A STRATEGY FOR DEVELOPING MPT ANALYSIS CAPABILITY

Lieutenant Colonel Frank C. Gentner
Chief, Analysis Division (ASD/ALHA)
Manpower, Personnel, and Training Directorate
Acquisition Logistics Deputate
Aeronautical Systems Division, Air Force Systems Command

ABSTRACT

Manpower, Personnel, and Training (MPT) analysis in the Weapon Systems Acquisition Process (WSAP) is currently inconsistent, incomplete, and often unquantified. The MPT Directorate (ALH) was established in September, 1986, to influence weapon system design so that MPT factors were considered early in the acquisition process when the cost of design changes are less expensive. But data necessary for MPT analysis were not available in a usable format to analyze weapon system design and suggest trade-offs. On-line data transfer networks were not readily available to expedite use of MPT data. Existing MPT requirements analysis tools were segmented and lacked the capability to complete analyses to support the decision process. Given this state of affairs, a strategy was developed to obtain MPT data and analysis tools, and to bridge gaps between these fragmented databases. This paper addresses the problems faced, ALH's mission, existing tools available to accomplish this mission, and focuses on the efforts undertaken by and for the MPT Directorate. The goal of these efforts is to integrate MPT data-based considerations into the WSAP to improve design for more MPT-supportable weapon systems. Systems which more fully consider the people, their career fields, and training will ultimately contribute more to force readiness and mission effectiveness.

SECTION I
BACKGROUND

NEED FOR MPT ANALYSIS

MPT INTEGRATION PROBLEMS TO BE SOLVED. One third to one half of every dollar spent on Air Force (AF) weapon systems over their life cycle goes toward funding manpower, personnel, and training. In today's environment of declining manpower authorizations, decreasing skilled labor pools, and severe budgetary constraints, MPT integration offers potential multi-billion dollar savings by more effectively using AF people resources. Beginning in the early 1980s, a number of studies (Defense Science Board Study, AF contract studies, Government Accounting Office [GAO] reports, and AF Functional Management Inspections) brought MPT integration problems into clearer focus. These studies demonstrated that early design influence was key to making substantive impacts on MPT requirements. Benefits derived from early MPT optimization include reduced life cycle cost, reduction of human limitations in weapon system performance, and enhanced combat capability.

MOA-IDENTIFIED PROBLEMS. The March 1986, MPT Memorandum of Agreement (MOA) between Air Staff, HQ AF Systems Command (HQ AFSC), and Air Training Command (ATC), established the MPT Directorate. It identified major MPT integration problems: The AF WSAP needs a systematic approach to manage MPT integration. MPT planning was fragmented and ill-timed, resulting in MPT factors being considered too late in the WSAP to influence system design. Usually, major efforts to analyze MPT impacts were delayed until the full-scale development phase, after most life cycle costs were fixed. Planning efforts were not comprehensive. MPT goals were not clearly defined for contractors. Manpower estimates needed to be identified accurately at the outset, with full consideration given to the specialties involved. Data for MPT analyses were not available in a usable format to suggest trade-offs, nor were they available through on-line data transfer networks to expedite data use. Existing MPT analysis tools were segmented and lacked capability to support management decisions. Training systems were not adequately or consistently developed, funded, or procured concurrently with their weapon system. Consequences of delayed training systems were not clearly communicated or advocated. MPT management was highly decentralized, with lack of controls over the MPT process, resulting in duplication of effort, higher cost for weapon systems, and ill-defined and late-to-need aircrew and maintenance training systems.

ALH MISSION AND ANALYSIS FRAMEWORK

To define the nature of the needed MPT tools, it is important to understand the users and their organizational perspective.

THE MODEL MPT ORGANIZATION. Based on the critical need to enhance consideration of MPT factors early in the WSAP, the AF established a 36-person model MPT integration organization at the Aeronautical Systems Division (ASD) within the Acquisition Logistics Deputate at Wright-Patterson AFB, Ohio. The organization was chartered to study, recommend, and test ways that the needs of the AF's most expensive asset, its people, can be more fully integrated into the WSAP. The model organization's primary goal was to improve analysis and integration of MPT issues in the acquisition cycle. To achieve this goal the following must be accomplished: (1) Ensure MPT goals and constraints are identified early in acquisition, where potential payoffs are greatest. (2) Bridge WSAP gaps to ensure MPT is considered as a major factor in supportability along with cost, schedule, and performance; thus providing a more realistic, economical life cycle cost. (3) Ensure that training planning, requirements, analysis, and training system development and production are planned, coordinated, and funded. (4) Establish data sources, analytical tools, and procedures which support MPT trade-off analyses. (5) Make...
MPT analyses available which emphasize life cycle cost-effective use of critical MPT resources while contributing to force readiness and mission effectiveness.

