS | SM | MOS & GRADE |
| S-3 | PS, PRR, REPLACEMENT PRIORITIES | PASR, SM, REPL OPS | MOS & GRADE |
| S-4 | CREW STATUS | PASR, SM | MOS & GRADE |
| CDR | S-1 PERSONNEL ESTIMATE | PASR, SM, REPL OPS | MOS & GRADE |
| **ANALYTIC MODELS** | | | |
| VIC | REPLACEMENT SYSTEM PARAMETERS<br>- DELAYS f(PERSONNEL WORKLOAD)<br>- MORE ACCURATE MEDICAL DELAYS<br>IMPROVED REAR AREA CASUALTY ESTIMATES<br>IMPROVED MOS MODELING | REPL OPS | PERSONNEL SYSTEM |
| **OTHERS** | | | |
| CAA | IMPROVED REAR AREA CASUALTY ESTIMATES<br>WAKEFIELD METHODOLOGY | REPL OPS (RTDs) | THEATER |
| OTSG | DETAILED HOSPITAL SIMULATIONS<br>- DISTRIBUTION OF WOUNDS<br>- EXPERT OPINION PULSES PER WOUND CAT<br>- PROCESSING TIMES PER WOUND CATEGORY<br>- QUANTITIES OF "WALKING WOUNDED" | REPL OPS (RTDs) | DIV,CORPS,THEATER |
| PERSCOM | IMPACT OF WOUND DISTRIBUTION ON CRITICAL MOSs | REPL OPS (RTDs) | ARMY |

Figure 9

| USERS | PRODUCTS | PSS FUNCTIONS | RESOLUTION |
|---|---|---|---|
| LOGCEN | REPLACEMENT REQUIREMENTS FOR<br>- TRANSPORTATION<br>- BILLETING & FEEDING<br>- RE-EQUIPPING (MASK, WEAPON) | REPL OPS | REPL SYSTEM |
| SSC | REPLACEMENT SYSTEM MODEL<br>- PROCESSING DELAYS<br>- FORCE STRUCTURE ANALYSIS<br>- RC CAPABILITY<br>- ICR IMPACT<br>- THREAT EFFECTS<br>- EFFECT OF "WALKING WOUNDED"<br>- LOGISTICAL DEMANDS | PASR, SM, REPL OPS | DIV % FILL BY MOS & GRADE |
| | ESTABLISHMENT OF RECLASSIFICATION DOCTRINE | | |

Figure 9 (Continued)

(1) First of all, replacement operations (includes strength management, personnel accounting and strength reporting, data base management, and personnel information management) provides the right man in the right job at the right time. With the tremendous numerical advantages enjoyed by our advisories, replacing attrited units with qualified replacements is key to our combat capability and ultimately to success on the modern battlefield.

(2) Personnel Administration includes the postal system. The postal system operates a network to move, deliver, and collect personal and official mail in the combat environment. The Army also uses it to deliver critical spare parts and medical supplies and provides an alternative delivery system for personnel information on the battlefield. This function directly affects the soldiers "will to fight" and our combat capability by providing the soldier with a flow of information to and from friends and family members, and indirectly by the support it provides to the medical and logistical systems. Quantification of the overall benefits of this system have also not been estimated.

9. What must be done in order to integrate PSS into Army models? What is the priority for this integration?

a. The first priority for integration of PSS into Army models is the incorporation of the strength management function into the training models SIMNET, ARTBASS, and CBT-SIM. We list this as the number one priority because it requires minimal expenditure of resources. The methodology outlined in this study will cause the commander to consider personnel constraints in the simulated combat environment.

b. Next we should develop WARPAM. The simulation will provide a mechanism for examining the replacement system force structure (e.g., RC), impacts of doctrinal requirements imposed on the system, system threat impacts, and the logistical requirements to support the replacement system. The initial goal of WARPAM is a skeletal model of the process. Over time, we will validate the parameters initially used in the model by simulations, field exercises, and other experiments.

c. We will use PSS/BSS experiments to determine system performance parameters based on workload (e.g., casualties). This process will improve the parameters used in WARPAM, and the replacement processing delays represented in other models (e.g., VIC). The PSS/BSS experiments be executed concurrently with the development of WARPAM.

d. During the development of 9b and 9c we can also develop better rear area casualty estimates using the JANUS(T) model. This modeling effort will also provide an analytical means to evaluate the effect of the threat on rear area units. The degradation caused by the threat will be estimated and used in the WARPAM model. The result will be a more realistic portrayal of the replacement system's ability to perform its mission.

e. As outlined in the SOW at Tab G, we should pursue means by which we can realistically forecast the RTD dispcsition of critical MOSs. This will effect the replacement system's ability to deliver the right man in the right job at the right time. A key element in the accomplishment of this objective is a methodology which predicts the distribution of wounds given specified fighting conditions (Wakefield Methodology).

