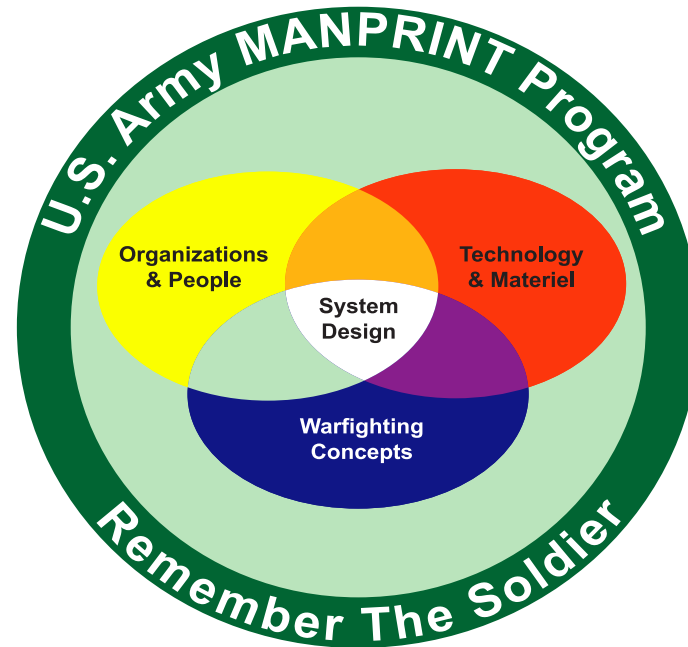


Army MANPRINT



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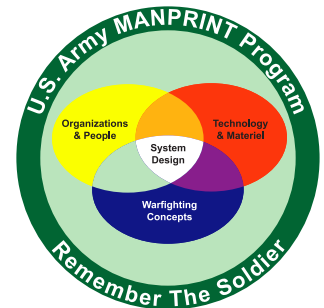
MANPRINT Mission

Optimize total system performance, reduce life cycle costs, and minimize risk of soldier loss or injury by ensuring a systematic consideration of the impact of materiel design on Soldiers throughout the system development process.

- **MANPRINT accomplishes its mission by**
- developing MANPRINT policy,
- assessing materiel development programs for MANPRINT compliance,
- serving as the proponent for Soldier-oriented research, development, analysis, and studies
- overseeing assistance to materiel development programs by MANPRINT practitioners,
- advocating MANPRINT education,
- integrating the MANPRINT domains of manpower, personnel capability, human factors engineering, training, Soldier safety, health hazards prevention, and Soldier survivability to manage the impact of these domains on system design.

What is MANPRINT?

- **A culture**
 - The advocate for the Soldier in system design and acquisition
- **A community**
 - Behavioral scientists, Human factors engineers, Safety, Occupational health, Instructional technologists, Trainers, Survivability analysts, Industrial engineers
- **Regulations**
 - DoD 5000.2
 - CJCSI/CJCSM 3170.01
 - Army Regulation 602-2
- **Process/Procedures**
 - Assessment
 - Assistance
 - Test and Evaluation
- **Science and technology**
 - Task behavior
 - Modeling and Simulation
- **A set of analytic tools**
 - IMPRINT
 - et al
- **Department of Defense and International**
 - The Army implementation of Human Systems Integration (HSI)
- **An Army Program**
 - Directorate in HQDA, DCS G-1