ALH MISSION. The MPT Directorate’s mission is to provide centralized planning, direction, and control for MPT elements in the ASD WSAP. It (1) develops plans, policies and analytical tools to quantify MPT impacts on and of developing weapon systems; placing special emphasis on front-end analysis; (2) employs analysis techniques, policies and procedures to ensure consideration of alternative MPT utilization concepts and systems designs, encouraging necessary trade-offs to optimize cost and force effectiveness; (3) furnishes support to Systems Program Offices (SPOs) and other offices to encourage participation in studies and analyses; (4) maintains liaison with research organizations to promote research into areas beneficial to MPT; (5) functions as the ASD focal point in directing activities of MPT analysts assigned to SPOs to advise, assist, and provide technical information and analysis support; (6) provides direction and leadership to obtain needed MPT information systems; and (7) acts as the ASD and HQ AFSC advisor on MPT matters.

FUNCTIONAL ALIGNMENT OF ALH. The MPT Director is responsible to the Deputy for Acquisition Logistics (ASD/ALH) who provides oversight of activities of the home office and personnel matrixed to SPOs. Matrixed personnel are responsible to the Director for MPT (ASD/ALH) for MPT functions within ASD SPOs. This structure provides a central group of MPT personnel in the home office with visibility across program lines to ensure support and organizational objectives are attained; provides expertise for specific programs and/or issues during high demand periods (preparation and review of Requests for Proposal (RFPs), source selections, etc.); and provides colocated MPT expertise to work the program-specific issues. As a specific weapon system trades through the WSAP, ALH personnel aid the SPO in establishing an MPT baseline, and ensure affected agencies know impacts upon that baseline as design, operational, or maintenance concept changes are proposed. ALH personnel, matrixed to selected SPOs, work for the Directors of Logistics (DOLs), assisting them with MPT expertise in working the Integrated Logistics Support (ILS) and Training Development plans. They also support the chief systems engineer in identifying the full MPT ramifications of design options. They work interactively on all design issues having MPT implications, with SPO-matrixed engineering and logistics personnel.

IMPACTS PROGRAM ANALYSIS FRAMEWORK. Integrated Manpower, Personnel, and Comprehensive Training / Safety (IMPACTS) was established as the official AF MPT and Safety integration program by the Colonel-level MPT Steering Committee in April, 1988. The goals of the program are to integrate human-centered disciplines of MPT, safety, and human engineering (MPTS) to support development of mission capable systems that can be safely operated, maintained, and supported in present and future operational environments at the lowest life cycle cost, and with the people who will be available. IMPACTS focuses on setting MPTS goals and constraints at program initiation, participating in the trade process, measuring the MPTS impacts on system design, and ensuring that the MPT pipeline is ready to support the system when needed. ALH drafted a IMPACTS regulation for inclusion in the AFR 800 (Acquisition) series. The IMPACTS draft regulation is in final stages of coordination and will implement DoDD 5000.53 (December, 1993); MPTS in the Defense Systems Acquisition Process. The basic forum which brings acquisition disciplines concerned with human issues together is the proposed IMPACTS Planning Team (IPT), which produces an IMPACTS Program Plan (IPP). Comprised of representatives of the implementing, supporting, and using MAJCOMs, the IPT is critical to the interdisciplinary approach needed to integrate MPTS. The IPP documents the IMPACTS strategy, identifies goals, requirements, constraints, and issues for each IMPACTS element. It specifies design trade-offs and studies necessary to obtain IMPACTS objectives; lists the major MPTS tests and evaluations; and outlines necessary milestones to meet these objectives. As analysis tools are developed, they can feed results into the IMPACTS framework for consideration by the IPT.

SECTION II

REQUIRED ANALYSES AND POTENTIAL USERS

REQUIRED MPT ANALYSES

A number of sources mandate MPT analysis throughout the WSAP. For example, DoD Directives and Instructions 5000.1, 5000.2, and 5000.53, all require consideration of MPT issues at each milestone. The MPTS Description must be prepared with increasing accuracy at each milestone progressing through the WSAP. The Manpower Estimate Report (MER) is due to Congress prior to Milestone II and III, and these reports feed other mandatory analysis, like the Cost and Effectiveness Analysis (COEA). To accurately produce these reports, and meet the requirements of these directives, MPT analysts must have the tools to accomplish the following: (1) identify realistic MPT goals, constraints, predecessor system problems, and technological opportunities; (2) find or develop meaningful and reliable MPT data to utilize in the design trade-off process, and identify implications of alternative designs; and (3) prepare the personnel and training pipelines to recruit, reassign, and train qualified people for the emerging system, and ensure they maintain currency.

