MANPRINT BULLETIN

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HARDMAN II.3

Jane Bondaruk
Dynamics Research Corporation

Dynamics Research Corporation (DRC) is currently under contract to the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) to develop the HARDMAN II.3 software system. ARI and DRC have been developing this software system, originally known as the Man Integrated Systems Technology (MIST), since 1983. The name of the software was changed to HARDMAN II in 1989, and a new contract began in June 1989 to develop HARDMAN II.2. HARDMAN II.3 development began in January 1990 and was completed in September 1990.

Hosted on a Digital Equipment Corporation VAX mini-computer, HARDMAN II.3 is an automated system of worksheets and models that can be used to estimate a weapon system's manpower, personnel and training (MPT) requirements. This software is based on the HARDMAN Comparability Methodology, a quantitative MPT estimation methodology. The HARDMAN methodology is an approved MANPRINT tool, as cited in AR 602-2, Manpower and Personnel Integration (MANPRINT) in the Materiel Acquisition Process. The methodology is also an approved Logistic Support Analysis Technique, as cited in AMC Pamphlet 700-4, Logistic Support Analysis Techniques Guide.

HARDMAN II.3 provides several unique benefits to a HARDMAN study. Because it operates in a multi-user environment, many analysts can work simultaneously on the same weapon system and always be guaranteed of accessing up-to-date information. HARDMAN II.3's integrated data base allows sensitivity and trade-off analyses to be conducted quickly and easily across the manpower, personnel, and training domains. HARDMAN II.3 also provides an extensive, automated audit trail of a weapon system's MPT analysis. In all, HARDMAN II.3 generates 110 reports, including output from the MPT models and extracts from the integrated MPT data base.

The HARDMAN II.3 manpower model calculates manpower requirements by Military Occupational

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NEW YEAR, NEW CHALLENGES !

1991 brings new challenges to the MANPRINT Program as work to integrate man-machine issues into the materiel acquisition process continues: the MAISRC process, and the continuing evolution of the HARDMAN methodology.

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"Remember the Soldier"

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Specialty (MOS) and Additional Skill Identifier (ASI), paygrade, and maintenance level for every unit within a specified force structure. The manpower model can produce manpower requirements for the Active Army, Reserves, and National Guard components, and can also produce manpower results for the total force as systems are deployed and retired.

The personnel model estimates a weapon system's personnel requirements by MOS and paygrade. Personnel requirements are defined as the quantity of individuals who must be provided to an MOS/paygrade to support the entire personnel structure given a set of manpower requirements.

The training model estimates a weapon system's total course costs, costs per graduate, instructor requirements, and training man-day requirements. The HARDMAN II.3 training analysis can also be used to conduct an instructional task analysis, including selection of tasks for training and media selection.

EVOLUTION OF HARDMAN SOFTWARE SYSTEM

	MIST (1985)	HARDMAN II.2 (March 1990)	HARDMAN II.3 (Sept. 1990)
Manpower	• By MOS/ASI, paygrade, and maintenance level for five types of units and total system density	• Added ability to generate manpower by subsystem for every unit within a force structure	• Will add ability to generate Depot, Unit Supply, Deployment/Retirement, and Reserve/National Guard manpower • Will add ability to calculate Combat Damage Workload
Personnel	• By MOS/ASI and paygrade using promotion, attrition, and transient, trainee, holdee, and student (TTHS) flow rates	• Added migration rates	
Training	• Task Analysis • Task Selection • Media Selection • Course Resources - Instructors - Training Man-Days - Cost	• Added ability to inflate training costs • Updated cost algorithms	• Will add ability to calculate unit training requirements

The HARDMAN software has been used to conduct MANPRINT analyses on over 15 Army weapon systems, including the APACHE helicopter, the Firelinder II radar, and the Light Air Defense System. The software has also been used to produce Manpower Estimate Reports (MER) for the Army's Light Helicopter Program and to evaluate Engineering Change Proposals (ECP) for MANPRINT impacts for the Bradley Fighting Vehicle and the BLACK HAWK helicopter.

The following are just a few of the questions that can be answered using the HARDMAN II.3 software.

