SYSTEMS MANAGEMENT STANDARD

SAE1010™

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Standard Practice for Manpower and Personnel

RATIONALE

This standard was written to support a U.S. Department of Defense (DoD) system acquisition need for a Manpower and Personnel Standard Practice. However, its applicability is not limited to the DoD.

FOREWORD

This standard describes the best practices for consistent application and conduct of Manpower and Personnel (M&P) activities in support of a system acquisition contract. The Manpower domain is concerned with ensuring that the number and mix of system operators, maintainers, trainers, and support personnel are adequate and minimize manpower-driven ownership costs. The Personnel domain is concerned with the human aptitudes, skills, experience levels, and capabilities required to operate, maintain, and support a system and minimize personnel-driven ownership costs. M&P concerns are addressed through the coordination with design Integrated Product Teams, other disciplines such as Human Factors Engineering, Training, Safety, and Occupational Health, Habitability, Force Protection and Survivability, maintainability, logistics, test organizations, program management, and others.

The G-45 Human Systems Integration (HSI) Committee of SAE International developed this standard practice document, in collaboration with U.S. Government agencies, including the Department of Defense, U.S. Army, U.S. Navy, U.S. Marine Corps, U.S. Air Force, U.S. Coast Guard, NASA, the Department of Homeland Security (DHS), and representatives from industry. This standard will serve an even broader community of customers in the future.

Manpower and Personnel comprise two of the seven HSI domains and contribute to the overall success of an HSI program. While HSI responsibility comprises tasks to plan, manage, and integrate the HSI domains, it does not include the normal activities of the domains themselves. It is important to distinguish between domain and HSI responsibilities. The purpose of this standard is to describe the Manpower and Personnel domain responsibilities.

BACKGROUND

For many years, M&P considerations were rarely addressed comprehensively by prime contractors during system development. This was based primarily upon an assumption that the acquisition customer had total responsibility for conducting all analyses in these disciplines. However, prime contractor M&P analysis can contribute significantly to system design decisions, the ability to meet affordability goals and the ability to minimize personnel-driven ownership costs. To date, there has never been a best practice standard to guide contractor activities in planning and executing M&P activities in support of system acquisition projects.

The DoD established an HSI Standard Working Group in 2012 to research and develop a new standard for Human Systems Integration to provide additional guidance to industry. The DoD selected the SAE International G-45 Human Systems Integration Committee to lead this task. SAE International executed a multi-year effort beginning in May 2016 that resulted in the development, release, and DoD adoption of a Best Practice standard (SAE6906).

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To achieve a full, seven-domain HSI program, an acquisition contract must contain an HSI program requirement as well as requirements in all seven of the domains. As of 2019, military and/or industry standards existed in just three of the HSI domains: Human Factors Engineering (HFE), Training, and Safety and Occupational Health. Best practice standards are needed in the other four HSI domains: Habitability, Manpower, Personnel, and Force Protection and Survivability. If the intent is for the contractor to validate existing Government M&P assumptions, then the acquisition contract should contain M&P requirements in addition to an HSI program requirement.

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1. SCOPE

This Standard covers Manpower and Personnel (M&P) processes throughout planning, design, development, test, production, use, and disposal of a system. Depending on contract phase and/or complexity of the program, tailoring can be applied. The scope of this standard includes Prime and Sub-contractor M&P activities; it does not include Government M&P activities.

The primary goals of a contractor M&P program typically include:

- Ensuring that the system design complies with the latest customer manpower estimates (numbers and mix of personnel, plus availability) and that discrepancies are reported to management and the customer.
- Ensuring that the system design is regularly compared to the latest customer Personnel estimates (capabilities and limitations) and that discrepancies are reported to management and the customer.
- Identifying, coordinating, tracking, and resolving M&P risks and issues and ensuring that they are:
    - Reflected in the contractor proposal, budgets, and plans.
    - Raised at design, management, and program reviews.
    - Debated in Working Group meetings.
    - Coordinated with Training, Logistics, and the other HSI disciplines.
    - Included appropriately in documentation and deliverable data items.
- Identifying and pursuing opportunities to reduce Manpower and Personnel demands and costs.
- Ensuring that M&P considerations are addressed in analyses, design decisions, trade-offs, and design changes (e.g., ECPs).
- Conducting Manpower and Personnel analysis activities and supporting human factors analyses (e.g., workload analysis) and other HSI domain analyses to provide evidence to support design decisions and trade-offs and to coordinate shared data (e.g., task analyses).
- Ensuring that M&P analyses and results are timely, technically competent/complete, and in a format that enables them to be included in design decisions, tradeoffs, and changes.
- Ensuring that M&P issues discovered in test, evaluation, demonstration, Operational Test and Evaluation (OT&E), and operations are tracked and resolved in a technically competent/complete and timely manner.
- Ensuring that the subjects used in experiments, simulations, tests, evaluations, and demonstrations are consistent with the customer's latest projected target audiences.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations or contracts unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

GEIA-STD-0007B	Logistics Product Data
HEB-1B	Human Engineering - Principles and Practices
SAE EIA-649C	Configuration Management Standard
SAE6906	Standard Practice for Human Systems Integration
TA-STD-0017	Product Support Analysis

2.1.2 Other Applicable Documents

MIL-HDBK-502	DoD Handbook: Product Support Analysis (PSA), 08 March 2013
MIL-HDBK-1908B	Department of Defense Handbook: Definitions of Human Factors Terms (16 Aug 1999)
MIL-STD-961	Defense and Program-Unique Specifications Format and Content, 09 January 2014
MIL-STD-1472G	DoD Design Criteria Standard, Human Engineering, 17 January 2019
MIL-STD-46855A	DoD Standard Practice: Human Engineering Requirements for Military Systems, Equipment and Facilities, 24 May 2011

