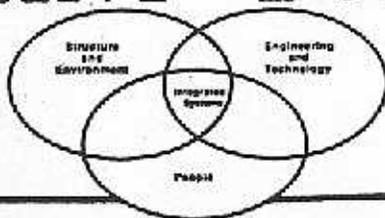




# MANPRINT BULLETIN



I. I No. 4

October 1986

## Preparing for a HARDMAN Analysis

by Thomas E. Mannle, Jr.

The HARDMAN (Hardware vs. Manpower) comparative methodology is an analysis tool for determining the manpower, personnel, and training (MPT) requirements of emerging systems. Originally developed for the Navy, HARDMAN has been adapted for the Army and applied to a wide variety of Army systems. The components and mechanics of the methodology have been described in a previous issue of the MANPRINT Bulletin. This article provides some lessons learned/helpful hints/do's and don't's/timely tips--so that you, as a prospective HARDMAN customer, can apply the HARDMAN methodology effectively. A subsequent article will deal with what you should do after you get the HARDMAN results.

The principal characteristic of most system acquisitions is uncertainty--about the requirements, the prospective system concepts, technically feasible and cost-effective materiel solutions for each concept, tactics and doctrine, scenario usage rates, organizational alternatives, and so forth. HARDMAN attempts to resolve some of

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## AMC Stresses Design for Discard in Lieu of Repair

The anticipated highly mobile and dispersed battlefield of the future requires that equipment be repaired as far forward as possible by means of rapidly replacing modules and assemblies. The field component repair capability mandates that we strive to design or select components which are operationally and economically discardable upon failure.

To achieve this capability, General Thompson, Commanding General, U.S. Army Materiel Command, places high priority on the concept of designing modules, components, and assemblies that can be discarded rather than repaired. Design for discard (DFD) in lieu of repair overlaps with integrated logistics support (ILS), design to cost (DTC), and MANPRINT. This system engineering concept is designed to meet the objectives of the MANPRINT program as a technique for reducing or eliminating the amount of manpower, personnel, and training required to maintain a field repair capability.

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HARDMAN  
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these uncertainties, although the methodology is not intended to completely define the system or to provide exhaustive plans for its introduction into the Army inventory. Rather, HARDMAN uses available information--system description, usage rates, etc.--and whatever assumptions and guidance are being used in other aspects of the acquisition program. This information is often contradictory or contains inconsistent assumptions and definitions. The HARDMAN application serves as a catalyst for pointing out these inconsistencies. Although this was never a deliberate intent of HARDMAN, experience has shown that one of the most valuable aspects of the analysis is the process itself--asking questions about the impact of acquisition of a system on MPT. Such questions transcend organizational and functional responsibilities so that impacts can be made clear to all parties concerned.

We have found that it helps enormously for users to have anticipated some of these questions and to have as many of the answers as possible in hand at the beginning of the analysis. HARDMAN analysts need information as soon in the acquisition process as possible. Furthermore, the kinds of things that they really like to know about new and predecessor systems, force structure, and system scenario are as follows:

- **New System.** Do you know what new systems you want? Are they described anywhere? Is there more than one alternative that would be acceptable? Are they described? Are there new system alternatives that may not be preferred now, but might be preferred under different circumstances? How likely is it, in your view, that circumstances will change? Is the range of the new system alternatives wide open or limited to a narrow choice of system types? If the range is wide, do you want it to be narrow, or vice versa? Finally, given your position in a certain organization (i.e., AMC, TRADOC), do you expect interested parties in other organizations to give the same answers to these questions?

- **Predecessor System.** Which system presently in the Army inventory, if any, is the new system designed to replace? Is there more than one predecessor? What is the replacement ratio, and if there is more than one predecessor, what mix should be considered?

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• Force Structure. In what type of units is the predecessor system found? What is the density and mix of these units in the current force structure? Are the unit TOEs changing? How? Are the density and mix of the units in the force structure also changing? Are these changes directly related to the change from the predecessor to the new system or are they merely coincidental?

• Scenario. Under what conditions will the new system be employed? What are the system's usage rates, (i.e., miles driven, hours operated, rounds fired, and so forth)? Are different parts of the system "driven" by different usage metrics (i.e., rounds, miles, and hours for a tank's gun, tracks, and engine respectively)? If so, which parts, which metrics? Also, if you haven't done a mission profile/operational mode summary yet, it would help if you did, or at least if you put your usage rate information in that format.