## THREAT ASSESSMENT

1. The following threat assessment was provided by the Soldier Support Center, Threat Management Office.

a. On the airland battlefield PSS units are found in Theater, Corps, and sometimes in the division rear area. These units provide Personnel Service Support across a wide spectrum of combat. These unit's secondary mission is to defend against all types of threat and they must be mission capable in high, medium, or low-intensity conflicts.

b. Low-intensity conflict will predominate over the next ten years, with the potential for escalation to mid-intensity conflict at any time. Low-intensity conflict is the most likely scenario outside the European or East Asian Theaters. The threat forces will most likely be supported by Soviet personnel, weapons, and equipment. Rear area facilities such as airfield and command and control centers will be prime targets. The threat in Southwest Asia (SWA) is further complicated by extreme religious and political beliefs which will prompt terrorist activities against US personnel and facilities outside of the battle area.

c. The greatest potential threat to PSS operations in a mid to high-intensity conflict is from the Soviet, Warsaw Pact or Soviet surrogate forces, or sympathizers/agents. Although tactics may differ slightly from country to country, the strategy for all threat forces remains the same: strike hard, with surprise, deep into the allied rear to disrupt the lines of communications, logistical support, command and control, reinforcement of frontline/enveloped units, and to negate the nuclear delivery systems and capabilities. The anticipated threat force ratio for offensive actions is expected to be 3:1 or 4:1. Once breakthrough is accomplished, second echelon units or operational maneuver groups (OMG) will funnel through the breach and attack strategic objectives in our rear area.

d. Although PSS units may not be targets themselves, they will frequently collocate with units that are priority targets. The threat priorities respectively are airfields, C3 Centers, transportation centers, and troop locations.

e. The threat to PSS units involves more than ground troops. PSS units can expect to be attacked by artillery bombardment in the division rear area, and by missile and air strikes as far back as the theater rear. Chemicals, both persistent and nonpersistent, can be expected at any time after initiation of hostilities. Nuclear employment can be anticipated once a threat force is halted and can no longer realize the accomplishment of their objectives.

f. Rear operations will be threatened primarily by NBC weapons, electronic warfare, SPETSNATZ (Soviet special purpose forces), and terrorists. PSS units can expect confrontation from all levels of threat, one or all of which may occur simultaneously.

LEVELS OF THREAT

Level I:

Enemy controlled agent activity

Sabotage by enemy sympathizers

Terrorism

Level II:

Diversionary and sabotage operations conducted by unconventional forces.

Raid, ambush, and reconnaissance operations conducted by combat units.

Special missions or unconventional warfare (UW) missions.