USERS OF MPT ANALYSIS TOOLS AND DATABASES

This article primarily focuses on analysis tools for ALH’s home office analysts and SPO-matrixed personnel, but other offices need similar analysis tools and databases. Other key ASD organizations also support MPT analysis: the Deputy for Engineering (EN), Training Systems (YW), Development Planning (XR), and the ATC Operating Location (TTGT). Also, in keeping with HQ AFSC command policy, ALH works closely with the using MAJCOM to identify and satisfy user requirements during the WSAP. Under DoDD 5000.53 and AF policy, the using MAJCOM must identify MPT goals and constraints at Milestone 0, and update them at each succeeding WSAP milestone. Also, they must consolidate weapon system manpower estimates from across the AF (SPO, ATC, AF Logistics Command (AFLC) and AF Operational Test and Evaluation Center [AFOTEC]) into the MER. Close cooperation between these organizations and prime contractors is essential to ensure that these important estimates are accurate and the system design meets realistic MPT constraints. These key players must closely coordinate to achieve an optimum balance between manpower, system design, and mission effectiveness. Standard integrated analysis tools and common databases could greatly improve this iterative analysis and coordination.

SECTION III

PRESENTLY AVAILABLE MPT ANALYSIS TOOLS

While the AF led development of advanced analytic tools and data systems valuable for assisting MPT integration, it has not consistently applied available tools, especially in an integrated fashion. ALH is attempting to apply the existing MPT analysis tools described below sufficiently early in acquisition to influence system design.
LCOM AIRCRAFT MAINTENANCE MANPOWER ESTIMATES

The most valuable aircraft maintenance manpower analysis tool is the Logistics Composite Model (LCOM). LCOM is the AF-approved model for determining maintenance manpower requirements for both existing and developing aeronautical weapon systems. This method has been found to be a more accurate predictor than the other procedures which sum workload figures, rather than model the interactive curing effects. LCOM uses the AF Maintenance Data Collection (MDC) system to furnish the crew size, frequency and maintenance tasks times for each aircraft system. Before inputting these data into LCOM, manpower analysts operationally audit MDC data for consistency and accuracy. The MDC system offers hard maintenance data on predecessor systems, which can be used in LCOM comparable system simulations of future aircraft maintenance. LCOM is used to identify MPT high drivers and to make manpower assessments during development. LCOM analyses are conducted at increasing levels of specificity from Preconcept sensitivity analyses on the predecessor system, to baseline system comparisons during Concept Development, to LCOM studies on individual engineering data during the Demonstration/Validation Phase, and more final LSA Engineering data during Full Scale Development. Accordingly, ALH is applying LCOM to Technical Advanced Tactical Fighter (ATF) in a joint venture with Tactical Air Command and ASD/EN. This group is exploring the manpower implications of alternate AF specialty structure (differing task assignments to specialties). Results are presented to ATF and MAJCOM officials through the Training Planning Team forum.

PERSONNEL AND OCCUPATIONAL SURVEY DATA

The AF has one of the most sophisticated personnel data systems available to any Service. The Advanced Personnel Data System (APDS) describes AF military personnel in great detail, by career specialty and as flexibility for data manipulation to answer MPT questions. Comprehensive Occupational Data Analysis Programs (CODAP) enable the USAF Personnel Measurement Center to describe each AF specialty’s tasks and their learning difficulty. Both APDS and CODAP databases feed the Occupational Research Data Bank (ORDB) which makes these data available through "on-line" modem access. The obstacle to effective use of these data is their presentation by AF Specialty Code (AFSC), which presently may or may not be directly related to an aircraft system. As the new Rivet Workforce AFSCs are implemented, the AFSP and CODAP databases will be tied to an aircraft system through the 14-year point in a maintainer’s career. As the ORDB and included occupational survey data become more weapon system-specific, they can streamline obtaining necessary personnel and training-related data, and permit quick, in-depth orientation to specialties and longitudinal changes.

LCM/LSAR

Logistics Support Analysis (LSA) and LSA Record (LSAR) data, ordered iteratively from the prime contractors throughout the WSAP, can require contractor analyses and provide data for addressing MPT issues. Later in the WSAP, complete, timely, and accurate LSAR reports are needed to address MPT issues. If the LSA is late, the training development system cannot ensure adequately trained personnel for the Initial Operational Capability (IOC). In the past, the LSA LSAR has received low priority. ALH is attempting to give higher visibility to LSA through the IMPACTS Program Plan so that the AF buys a total weapon system, including everything necessary for trained personnel to operate it when fielded. To help matrixed analysts use MPT LSAR effectively, ALH is preparing a MPT LSAR user guide based on a detailed study of LSA utility.

