INTERDISCIPLINARY SYSTEMS DEFINITION MODEL

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ABSTRACT

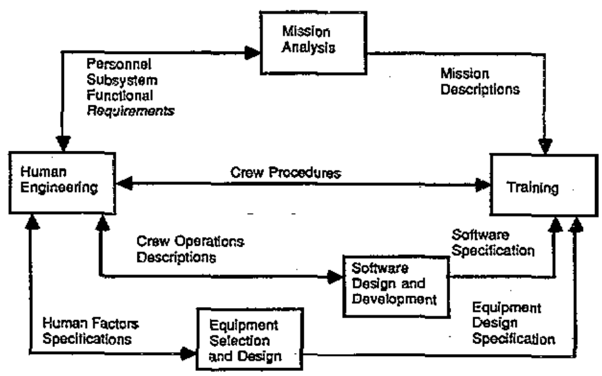
This paper will present information on an Interdisciplinary Systems Definition Model (ISDM) for training design and developments which is implemented during the military acquisition process, and which utilizes a diverse range of technical skills and disciplines. The central theme of the model emphasizes the need for individual technical disciplines to coordinate not only products but processes which may affect an adjacent discipline's methodology. The focus of the model is the definition and development of those aspects to be trained which address the functional and operational aspects of the system. Functional aspects in this context deal with the skills required to place the system into a state of functioning, or simply, the man-machine-interface. Operational aspects refer to activities performed by the operator(s) in response to the changing tactical environment, including coordination and communication with the supported echelon of deployment. In addition, this paper provides information on the systems engineering approach used to define doctrinal deployment and tactical applications of a system with no type classified predecessor or similar system in the field. The model will show how the disciplines of Mission Analysis, Human Factors Engineering, and Training have been brought together to define user applications. In this paper, these factors are considered in the context of the Human Factors, Manpower, Personnel, and Training (HMPT) model which preceeded the current MANPRINT model. This paper will describe how the variables of the battlefield environment, threat, and taskings affect the hardware, software, soldiers, and procedures which determine the overall contribution of the system to force effectiveness. As an example, this paper will show how the model has been applied to the Joint Surveillance Target Attack Radar System (Joint STARS), an evolving system in the Military Acquisition Process. By utilizing the skills of mission analyst, human factors engineer, and training developer, concerns related to work station layout, workload, crew size, sensor performance, and training developments have been addressed during the validation and full scale engineering development stages of the acquisition cycle for Joint STARS. Finally, this paper will show examples of how the inter-disciplinary approach was applied to system and personnel issues which affected software design, operational concepts, and training.

INTRODUCTION

The effectiveness and readiness of a weapon system depends, to a large degree, upon the system operator, crew, and maintainers. Yet, frequently, little attention has been given to human performance capabilities and to Human Factors, Manpower, Personnel, and Training (HMPT) issues during the development phase of new systems.

Because of system effectiveness being dependent on operator, crew, and maintainers, there has been an increased awareness of HMPT concerns within the DoD which is reflected in changes to system acquisition regulations and policies. A greater emphasis is now placed upon the incorporation of HMPT considerations in the planning stage of new systems, as well as during their development, evaluation, and fielding. The changes in DoD regulations and policies focus particular attention on the ability of system design to meet the capabilities of the people who will use the system, and on the availability of adequate numbers of people with the right skills to operate and maintain the system. Further attention is focused on provisions for safe and effective system operation and maintenance.

The Interdisciplinary Systems Definition Model (ISDM) diagram represents the approach used to address HMPT concerns. The approach focuses primarily on Human Factors, Mission Analysis, Training, and System Design.

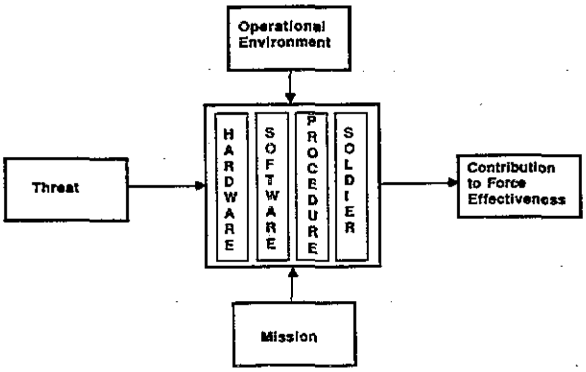


The selection among alternative design concepts involves consideration of human capabilities for information processing and decision making when dealing with system throughput of target information. Performance is considered both for the human as an individual and for the human as a member of an interacting team. The design and evaluation process entails allocating functions between the operator and machine in accordance with human strengths and weaknesses, and providing the operator with job and decision aids to optimize the man-machine interface.