Level III

Heliborne operations

Airborne operations

Amphibious operations

Ground force deliberate operations

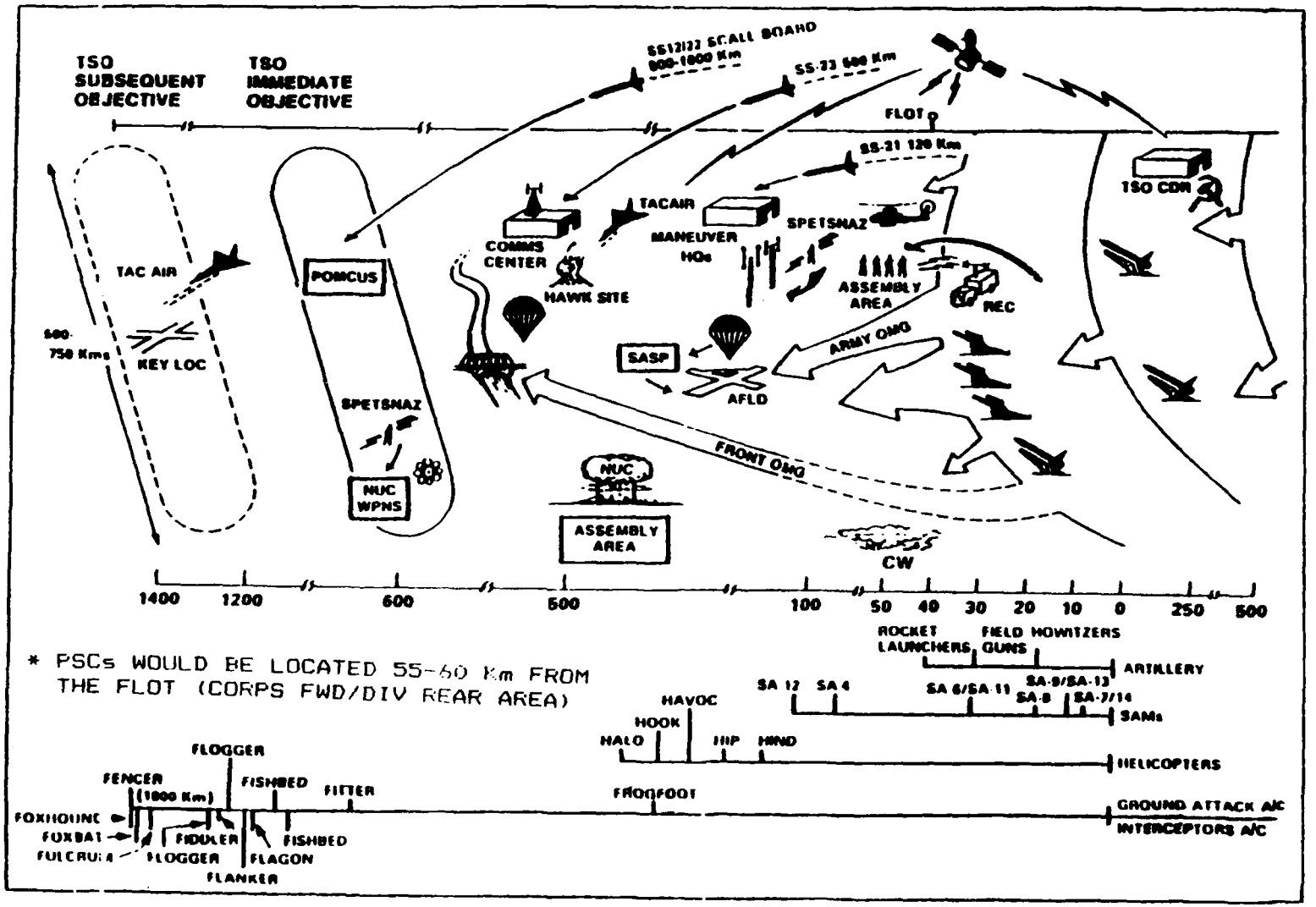
Infiltration operations

g. PSS units assist in defending the base cluster they are assigned to in countering threat level I forces. Military police may be available to assist in countering threat level II forces that cannot be defeated by local units. Threat level III forces will be countered by tactical combat units.

h. Agents and special operations forces will launch direct attacks in the rear area to destroy lines of communications and disrupt sustainment operations. Agents and terrorist groups will concentrate their activities in the rear area. These activities include assassination of key personnel, sabotage, and armed attacks of facilities, personnel, and nuclear weapons delivery systems and their storage sites.

i. Threat Radio Electronic Combat (REC) will hinder Command and control (C2). REC combines signal intelligence, direction finding, intensive jamming, deception, and suppressive fires to attack C2 systems. Communications systems are subject to extensive jamming. The enemy may use Remotely Piloted Vehicles (RPVs) to verify rear area targets.

THEATER STRATEGIC OPERATIONAL (TSO) DEPTHS




Theater Strategic Operations -- 1200-1400 Km-20-30 days

Figure 10

j. Threat forces will exploit space. Platforms currently used for reconnaissance and surveillance will perform additional missions of anti-satellite, C2, intercontinental ballistic missile (ICBM) detection, and satellite maintenance and repair.

k. The lethality and fluidity of the airland battlefield will adversely effect our soldiers. Continuous operations create great stress resulting in fatigue, the inability to communicate effectively, life-cycle disturbance, feelings of isolation and disorientation. The threat or actual use of chemicals will force personnel into Mission Oriented Protective Posture (MOPP) equipment. Wearing of MOPP will hamper automated, as well as manual operations. Automation and communications equipment not protected could be rendered inoperable from chemical exposure or electro-magnetic pulse (EMP) form nuclear explosions. The use of REC and Psychological Operations (PSYOPS) may further degrade operations. Potential mass casualties may overtax automated systems, especially if administrative personnel are forced to operate in MOPP equipment.

## STUDY PLAN

## PSS IN ARMY MODELS

The following study plan was produced by modifying an earlier plan developed by the the Analysis Division, Directorate of Combat Developments (DCD), Soldier Support Center. DCD concurred with the modifications made to the original study plan.

1. PURPOSE. The purpose of the study is to catalog the PSS functions that are represented in existing models; to identify requirements for additional functions in current and future models; and to write a management plan designed to implement the recommendations of the study.

2. STUDY SPONSOR. Director of Combat Developments, U.S. Army Soldier Support Center (USASSC).

3. STUDY AGENCY. TRADOC Analysis Command - Ft. Benjamin Harrison (TRAC-FBHN).

4. STUDY MONITOR. TRAC-FBHN.

5. TERMS OF REFERENCE.

a. Problem. Many of the Army's current analytical and training models treat the PSS function in a simplistic manner. PSS functions affect the Army's ability to sustain combat power and in particular, control the flow of replacements to combat units. The consequences of inadequate or simplified inclusion of PSS functions into Army models may be to systematically overstate the combat power of the blue force, leading to overly optimistic model results upon which policy and strategic/tactical alternatives are evaluated.

b. Objectives.

(1) To identify and catalog the PSS functions that are represented in current Army models.

(2) To identify and prioritize the PSS functions that should be included in present and future Army models.

(3) To prepare a management plan designed to implement the recommendations of the study.

c. Scope. This study will be limited to selected training and analytical models. Model selection will be based on the importance of the models and the extent to which PSS functions influence their outcomes.

d. Time Frame. Model has to accommodate current and future forces and scenario dependent structures for the red and blue forces.

e. Essential Elements of Analysis (EEA).

(1) What are the Army models that fall within the scope of this study?

(2) What PSS functions are included in the Army models that fall within the scope of this study? How and to what level of detail are they portrayed?

(3) Which PSS functions are candidates for inclusion in Army models? How and to what level of detail should they be portrayed? What functions lend themselves to post/pre-processing instead of inclusion in the model(s)?