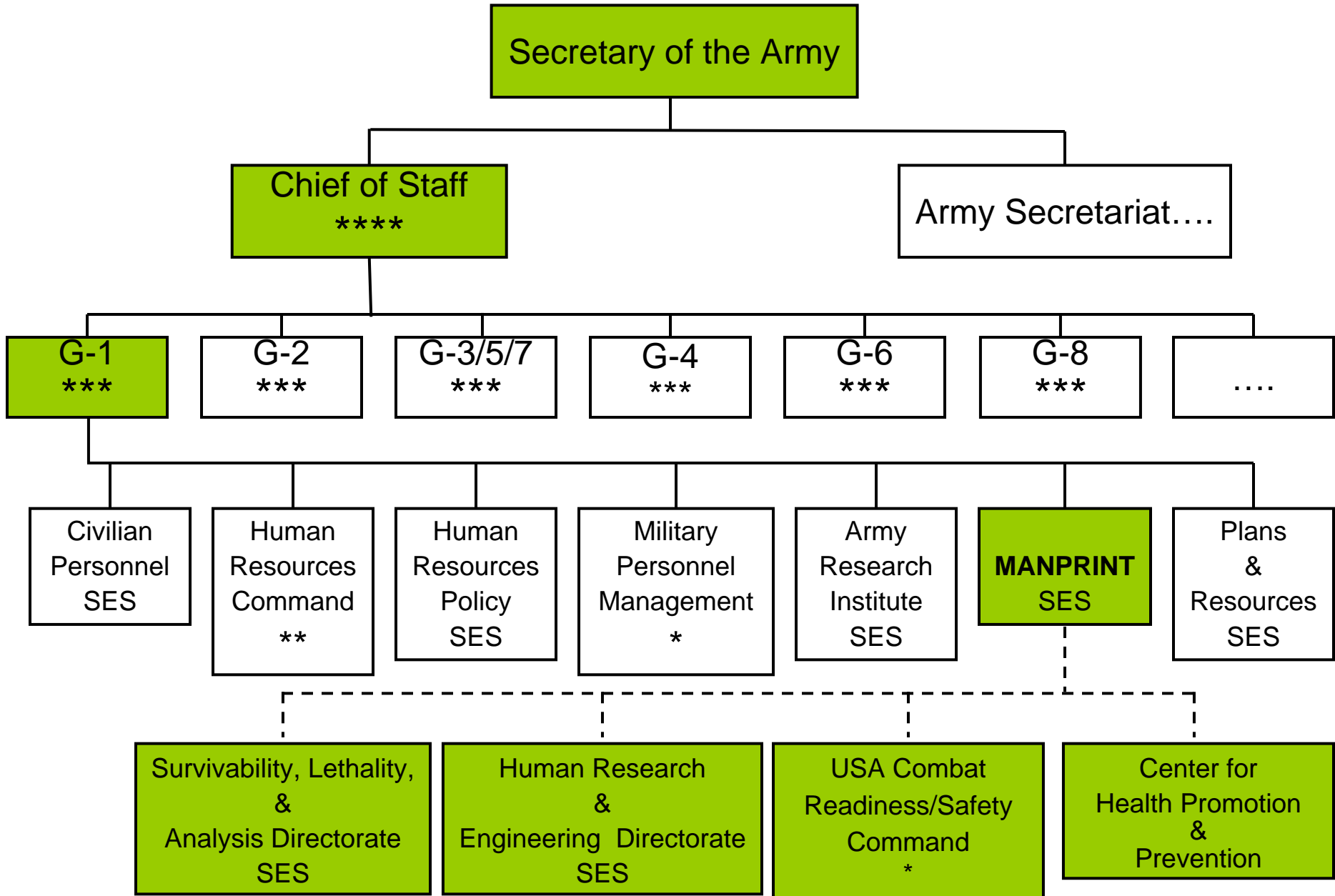


MANPRINT



- **MANPRINT's premise**
 - Manpower requirements and human performance characteristics must drive materiel design. They should not be a “system retrofit”
- **Why MANPRINT**
 - Manpower is currently 50-60% of systems' life-cycle costs
 - Manpower requirements must be considered at every stage of system acquisition
- **MANPRINT is**
 - A scientific and technical approach to system design that integrates analyses of
 - *Manpower*
 - *Personnel Capabilities*
 - *Training*
 - *Human Factors Engineering*
 - *System Safety*
 - *Health Hazards*
 - *Soldier Survivability*
- **MANPRINT results in**
 - Improved total system performance
 - Reduced system life-cycle costs
 - Optimized manpower requirements
 - Increased soldier survivability and safety
 - Better KSA match,
 - Less training
 - More usable interfaces (reduced errors)
 - Reduced workload
- **MANPRINT does this through Assistance and Assessment**
- **MANPRINT customers are the Acquisition Executive, PEOs, PMs, and the Soldier**

MANPRINT is the G-1's only influence over the Army's manpower needs and expenditures for the future Army.



MANPRINT Objectives

- Enhance The Operational Effectiveness Of The Total System By Optimizing The Soldier-System Interface.
- Ensure That System Design Conforms To The Capabilities And Limitations Of The Soldier.
- Ensure Systems Are Suitable, Survivable, And Safe For Their Intended Use.
- Reduce Total Life-cycle Costs Of Soldier-materiel Systems.