The products of these activities provide the basis for the preparation of design requirements and training needs. Included in the design are such elements as workspace layout, crew station configuration, and crew composition. The design of the man-machine interface takes into account procedures for processing, manipulating, and transmitting information in terms of human requirements and capabilities. Training requirements are extrapolated so that recommendations can be made for training equipment, support personnel, and facilities.

DEFINITIONAL MODEL DESCRIPTION

In the context of structuring the ISDM, a systems operational concept Definitional Model was defined and is diagrammed below. The Definitional Model allowed for the specific interactions of the ISDM disciplines while permitting interface with the variables that affect the communications and responses between the Hardware, Software, Procedures, and Soldiers.



Procedures/Soldiers

Well defined procedures are essential to ensure adequate training of operators and to ensure the *operational adequacy of the hardware and software* to meet the user needs. Definition of the procedures are categorized as Functional and Operational and are presented below.

Functional Procedures. Functional procedures are those tasks performed to place the system in operation. These tasks may require interaction with other operators. However, emphasis of these tasks is on the interaction of a single operator *with the hardware and software.*

Operational Procedures. Operational procedures are those tasks involving more than one operator and/or tasks involving an operator(s) plus a user for accomplishment. Operational procedures generally involve tasks associated with communication and coordination with the user elements in reference to the information provided by the system.

Procedures designate how the soldier is to:

—Convert user taskings into operator functions.
—Filter non-essential information.
—Interface with other battlefield systems.

Operational Environment

The Operational Environment offers unwanted surprises to the operational system. Identification of these surprises and the effects they have on system performance will determine the tasks for which operators need to be trained in order to mitigate the effects on system performance. The Operational Environment considerations include:

Non-linear Battlefield. In modern battle, the US Army will face an enemy who expects to sustain rapid movement during the offense and who will probably use every weapon available. Opposing forces will rarely fight along orderly, distinct lines. Massive troop concentrations or immensely destructive fires will make some penetrations by both combatants nearly inevitable. This means that linear warfare will most often be a temporary condition at best and that distinctions between rear and forward areas will be blurred. Air and ground maneuver forces; conventional, nuclear, and chemical fires; unconventional warfare; active reconnaissance, surveillance, and target-acquisition efforts; and electronic warfare will be directed against the forward and rear areas of both combatants.

Weather. Weather affects equipment and terrain, but the greatest impact is on the soldiers. Perhaps the most important effect of weather is on the soldier's ability to function effectively in battle. Inclement weather generally favors an attacker because defending troops will be less alert.

Airspace Management. Airspace coordination maximizes joint force effectiveness in the battle without hindering the combat power. Friendly aircraft must be able to enter, to depart, and to move within the area of operations free of undue restrictions, while artillery fires in support of ground force continue uninterrupted. The tempo and complexity of modern combat rule out a system that requires complicated or time-consuming coordination. Also, the likelihood of poor or enemy-jammed communications dictates maximum reliance on procedural arrangement. To be simple and flexible, our airspace coordination system operates under a concept of management by exception.

Line-Of-Sight. The application of the Definitional Model requires the identification of visibility criteria among three variables; 1) aerial platform, which is defined as altitude, stand-off distance, and position, determined by time; 2) intervening terrain, which determines masked areas and graying angle for target detection, and 3) shelter location, to maintain maximum line-of-sight between the airborne and ground based data links.

Threat

As defined and utilized within the Definitional Model, the Threat is the Warsaw Pact Forces in general and the forces opposing the United States contingency of the U.S. Corps along the Fulda Gap avenue of approach in particular.

