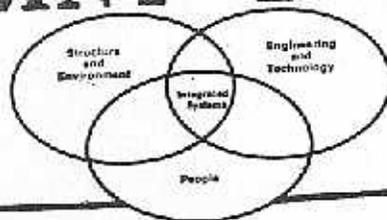




# MANPRINT BULLETIN



September 1986

Vol. I No. 3

## MANPRINT Analytical Techniques

by Dr. Joyce Shields  
and LTC William Blackwood

The purpose of this article is to define MANPRINT and to present the types of analyses that must be performed to support the program.

The Manpower and Personnel Integration (MANPRINT) Program is a comprehensive effort to enhance human performance and reliability during weapon system and equipment (hereafter referred to as "system") design, development, and production.

The goal of MANPRINT is to optimize total system performance by including human performance as an integral element of the total system performance equation. The total system is comprised of all of the people and equipment necessary to field and sustain the weapon system in peacetime and in combat. This includes not only the principal item, but also associated support items of equipment, other support equipment, and training devices. Each has its own respective logistical tails necessary for sustainment. To estimate total system performance, analysts must consider

(Cont'd. on p.2)

## MANPRINT Independent R&D

Recently, industry has raised questions regarding unsolicited proposals and independent R&D (IR&D) projects related to MANPRINT. These questions focused on the legality of submitting MANPRINT-related unsolicited proposals when RFPs for similar work were in preparation and on MANPRINT considerations in technical evaluation of IR&D projects.

A company may perform IR&D on any subject at any time. Costs of IR&D projects that have potential military relationships are allowable overhead costs and may be recovered, within the limits of negotiated cost ceilings, through overhead charges under contracts with DOD. DOD regards MANPRINT-related IR&D projects as having potential military relationships.

The Army Materiel Command's (AMC) goal is to encourage industry to consider MANPRINT in IR&D efforts where possible. AMC has initiated action to include MANPRINT managers in the existing IR&D evaluation process. Specially, a letter was sent to the major commodity commanders directing that all evaluators of IR&D projects consider MANPRINT factors in

(Cont'd. on p.2)



Analytical Techniques  
(Cont'd. from p.1)

combinations of doctrinal, training, organizational, and materiel alternatives. Therefore, the critical issue for MANPRINT analysts is how to obtain the information needed by decisionmakers to determine that combination of technology, people, and force structure will satisfy mission requirements under all environmental conditions at the lowest possible costs.

In the Training and Doctrine Command, analysts have distinguished operational effectiveness from performance. "Operational effectiveness is a force attribute; performance is an attribute of a particular system." (TRADOC Pam 11-8). The Pam goes on to point out that a "new system may accomplish its assigned task far better than some alternative, but its operational effectiveness may not be significantly greater than the alternative because its introduction into the force does not produce a significant improvement in the force." For example, advanced

equipment may not, in itself, increase operational effectiveness, because the advanced technology and complexity may require soldiers with more sophisticated aptitudes and skills, particularly for maintenance and repair. If personnel lack the necessary aptitudes and skills, the ability of the force to accomplish its mission is not increased. On the other hand, if personnel characteristics are matched to the hardware design the operational effectiveness of the force could be increased significantly.

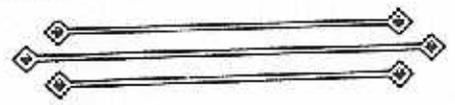
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IR&D (Cont'd. from p.1)

their evaluations. IR&D projects that focus on technical performance without considering MANPRINT factors will receive lower evaluation scores.

The Army Laboratory Command is currently updating AMC Pamphlet 70-6, A PRIMER on Technical and Industrial Liaison Office (TILO) Programs, to include specific information on MANPRINT. Once published, it will be announced in the Commerce Business Daily and in press releases, as well as in handouts at trade and professional forums, including advance planning briefings for industry (APBI).

For additional information or clarification, contact Mr. Warren Theis, U.S. Army Materiel Command, ATTN: AMCDE-PQA, 5001 Eisenhower Avenue, Alexandria, VA 22333-0001. Telephone: (703) 274-5696 or Autovon: 284-5696.