(4) Who are the users or user groups which require that PSS be represented in Army models?

(5) What products and benefits do the users need?

(6) What PSS functions will satisfy the needs of each user or user group?

(7) What is the level of resolution that will satisfy the needs of each user or user group?

(8) How do PSS functions affect combat capability?

(9) What must be done in order to integrate PSS into Army models? What is the priority for this integration?

f. Constraints. Manpower for this effort will not exceed current levels delineated under paragraph (i).

g. Alternatives.

(1) Status quo.

(2) Develop a PSS functional model to reflect PSS functions independent of other modeling efforts.

(3) Develop a hierarchy of PSS models that can interface with other Army models.

(4) Provide pre and post processing of PSS functions for the hierarchy of Army models.

(5) A combination of alternatives 2, 3, and 4.

(6) Create individual PSS modules for each Army model considered.

h. Methodology.

(1) Identify all of the PSS functions that could be included in Army models. The study team will create the list of PSS functions by reviewing doctrinal materials and consulting with the SSC's schools and the community of PSS data users.

(2) Identify the models that are of interest within the scope of this study. Survey these models to determine what PSS functions they include and the manner in which those functions are represented.

(3) Determine how PSS functions affect combat capability. The study team will identify the PSS functions that have a significant impact on combat capability and attempt to quantify their effects. The effort will focus on the number and effectiveness of the weapon systems available to the combat arms commander.

(4) Identify the users of model derived PSS data and determine their requirements.

(5) Identify the PSS functions that will satisfy user requirements for model derived data.

(6) Prepare a management plan to implement the recommendations of the study. The number of PSS functions that a model must include is determined by the purpose of the model. Combat models need only include those functions that have a significant impact on combat capability, while functional or training models may require the inclusion of different sets of functions. In developing the management plan, the study team will account for these differences so that PSS functions will not be needlessly added to existing and future models.

i. Support and Resource Requirements.

(1) Manpower requirements in professional staff years (PSY).

(a) USASSC: 0.1 PSY.

(b) Concepts, Studies & Threat Division (CSTD): 0.25 PSY (Concurrent with threat study).

(c) TRAC-FBHN: 0.5 PSY.

(2) TDY. Travel may be required to the following locations. Each organization is responsible for funding its own TDY.

(a) U.S. Army Logistics Center (USALOGCEN).

(b) TRADOC Analysis Command - White Sands Missile Range (TRAC-WSMR).

(c) U.S. Army Concepts Analysis Agency (USACAA).

(d) TRADOC Analysis Command - Fort Leavenworth (TRAC-FLVN).

(e) Academy of Health Sciences.

(f) Headquarters Department of the Army (HQDA).

(3) TRAC-FBHN

(a) Provide study management.

(b) Answer the EEA's for the Army's analytical and functional models.

(c) Write the management plan to include PSS functions in Army models.

(d) Write the study report.

(4) DCD.

(a) Assist in literature search (concurrent with threat study).

(b) Assist TRAC-FBHN in answering EEA's 3, 4, 5, 6, 7, and 8 for the Army's functional and analytical models.

(c) Assist in developing the management plan to include PSS functions in Army models.

(d) Provide a point of contact to TRAC-FBHN

(5) Directorate of Training and Doctrine.

(a) Answer the EEA's for the Army's training and medical models.

(b) Assist in developing the management plan to include PSS functions in Army models.

(c) Provide a point of contact to TRAC-FBHN.

j. Related Studies/Models.

(1) Vector-In-Command Combat Service Support (VIC-CSS) Study.

(2) Model II (MOD II).

(3) Logistics Functional Model Development Study.

(4) CORBAN.

(5) PSS Planning Factors Study.

(6) Manpower Requirements Criteria (MARC) studies.

(7) Personnel Service Support Battlefield Simulation Study (PSS/BSS).

(8) Wartime Replacement System Study (WRSS).

(9) Casualty Stratification Model (CSM) I and II.

(10) FORCE - Command, Control, Communications, and Combat Effectiveness Model.

(11) Army Training Battle Simulator System (ARTBASS).

(12) Combined Arms and Support Task Force Evaluation (CASTFOREM) Model.

(13) Joint Exercise Support System (JESS)

(14) JIFFY Model.

(15) Maintenance Capability Attack Model (MACATAK).

(16) Tactical Simulator (TACSIM).

(17) Transportation and Supply Activities (TRANSACT).

(18) Soldier Dimensions in Combat Modeling (FY 89 AR 5-5 Program).

6. ADMINISTRATION.

a. Milestones:

| DATE | TOPIC |
|---|---|
| 14 October 1988 | Complete preliminary data collection. |
| November 1988 | Complete EEA 1. |
| January 1989 | Complete EEA's 4, 5, 6, and 7. |
| February 1989 | Complete EEA's 2, 3, and 8. |
| March 1989 | Complete EEA 9 and the management plan to include PSS in Army models. |
| April 1989 | Draft Report Coordination. |
| May 1989 | Publish the final report. |

b. Study project officer is MAJ Jim Thomas, TRAC-FBHN. TRAC-FBHN will manage the conduct of the study using the procedures outlined in Appendix A, TRADOC PAM 11-8.