Development of the Army only threat scenario proceeded within the guidelines described by Soviet Army Operations IAG-13-U-78. This document describes the basic flow of maneuver and air deployment patterns and provides an ending location for maneuver units at the regimental level. The Red Force organization depicted is representative of a 1986 time frame. Based on accepted Red Force doctrine, extensive terrain analysis, and the documentation guidelines, specific movement routes, forward assembly areas, velocities, and formations were defined for each maneuver battalion in the threat area.

Mission

Effective taskings help ensure that the right information is collected to support mission accomplishment while using the least amount of critical resources. Tasking controls the information flow through a system by specifying the information needs in terms of level of command, location, and time.

Level of Command. The deployment of a system to a specific echelon will, by the nature of the threat encountered by that echelon, determine mission types and taskings encountered. Associated with the mission requirements of the level of command are the area of influence and the area of interest.

The area of influence is the assigned area of operations wherein a commander is capable of acquiring and fighting enemy units with assets *organic to, or in support of, their command.* It is a geographical area, the size of which depends upon the factors of METT-T (Mission, Enemy, Terrain, Troops Available and Time). It is assigned by higher headquarters and designated by boundaries and a forward terminating line.

The area of interest extends beyond the area of influence. It includes territory which contains enemy forces capable of affecting future operations. The area of interest is usually within the next higher headquarter's and a portion of adjacent units' areas of influence. The area of interest contains units not yet closed in battle, but within striking distance of an echelons forces.

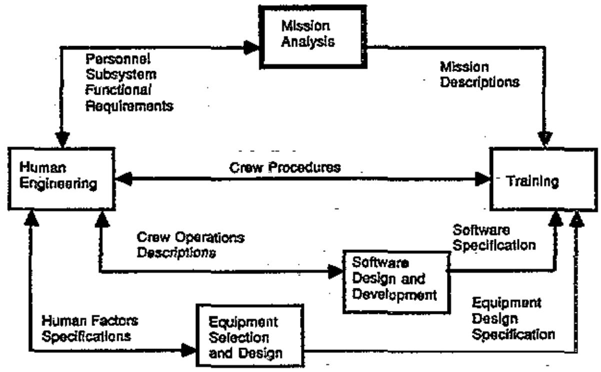
Contribution To Force Effectiveness

The ability of a single system to influence or contribute to the success of an operation must be considered in conjunction with and in the context of its supporting system and the system which it in turn supports. To quantify the contributions of a specific systems intra-actions, the intra-actions must be levied against the parallel, queued, and queuing systems, with which that specific system interacts in the larger operational environment. The range of specific system contribution to force effectiveness is therefore subject to the particular question being asked and the paradigm being addressed. Due to the variety of circumstances and the situational nature of a system's placement, to arrive at "contribution to force effectiveness" the implementation of the operational concept design was exercised only at the intra-action system level. However, this is not to infer that by restructuring the operational concepts during intra-actions outputs that the results could not be coordinated to affect results of play on a larger scale.

ISDM JOINT STARS APPLICATION

ISDM Mission Analysis

The mission analysis portion of the ISDM supported the definition of the Operational Environment and Threat in the system's operational concept design. The purpose of the mission analysis effort was to provide a movement scenario which depicts the activity of a Red Force army conducting a supporting attack as part of a Red Force Front assault on the Federal Republic of Germany.



Development of the movement scenario proceeded within the guidelines described by Soviet Army Operations IAG-13-U-78. This document describes the basic flow of maneuver and air deployment patterns, and provides an ending location for maneuver units at the regimental level. In the development process of the movement scenario, movement resolution is increased by depicting the regimental movement described at the battalion level, thus providing greater detail within the scenario. The overall scenario involves a massive Red Force build-up to and conduct of a breakthrough attack. Red Forces depicted include two divisions and an independent tank regiment in the first-echelon, and two second-echelon divisions. The army that is depicted is a first echelon army in the Red Force attack.

The Red Force organization depicted therein is representative of a 1986 time frame. Based on accepted Red Force doctrine, extensive terrain analysis, and supporting documentation guidelines, specific movement routes, forward assembly areas, velocities, and formations were defined for each maneuver battalion in the scenario. All Red Force units were nationalized and their designations are described in this document as such. Blue Forces were not depicted in the scenario.