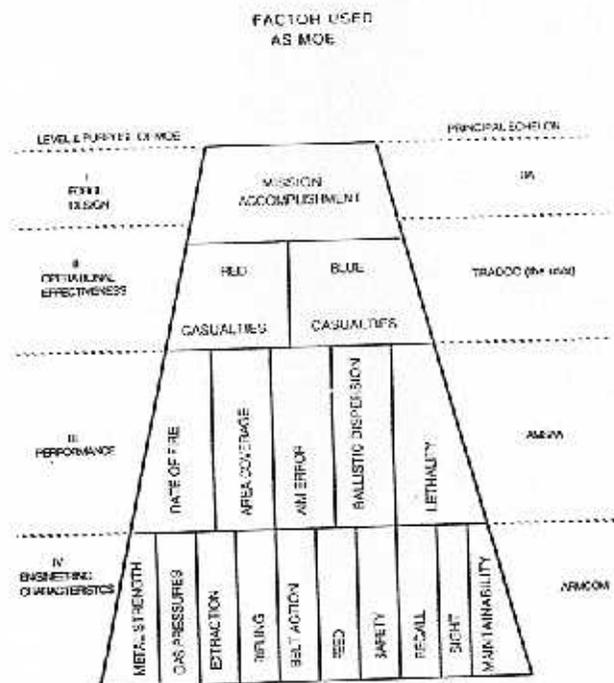
## Analytical Techniques (Cont'd. from p.2)

Historically, the contribution of human performance and reliability to system performance was not quantified. In the materiel acquisition process the focus was on the performance characteristics of the hardware despite the writings in the AMC Engineering Design Handbook, DARCOM Pam 706-102, which focuses on human performance and reliability. These performance characteristics were usually provided by the combat developer, were calculated within the materiel community, and represented system performance against passive targets. The contribution of the system to operational effectiveness or total systems performance could only be inferred, since the estimates did not describe the interaction of groups, types of weapons, and soldiers that actually occurs on the battlefield. Field tests were used to estimate operational effectiveness. Today total system performance can be evaluated quantitatively by establishing measures of effectiveness. However, it also includes qualitative variables such as leadership, soldier performance, and morale.

To accomplish MANPRINT, Army combat developers, trainers, acquisition specialists, testers and evaluators, logisticians, laboratory scientists, and engineers must apply the appropriate analytical techniques to predict, understand, and control the relationship between force structure, soldiers, and technology. These analytical techniques can be classified in a number of ways, but it may be most helpful to relate MANPRINT

analytical techniques to the hierarchy of effectiveness measures described in TRADOC Pam 11-8 and shown below.

As shown in the figure, there are multiple levels of measures of performance and effectiveness, and a variety of analytical techniques for acquiring those measures. Measures at one level are dependent upon one or more measures at a lower level. The figure shows information that could be used in selecting the best artillery system. The materiel acquisition system has traditionally focused on engineering characteristics (level IV) and hardware performance (level III). MANPRINT goes beyond this traditional focus and makes early estimates of the total system performance.



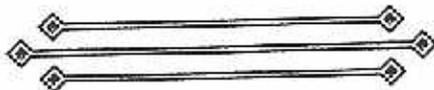
But how is soldier performance and reliability integrated at each level?

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## Industry Access to Headquarters, Army Materiel Command, in Alexandria, VA

analytical Techniques  
(Cont'd. from p.3)

The question that remains is how to approach the analysis plan. The MANPRINT program does not prescribe a "school solution," but rather emphasizes the criteria upon which decisions should be made that will direct the analytical plan. As many of you are aware, the selection of an analytical technique often depends on factors such as cost, need for data, time needed to accomplish, results desired, available techniques, complexity, and validity. Armed only with this nebulous guidance, the action officer experiences a tremendous amount of frustration. In the following months we will publish a series of "how-to" articles to help simplify and demystify the analytical planning process. These articles will describe analytical techniques that support the areas of Structure and Environment, Engineering and Technology, and People. The articles will address strengths, weaknesses, when to do them, who does them, and how to get them.



### WATSON'S LAW:

The reliability of machinery is inversely proportional to the number and significance of any persons watching it.

As many of you know, we recently sent letters to contractors asking them to resubmit names of persons authorized for access to the headquarters building. The letters were not intended to discourage industry visitors. This action was prompted by an interest in assuring that controls are properly exercised and that Department of Defense requirements are fully met. The initiative is designed to permit access by those with legitimate business in the headquarters and accelerates already established revalidation requirements outlined by DOD 5220.22-M, Industrial Security Manual for Safeguarding Classified Information. Successful revalidation will permit those of you with legitimate government business, requiring recurring access, to continue to enter the headquarters. It will not require that you be escorted. Those with only infrequent need to visit can expect to be escorted. These procedures are similar to those used by most government contractors, and they ensure that controls are applied to protect the interests of all. Industry visits to HQ, AMC, are still encouraged and will be conducted in accordance with the appropriate security measures. Questions concerning requirements may be addressed in writing to Commander, U.S. Army Materiel Command, ATTN: AMCPE-SH, 5001 Eisenhower Avenue, Alexandria, VA 22333-0001, or by telephone: (703) 274-9141.