HUMAN FACTOR DESIGN TOOLS

In the past, most AF human factors efforts centered around the cockpit. Because of increasing expense and lesser availability of maintenance manpower, it is critical to assign high priority to human factoring of maintenance. Validated human factor tools, which have been applied for years to cockpit design, can now be applied more fully to maintenance. For example, most prime contractors now use Computer Aided Design (CAD) systems, and some have design tools like the recently developed Armstrong Aerospace Medical Research Lab (AAMRL) - AF Human Resources Lab (AFHRL) programs, Crew Chief and COMBIMAN. These tools assist contractor engineers concurrently with the design process. They use a three-dimensional makin on the CAD screen, allowing engineers to "see" accessibility problems. Their use can result in designing maintenance tasks and equipment which reduce manpower requirements per unit, and increase the efficiency of maintenance turn-around and wartime readiness of new systems, while decreasing the probability of accidents or incorrect maintenance actions. As a result, they standardize use in the design process. When the Defense Advisory Committee On Women's Issues In The Services (DACOWITS) raised a question on how well a developing aircraft accommodated women, ALH used these tools in conjunction with ASD/EN and engineering personnel to provide a response before manual mockups were constructed.

PROGRAM MANAGEMENT TRACKING TOOLS

While conducting a thorough review of regulatory guidance, ALH developed an MPT time-phased roadmap which is presented on the Computer Supported Network Analysis System (CSNAS). This computerized PERT diagram provides SPOs a model MPT network which shows the relative timing of needed activities, while allowing the network to be tailored to their program. As program milestones change, the computerized network automatically adjusts MPT suspenses. CSNAS is a government-owned project management tool which meets regulatory requirements for SPOs to have a networking system.

SECTION IV

STRATEGY FOR DEVELOPING INTEGRATED MPT ANALYSIS

Since ALH is an operational (versus a research) organization supporting SPOs, a three-phased strategy utilizing MPT and logistics-related R&D resources was developed. In the near-term, ALH has applied existing tools and databases, though not fully integrated, or in some cases manual and subjective processes. In the mid-term phase, ALH plans to identify and implement at least partly integrated tools, and to define and standardize manual processes. In these two early phases, the goal is to assist MPT matrix personnel to provide prompt and objective MPT feedback to acquisition managers regarding proposed design and MPT issues. Also, ALH is interfacing with developing data systems to ensure needed MPT data elements and analysis tools are embedded within their systems. For the long-term, ALH has requested research organizations to develop fully integrated MPT analysis tools and databases. The goal for these fully integrated tools is to provide automated tools to support with trades between M, P, and T, and between MPT and system design.
NEAR-TERM STRATEGY

LCOM AS MOST INTEGRATED TOOL. ALH is currently applying the tools available. LCOM is the most fully-developed and accepted tool. As expounded above, LCOM uses mission scenarios, operations and maintenance concepts, reliability and maintainability (RAM) design parameters, and the proposed AFS structure to derive estimated maintenance manpower requirements. Thus, it integrates system design with manpower and personnel issues. However, LCOM lacks the ability to derive optimal AFS structure, predict training implications, and optimize MPT with system design. Still, accurate prediction of maintenance manpower, one of the major gaps exist in tying personnel and training data to weapon systems. These disconnects between system data and AF specialty or training data impede WSAP analysis. To solve the problem of speedy access to predecessor system MPT data, ALH requested the Defense Training and Performance Data Center (TPDC) to develop a prototype Footprint for one of ASD's emerging systems.

RETRIEVE MPT-RELATED DATA MANUALY FOR SPOs. A number of the MPT matrixed personnel have requested the home office to find predecessor system MPT-related data for use by the SPO or prime contractors in comparability analysis. ALHA found that MPT data resides within many offices scattered throughout the AF, and that it is difficult to retrieve promptly in the format needed. One request has taken over a month to receive. In the process of securing needed data, ALHA identifying and tracking data sources and uses for future reference.

AF CROSSWALK / FOOTPRINT. Surprisingly, few existing AF databases link personnel and training data with weapon system data, yet such matches are critical to comprehensive MPT analysis. Front-end LCOM programs link AFSCs with work unit codes for manpower determinations, major gaps exist in tying personnel and training data to weapon systems. These disconnects between system data and AF specialty or training data impede WSAP analysis. To solve the problem of speedy access to predecessor system MPT data, ALH requested the Defense Training and Performance Data Center (TPDC) to develop a prototype Footprint for one of ASD's emerging systems.

Footprint. A Footprint is a description of the total MPT-related resources devoted to a predecessor system. It can help set MPT goals and constraints, and speed comparability analyses. A Footprint can be developed manually, but more efficiently, an automated look-up table can link the MPT-related data with weapon system databases to produce the Footprint.

Crosswalk. A Crosswalk is an automated look-up table linking MPT data with weapon system data. It allows one to quickly display the AFSCs associated with weapon systems and equipment items, and vice versa: all pieces of equipment operated or maintained by each AFSC. Crosswalk uses existing MPT and weapon system databases to define predecessor/comparable system data for future weapon systems.