MANPRINT MUST EMBRACE AN
INTEGRATED APPROACH TO
TOTAL SYSTEMS ENGINEERING

Typical Domain Issues

- **Manpower**
 - Too many or too few personnel?
- **Personnel Capability**
 - Some systems require very demanding skills.
- **Training**
 - The quality of new equipment training can vary drastically
 - Training is typically the last item to which PMs attend

Typical Domain Issues (cont.)

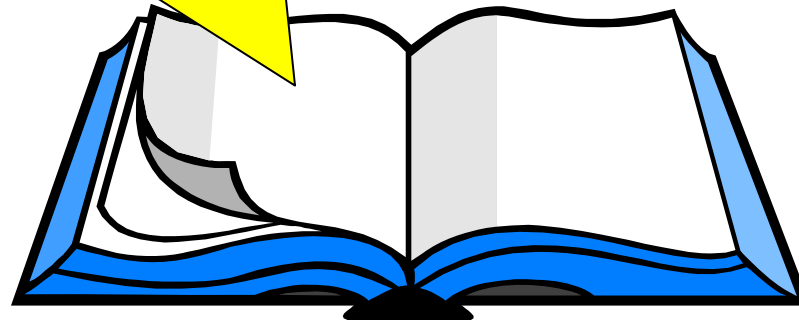
- **Human Factors Engineering**
 - Workload may be too high for effective performance of all required tasks
 - Greater connectivity increases complexity of analysis
 - New systems may restrict the size of crewmembers
- **Soldier Survivability**
 - Systems seek to use the benefits of better situational awareness, through networks, to substitute for armor
- **Safety and Health Hazards**
 - Modern materials pose new challenges in these areas.



WHY Human Systems Integration?

“The Project Manager shall have a comprehensive plan for HSI in place early in the acquisition process to optimize total system performance, minimize total ownership costs, and ensure that the system is built to accommodate the characteristics of the user population that will operate, maintain, and support the system.” *DoD Instruction 5000.2, 12 May 2003).*

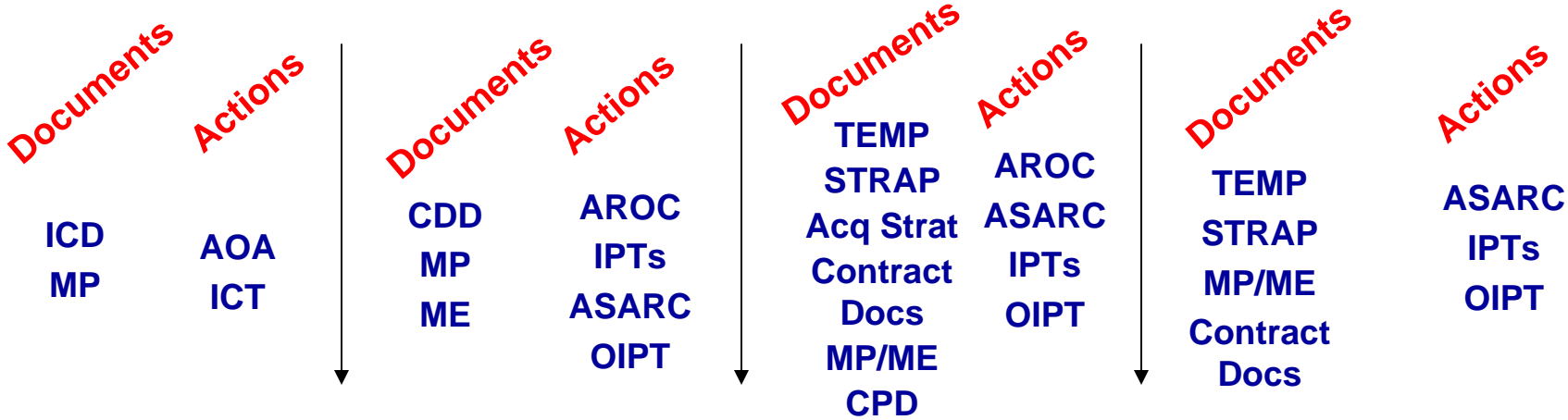
Also in JCIDS: CJCSI 3170.01



MANPRINT is the Army implementation of HSI

MANPRINT In System Acquisition

Assistance

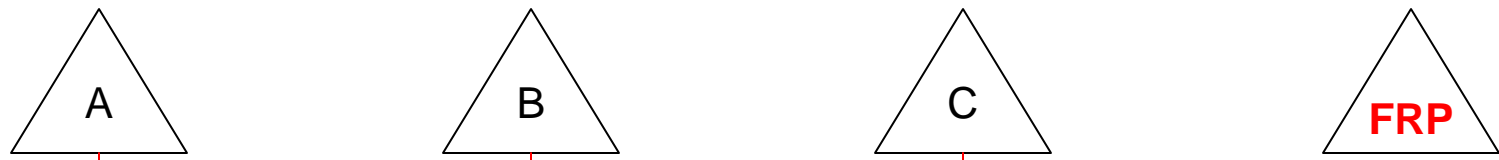


Soldier-Oriented Research & Development → Soldier-Oriented Studies

Assessment :