### Impact of Confinement and Isolation on Crew Performance

What does the manned space program have to do with MANPRINT? More than one might think! In a recent literature review (April 1985), Capt. Daniel L. Collins (USAF) describes psychological problems among the crew of various space missions brought on by confinement, close quarters, and isolation.

Behavioral problems among astronauts have occurred during both U.S. and Soviet space flights. Interpersonal problems among the crew members on space flights have resulted in impaired judgments and conflicts, which have jeopardized the mission. The adverse effects of confinement and isolation are also experienced by Army soldiers manning tanks and by Army personnel stationed in remote posts. Thus, Collins' findings and recommendations are relevant and valuable to the Army in its effort to improve total system performance by considering the human factors involved in successful job performance.

Collins recommends using psychological tools to select candidates who will be most resistant to these effects and to ease a tense space flight situation that threatens to

become volatile. One of the psychological tools he recommends is the Personal Attributes Questionnaire (PAQ) masculinity/femininity scale. The ideal candidate for space flight is one who is psychologically androgynous, demonstrating both the instrumentality and goal-seeking characteristics of men and the expressiveness and sensitivity that are characteristic of women. This combination of traits will enable astronauts to complete their mission effectively but also to cope with the interpersonal conflicts that often result from the hardships of space travel.

Collins also recommends testing candidates' motivation for participating in the mission using McClintock's three types of motivation: own gain, relative gain, and joint gain. Motivation is important because it often predicts a person's interest in cooperating with others. A person who is motivated by his own gain regardless of the harm it may do others is not likely to be cooperative and is clearly a bad choice for a space mission. One who seeks a higher reward than others (relative gain) will be too competitive to be a good crew member. However, a candidate who seeks courses of action that will benefit all (joint gain) is likely to be a good choice for the mission.

Collins also focuses on types of leadership, specifically, task-oriented and socio-emotionally oriented leadership. A task-oriented leader is concerned with accomplishing the goal of the mission.

(Cont'd. on p.6)

Confinement (Cont'd. from p.5)

Socioemotional leadership promotes harmonious relations among the group members. Both are essential to the success of a mission, but each is used under different circumstances. Therefore, a good candidate to lead the space mission must be able to use both types of leadership. However, a person with both skills who is also able to change his style of leadership as the situation changes is hard to find.

Further research is needed before NASA will be able to choose compatible mission candidates and more versatile leaders. Collins makes five recommendations for research in these areas. First, he suggests that research be conducted to determine how to match the appropriate style of leadership with the situation at hand. Furthermore, NASA must learn more about what effect an autocratic style of leadership has compared to a participatory style and which style is more effective under what conditions. Collins' third recommendation is that NASA determine what procedures crew leaders can use to diagnose the causes of interpersonal conflict among the crew and to alleviate some of the friction before it creates a dangerous situation.

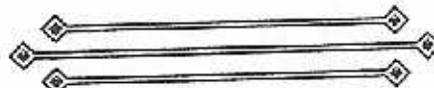
As desirable as it is to select candidates for space flight who will be resistant to the psychological problems that accompany space travel, it is inevitable that "high risk" candidates will be selected inadvertently. Therefore, it is essential that NASA conduct research to determine the psychological props that can be

used to enable these individuals to preserve or restore their emotional stability under adverse conditions.

Finally, Collins emphasizes the need for NASA to continue researching operational aspects of the manned space program in light of the behavioral problems that persist. Collins concludes that if psychological research is not pursued, these behavioral problems are likely to become more frequent and more severe.

Some of the psychological problems created by space flight are unique to that environment; however, some of the hardships, especially confinement and isolation, are also experienced terrestrially, especially in Army tanks and at remote posts. As such, many of Collins' insights and recommendations can be applied to the Army. The U.S. Army Armor and Engineer Board's project Physiological and Psychological Effects of Nuclear, Biological, and Chemical Warfare and Extended Operations on Crews (P<sup>2</sup> NBC<sup>2</sup>) address performance of encapsulated crews over time. For information on this study contact: U.S. Army Armor and Engineer Board, Attn: LTC Leekley, Fort Knox, KY 60121-5470; telephone: (502) 624-5969 or Autovon: 464-5969.