7. CORRELATION.

a. Study ACN: 073765.

b. AR 5-5 category: Non-major study, category G.

c. Study priority within the TRADOC Study Program: 213.

## KEY PERSONNEL CONTACTED

| | |
|---|---|
| CPT Ted Basila | SSC NCR, Analysis Division |
| LTC Vern Bettencourt | Director, TRAC-Monterey |
| Ms. Gloria Brown | Deputy Undersecretary of the Army Operations Research - Study Program Management Agency |
| CPT Bob Cadigan | Adjutant General School, PSS/BSS |
| Mr. Dick Caukins | Chief, TRAC Combat Developement Model Support Division |
| CPT(P) Mike Coville | TRAC Training and Simulations Directorate |
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| MAJ Bruce Elliot | PERSCOM Mobilization Directorate |
| Mr. Gary Flack | TRAC-WSMR, JANUS Division Chief |
| COL Frank Foster | Commandant, Adjutant General School |
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| MAJ Ken Hughes | Deputy Director, Directorate of Combat Developements, SSC |
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| MAJ Frank McDonald | Office of the Surgeon General |
| CPT Irmgard McMahon | PERSCOM Mobilization Directorate |
| Mr. Stanley Miller | CAA |

| | |
|---|---|
| Dr. Sam Parry | Professor, OR, NPS |
| Mr. Dick Porter | TRAC-WSMR (VIC) |
| CPT Postman | Chief of Training - 1st Battle Battalion-Corps (BC) |
| Ms. Wilma Rose | TRADOC Contracting Agency |
| Mr. Ron Rury | Concepts, Studies, and Threat Division, SSC |
| SFC Bob Sheldon | Concepts, Studies, and Threat Division, SSC |
| CPT Jim Stover | Project Officer, CBT-SIM (Combat Simulation) |
| LTC Arpad Szurgyi | Deputy Director PSS, PERSCOM |
| Ms. Sherry Thomas | TRAC Training Simulation Study Support Division (CORBAN) |
| MAJ Dave Tyner | TRAC-TOD |
| MAJ Walter Wakefield | CAA |
| Mr. Billy Williams | TRADOC Analysis Command - Fort Lee (TRAC-LEE ), Chief Studies Division |

## SAMPLE QUESTIONNAIRE

APPENDIX OVERVIEW. In Chapter 5, we discussed a methodology for estimating the effects on unit combat effectiveness from the PSS functions of Chaplaincy, Public Affairs, Legal Affairs, and Finance Operations. While we did not pursue this procedure due to our limited resources for this study, this appendix outlines a method which can be used to quantify these effects using a survey instrument and an analytical procedure "Interval Estimates Using Categorical Judgements" (reference 17). This appendix was developed using reference 5.

1. PURPOSE AND MOTIVATION

a. The purpose of this questionnaire is to obtain an estimate of the degradation in a unit's effectiveness based on the threat posed and the variation of 5 key variables of the unit. This survey will be used to assist the G-3 and the decision maker in determining if they can handle a mission based on the status of these 5 key factors. Your answers are therefore very important to insure a good decision is make. Your answers, as the decision maker of the percent degradation of your unit's effectiveness based on the changes to these key variables is a measure of the relative importance of each variable to the accomplishment of your mission. Your answers will also help to develop a more accurate and realistic representation of how changes to the key variables effect your view of its relative importance.

b. Key Variables. The five key variables used throughout this questionnaire are:

(1) % Personnel

(2) % Ammo

(3) % Weapon Systems/Combat Vehicles

(4) % POL (fuel)

(5) % PSS Support (Chaplains, Judge Advocate General (UCMJ), Public Affairs, and Finance)

c. Instructions.

(1) In the remainder of this questionnaire, you will be asked to place yourself in the role of the decision maker of the unit and determine how changes to your unit's fuel, ammo, personnel, vehicles, and PSS support will affect your interpretation of your unit's ability to accomplish its assigned mission.

(2) Please respond to the questions asked in accordance with your feelings regarding the situation. There is no right or wrong answer to any of the questions. As a decision maker in a

combat situation you will be required to make rapid estimates of the situation. Therefore, with this in mind you should only take enough time to fully understand the situation presented and record your response.

(3) You will receive an example question and two practice questions. You are than asked to answer 48 questions by putting an X under the response you feel best describes the unit's ability to accomplish its assigned mission.

d. Situation

(1) Based on the following situation your will be asked to answer questions on the degree to which you determine your unit is able to accomplish its assigned mission. Use the following situation to answer all of the questions in this survey.

(2) Enemy - Motorized Rifle Division

(3) Friendly - Your unit (7th Corp) is currently conducting deliberate defensive operations in the Fulda Gap. Your unit is presently in prepared defensive positions and engaged in combat with the enemy.

(4) Mission - Your unit will conduct a deliberate defense of present positions for a minimum of 72 hours, longer if possible, to prevent the enemy from controlling this key terrain.