One thing to emphasize is that the answers you provide to these questions are points of departure, not final destinations. Because we've had to accommodate them, we have come to expect users to revisit input data and assumptions everyone agreed were final at the outset; as a result, the analysis process is somewhat flexible. Even so, at the start it helps to understand how much of the information you know, how much is assumption and opinion, and

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DFD is an "a priori" and proactive systems engineering effort intended to realize economies in production and support by removing the need for repair. DFD is a top priority in designing modules, components, and assemblies. It results in design changes to hardware, software, and procedural systems. AMC does the hardware and software design changes, while both AMC and TRADOC make changes to procedural systems design. Changes to maintenance support concepts and organizational are done primarily by TRADOC.

Tradeoff analyses associated with the level-of-repair analysis (LORA) program help define those components that are DFD candidates. While LORA is usually applied only to components and assemblies that are already designed, its techniques and methodologies can and should be applied during the initial design process. The AMC policy governing LORA is addressed in AMC-R 700-27 and requires that the LORA methodology be applied as early in the developmental process as practical, preferably prior to establishing the basic configuration. LORA provides information to the decision-maker on whether to repair (and at what maintenance level) or discard a failed item of equipment for each maintenance action on that item. The goal of the LORA program is to establish equipment and component repair-level or discard decisions on an economical and effective basis that integrates design,

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Design for Discard  
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operations, and logistics support characteristics. It is an integral part of the ILS and Logistics Support Analysis (LSA) Program.

Results of early comparability analysis (ECA) can be used in conjunction with LORA Program to identify manpower, personnel, and training (MPT) resource-intensive tasks associated with the operation, maintenance, and repair of predecessor systems. With this information, the materiel developer can then concentrate designing components, modules, and assemblies with greater emphasis on discard rather than field repair.

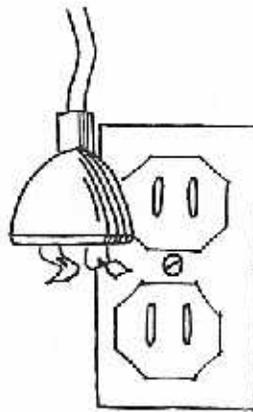
When considered with ECA results, DFD can minimize special MOS skills and knowledge prerequisites for the performing specific operator, maintainer, and repairer tasks for a field repair organization. Furthermore, maintenance organizational manning levels and soldier task complexity can be reduced through judicious use of the DFD concept with favorable force structure implications. The cost-effectiveness of not maintaining a repair capability and of converting "tail" to "teeth" will exceed the waste of discarding seemingly expensive components or assemblies.

For additional information on DFD, contact Paul Bubernak. Telephone: (202) 274-9361 or Autovon: 284-9361.



LOWERY'S LAW

If it jams--force it.  
If it breaks, it needed replacing anyway.



HARDMAN  
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what is unclear. If some of the answers are a guess, say so, and we'll start with that. If better information surfaces, it will be incorporated into the analysis. As the analysis proceeds, more and more of these areas of uncertainty will be filled in, until the final results are obtained. Many of the HARDMAN success stories result from the ability to trace the analysis back to its beginnings as well as the hard work and critical thinking users devoted to preparing for it.

Next: Dealing with HARDMAN results.

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## HARDMAN (Cont'd. from p.4)

The following documents can be ordered from the Defense Technical Information Center (DTIC) by agencies of the Federal Government and government contractors holding accounts with DTIC.

To open a DTIC account, contact DTIC, Cameron Station, Alexandria, VA 22304-6045; telephone: (202) 247-7633 or Autovon: 284-7633.

1. Application of the HARDMAN Methodology to the Enhanced Self-Propelled Artillery Weapon System (ESPAWS). Vol. 1. AD E750 745.
2. Application of the HARDMAN Methodology to the Enhanced Self-Propelled Artillery Weapon System (ESPAWS). Vol. 2. AD E750 747.
3. Army HARDMAN Familiarization Report. AD A164 628.
4. Estimating Manpower, Personnel, and Training Requirements Early in the Weapon System Acquisition Process: An Application of the HARDMAN Methodology to the Army's Division Support Weapon System. Appendices. AD A138 537.
5. Estimating the Manpower, Personnel, and Training Requirements of the Army's Corps Support Weapon System Using the HARDMAN Methodology. AD A134 037.
6. Estimating the Manpower, Personnel, and Training Requirements of the Army's Corps Support Weapon System Using the HARDMAN Methodology. Appendices. AD A129 874.
7. Evaluation of the HARDMAN (Hardware vs. Manpower) Comparability Methodology. ART Tech Report 646, Aug. 1984, 186 pages. AD A162 847.

8. HARDMAN Comparability Analysis Methodology Guide, Vol. 1 through Vol. 5. AD A156 787; AD A156 788; AD A156-789; AD A156 790; AD A156 791.