Milestones:



Phases

Concept Refinement

Technology Development

System Development & Demonstration

Production & Deployment

O&S

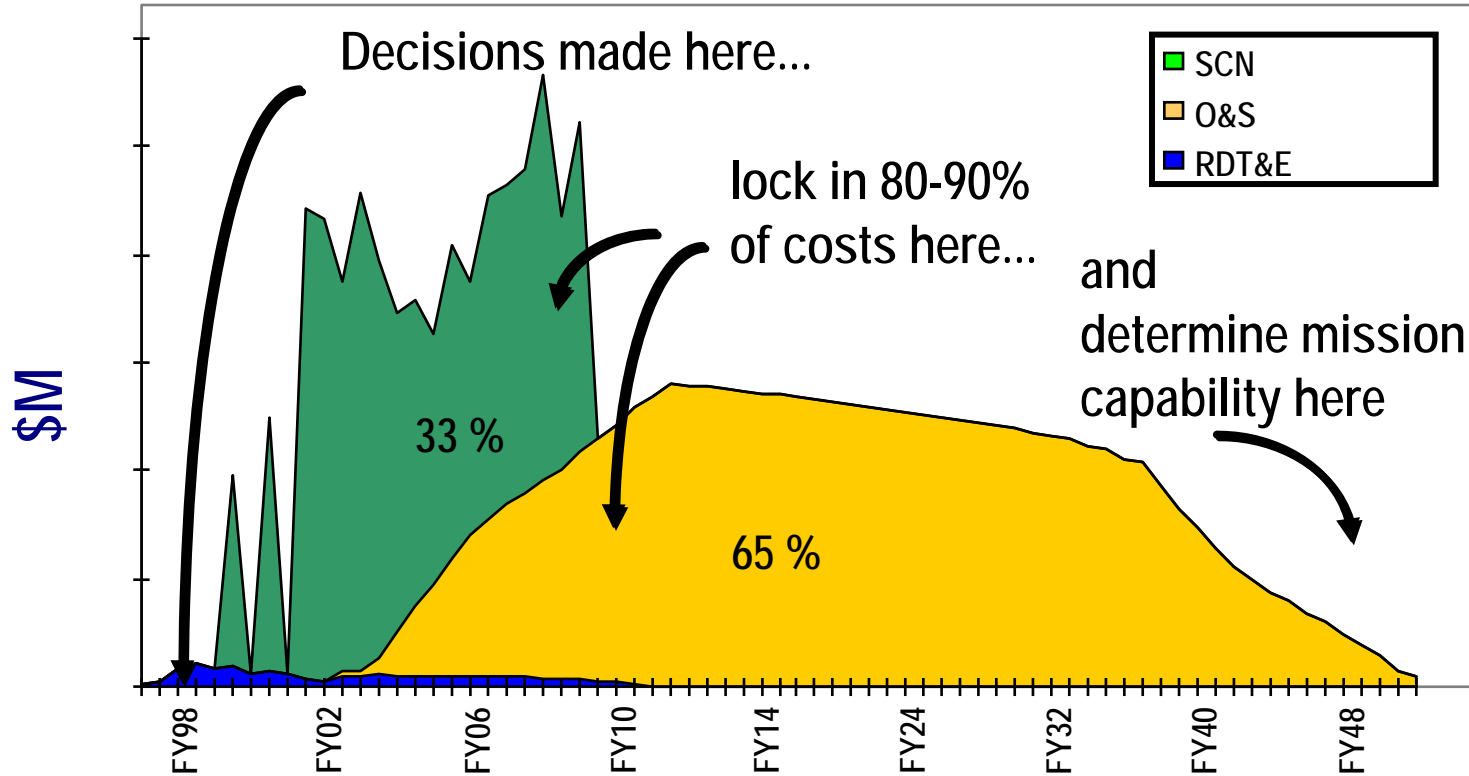
ICD

CDD

CPD

FRP

Why Do HSI?