An in-depth terrain analysis allowed us to select the most realistic and efficient movement routes. Since Red Forces mass their units in specific avenues of approach, this analysis provided the network from which to control the ebb and flow of traffic.

The documents were researched and analyzed which allowed the extraction of ending locations for regimental-size units at approximately four hour increments based on critical incidents. This information was then compiled into event-based timelines at the regimental level. The event-based timelines were transformed into movement timelines at the battalion level with the use of appropriate terrain maps. This allowed us to select the best suited road network on which to deploy the troops forward. The movement timelines were organized in layers by combat division, which reflected the type of activity: maneuver, artillery, or logistics.

The maneuver overlay of the scenario includes 14 hours of pre-attack build-up. The construction of this build-up was based upon possible Red Force deployment patterns and Red Force strategies depicted in available literature. The main areas researched were deception, surprise, and deployment. The combat troop build-up utilized an FTX wargame area in East Germany from which a deception plan could be established. The build-up began with an eight battalion two-sided wargame already in progress. As the wargame took place, Red Force combat troops from the rear were deployed forward in such a way as to imitate combat support. In total, seven regiments were deployed forward from the rear area. The troops were deployed using major autobahns and existing railroad routes. An attempt was made to show the first-echelon battalions who initially conduct the attack already moving when they reach and deploy from their assigned initial positions described by the documentation.

Deployment of regimental Artillery Groups (RAGs), Division Artillery Groups (DAGs), and Army Artillery Groups (AAGs) supporting the Red Force attack was defined from an analysis of the maneuver posture depicted in the scenario and from Red Force doctrine. Thus, the movements of cannon artillery units between alternate firing positions were defined based on their requirements to support the Red Force attack. Multiple Rocket Launcher (MRL) battery movements were described to reflect their anticipated "run and gun" tactics.

Because the researched documentation does not describe the movements of supply units, an analysis of re-supply requirements was also undertaken. These requirements were then translated into supply unit movements following accepted Red Force logistics doctrine. These movements were depicted in terms of specific arrival and departure times, speeds, and formations of units, traveling along specific movement routes between supply points. Both delivery and return-trip activity were depicted. The lowest level of supply activity depicted was regiment transporting to battalion.

Several additional features have been incorporated into the movement scenario. These include:

- Rail Traffic - This feature was implemented as a means of deploying the first-echelon combat troops and artillery forward from the rear area during the pre-attack period.

- River Crossings - Several river crossings are depicted in the scenario, including the build-up to and the conduct of the actual crossing.

- Airmobile Landings - Two battalion-size airmobile landings are depicted in the scenario.

- Formations - Several new formations have been added to the movement scenario including:

  - Rail Roads
  - Advanced Guard Administrative Columns
  - March-to-Contact Administrative Columns
  - Regimental Headquarters
  - Main Body Administrative Columns
  - Rear Guard Administrative Columns
  - River Crossings

- Semi-fixed Installation (SFI) Signatures - The purpose of the SFI modeling effort within the movement scenario was to represent the movement patterns of lucrative milling targets for both artillery and acquisition functions. The following signatures were depicted in the scenario:

  - Forward Line of Troops (FLOT)
  - Assembly Areas
    - --Battalion
    - --Regimental
    - --Division
  - Command Posts
  - Supply Points
  - River Crossings
  - Special Operations

The scenario depicted the detailed movement of all significant MTI-detectable maneuver, supply, and field artillery units participating in a Red Force Army breakthrough attack during a 66-hour period. It should also be noted that, during the plotting of all maneuver, supply, and artillery movements, care was taken to time-phase unit movements with respect to one another. Thus, the movement scenario sought to realistically depict the ebb and flow of traffic and the use of routes and avenues.

The completion of the operational environment description and threat depiction by the Mission Analysis discipline produced a movement scenario which could then be coded by software personnel. The movement scenario was significant because it was the basis by which simulated MTI imagery could serve as the driver for the Joint STARS Ground Station Simulator (GSS) to present typical threat density arrays to a trained subject population for throughput studies, operator evaluations and system analysis.