Manpower

- How many maintainers will the weapon system require?
- Will the weapon system require the creation of new MOS or ASI?
- How will the manpower requirements change as an existing system is retired and a new system is deployed?
- What effect will a new weapon system's manpower requirements have on the existing force structure?

Personnel

- How many soldiers must be recruited annually to support this system?
- What effect do historical personnel flow rates have on the personnel structure? What would a change in those flow rates do to the structure?
- What effect would a different manpower distribution have on the personnel structure?
- How many soldiers need to be trained each year to support the new weapon system?

Training

- What new training must be developed and how much of the existing training can be used unchanged?
- How will existing courses be affected?
- What are the new system's instructor requirements?
- How much will the new training cost?
- What are the expected unit training costs?

The U.S. Army Personnel Integration Command (USAPIC) is the proponent for a major follow-on project to be carried out by ARI for HARDMAN Training and Documentation. This effort is designed to develop training and documentation for the HARDMAN Comparability Methodology (HCM) and its supporting software, HARDMAN II. This objective will be achieved through the development of a software user's guide, a training course for system analysts and a familiarization report. Government points of contact for this project are:

USARI - Mr. Arthur Marcus (703) 274-8917

USAPIC - Mr. Jan Dykhuis (703) 325-2074

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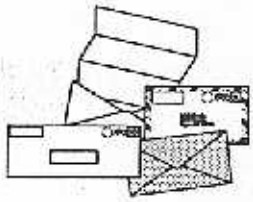
The British Perspective

Letter from London



Elizabeth Wheatley
U.K. MANPRINT Office

Editor's Note: *The following was reprinted from* MANPRINT briefing, *a publication produced by British Aerospace (Dynamics) Ltd. For more information, contact Mr. Giles Colborne, B.Ae.(Dynamics) Ltd., Filton, BS127QW, England.*

The U.K. MANPRINT Office was created on October 30, 1989 with a joint military and civilian staff. The work of the office was to adopt and adapt the U.S. Army's MANPRINT programme, "spread the word" and later, to advise the Operational Requirements and Project Management Branches on specific projects.

The need for change was illustrated by the findings of the U.S. Army Research Institute's "reverse engineering studies." These provided an audit of the human factors failings of four major systems. Successful cost savings were identifiable, and reference was made to a number of U.K. projects which might have benefited from an early application of MANPRINT. Procedures and policies which are to become mandatory for land system sponsors and managers are being staffed, and aim to make [Ministry of Defence] MoD a "smarter customer." They draw on the U.S. system of MANPRINT working groups of experts generating concerns and questions across the six MANPRINT domains, and a System MANPRINT Management Plan for resolving these at the appropriate stage of procurement. The resulting tasks may fall to MoD researchers or analysts or to industry, and the findings should influence contracts and hence design solutions. Another role for the office is, therefore, to brief industry on the likely outputs from 1991 onwards.

Better quantitative requirements for human factors should be included in requirements and specifications, and MANPRINT issues can be expected to influence source selection, as it does in the USA. The news is spreading through trade associations, conferences, and one-to-one briefings.

As well as establishing the procedures and promulgating them outside the MoD, the MANPRINT office needs to initiate a training programme for military and civilian staff in the importance of the human influence on system performance, and on how to apply the MANPRINT process. Methods and tools for various forms of "front-end analysis" (techniques used pre-design to discover requirements and constraints in the MANPRINT areas) also need to be developed, so research in this new area will be sponsored when resources become available. Existing and new data bases need to be coordinated to support, in particular, the manpower, personnel and health domains. Links with related activities for the other Services and in other countries must be explored.

The office is also intending to run two or three pilot studies, and feed this experience back into the procedures and the teaching. Currently, we also provide a chairman and secretariat for the working groups. The intention was that MANPRINT should "run itself" with responsibilities remaining unchanged. This would include industry's authority - the office is not set up to act as an information source or support agency to defence contractors.

In any case, the functional location and role of the office are to be reviewed in 1992, when the need for a permanent office will be scrutinised, and application to the other system areas (Sea, Air, Command Information Systems) will be considered. At present, a continuing and wider role seems to be required.