Status. TPDC has already successfully developed Crosswalk for the Army's MANPRINT program, and is now developing the AF Crosswalk/Footprint prototype. TPDC is determining user needs and developing specifications for an automated system to link databases. ALH is participating in the needs assessment and data element definition process to ensure both AF and Industry users will be provided needed data. TPDC is presently prototyping the MPT Footprint of ASD/XR's Preconcept study of the Advanced Tactical Transport (ATT). The ATT will replace a portion of the C-130 fleet in the year 2000. Identification of the total MPT resources on the predecessor system will help identify MPT realistic goals and constraints. ALH is assisting USAFOMC, the AF requirements manager, and TPDC in developing prototype Crosswalk and Footprint by: (1) prioritizing potential weapon systems for prototyping, (2) identifying relevant MPT data elements, (3) helping TPDC identify AF data sources, and (4) evaluating the system's utility. Crosswalk/Footprint products will have wide application within the AF and defense contractor logistics communities in virtually all MPT acquisition planning activities.

DEVELOP "CROSSWALKED" ORDB Initial versions of Crosswalk/Footprint are not expected to contain specific, task-level data. ALH identified the need and opportunity for developing this task-specific data on aeronautical systems ahead of TPDC's original schedule. Because of the Rivet Workforce changes to AF aircraft maintenance specialties, and recent occupational surveys of these career specialties, very specific task-level data will be required to be retrievable by weapon system from the ORDB beginning this year. To facilitate use of the ORDB by MPT analysts, AFRL/MOD, working in conjunction with TPDC, is providing an automated look-up table within the ORDB. The automated look-up table will enable the analyst to obtain weapon system-specific personnel listings and reference to career specialty occupational survey data. Since the ORDB contains specific occupational surveys performed by Rivet Workforce specialties, this "crosswalked" ORDB furnishes a short-cut to very specific personnel and training data for aircraft systems. The first 20 weapon system crosswalks are expected by December, 1989.

DEVELOP AUTOMATED COMPLIANCE AND TRACKING AIDS. Automated procedures and program tracking aids could help ALH SPO-matrix personnel make manual comparisons and ensure programs are on target. One such project is to automate the Manpower Estimate Report (MER). When the Defense Authorization Act of 1987 required the MER for Congress prior to Milestones II and III, the process of identifying, tracking, and consolidating requirements for all military, civilian, and contractor personnel who operate, maintain, and support the weapon system, became exceedingly complicated. Estimates need to be collected in a standard format from the SPO, HQ AFLC, HQ ATC, AF Operational Testing and Evaluation Center (AFOTEC), and the using command and "rolled-up" into a summary report. ALH initially worked with the Advanced Tactical Fighter (ATF) SPO and HQ USAF/PRM (AF Manpower) to produce a detailed spreadsheet (in Lotus 1-2-3 format) to integrate and summarize the manpower estimates of each participating MAJCOM. The MER spreadsheet is deceptive simple to the user, who merely has to complete the standardized screens that pertain. It compiles the data entered by each participant into a report. Once the program was perfected on the ATF, ALH began developing generic screens suitable for all major programs. The ALH automated MER templates will save time and funds in reporting future manpower needs.

SUMMA TECHNOLOGY TRANSFER. Small Unit Maintenance Manpower Analyses (SUMMA) research contains a software application designed by AFRL/UUR to depict the effects of aircraft maintenance specialty merger or AF specialty restructure on MPT requirements. SUMMA includes a
MID-TERM STRATEGY
MPT MEASURES OF EFFECTIVENESS (MOEs). The MPT Steering Committee requested that ALH identify MOEs needed to measure the impact of MPT during a weapon system's acquisition. ALHA approached this task by (1) conducting a literature search to discover and evaluate MPT MOEs already in existence; and then once deficiencies or gaps in MPT MOEs are found, (2) forming a DoD-wide expert team to develop new MOEs. Begun in November 1988, the literature search is currently in progress. As this project develops, relationships between M, P, and T and between MPT and the developing system will be highlighted. Discovering and/or developing standard MOEs to measure WSAP MPT issues should provide measures to use in developing MPT models. Also, the MOEs might prove useful in future MPT study/system Operational Requirements Document (ORD) and RFP development, source selection, and testing and evaluation.

DEVELOP SOURCE SELECTION CRITERIA. ALH has developed MPT integration issues to be placed in RFPs, Instruction to Offerers, and Statements of Work (SOWs). But to fully motivate contractors to integrate MPT, these issues must be quantified evaluation factors during source selection. ALH formed a tiger team to find the most effective ways to measure contractor integration of MPT in proposals. This project will help ASD meet the DoDD 5000.53 requirement to "evaluate attainment of MPT goals in contractor proposal selection." By providing defense contractors proper incentives to conduct effective human factors and MPT analysis throughout system design, the goal of improved weapon systems, designed with the human in mind, is more likely to be achieved.