Capt. Collins' review "Psychological Issues Relevant to Astronaut Selection for Long-Duration Space Flight: A Review of the Literature" can be ordered from the Defense Technical Information Center under document number AD-A154051. Send request to: DTIC, Cameron Station, Alexandria, VA 22304-6145. Telephone: (202) 274-7633; Autovon: 284-7633.



### MANPRINT Staff Officer Course

The MANPRINT Staff Officer Course (MSOC) was developed to provide military and civilian personnel with the skills and knowledge to apply MANPRINT principles at their respective commands and agencies. The course is useful for personnel serving in or pending assignment to positions that perform combat, training, or materiel development, or test and evaluation of military equipment.

The MSOC consists of three weeks of intensive training for entry level personnel in grades E7 through E9, O2 through O4, and GS-9 through GS-12. Based on the assumption that personnel in these grades have limited experience in materiel development and acquisition, emphasis is placed early in the course on the classic life cycle system management model. This approach establishes a common baseline among students before moving to more complex subjects.

Next, the students establish a firm foundation in the six domains of MANPRINT--human factors engineering, manpower, personnel, training, health hazard assessment, and system safety. The blocks of instruction are reinforced in a practical exercise during which a system MANPRINT management plan (SMMP) is developed. The SMMP is the management document that gives MANPRINT the visibility required to make it a viable program. A list of course subjects follows this article.

The MSOC is conducted in one of two locations in the Washington metropolitan area--Humphreys Engineer Center Support Activity, near Fort Belvoir, VA, and Xerox International Center For Training in Leesburg, VA. Both locations have excellent classroom facilities. A list of scheduled course dates is included in this issue of the Bulletin.

(Cont'd. on p.8)



**MANPRINT Question  
Call Toll-Free**

The MANPRINT Information Hotline will be operational from 0900 to 1600 hours Eastern Standard Time, Monday through Friday. The phone numbers are: outside Virginia, 800-262-1626; inside Virginia, 800-327-1626. The hotline is operated by Automation Research Systems (ARS), Ltd., under contract to the office of the Deputy Chief of Staff for Personnel. Depending on the nature of your question, ARS will either provide an immediate answer, research the answer, and call you back, or refer you to the appropriate agency or person for a response.



Staff Officer Course  
Cont'd. from p.7)

Allocations for the MSOC are provided to the Army major commands (TRADOC, HSC, AMC, etc.), the Army staff, and nongovernment agencies by the MANPRINT Policy Office. For further information, contact Maj. Richard Patrick or Mrs. Patricia Colliver. Telephone: (703) 695-9213 or Autovon: 25-9213.

COURSE SUBJECTS

- Orientation
- MANPRINT Introduction
- Project Planning
- Life Cycle System Management Model
- Manpower
- Personnel
- Target Audience Description
- Work Load
- Training
- System Safety
- Health Hazard Assessment
- Human Factors Engineering
- MANPRINT Management I
- Analytical Techniques
- Early Comparability Analysis
- MANPRINT Management II
- Requirements Documents
- Case Study
- Acquisition Strategy
- Procurement I
- Procurement II (RFP)
- Integrated Logistic Support
- Logistic Support Analysis
- Funding
- Costing
- System MANPRINT Management Plan
- Test and Evaluation
- Tech Base
- Practical Exercise
- Information Briefing

**System MANPRINT  
Management Plan (SMMP)**

The U.S. Army Soldier Support Center, National Capital Region, has recently completed the System MANPRINT Management Plan (SMMP) Procedural Guide, dated July 1986. The guide contains guidance and examples for developing a SMMP.

The SMMP is the management device used by the proponent to ensure that MANPRINT issues are identified and addressed as early as possible in and throughout the materiel acquisition process (MAP) to effect the design and supportability, from a MANPRINT perspective, of the subject system. It serves as a management guide and an audit trail to identify the tasks, analyses, tradeoffs, and decisions relating to MANPRINT issues. The purpose of the SMMP is to integrate and systematically address the system MANPRINT goals, issues, and concerns and to provide a living document for implementing actions.

A SMMP will be initiated for all materiel systems. TRADOC [specifically the proponent MANPRINT Joint Working Group (MJWG)] initiates all SMMPs, regardless of where the system is in its life cycle. The system's position in its life cycle also determines the content of the SMMP:

- For systems that are pre-Milestone I, the SMMP focuses on influencing the design of the system.