9. HARDMAN for the Division Support Weapon System (DSWS). AD A144 453 and AD A138 537.

10. HARDMAN Life-Cycle Cost Methods; Recommendations. AD A085 245.

11. Military Manpower vs. Hardware Procurement Study (HARDMAN). AD A047-069.

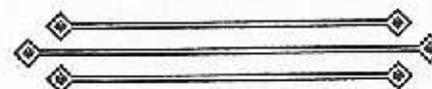
12. Restricted Visibility Land Combat Analysis - Summary and Overview. AD A528 567.



Keep Those Cards and  
Letters Coming In!



We have received many good suggestions about the MANPRINT Bulletin from our readers, many of which have been incorporated into subsequent issues. We encourage you to keep sending in those suggestions, but also please feel free to send in any ideas, information, or "lessons learned" that you would like to share with the MANPRINT Bulletin audience. In fact, if you'd like to write a full article on a topic related to MANPRINT, send it in! The editor will give credit where it is due or leave the source anonymous. Just let us know your preference.





## Elton Makes Speech to Human Factors Conference

by Dr. Kent Myers

Lieutenant General Elton spoke before the Human Factors Society conference on October 1, 1986, in Dayton, Ohio. Commercial airplanes were grounded, but General Elton, a true Ohio Buckeye, pressed on to meet his appointment. In his presentation he encouraged human factors professionals to get involved in a new style of military procurement that will lean much more heavily on their skills. General Elton admitted that in the past the Army has done a poor job on human factors, as with the STINGER missile, which creates an undue burden on intelligence and training, and with the Dragon antitank weapon system, which is difficult to handle and whose failures were apparent at an early stage but went uncorrected. He also agreed that manpower and personnel have been poorly matched with technology at a broader level, as described in Martin Binkin's newly released book from Brookings (to be reviewed in the next Bulletin). However, General Elton said that the worst of the problems are behind us. Even so, a constant effort is required to be "good stewards over our talent."

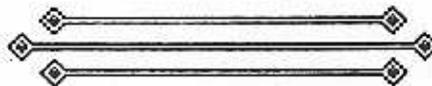
Stewardship will often take the form of deciding tradeoffs between system performance and people requirements. The LHX helicopter under development is one instance where human performance is clearly the limiting factor since it is

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## American Defense Preparedness Association Meeting To Address MANPRINT Issues

The 1986 Annual Meeting of the Small Arms Systems Division of the American Defense Preparedness Association (ADPA) will be held in Tacoma, Washington, and Fort Lewis, Washington, on November 18-19, 1986. The theme of the meeting will be small arms development and acquisition for light infantry divisions in low- to mid-intensity conflicts. Emphasis will be placed on anti-aircraft and antitank weapons up to 40mm and other materials, such as night observation devices, to properly equip the U.S. Army's new light infantry division. MANPRINT concerns will be included among the session topics. In addition, Dr. Harold Booher, Special Assistant for MANPRINT for DCSPER, will be the luncheon guest speaker on November 18. For more information on this meeting, please write to Col. Duke Wolf or Leigh Dunlap, the American Defense Preparedness Association, Rosslyn Center, Suite 900, 1700 North Moore Street, Arlington, VA 22209-1942, or call (703) 522-1820.



Elton Speech  
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designed for operation by one man. Thus the LHX physical design must begin with what one pilot is capable of and not exceed that limit as highly complex subsystems are added. In addition, the 'tail' has not been neglected in this design; maintenance and logistics for the LHX have been streamlined.

The improvement in the crew performance in the M-1 tank over the M-60 tank is a well-documented example of where MANPRINT concerns are currently showing a payoff. In the M-1, crews with lower ratings in mental capacity can perform as well as high mental capacity crews, while there is a significant differential, correlated to intelligence, in the performance of M-60 crews. Furthermore, M-1 crews with the least mental capacity can match the performance of the best M-60 crews. The implications go beyond immediate performance to increased flexibility and simplification in assignments and recruiting.

General Elton pointed out several weak points in the material acquisition process that the MANPRINT program will address. In the past, the concept designers have remained essentially disconnected from the human resource experts. Under MANPRINT, the human resource experts will also participate in system design. Furthermore, the MOS requirements for a new technology are addressed much too late in the cycle. A more fundamental problem concerns the chronic tendency to define a weapon system too narrowly. A system certainly includes its human operators, maintainers, and the organization that

supports them. But it also includes other support equipment, associated items of support equipment, and training devices.

The solution to this problem is not simple. MANPRINT requirements will be called out separately as source selection criteria, and it is expected that this will turn heads quickly. But there are ingrained attitudes that will have to be changed more slowly. General Elton, as a director of personnel in the Army, will exercise a direct influence, but he is acting primarily as a policy and guidance catalyst throughout the Army, letting others in AMC, TRADOC, and elsewhere exercise the operational initiative. He calls on human factors professionals to help make these policy changes effective.



**MANPRINT Questions?  
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.