EVALUATE EXISTING MPT ANALYSIS MODELS. As ALH analysts discover existing MPT models and tools with potential, they evaluate them for possible application to ASD programs. Since most of these models were developed for operational personnel and training managers, they only project a few years into the future. To date, common problems found with these tools are that they cover only a small area, lack integration, and do not seem adaptable to the acquisition arena or available databases. In many cases issues that need to be analyzed are not considered in sufficient depth or breadth by these models. Models need to be designed from the outset for acquisition purposes to better address specific MPT integration issues. ALH is working with the Human Systems Division (HSD) and AFHRL to secure funding for this kind of model development.

MPT-LSA INTEGRATION STUDY. ALH is conducting a study to evaluate LSA's effectiveness for MPT integration. LSA is a systematic and comprehensive analysis usually conducted by contractors on an iterative basis through all phases of the system/equipment life cycle to satisfy supportability objectives. It optimizes design for supportability, and documents the required support structure in the LSA Record (LSAR). LSA is required for all system/equipment modification programs, and applicable research and development efforts. While the military standard 2-248 microcomputers. After the specifications are delivered, and HSD builds the prescribed analysis system, ALH plans to apply current-technology MPT analysis system to ASD programs.

Four MPT Goals Examined. Four MPT goals were selected for the initial thrust of the study to determine how well LSA supports MPT integration. Develop LSA procedures (1) for furnishing comprehensive input to develop the MER; (2) to provide complete data for Instructional Systems Development (ISD) of training systems; (3) to ensure manpower trade-offs are conducted and influence design by defining contractor-government interaction during weapon system design phases; and (4) for requalifying and analyzing contractor-proposed revisions to the AFS structure, considering new technologies, equipment design, and optimal use of manpower and training.

Five Issues Considered. The MPT goals are being evaluated by how well the LSA process accomplishes the following: (1) how completely the process furnishes the data needed for MPT activities; (2) whether the right task or data is sufficiently available by the time needed to influence design; (3) whether standard procedures and methodologies exist to ensure the quality of the MPT-related data produced by LSA; (4) whether the Government-Industry relationship is optimal and the Government is providing the contractor with baseline data for LSA to minimize cost, in accordance with DoDD 5000.53; and (5) whether the Government is able to properly verify that LSA tasks were properly accomplished and that LSAR is correct or reasonable.

Initial Findings. The MPT/LSA study initial findings indicate: (1) LSA needs to be implemented within the Weapon System Acquisition Processes. (2) MPT analysis is to impact design. Otherwise, LSA is simply an historical documentation process. (3) Presently, no standard process exists for the AF MAJCOMs to access the system comparability information to compute their MER input. (3) Predecessor and comparable system databases are often built multiple times, which detracts from valuable analysis time and adds unnecessarily to acquisition costs.
LSA Enhancements. Drawing on the LSA study, ALH plans to influence changes in the LSA process and LSAR data structure. As these changes are implemented and automation analyzed, LSA can become more integrated with engineering design, more timely, and standard. LSA/LSAR could play a more central role in MPT integration.

INSERT MPT INTO EMERGING DATABASES AND ANALYSIS SYSTEMS. Several logistical and human factors databases, systems, and analysis centers will emerge during the 1990s. ALH's strategy is to join forces with these efforts by ensuring appropriate MPT data are included. Integrated analyses are requested, and efforts are made to speed interchange of MPT-related data between Industry and concerned AF agencies. A sample of some of these efforts includes the following:

CSERIAC. The Crew System Ergonomics Information Analysis Center (CSERIAC) was recently established at Wright-Patterson AFB, with AAMRL as its host. Information Analysis Centers (IACs) acquire, analyze, and disseminate specialized technical information. Most are administratively managed and funded by the Defense Logistics Agency (DLA) and the Defense Technical Information Center (DTIC). They are designed to provide users with specialized engineering, technical, and scientific analysis services and products. A number have been established to deal with the inordinate growth of information within their area of specialization. Crew systems (more than just the cockpit, including operations and maintenance of all systems) ergonomics (an international word for human factors) has to do with information concerning human characteristics, abilities, limitations, physiological needs, performance, body dimensions, biomechanical dynamics, strength, and tolerances. It also includes engineering design data concerning equipment used, operated, controlled, or maintained by military crews. CSERIAC will provide information through a wide range of media from handbooks, reports, critical reviews and technological assessments through computer-based models of human operators and maintainers, like Crew Chief. The purpose of CSERIAC is information analysis, rather than data storage, with the goal being to furnish a data gateway. CSERIAC will furnish its services to DoD, NATO countries, and Government contractors; consequently, it will be critical to make MPT-related data, studies, and analyses available through this IAC. ALH plans to utilize this resource and ensure MPT-related issues and data are fully addressed.