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SMMP (Cont'd. from p.8)

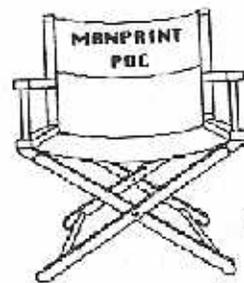
- For systems that are post-Milestone I, the SMMP focuses on manpower, personnel, and training (MPT) supportability of the system.

Ideally, the SMMP is initiated by the proponent MJWG prior to program initiation. At this point in the acquisition process, the SMMP influences the design of the subject system. The SMMP is also used to identify, among other things, existing guidance that will affect the development of the system, potential predecessor or reference equipment, data sources, areas of concern, and analyses that will or may be performed during the MAP. As the system develops, more information will become available and the SMMP will become more specific and refined as the system matures.

As stated above, SMMPs for post-Milestone I systems focus on the MPT supportability of the systems. Analyses and studies scheduled in these later SMMPs focus on those MPT decisions that remain to be made (i.e; TOE and MOS decisions). These SMMPs will contain more information than those initiated prior to Milestone I because of the advanced state of the systems (i.e., the availability of prototypes for study will provide more data for identifying and answering MANPRINT issues).

SMMP formats and examples are contained in the SMMP Procedural Guide. The guide can be ordered from the Defense Technical Information Center (DTIC) under document number AD-A171130 by agencies of the Federal Government and government contractors holding accounts with DTIC. Contact DTIC, Cameron Station, Alexandria, VA 22304-6145. Telephone: (202) 274-7633; Autovon: 284-7633.

Questions and comments concerning the SMMP or the procedural guide should be addressed to: Commander, USASSC-NCR, ATTN: ATNC-NMF-B, 200 Stovall St., Alexandria, VA 22332-0400. Telephone: (703) 325-0395; Autovon: 221-0395.



### MANPRINT Points of Contact (POC) List To Be Updated

The POC list published with the July MANPRINT Bulletin will be revised and published in October. The list will be updated quarterly. Readers who are MANPRINT POCs for their organization are asked to complete the address blank included with this bulletin and return it by October 24, 1986, to: The Editor, MANPRINT Bulletin, c/o Automation Research Systems, Ltd., 4401 Ford Avenue, Suite 400, Alexandria, VA 22302.

Schedule of MANPRINT Courses for FY 87



GO/SES MANPRINT Seminars

\*\*All located in Washington, D.C.\*\*

Date

30 Oct 86	23 Apr 87
2 Dec 86	21 May 87
15 Jan 87	23 Jun 87
25 Feb 87	22 Jul 87
26 Mar 87	20 Aug 87

MANPRINT Staff Officer Course

Date                      Location

Oct 86 - 7 Nov 86	Leesburg, VA
Dec 86 - 19 Dec 86	Washington, DC
Jan 87 - 13 Feb 87	Ft. Belvoir, VA
Mar 87 - 20 Mar 87	Ft. Belvoir, VA
Mar 87 - 17 Apr 87	Ft. Belvoir, VA
May 87 - 22 May 87	Leesburg, VA
Jun 87 - 3 Jul 87	Ft. Belvoir, VA
Jul 87 - 14 Aug 87	Ft. Belvoir, VA
Sep 87 - 2 Oct 87	Ft. Belvoir, VA

Information on course allocations can be obtained from HQDA (DAPE-ZAM), Washington, D.C. 20310-0300. Telephone AV 225-9213 or COM 202-695-9213.

One-Week MANPRINT Course

Date                      Location

6-10 Oct 86	Ft. Belvoir, VA
7-21 Nov 86	Aberdeen Proving Gd., MD
2-16 Jan 87	Ft. Belvoir, VA
3-27 Feb 87	Ft. Lee, VA
0-24 Apr 87	Ft. Belvoir, VA
1- 5 Jun 87	Ft. Leavenworth, KS
3-17 Jul 87	Ft. Belvoir, VA
7-21 Aug 87	Ft. Harrison, IN
1 Aug - Sep 87	Ft. Belvoir, VA

FUTURE ARTICLES

The following articles are planned for future issues of the MANPRINT Bulletin:

- ★ Examples of MANPRINT Considerations in Requirements Documents
- ★ Pre-ASARC MANPRINT Review
- ★ Hardware vs Manpower (HARDMAN)
- ★ Levels of Analysis

Lt. Gen. Robert M. Eiten, Deputy Chief of Staff for Personnel  
 Mrs. Patricia Collier, Editor, ODCSPER

Harold R. Booher, *Harold R. Booher*  
 Special Assistant to the Deputy Chief of Staff for Personnel (MANPRINT)

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