*Early decisions drive TOC -
Design decisions drive HSI costs (40-60%)*



What Does HSI Impact?

- **Cost**

- **Acquisition**
 - Fewer Changes
- **Operations**
 - Reduced Workload
- **Support**
 - Reduced Workload
- **Training**
 - Reduced Hours

- **Performance**

- **System Effectiveness**
- **Availability**
 - Turn Around Time
 - Sortie Rate
- **Survivability**
- **Lethality**
- **Safety & Hazards**



VARIABLES ASSOCIATED WITH HSI DOMAINS: HFE

Human Factors Engineering

Human Performance

Human Error Avoidance

Design for Usability

Design for Maintainability





VARIABLES ASSOCIATED WITH HSI DOMAINS

Manpower

Workload

Wartime Requirements
(Quality/Quantity)

Peacetime Requirements
(Quality/Quantity)

Officer, Enlisted and Civilian





VARIABLES ASSOCIATED WITH HSI DOMAINS

Personnel

Personnel Classification

Selection

Recruiting

Retention

Career Progression

Skill Mix

Special Skills

Occupational Standards

Distribution

Manning Concepts





VARIABLES ASSOCIATED WITH HSI DOMAINS

Training

Knowledge, Skills and Attitudes

Initial Skill Identification

Skill Progression

Individual and Team

Initial & Follow-on

Delivery Systems

Organic/Embedded Training

Distance Learning

Virtual Environment

Intelligent Tutoring





VARIABLES ASSOCIATED WITH HSI DOMAINS

Personnel Survivability

Anti-Fratricide

Personnel Protection

Damage Control



Allied soldiers helped protect themselves from friendly fire by distinguishing their vehicles with inverted "V"s, seen here on the A-1 echelon of the Royal Scots Dragoon Guard advancing into Kuwait. Also visible on some of these vehicles are fluorescent orange air recognition panels. (USN photo by PHC Holmes)



VARIABLES ASSOCIATED WITH HSI DOMAINS

Safety and Occupational Health

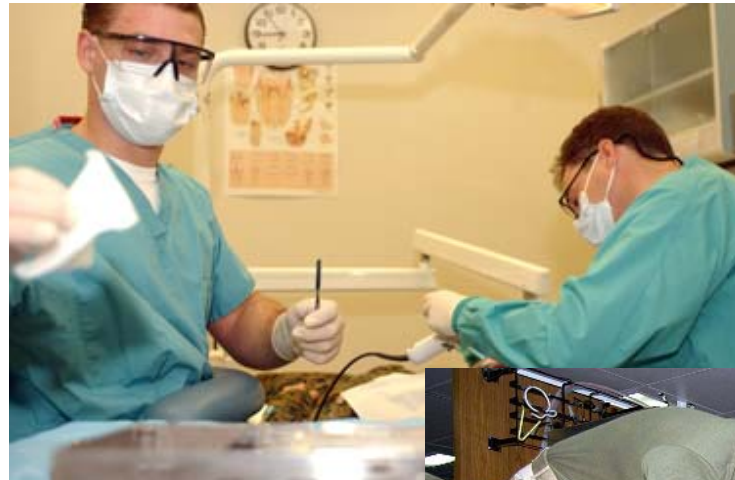
Accident Avoidance

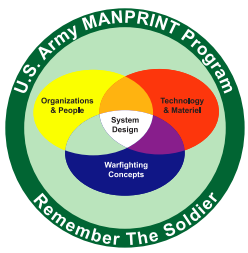
Safety Hazard Avoidance

Health Hazard Avoidance

Risk Mitigation

Medical





FCS Soldier-System of Systems- Challenges

Compared to current force, FCS requires:

- Fewer soldiers to operate and maintain a larger number of systems (M)
- Soldiers managing greater volumes of information, faster (HFE)
- Soldiers performing more cognitively-intensive functions, while vehicles are in motion (HFE, T)
- Soldiers operating over much greater distances (HFE)
- Soldiers depending on and using embedded training (P,T)
- Soldiers acquiring more combined arms skills at lower echelons (P)
- Soldiers placing greater trust in networks to keep them alive (SSv)
- Soldiers performing all duties without degradation over 3 days of intensive combat, after deploying over a 4 day period under a wide range of environmental conditions (HFE, S&H, SSv, T)

SoS and individual platform designs must meet these challenges within the cognitive and physical limits of the future soldier. **The future soldier looks much like today's soldier.**

MANPRINT activities are targeted to address these issues throughout the FCS program.