The GSS testbed facility was developed to verify Joint STARS deployment concepts and to define operator functions and tasks. The Ground Station Simulator provided hardware and software capability to assist in Human Factors Analysis and the training of Joint STARS ground station individuals and crews in both functional and operational tasks. The GSS had the capability of simulating those functions of the Joint STARS Ground Station Module (GSM) which were necessary for training and analysis of the GSM crews. The bases for all Joint STARS Ground Station functions were the Critical Design Plan (CDP) and the Joint STARS B-5 functional software specification. The GSS incorporated both full and/or part task training features as necessary to train operators in individual, team, and superteam tasks. The GSS also had a subset of the communications linked to Joint STARS users. This subset consisted of those links determined by Honeywell and the Program Office to be necessary for training operators in the defined areas.

The GSS computer based facility consisted of 10 Joint STARS GSM operator student stations, three Joint STARS user workstations, and the computer processor and peripherals necessary to simulate the functions of a Joint STARS ground station and its communications links to users. Five simulated S-280 shelters housed the ten student stations, with two student stations per shelter.

The layout of the GSS allowed it to be operated in any of several different configurations, including full operating capabilities and degraded modes of operation.

A GSS shelter simulation consisted of two student stations, two digitizer boards, a serial printer, field phones, internal intercom capabilities, and equipment rack mockups. The ten student stations were placed in five shelters of approximately the same size as the Joint STARS GSM to be fielded. The internal layout of the GSS shelter possessed a high degree of physical fidelity with the layout of the Joint STARS GSM.

The combination of the movement scenario and the Ground Station Simulator testbed provided the capability to initiate the analysis of Joint STARS concepts on a total systems level, and of the functional and operational procedures required to accomplish mission objectives.

ISDM Human Factors Engineering

Once the movement scenario had been combined with the GSS, efforts could continue in the areas of further defining the system concept and identifying operator tasks. The lead discipline in this analysis was the Human Factors domain; however, the analysis was structured to utilize the maximum potential of the Human Factors and Mission Analysis integration. During the process of defining the effort, an audit trail was produced for the identification of decisions and tradeoffs between decision elements. The areas addressed by this effort were functional analysis, procedural analysis and effectiveness analysis.

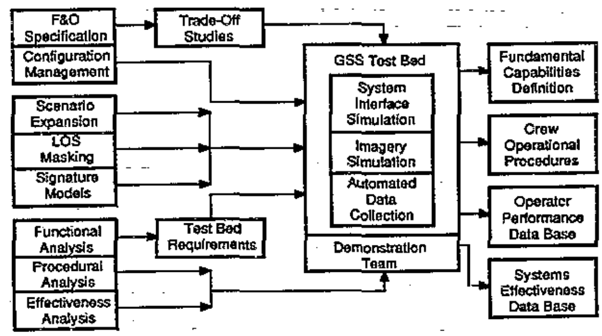
Functional Analysis - All major systems concepts were developed around some stated mission. The proposed mission was analyzed in terms of clarifying its purpose and objectives. These became the underlying basis for all succeeding decisions regarding both the projected hardware and the facility and personnel requirements for the system. Once the general mission purpose and objectives were identified, reasonably detailed operating requirements were defined to clarify the demands to be made on the elements of the system. These requirements were used to define functions that had to be performed by physical elements, such as hardware, facilities, or software, and/or by operators, technicians, maintainers, or managers.

Procedural Analysis - Once baseline functions were defined, various procedural approaches toward functional accomplishment were examined. Objective evaluation criteria were established against which to compare alternative procedural accomplishment methods, modes, or techniques. An important aspect of this procedural analysis was the decision whether certain functions would be performed more efficiently or cost effectively by humans, or by equipment (machines or software).

Effectiveness Analysis - The effectiveness analysis provided the basis for adding appropriate human factors information and/or recommendations to the hardware and software specifications. This analysis focused on developing and quantifying preliminary descriptions of what humans do in the system, how they do it, and what the critical input and output characteristics are between human, machine, and operating environment. The descriptions on which analyses were run included:

- The location of the tasked activity
- The type and amount of information input and output
- Time and accuracy requirements
- The potential failure modes and consequences (including effects on operator performance and potential hazards)
- Operator skill requirements

The interactions of these analyses and the products provided by them established a data base from which alternative concepts and functional or operational procedures could be assessed.