2. SURVEY (Example of the response form)

a. Based on the above scenario and mission answer the following questions.

b. The current status of your unit is:

(1) 75% Personnel

(2) 25% Ammunition

(3) 50% Weapon Systems

(4) 50% POL

(5) 75% PSS Capability

c. Based on this status, indicate below the current effectiveness of your unit's ability to continue to accomplish its current mission of deliberate defense.

| TOTALLY EFFECTIVE | EFFECTIVE | MARGINAL | INEFFECTIVE | TOTALLY INEFFECTIVE |
|---|---|---|---|---|
| ( ) | ( ) | ( ) | ( ) | ( ) |

## 3. ANALYSIS METHODOLOGY

a. From the survey responses we can transform the categorical responses to interval scales using a technique developed by Dr. Glenn Lindsay of the Naval Postgraduate School. This process is summarized as follows;

(1) Arrange the raw frequency data in a table where the rows are scenarios and the columns are categories. Columns should be in rank order with the least favorable category in the left column and the most favorable in the right column.

(2) Compute the relative cumulative frequencies for each row and record these values in a new table. This table is referred to as the P array and all values of $P_{ij} >= 0.98$ and $P_{ij} <= 0.02$ are removed. This creates an n x (m - k) array, where k is the number of columns removed.

(3) Treating these $P_{ij}$ values as leftward areas under a Normal (0,1) curve, look up the values of Z from a table of the normal distribution. Record these as a new table which will be the $Z = ABS[Z_{ij}]$ array for the computations that follow.

(4) For each instance, i, in the Z array, compute the row average, $Z_i$ Bar.

(5) For each column, j, in the Z array, compute the column average, $b_j$ Bar. Note that $b_j$ Bar is the value of the upper bound of category j on the scale being developed.

(6) Compute the grand average, b Bar, of all values of the Z array.

(7) Compute the sum of the squared column differences.

(8) For each row compute $A_i$, the sum of squared individual differences.

(9) For each scenario compute $SQR[B/A_i]$.

(10) Finally for each row (scenario) compute $S_i$ = b Bar - $Z_i$ x $SQR[B/A_i]$, for all i. These $S_i$'s are the scale values of the instances, on the same interval scale as the category bounds, $b_j$. Now all instances and category bounds are on the desired scale and any linear transformation may now be performed to adjust the scale as desired using the same transformation to move both scenarios and category bounds.

## 4. TRANSFORMING CATEGORICAL RESPONSES TO INTERVAL SCALE RESULTS

Based upon the survey data and the methodology outline in 3 above, we would obtain transformed values on an interval scale as depicted below.

## CONSTRUCTING INTERVAL SCALES FROM ORDINAL DATA

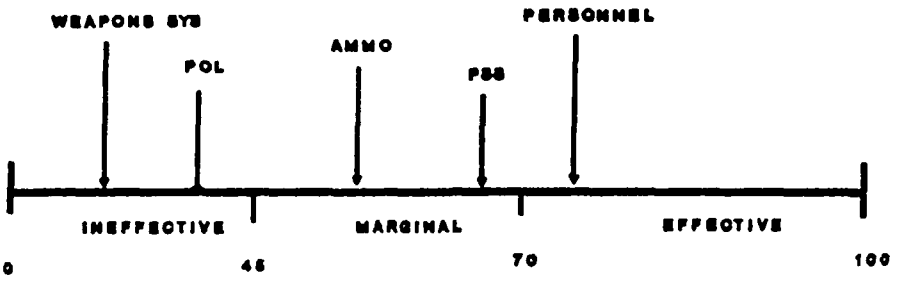


Figure 11

Using this type of analytic tool, we can estimate the relative importance of PSS functions on the battlefield. Methodologies could then be employed for incorporating these PSS functions into Army models.

# JANUS(T) REAR AREA

## THREAT STUDY METHODOLOGY

1. INTRODUCTION. In selecting an analytical model to estimate the effects of the threat on PSS units in the rear area, the study team determined there are two driving factors for model selection. First of all, the model must be able to portray the threat as described in Appendix B. Secondly, the resolution of the model must be of sufficient detail to portray both the threat units and our PSS units in the rear area.

2. MODEL REQUIREMENTS.

a. The primary threat to PSS units is from NBC weapons, electronic warfare, Spetsnatz (Soviet Special Forces), and terrorists. The secondary threat is from heliborne and airborne operations, artillery bombardment in the division rear area, and air strikes as far back as the theater rear. Proper portrayal of the threat requires unit resolution of squad through battalion; NBC and electronic warfare; and artillery and air strike capability.

b. PSS unit size is primarily that of company. Platoons are also deployed by finance and personnel units in the division rear area. Weapons systems found in the rear area are primarily small arms, but also include air defense systems.

3. MODEL SELECTION. The models which have the required capabilities are TRADOC models. The three primary candidates are VIC, JANUS(T), and CASTFOREM. CASTFOREM resolution is individual soldier and consequently is too high. The smallest resolution in VIC is essentially regiment and therefore is too low. Conversely, JANUS(T) can represent individual soldiers, platoons, and companies. The JANUS model used at TRAC White Sands can depict approximately 3200 entities. Entities can be individual soldiers or aggregated units to company level. It also has the capability to model the required weapons systems.