For more information, contact Mrs. E. Wheatley, Ministry of Defence, Main Bldg., Whitehall, London, England SW1A 2HB. The U.K. MANPRINT Office publishes MANPRINT Mail *and welcomes articles for publication.*

HARDMAN (continued from page 2)

The challenge of determining a weapon system's MPT requirements can be met using the HARDMAN II.3 software system.

For more information, contact Jane Bondaruk, Dynamics Research Corporation, 60 Concord Street, Wilmington, MA 01887; (508) 658-6100.

MANPRINT NOTES

From the MANPRINT Program Office

■ **HARDMAN III.** From 7-9 November 1990, a three-day training class on HARDMAN III technology was conducted jointly by Micro Analysis and Design, Inc. and Dynamics Research Corporation under the sponsorship of the Army Research Institute. Twelve individuals from DoD agencies and industry were introduced to the HARDMAN III methods to enhance its potential applications. HARDMAN III provides a PC-based means of incorporating manpower, personnel and training (MPT) considerations into system development from the earliest phases of acquisition. The tools under this approach assist government and industry to:

- Help assess design impact on likely user populations
- Allow MPT trade-off analyses to improve system-work force fit
- Determine the profile of skills and skill level requirements
- Assess system performance levels to be achieved
- Evaluate alternative production strategies.

Following the training session, HARDMAN III will undergo Beta testing at selected Army sites. Questions and interest should be directed to Mr. Charlie Holman, AV 284-8917 or COM (703) 274-8917.

■ **Directory of Design Support Methods.** *The Directory of Design Support Methods* was developed under the auspices of the Designing for the User Subgroup of the Department of Defense Human Factors Engineering Technical Group. The MANPRINT Directorate (ODCSPER), HQ DA, published the document 1 November 1990. This directory updates the 1988 *Catalogue of MANPRINT Methodologies* (by M. Sue Bogner) with 74 human factors techniques. The directory will be available from the Defense Technical Information Center (DTIC) in the near future. Inquiries may be directed to LTC Glen Hewitt, AV 225-9213 or COM (703) 695-9213.

■ **MATRIS On-Line Reports.** The Manpower and Training Research Information System (MATRIS), Office of the Defense Technical Information Center (DTIC), has devised a format and schema for recording and reporting human factors techniques. Their first effort will be to incorporate the tools described in the newly published *Directory of Design Support Methods*. Creating this repository of information will allow interested individuals to receive customized reports about MPT tools and techniques. Questions should be directed to Byars Vicino, AV 553-7000 or COM (619) 553-7000.

■ **MANPRINT Practitioner's Guide Completed.** The *MANPRINT Practitioner's Guide* replaces the draft guide published in 1988. The guide's purpose is to clarify the MANPRINT approach and its application in the materiel application process. Extensive references and a selected reading list at the end of the guide direct the practitioner to more detailed publications. It can be obtained from the Defense Technical Information Center under DTIC # A227 434.

■ **New USAPIC Director.** LTC John Carley has assumed the position of Director, U.S. Army Personnel Integration Command, 200 Stovall Street, Alexandria, Virginia. His office symbol is ATNC-NM; phone number AV 221-2021 or COM (703) 325-2021. LTC Carley is an Infantry soldier (11A/49,Operations Research Systems Analysis [ORSA] secondary) who served in the 9th Infantry Division and the 1st Armored Division. He has extensive experience with war gaming to support combat developments and doctrine development studies.

? DID YOU KNOW?

- The Army Forum - MANPRINT Net is back in operation. This is an especially useful tool for passing important information about the MANPRINT Program and also for sharing news and items of interest on various projects you may be working on.For more information, contact LTC Shaw at AV 225-9213 or COM (703) 695-9213.

- An NSIA Joint Logistics Management General Membership/ATC/LoMC Integrated Diagnostics Group Meeting will be held in January.See "Meetings of Interest "on page 10 for contact information.