ISDM Training

The information and materials generated during the Mission Analysis and Human Factors Engineering efforts were then used to provide for training a realistic scenario and a ground station simulator that had physical and functional fidelity with the anticipated Ground Station Module. By making use of the Events Detection and Sorting Routines software and interdisciplinary information exchanges throughout the system development process, training scenarios that allowed for accurate evaluation of operator performance against known ground truth were developed. The implemented training approach was a seven-staged process leading to the development and conduct of a total of 110 lesson plans for the Joint STARS training package. The lesson plans called for 360 Instructor Contact Hours, of which over 75% were designed and used for hands-on performance.

In developing the training package, well defined procedures were essential to ensure that operators would be adequately trained to use the system efficiently and effectively. In the ISDM, defining these procedures required the application of the functional and operational procedural areas of the systems operational concept. To develop the training package, then, a systems engineering approach that involved seven stages was used to look at both the functional and operational aspects of the proposed system. Those stages were to:

1) Review Materials
2) Develop Total Task List
3) Develop Critical Task List
4) Develop Course Outline
5) Develop Lesson Plans
6) Provide Lesson Analyses
7) Develop and Maintain Administrative Documentation

Review Materials - The review process was begun the moment the original specification materialized for the system under development. Along with the mission analysts and human factors engineers, training personnel worked with the system specification to gather information about the system objectives in each area of expertise. This process led to many discussions and to the development of throughput, or trade-off, studies to further define potential functional and operational procedures in each of the interdisciplinary areas. Many of the results of these studies were directly folded into the training development process.

The Joint STARS program had additional information available for review since Joint STARS evolved from the PAVEMOVER and I2 SOTAS programs. Preliminary use task lists for the SOTAS Ground Station operators yielded information concerning the functional tasks required to operate the SOTAS Ground Station equipment in the operational environment. Although the displays, controls, hardware, and software characteristics of the Joint STARS were substantially different from those of the I2 SOTAS, many of the operational tasks (those activities needed to perform missions and to carry out taskings) were identical.

Develop Total Task List - The result of the review process was an inclusive list of tasks required of system operators. This list encompassed tasks that were both functional and operational in nature; however, the list did not look at the criticality of the tasks. The task list did not include any procedural narrative at this stage; rather, tasks were defined at such a level that minimal narrative was needed to describe actions associated with a task. As a structural and developmental vehicle, these tasks were formatted into a sequenced training topic list for each operator of the Joint STARS.

Develop Critical Task List - The total task list was then subjected to determinations of each task's criticality toward mission success. The determination of task criticality was based on a modified Delphi technique using the Training and Doctrine Command (TRADOC) Four-Factor Model. People most knowledgeable about the subject matter under evaluation were identified to evaluate each area of the total task list using the Four-Factor Model. Discrepancies among these experts were then resolved through discussions, resulting in the compilation of a list of the tasks considered most critical to efficient and effective system operation. These critical tasks to be trained were further categorized into functional and operational tasks and sequenced for potential course conduct.

The critical task list produced by these experts also provided the opportunity to evaluate the most appropriate media with which to train the critical tasks. This media selection process took into account the tasks, the identified-operator skills (skills defined by Military Occupational Specialty) and potential-task familiarity (prerequisite skills), the effectiveness of various training methods given the defined tasks, and the training media available at the defined training site. With these considerations, training media were identified for the Joint STARS Operator's Course.

Develop Course Outline - The information necessary to define a course sequence for system operators resulted from the sequenced list of critical tasks to be trained. After the categorization of tasks into functional and operational groups, the course flow established progressed from individual tasks to team tasks to superteam tasks.

Individual tasks evolved around the individual operator learning the functional aspects of the system's hardware and how to manipulate the software efficiently and effectively. The team tasks built on the individual and functional tasks learned by individual operators and combined those skills with the operational aspects of working with another operator inside the same GSS or GSM. The course sequence culminated in training the superteam tasks. The superteam tasks trained the operators in the operational aspects of coordination and communication with the outside user community needed to result in successful mission completion.

Develop Lesson Plans - After course sequencing was defined, the narratives required to support the teaching of critical tasks were developed. For the Joint STARS program, lesson plan development culminated in 110 lesson plans. These lesson plans each had up to three parts: a classroom conference, a self check test with answers, and a hands-on simulator practice script.