4. METHODOLOGY.

a. A disadvantage to using the higher resolution JANUS model, as compared to the lower resolution VIC model, is the amount of terrain which can be depicted. Using the JANUS model, we will have to use a slice of a Corps Support Group area for our study. Statistical techniques from this area sample will be required to make inferences regarding the entire rear area.

b. After the appropriate scenario is selected, we will portray the "slice" in the rear area. We want to determine the effects of the threat on our PSS units, given they are attacked. This methodology will perhaps require Baysian statistical methods.

c. If we select a scenario that has also been simulated by VIC, we can overlay the VIC battle on our "slice" and obtain information on breakthroughs, and more importantly, required movements of our PSS units. Obviously, when our units are required to move or defend in a perimeter defense, they are not able to perform their primary missions.

## STATEMENT OF WORK

**APPENDIX OVERVIEW. This statement of work in this appendix was developed to support several recommendations of the study. Once we execute this contractual effort, we will have an tool which we can use to measure the effectiveness of the entire replacement system.**

1. Class of Analysis: Modification or Development of Army Models

2. Title: Wartime Personnel Assessment Model (WARPAM)

3. Contract: MDA903-88-D-1000, Task xxxx

4. Task Background:

Failure to represent the doctrinal force structure's inherent capabilities in the flow of replacements is a serious flaw in the Army Family of Models. In addition to the potential problem of making incorrect force structure and tactical decisions from an overly simplistic representation of the system, the lack of a model linking the various stages of the replacement process precludes detailed analysis of the personnel system's ability to deliver qualified replacements on the Airland Battlefield.

Complicating the modeling problems caused by omitting the doctrinal force structure, the Wartime Replacement System Study (WRSS) estimates 40-50% of all replacements in the first 90 days of warfare will be returns to duty (RTDs) from the medical system. RTDs are grouped into two primary categories; wounded in action (WIAs) and disease non battle injury (DNBIs). The current methodology for estimating RTDs in Army modeling assumes that within each category the distribution of patient conditions is equal and, as a result, RTDs per category have the same probability of recovery. Furthermore, the methodology assumes that remaining physical disabilities never limit the reassignment of the returning soldier. We suspect, however, that MOS may affect the distribution of patient conditions which an injured soldier may experience and that many soldiers will incur serious injuries which will mandate MOS reclassification. Since a unique probability of recovery is associated with most patient conditions, different MOSs would not have the same probability of returning to duty. This phenomenon may change the number of RTDs available in critical MOSs.

Current computer simulations of theater combat define casualties in terms of combat or noncombat. There are no provisions during or after the simulation to consider the correlation between any of the multiple patient classification databases, the expected presentation of casualties resulting from a combat engagement, or the effect the patient reclassifications have on the personnel system's ability to provide the right man to the right job at the right time.

The medical and personnel communities have developed post-processing methods to disaggregate reported casualties from Army combat simulations into categories for treatment analysis (patient classification) and/or replacement estimation (MOS category/grouping). These methods do not draw upon the vast information contained in the combat simulation to ascertain the patient treatment classifications or MOS fitness for the return to duty patient in the replacement system.

The Concepts Analysis Agency (CAA) uses the historically based Patient Flow Model (PFM) to estimate from the gross quantities of casualties generated by combat simulations, their probable dispositions; RTD, evacuated, died in hospital, and patient length of hospital stay. CAA uses the PFM in conjunction with other models to support MOBMAN. The Department of the Army is required to submit annually, in conjunction with the Program Objective Memorandum (POM), military manpower data for MOBMAN. This data depicts time-phased personnel requirements, supply, and shortfalls for a specific theater within the Defense Guidance (DG) scenario. It should be apparent that the problems attributable to inaccurately portraying the personnel replacement system impact on decision making at the highest levels in the Department of Defense.

Since RTDs will comprise 40-50% of the total replacements in the early stages of the next war, it is imperative that we analytically estimate the immense effect that the distribution of casualty types, the resultant patient conditions, and the resulting physical profile limitations that RTDs will have on 1) the personnel replacement system's ability to reclassify and process the potentially large numbers of RTDs on a timely and accurate basis; 2) the personnel replacement system's force structure, doctrine, and planning; 3) manpower levels demanded for specific MOSs overtime (MOBMAN); and 4) medical force structure, doctrine, and planning.

5. Task Objective:

The objective of this task is to develop a skeletal computer model which will depict the flows in the U.S. Army's personnel replacement system. This model will provide: (1) a representation of the key doctrinal "links" in the personnel replacement system; (2) the ability to model replacements by grade, MOS, gender, physical profile, and service; (3) a stand alone capability to model the reclassification of RTDs based upon inputs from combat simulations, patient condition classifications, medical treatment system capabilities, results of expert opinion regarding the PULHES profile distribution for the patient conditions, and the personnel system's resultant utilization based upon the reclassification, and; (4) the ability to generate requirements for the logistical system to support replacement operations, including individual equipment items (e.g., NBC equipment, individual weapon) and transportation assets.