SIDAC. AFLC and AF Wright Aeronautical Laboratories (AFWAL) are assessing potential benefits of a Supportability Investment Decision Analysis Center (SIDAC). The proposed SIDAC would provide a central integration point for the analysis of impacts on weapon system combat capability and effectiveness; R&M information; and technology applications. This program is currently in a 12 month contracted Concept Development phase. Since MPT issues have major impacts upon combat capability and system effectiveness, and since R&M data and technology are key factors in MPT analysis, many of the proposed tools and databases can either be used for MPT analysis or contain MPT factors within them. ALH personnel interact with SIDAC representatives concerning MPT goals and needed databases for inclusion. Possible benefits of SIDAC include the ability to: (1) provide access via a central point of contact to a wide variety of supportability models and databases useful in MPT analysis; (2) standardize database protocols and modeling efforts; (3) integrate MPT considerations by incorporating them into the SIDAC decision models; (4) facilitate technology transition from the AFSC laboratories to ASD programs and AFLC Air Logistics Centers (ALCs); (5) bridge between system acquisition and support information analysis across the life cycle of systems; and (6) support the SPD and MPT matrix personnel's data needs.

REMIS. The Reliability and Maintainability Information System (REMIS) will replace 28 existing AF logistical data systems with an interactive data storage, access, and processing system for maintenance and operational data on AF weapon systems and equipment. REMIS will become the primary AF maintenance and status accounting information database. It will improve the availability and accuracy of these data by providing AFLC, ASD, and each ALC, fast and reliable access to weapon system and equipment product performance data. This improved database will allow early identification and projection of weapon system performance and R&M trends. It will automate various analysis tools, track modifications, examine their results, and standardize terminology and algorithms used throughout the AF. REMIS consists of four models:

EIMSURS. Equipment Inventory, Multiple Status and Utilization Reporting Subsystem (EIMSURS) provides a real-time capability for automatically determining equipment inventory, multiple status and utilization by a wide variety of Indenture levels (IOC: Jul 89).

GCAS. Generic Configuration Status Accounting Subsystem (GCAS) will provide consolidated weapon system configuration data. GCAS will help manage modification data and Time Compliance Technical Order (TCTO) status reports (currently unfunded).

MICAP/AWP. Mission Capable (MICAP) and Awaiting Parts (AWP) Subsystem (MAPS) will provide a single source for MICAP/AWP data to help monitor weapon system support, address specific problem areas, and identify and manage critical items (unfunded).

PPS. Product Performance Subsystem (PPS) will provide a continuous audit trail of equipment maintenance, and cross-to-grave R&M tracking via on-line access to LSAR data. LSAR contains original R&M design specifications and performance parameters. This subsystem will replace the current MDC systems in 1990 and will be important for MPT analysis.

Tracking REMIS Development. ALH personnel are working with the REMIS office and AF Management Engineering Agency (AFMEA) to ensure future access to REMIS and that MPT considerations are incorporated into the system. REMIS will be the data source for all future LCOM analyses as well as many other MPT models which require R&M, configuration, and forecasting data.

CALS. Computer-aided Acquisition Logistics Support (CALS) is a joint DoD-industry effort to improve productivity through digitalization and integration of technical information throughout the WSAP. It will form an interactive system of systems whose goals include: (1) integrating R&M design tools into Computer Aided Design (CAD)/Computer Aided
Manufacturing (CAM) processes to make future weapon systems easier to support; (2) Improving design by accelerating the exchange of logistics information between the Government and Industry; (3) reducing life cycle costs by increasing abilities to communicate logistics information within the Services in digital form, decreasing duplicate data purchases, and improving planning; (4) decreasing weapon system purchase lead time by allowing them to be designed and produced more rapidly; and (5) enhancing timeliness and accuracy of acquisition-related information. Three major initiatives were selected for the initial CALS digitalization because they are areas with a high pay back and a high level of user interest. They are: LSA automation, Engineering Data Computer-Assisted Retrieval System (EDCARS), and Automated Technical Order System (ATOS). These CALS initiatives directly contribute to ALH's efforts to integrate MPT. CALS will provide ready access to the data to lead MPT analysis models, and allow ALH personnel to quantity and communicate MPT trade-off information quickly and accurately. Consequently, ALH personnel are seeking to influence CALS projects to fully integrate MPT concerns and data.

INCLUDING MPT IN CONCURRENT ENGINEERING (CE) R&D. Improving the accuracy, reach, and timeliness of MPT analysis will certainly pay large dividends, but greater returns on research investment dollars may come from fuller integration of human performance considerations during design. The ideal MPT analysis system must be useful, not just an aid to earlier and smarter planning for human resources after a design has been announced; MPT, and other aspects of supportability, must participate in decision-making during the design process itself. This idea is embodied in the AF CE initiative. CE seeks to develop hardware/software technologies allowing a rapid "fit" evaluation to be accomplished within modern computer-aided design (CAD) systems. Among the challenges for people-oriented researchers in this context are to find ways to: (1) describe and present scientific knowledge about human performance capabilities, and (2) make meaningful trade-offs involving people-in-system explicit, hence audible and quantifiable. The old problem of design influence for MPT supportability has new importance and, one hopes, new inroads through the CE approach.