MANPRINT Documents at DTIC

Many of the published MANPRINT guides and handbooks have not been given wide distribution. Limited printing funds make it difficult to disseminate large numbers of copies. MANPRINT practitioners desiring to obtain documents that will help them perform their duties are encouraged to solicit the documents from the Defense Technical Information Center (DTIC). The following provides the status of MANPRINT documents available from DTIC:

Document:	DTIC # Status:
Advanced Human Factors Engineering Tool Technologies (1988)	A195 252
Directory of Design Support Methods (1990) (previously, Catalogue of MANPRINT Methods)	TBD
Handbook for Conducting Analysis of the Manpower, Personnel, and Training Elements for a MANPRINT Assessment	None
Health Hazard Assessment Primer (1990)	A220 953
MANPRINT Handbook for Nondevelopmental Item (NDI) Acquisition (1988)	A227 033
MANPRINT Handbook for RFP Development, 1st ed. (1987)	A188 321
MANPRINT Handbook for RFP Development, 2nd ed. (1990)	A228 035
MANPRINT Handbook for Source Selection, 1st ed. (1987)	A193 742
MANPRINT Practitioner's Guide (1990)	A227 434
MANPRINT Primer (Historical Background) (1987)	A197 681
MANPRINT/System Safety Interface Report	A228 290
SMMP Procedural Guide	TBD

FOR MORE INFORMATION, CONTACT:

The Defense Technical Information Center (DTIC)
Cameron Station, VA 22304-6045

Telephone: (703) 274-7633

Human-System Integration: *Now More than Ever*

LTC Glen Hewitt
MANPRINT Directorate, ODCSPER

Anticipating changes to Department of Defense (DoD) acquisition documentation directives, force structure reductions, and budget cuts causes concern about how important MANPRINT will continue to be in the future. Will there still be MANPRINT work to be done? Will MANPRINT analyses be of increasing utility to the decision making process? The answer to these questions is a resounding YES! Here's why.

The most propitious opportunities in the MANPRINT arena are found in areas with continued growth potential. Such areas with increased requirements for MANPRINT products and services include: 1) defense systems acquisitions, 2) environmental management, 3) plant modernization, and 4) demographic changes.

Defense Systems Acquisition

In this first area, defense systems acquisition is about to get a shot in the arm from revised acquisition directives. Incorporating DoD Directive 5000.53 (MPTS) into DoD acquisition directive 5000.1, DoD Instruction 5000.2, and DoD manual 5000.2M will strengthen human resource considerations in the acquisition process. Replacing MPTS requirements with those addressing Human System Integration (HSI) is more than a name change. Accommodation of HSI concerns is enhanced by adding better definition to the components that comprise HSI and greater discipline in the documentation process that connects requirements and opportunities with resource decisions. Future initiatives supporting these HSI requirements will fall principally within three areas:

Manpower Requirements Definition and Reporting. Congressionally-mandated Manpower Estimate Reports (MER) will become better defined and more visible, thereby necessitating more lucid analyses and more detailed descriptions by the three services. The current lack of definition and discipline in manpower estimating and reporting can only be corrected through the application of rigorous analyses, a structured processing of the results of the analyses, and selective periodic comprehensive auditing.

Developing Systems. Concerns for system effectiveness and for avoiding program-jeopardizing reviews will cause an increasing percentage of developing systems to address MANPRINT considerations more analytically. Spurred by budget constraints, congressional over-watch, and force structure size limitations, renewed emphasis is being placed upon non-major systems development, software and information systems (especially those monitored by the Major Automated Information Systems Review Council [MAISRC] process). Non-Army systems will receive similar treatment as a result of burgeoning MANPRINT-type programs within the Marines, Coast Guard, and Air Force. As reported by the Defense Science Board (1989), "accounting for human performance early in system acquisition improves system capability and enhances the ability . . . to predict operational performance." System performance analyses and evaluations (embodying MANPRINT implications) conducted by technicians from both government and industry are necessary to support the developing systems.

Analytical Methodologies. Both government and industry MANPRINT endeavors have MANPRINT cost estimating tools. However, the use of such tools may be limited by such considerations as difficulty of use, propriety, cost (time, manpower, dollars), and appropriateness to specific projects. Prior to the recent application of sophisticated computer technology, most of the widely used methods and technologies depended upon extraordinary amounts of well-trained (if not well-paid) labor. Such techniques as HARDMAN Comparability Methodology or Early Comparability Analysis relied upon vast amounts of time and manpower. Typical analyses expended six months and employed half a dozen people. Other technologies required resources that the government or industry could not afford, or expertise that could not be sustained in the training base.