6. Scope of Work:

After replacements arrive at the CONUS Replacement Centers (CRCs), the model will track replacements (includes new replacements, CONUS and theater RTDs, and administrative RTDs) through the designated theater(s) and through the personnel system until delivery to the required unit. Statistics on percent fill by time, grade, MOS, the number of combat MOSs RTD but reclassified, and the total number of personnel replacements processed by the system are macro output parameters of the model. Micro level outputs include the number of reclassifications processed, the number of patients per condition serviced by the medical system, and the number of patients with temporary profiles (unable to function in a needed MOS due to temporary PULHES).

The contractor must also address the problems with and potential solutions to the aggregation-deaggregation inherent in using output from one model as input to another model. For example, in a combat simulation casualties occur as a result of various assumptions and inputs (e.g., in CEM; ballistic data from AMSAA). These casualties are then inputted into the Casualty Stratification Model (CSM) where we deaggregate and determine casualties by MOS and grade. If this output is used for the medical module outlined in this project, it will again be subject to its aggregated assumptions. The systemic affects of this aggregation-deaggregation-aggregation process must be addressed.

Due to the scope of this model and the monetary limitations of this project, the government will provide the data bases required to run the model to the contractor, only when readily available. If the data is not readily available, the contractor, with possible assistance by the Technical Representative (TR), will use estimates in the establishment of any data base or parameter required to run the model. Data bases or parameters used by the contractor in the model will be documented and provided as part of the contract. Additionally, the government will not furnish any computer software or hardware in the execution of this contract.

The focus of this contractual effort is to develop a skeletal model which over time can be augmented with more accurate data. A plan for future studies or simulations to support this effort is a requirement of the contract. Due to the technical expertise of TRAC-FBHN and the Soldier Support Center personnel, and the availability of computer hardware, the model should (negotiable) be written in American National Standards Institute (ANSI) 1978 full language standard FORTRAN.

7. Government Furnished Data: The government will furnish readily available data to the contractor. If the data is not available, the contractor should identify potential sources for the data, and then use estimates. The project must not be delayed because of data base collection or establishment.

8. Deliverables:

It is anticipated that the work discussed above will require 7-8 months to complete. The contractor will: 1) provide monthly letter-format progress reports to the Contracting Officers Technical Representative (COTR) and TR; 2) provide formal telephonic status reports to the TR at least every two weeks, 3) demonstrate a fully functioning model on the TRAC-FBHN target hardware, and 4) produce a draft final report 7-8 months after the task order award. The report will contain the source code for the developed model, documentation of the model, assumptions used in parameter estimation, data bases used in the model, suggested uses of the model for pre-processor/post-processor interface with the Family of Army Models, recommendations for data base sources, and recommendations for further study and analysis. A time phased system will be used to allow the TR to review key aspects of the project, rather than assessing the completed package. Accordingly, an in-progress review (IPR) will be held on the preliminary design of the model's architecture and methodology; a final IPR will be held that will identify all required linkages to/from other models. The TR will provide comments to the contractor within 30 calendar days of the draft report; the contractor will deliver a final report within 30 calendar days of the TR's comments. The contractor will furnish an oral briefing on the methods and findings to the TRAC-FBHN and others within 30 days of the delivery of the final report.

9. Agency Support:

a. Contracting Officers's Representative (COR) is Mr. Eugene P. Visco, Director, Study Program Management Agency, Office of the Deputy Under Secretary of the Army (Operations Research), ATTN: SFUS-SPM, Room 3C567, Pentagon, Washington, DC 20310-0102, telephone (202)-699-0026.

b. The Technical Representative for this task is MAJ James R. Thomas, TRADOC Analysis Command - Fort Benjamin Harrison, ATTN: ATRC-B (Bldg 401-B), Fort Benjamin Harrison, IN 46216-5000, telephone (317) 543-6883.

# DEFINITIONS

**PURPOSE.** This appendix was written to provide the reader with definitions of basic modeling terms used in the model descriptions in Chapter 3.

**Two-sided** - The model plays both the red and blue forces during the simulated combat.

**One-sided** - The model plays either the blue or the red force but not both.

**Deterministic model** - A deterministic model predicts a single outcome from a given set of circumstances.

**Stochastic model** - A stochastic model predicts a set of possible outcomes weighed by their likelihoods or probabilities.

**Event-stepped** - A modeling approach where an event contains all decision flows and updating that relate to the change in state the execution of the event requires. Since time elapses between events, one can regard a simulation as the execution of a sequence of events ordered chronologically on desired execution times. However, no time elapses within an event.

**Time stepped** - a modeling approach where each process is assigned to each entity being modeled. Each entity moves through the system and consequently through time. This time flow distinguishes this approach from event-stepped modeling.

**Interactive** - The model requires interaction from the user during the actual simulation.

**Digitized terrain** - Terrain is represented in the computer by the numerical representations (e.g., altitude) of the terrain.

**Real-time** - The time required to execute a function in the simulation is equal to the time required to actually perform the function.

**Man-in-the-loop** - A human interacts with the computer by performing decision making during the execution of the simulation.

**Level of aggregation** - The smallest sized military unit the simulation is able to portray. For example, if the level of aggregation is battalion, then the simulation can not play the smaller units which comprise the battalion (e.g., companies, platoons, etc.)

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