M manpower P personnel T training HFE human factors engineering S safety H health hazard SSv soldier survivability



HSI Solutions

- **Reduce workload and numbers needed per task/activity**
- **Define intuitive soldier-machine interfaces**
- **Provide easy access to required data**
- **Provide user-centered decision support systems**
- **Promote and exploit collaborative approaches**
- **Provide multi-modal displays and operator-focused formats**
- **Appropriate number of Personnel**
- **Better Knowledge, Skills, Ability Match**
- **Appropriate Training**
- **More Usable Interfaces (Reduced Errors)**

Making Warfighters an Integral Component in a Total Systems Engineering Approach

What can you do with IMPRINT?

- Set realistic system requirements
- Identify future manpower & personnel constraints
- Evaluate operator & crew workload
- Test alternate system-crew function allocations
- Assess required maintenance manhours
- Assess performance during extreme conditions
- Examine performance as a function of personnel characteristics and training frequency & recency
- Identify areas to focus test and evaluation resources
- Quantify human system integration risks in mission performance terms to support milestone review
- Represent humans in federated simulations

IMPRINT is a trade-off analysis tool

Examples of IMPRINT Reports

- Mission Performance
 - Predicted time & success rate
- Function Performance
 - Predicted time
- Task Performance
 - Predicted time & accuracy
- Operator Workload
 - Overall Workload
 - Operator activity



Intelligent Munitions System

- **System Description:**

IMS is a system of controlled ground munitions, linked into a network of systems, and capable of autonomous, unattended employment IAW the commander's intent.

- **Process:**

- Held User Jury I at Fort Leonard Wood, MO in FY07
- Held User Jury II at Fort Benning, GA in FY08
- Participate in MANPRINT, Training and C2 Integrated Product Teams



MANPRINT Results:

Over 80 design issues were examined and changed as a result of UJ I.

Over 35 design issues were scrutinized and changed as a result of UJ II.

AN/PSS-14 Mine Detection

System Description:

Handheld mine detector using both Ground Penetrating Radar and induction coil sensors

Process:

- Provided MANPRINT input during system development
- Provided MANPRINT support during Operational Testing
- Developed key elements of training program as result of research with predecessor
- Led collaborative research with Lincoln University, Missouri University for Science and Technology, and Carnegie Mellon University for improving Soldier use of the detector.
- Currently supporting and guiding related research funded by the Leonard Wood Institute



U.S. Army Combat Engineer with PSS-14 near Bagram Airport, Afghanistan, April 2004

MANPRINT Results:

- Human Factors included during design
- Recognition of GPR limitations in some soil conditions
- Enhanced training programs
- Developing methods to risk manage system capabilities and limitations

JNBCRS Increment I

System Description:

JNBCRS Increment I is a Nuclear, Biological, and Chemical Reconnaissance System for the Marine Corps

Process:

- Held System Safety Working Groups
- Held Human Systems Integration Working Groups
- Attended Logistics Demonstrations
- Analyzed Operational Tests to determine the potential issues and fixes



MANPRINT Results:
Hundreds of changes have been made to the design through analyzing the MANPRINT domains hence significantly improving the system.

Tactical Fire Fighting Truck

System Description:

TFFT is a modified Heavy Expanded Mobility Tactical Truck (HEMTT) that is designed as a multi-functional fire fighting truck with the capability to combat several different types of fires to include wild land, petroleum, structural and hazardous material containment and aircraft rescues.

Process:

- Initial system HFE evaluation
- Worked with SSE & SME
- Identified MANPRINT issues
- Tracked MANPRINT issues
- Recommended changes to issues
- Held JMWG meetings with PM
- Attended OT
- Reviewed TIR for MANPRINT issues
- Held After Action Reviews at OT
- Completed MANPRINT Evaluation
- Published article in HFES



MANPRINT Results:

Final product is a system that is much safer to operate, easier egress and ingress, and quicker response time to fight fires due to improve accessibility of fire fighting equipment.

The Bottom Line

- SOLDIERS will be using equipment to perform missions and to defend their lives.
- Equipment designed with the soldier in mind is:
 - Easier to use, employ, and operate
 - Easier to maintain and sustain
 - More effective
 - Safer
 - More efficient
 - More cost effective
 - Less likely to require redesign



We must equip the soldier, not man the equipment!