New technical tools that capture the power of PC-

based automation and enable decentralized MANPRINT analyses will dominate the field of technique development. Such tools respond to technical personnel's need for facile analytic methods. While high interest in technical tool development will continue, other supportive activities associated with this area will play an increasingly important role. These activities include maintaining the large data bases used by the new tools, training new analysts in the use and application of new tools, and facilitating the use and understanding of output from newly developed tools.

Environmental Management

Just as the HSI program promises to influence design with manpower, personnel, training, and safety implications, environmental management activities will become increasingly aware of the potential savings and cost avoidance that result from early MANPRINT analysis. Notwithstanding the impetus imposed by regulatory agencies such as the Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA), various agencies (e.g., the Office of the Assistant Secretary of Defense for Production and Logistics, or the Army's Construction Engineering Research Laboratory) respond independently to the cost/benefit imperatives of MANPRINT-minded strategies. As a result, facilities planning and installation management need front-end attention similar to MANPRINT requirements during weapon system design.

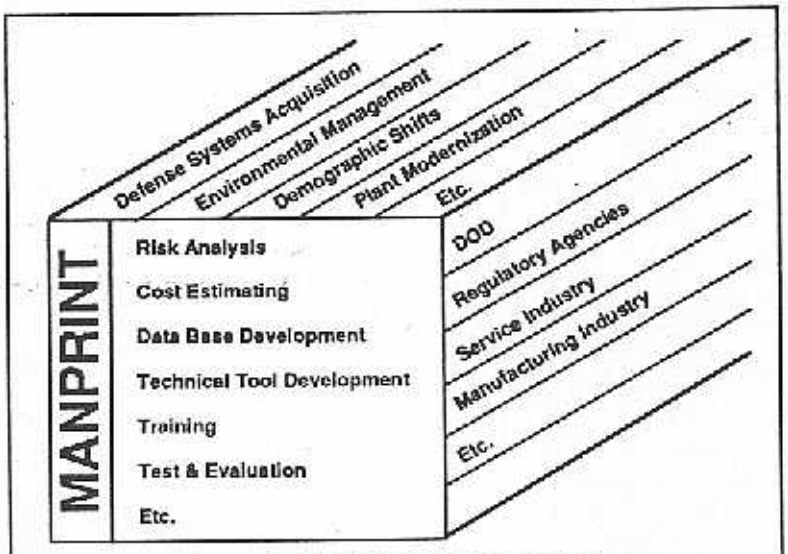


Figure 1. MANPRINT Applications

Plant Modernization

Plant modernization is another growing MANPRINT area. The introduction of new technology, capital equipment replacement, tooling modernization, and increased use of robotics and automation demands MANPRINT front-end analysis. These analyses provide a means to quantify risks, articulate resource requirements, expose schedule sensitivities, define transition needs, and hypothesize policy implications. The work currently underway in the Federal Aviation Administration's (FAA) National Airspace System airport modernization plan exemplifies the scope and value of such MANPRINT application. This $20 billion effort will cause dramatic changes in the way the FAA's human resources are managed. In a general treatment of the subject, Majchrzak, in *The Human Side of Factory Automation* (1988), has described the cascading impacts of plant modernization upon elements of the human infrastructure. She cites many, including those on:

- Job activities (e.g., task analyses, ergonomic requirements, coordination needs, information needs, human-machine work allocation)
- Technical Support Functions (e.g., engineering accounting,and marketing)
- Management and Supervisory Functions (e.g., change in responsibilities, reporting, oversight)
- Skill Requirements (e.g., new skills, retraining requirements, expertise, experience)
- Personnel Policy (e.g., implications and changes in selection considerations, alternative training strategies)
- Organizational Structure (e.g., design, location, lines of communication, staffing).