LONG-TERM ANALYSIS STRATEGY

MPT RESEARCH NEEDS (MPTNs). ALH's MPT research needs focus on the most deficient parts of the MPT analysis system. Those areas include developing the data and relationships between M, P, and T, and between MPT and system design. Research-established relationships are essential to develop valid optimization models which can help identify the most appropriate AF specialty structure. Specially structures need to be optimized for an emerging weapon system, and across weapon systems of the same vintage or technology type planned for the AF inventory. Analysis tools to project impacts of various configurations of AF specialties, and optimize for the lowest life cycle cost and highest readiness values are needed. Also, models that increase speed and accuracy of training development and projections are needed. Tools which optimize training planning and can operate from the data available during all acquisition phases are essential to MPT integration. Research into MPTs is the critical basis in constructing these models. Also, a taxonomy is needed which characterizes job tasks, and projects their learning difficulty level and associated aptitude requirements. This same taxonomy could help compare new technologies with present AF specialty tasks to determine the degree of aptitude and training must be changed from present levels. Finally, ALH MPTNs focus on the need for a major thrust in the MPT technology area. The result of the HSD-ASD MPTS Technology contract study should point the way and help set priorities for the research agenda. In line with ALH's model organization mission, it was recently appointed to chair the acquisition-related MPTN panel composed of AFSC Product Division representatives.

LOGISTICS (RESEARCH) NEEDS (LRNs). ALH LRNs focus on maintenance manpower and personnel issues. Simple, fast, but validated methodology for predicting maintenance manpower needs to be found which can predict LCOM results within 10-15 percent margin of error. These tools could be useful for rapid response studies to impact the trade-off process. Maintenance personnel demographics are changing; the manpower pool is shrinking; larger numbers of women are filling the ranks; more AF personnel speak English as a second language; and the quantity of education is lowered while the demand for higher technology is increasing. What effect will these changes have on the AB ability to recruit and train the quality people it needs to maintain the increasingly complex weapon systems? Will built-in tests, improved job aids, and computerized MPT analysis compensate for the projected shortages of quality people? What should be the AB personnel quality goals, and how can these achievements be measured for specific weapon systems? These are some of the demographic-related questions AF weapon systems designers face. ALH has also requested that links between the maintenance AF structure, and readiness, survivability, and vulnerability of the support structure be explored. A standard methodology is needed to develop measures of effectiveness for judging the merits of the maintenance MPT system.

IDENTIFY NEED FOR 6.4 R&D PROGRAM. Since ALH is not a research organization, but rather works operationally to support SPOs, ALH needs an MPT analysis system designed and tested for use in the SPO, and home-office analysis levels. The HSD-ASD MPT Technology Contract will lead to specifications for this current-technology analysis system, and the generated research agenda should bear fruit which can be added into this basic analysis system.

SUMMARY

The MPT Directorate was established to test whether a long-standing need to fully integrate MPT considerations into the WSDP could be institutionalized by a model organization at the AFSC Product Division level. ALH's goal is to demonstrate how existing MPT analysis tools, data sources and procedures can improve consideration of MPT factors in the WSDP. ALH is using LCOM, the ORDB, HFE CAD tools, and LSA/SAR. Already the impact of SPO-matrixed personnel is positive, even without sophisticated tools. However, accuracy of their recommendations in the SPO and the predictions about the MPT sub-system can be enhanced by improved analysis tools and databases. ALH is encouraging development of needed MPT analysis tools and databases by identifying voids, inadequate tools, and needed data. ALH is also developing the IMPACTS program to ensure MPTS factors are given appropriate planning, visibility, and integration across discipline areas. With this program and appropriate MPT tools and databases, realistic MPT goals and constraints will be developed; accurate trade-off analyses can be conducted; and optimal MPT support systems will be developed. Until research develops more integrated and automated MPT analysis tools, ALH is working to adapt, use and improve existing tools to influence weapon system design for MPT supportability and improved war-fighting capability.
REFERENCES


ABOUT THE AUTHOR

Lt Col Gentner is currently Chief, Analysis Division, of the Manpower, Personnel, and Training Directorate (ALH), Deputy of Acquisition Logistics, Aeronautical Systems Division (AFSC), Wright-Patterson AFB, OH. He is responsible for developing the analytic staff and integrated lecture and test training materials to be used by the Directorate, and also coordinates research needs with the Laboratories to facilitate integration of MPT issues into the weapon system acquisition process. He holds a Bachelors in Psychology and Masters in Rehabilitation Counseling from the University of Florida. In addition, he has taken post-masters Industrial Psychology courses at St Marys University. He has served as a personnel officer, an Air Training Command Technical Training instructor supervisor and course chief; Director of Training Evaluation for Defense Equal Opportunity Institute; occupational analyst, staffer, and planner at the USAF Occupational Measurement Center; and initial Chief of Plans for Training Development Service.

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