The classroom conference represented a clearly stated and measurable task, condition, and standard. Many of the standards were easily attainable as a result of the work performed by the human factors engineers' throughput studies and the threat scenario defined by the mission analysts.

The self check test presented questions on the more important points covered in the conference. An answer sheet was provided so answers could be checked immediately by the student operators. The self checks also were used by instructors to discover which procedures were found by students to be confusing. This information was then folded back into a revision of the course, or documented for later course revisions.

The hands-on simulator practice script reinforced the task covered during the conference. This hands-on time by the student operators allowed for practice with equipment and conditions that would be immediately transferable to the actual Ground Station Module. The hands-on portion of the training course comprised over 75% of the total training time. For the individual and team training portions of the course, the student-to-instructor ratio in the simulator was not more than two students to one instructor. During the superteam training the student-to-instructor ratio increased but was never more than five to one.

Provide Lesson Analyses - The Joint STARS Ground Station Simulator was designed to collect information that allowed instructors to assess how well students were performing functional tasks. For example, keypress data were collected by the system for each student and for each lesson run. These data could then be analyzed to define the keypress patterns used and the number of times specific keys were pressed. Information of this nature provided the opportunity for instructors to detect and change ineffective and inefficient keypress sequences. These data also provided that opportunity to eliminate some of the "superstitious behavior" that can develop when learning on a developmental system.

In addition, student performance in an operational context was readily measurable as a result of the baselines developed during the throughput studies, and the trainers' knowledge of the ground truth and tactical situation resulting from mission analysis and scenario development. These data about the functional and operational system usage were useful not only to identify the improvements needed for a particular training session but also to identify improvements to be folded into the next revision of the training course.

Develop and Maintain Administrative Documentation - One important aspect of the ISDM is the use of audit trails to document the results of information ascertained by each of the interdisciplinary areas. Communication is critical when using the ISDM so each area of expertise knows what the other areas are working on and how information is being implemented by other areas. Informal communications worked well for the Joint STARS program until a baseline hardware design, software configuration, and training course had been developed. At that point, because changes to the hardware or software could directly affect the development of the training course lesson plans, as could a change in the functional or operational requirements for the training course affect the hardware or software design, a more formalized documentation approach was required. This resulted in the development of Programs of Instruction (POIs) for the training of the main Joint STARS operators. In addition, technical notes were compiled to document specific aspects of hardware design, software implementation, scenario changes due to updated threat information, and the results of continuing human factors studies.

Summary

This paper has described how the disciplines associated with Mission Analysis, Human Factors, and Training have been able to exercise their specific areas of expertise and influence in a definitional model. The paper showed that each of these domains contributed significantly to the overall success of the effort without compromising a supporting area of the investigation. The success of the ISDM application to the Joint STARS program needs to be evaluated against a standard of measure which is greater than the sum of the parts. Because of the high level of communication between disciplines, the definitional and developmental efforts of one discipline were enhanced by the implementation, administration and interdisciplinary interactions. Although the quantity and quality of the communication is difficult to measure, total ISDM products were provided which contributed to the progress of the Joint STARS program. Among the numerous deliverables were: the Functional and Operational Specification, the build and delivery of a Joint STARS simulator; the development of a nine week Joint STARS operator course of instruction, and a trained cadre of military Joint STARS instructor personnel. The ability of each discipline to effectively contribute its expertise to the total effort was enhanced as a result of the channels of communication described within the ISDM.

The implementation of the ISDM at the initiation of the validation phase of the Life Cycle System Management Model provided a mechanism which identified, defined, and described, in quantitative terms, Functional and Operational tasks for the Joint STARS (Army) system. The description of operator tasks and system functions has also served as the foundation for the nine week Joint STARS (Army) Operator Course. This course trains both Target Surveillance Supervisors (TSS) and Search Track Operators (STO) in the functional tasking and operational skills necessary for GSM operation. Because of the systematic procedure for the course development, changes and revisions made to the GSM hardware/software configuration and deployment concepts have been documented and incorporated into the course lesson plans. Currently it is anticipated that the nine week Joint STARS (Army) course will be validated and verified during Instructor and Key Personnel Training and Player Training for DT/OTII evaluation.

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