Demographic Changes

In another area, changes in U.S. population demographics promise a continuous if not explosive shift in human service needs. As a result of people living longer, more affluently, with better health, fewer

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MANPRINT in the MAISRC Process

LTC Gary Shaw
ODCSPER, MANPRINT Directorate

The "forgotten area" is forgotten no longer. Bob Riviello's article ("IMA: MANPRINT's Forgotten Area," published in the Nov/Dec 1990 issue of the *MANPRINT Bulletin*) was right on target and timely to say the least. The Information Mission Area (IMA) has long been recognized as a critical area needing the inclusion of MANPRINT concepts. Now we are making headway in this endeavor.

A MANPRINT in Information Systems Working Group Meeting was held September 18-19,1990 in Alexandria, Virginia. The meeting's purpose was to examine the current MAISRC (Major Automation Information System Review Council) process and determine the best way of applying MANPRINT concepts to information systems acquisition.

The meeting was attended by both voting and non-voting representatives of the MAISRC and by several civilian industry representatives who have had extensive experience with information systems. The result of this two-day meeting was a strong recommendation for MANPRINT concepts to be incorporated throughout the information system acquisition process. In order to accomplish this task, DISC4 (Director, Information Systems Command, Control Communications, and Computers) will add MANPRINT requirements in the Letter of Instructions for the conduct of MAISRCs and also to AR 25-3 and a new DA Pamphlet 25-LCM (draft). The procedures and policies concerning assessments and other administrative requirements are currently being worked.

The end result of all of this work must be the complete incorporation of MANPRINT in the IMA. Granted, the revision of the governing regulations/documents is a small step, but it puts us on the road to eventual completion of a task long overdue for our consideration. We are moving ahead in this area and will keep you informed of the progress.

For more information, contact LTC Gary Shaw, HQ DA, ODCSPER (DAPE-MR), Washington DC 20310; AV 225-9213 or COM (703) 695-9213.

HSI (continued from page 7)

children, more mobility, etc., new emerging social dynamics will increasingly require manpower, personnel, and training initiatives and analyses. These will be evident in requirements for government services (e.g., demographic impact studies), home design (e.g., ergonomic enhancements, health care management (e.g., life cycle cost/benefit of equipment purchases), consumer products (e.g., human factors and safety devices for older drivers of automobiles), and the like. The degree to which the decisions affecting the design are influenced by changing demographics is indicative of the growing utility of MANPRINT analyses.

Figure 1 (page 7) illustrates that the capability to provide the needed product or service will continue to depend upon technical skills applied to technical activities (such as operations analysis, cost estimation, data base design, modeling and simulation) sponsored by a variety of organizations and entities.

The means to link the two ingredients described above (the requirements for MANPRINT and the capability to provide MANPRINT products and services) depends on: (1) a clear understanding of both the technical and managerial aspects of MANPRINT applications, (2) expertise in the six MANPRINTdomains, and (3) a vision of the opportunities that can be realized by prudent use of MANPRINT methodologies.

For more information, contact LTC Glen Hewitt, HQDA (DAPE-MR), Washington, DC 20310; AV 225-9213 or COM (703) 695-9213.

Ten Logistic Commandments for Engineers & Other Sorts

Once thou decidest what name to call a thing, that thing shall be its name forever after, until eternity passeth. Nor shalt thou call any other thing by that name, for each thing shall have a name unto itself.

And like manner shall be the enumeration of each thing.

Continue not to design a thing unto perfection, for verily an ounce of timeliness is more valuable than a pound of perfection. Once thou hast approved a design, go not back and improve it, unless of necessity most dire.

Cover not thy tracks but make thy calculations plain, that those who follow thee may trace any error to its beginning and thus set it and all its brethren upon the path of righteousness.

And mock not the necessary papyrus work, for it is the handmaiden of what thou createst in stone and iron. Completest all thy papyri as thou goest and hoardest them not as a surprise for manufacturing.

Attendest first to that which hath the most importance. Waste not time fixing thy wind to heavy papyrus with wire.

"The Ten Logistic Commandments" were submitted by Dave Davis, PMSW, SFAE-IEW-SG-TB, VHFS, Warrenton, VA 22186.