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 Related Publications

The Aerospace Corporation Report TOR-2015-014949-RevA, Tailoring of IEEE 15288.1: Systems and Specialty Engineering Supplement, Also published as USAF Space and Missile Systems Center standard SMC-T-006 (2017)

USAF Human Systems Integration Office, Human Systems Integration in Acquisition (Management Guide), Report number ADA519018. August 2009

Air Force Instruction 38-201, Management of Manpower Requirements and Authorizations, January 2014

Air Force Pamphlet (AFPAM) 63-128, Integrated Life Cycle Management, 10 July 2014

ANSI HFES100 (2007), Human Factors Engineering of Computer Workstations

Army Regulation 602-2, Human Systems Integration in the System Acquisition Process, created by United States Department of the Army, 27 January 2015

Army Regulation 700-127, Logistics Integrated Product Support, 11 October 2016

ASTM F1166: 07(2013), Standard Practice for Human Engineering Design for Marine Systems, Equipment, and Facilities Defense Acquisition Guidebook

Department of Homeland Security (DHS) Human Systems Integration, September 2012

DI-HFAC-80742, HESC Human Engineering Simulation Concept

DI-HFAC-81743, Human Systems Integration Program Plan (HSIPP)

DI-HFAC-81399, Critical Task Analysis Report (CTAR)

DI-HFAC-80743 Notice 1 Human Engineering Test Plan (HETP)

DI-HFAC-80745, Human Engineering Systems Analysis Report (HESAR)

DI-HFAC-80746, Human Engineering Design Approach Document – Operator (HEDAD-O)

DI-HFAC-80747, Human Engineering Design Approach Document – Maintainer (HEDAD-M)

DI-HFAC-80744 Notice 1, Human Engineering Test Report (HETR)

DI-HFAC-81742, Human Engineering Program Plan

DI-SESS-81517, Training Situation Document

DI-SESS-81518, Instructional Performance Requirements Document

DI-SESS-81519, Instructional Media Requirements Document

DI-SESS-81520, Instructional Media Design Package

DI-SESS-81521, Training Program Structure Document

DI-PSSS-81522, Course Conduct Information Package

DI-PSSS-81523, Training Conduct Support Document

DI-PSSS-81524, Training Evaluation Document

DI-PSSS-81525, Test Package

DI-PSSS-81526, Instructional Media Package

DI-PSSS-81527, Training System Support Document

DoD Directive 1322.18, Military Training, 13 January 2009

DoDAF Architecture Framework Version 2.02, August 2010

DoD Directive 5000.01, The Defense Acquisition System, 20 November 2017

DoD Instruction 1100.22, Policy and Procedures for Determining Workforce Mix, 12 April 2010

DoD Instruction 5000.02,Operation of the Defense Acquisition System (10 August, 2017), Enclosure 7

DoD Instruction 7041.04, Estimating and Comparing the Full Costs of Civilian and Active Duty Military Manpower and Contract Support

DoD Logistics Assessment Guidebook, July 2011

DoD Product Support BCA Guidebook, April 2011

DoD Risk, Issue, and Opportunity Management Guide for Defense Acquisition Programs, January 2017

Handbook of Human Systems Integration, published by John Wiley & Sons, Hal Booher (editor), 2003

Lacson, F. C., Risser, M. R., Kosnik, W., and Gwynne, J. (2017), The Human Systems Integration Framework: Enhanced HSI Support for Systems Acquisition. Proceedings of the Human Factors and Ergonomics Society, Austin, TX: Human Factors and Ergonomics Society

INCOSE Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities, 4th Edition, July 2015

ISO/IEC/IEEE 15288, Systems and software engineering -- System life cycle processes, May 2015

IEEE 15288.1, IEEE Standard for Application of Systems Engineering on Defense Programs, 2014

IEEE 15288.2, IEEE Standard for Technical Reviews and Audits on Defense Programs, 2014

ISO/IEC/IEEE 29148, System and Software Engineering – Life Cycle Processes – Requirements Management

Marine Corps Order 5311.1E, Total Force Structure Process, 18 November 2015

MIL-HDBK-470, Designing and Developing Maintainable Products and Systems, Rev A, 04 August 1997

MIL-HDBK-29612, DoD Handbook, Instructional Systems Development/Systems Approach to Training and Education (Parts 1-5), August 2001

MIL-PRF-29612, Training Data Products Performance Specification, 31 August 2001

National Aeronautics and Space Administration (NASA). Human Systems Integration (HSI) Practitioners Guide, Report number NASA/SP-2015-3709. November 2015

NATO RTO TECHNICAL REPORT TR-HFM-155, Human Systems Integration for Network Centric Warfare, February 2010

Navy Actions Needed to Optimize Ship Crew Size and Reduce Total Ownership Costs. GAO-03-520, Published: Jun 9, 2003. Publicly Released: Jun 9, 2003

Office of the Deputy Assistant Secretary of Defense (ODASD) – Systems Engineering, Best Practices for Using Systems Engineering Standards on Contracts for Department of Defense Acquisition Programs. April 2017

Office of the Deputy Assistant Secretary of Defense (ODASD) – Systems Engineering. Guidance and Tools

OPNAV Instruction 1500.76, Navy Training Systems Plan (NTSP), August 2013

OPNAVINST 5310.23, Navy Personnel Human Systems Integration, 17 October 2017

USAF HSI Requirements Pocket Guide, September 2009 (Accession Number: ADA517632)

Under Secretary of Defense (Personnel and Readiness) Memorandum for Secretaries of the Military Departments, Interim Policy and Procedures for Strategic Manpower Planning and Development of Manpower Estimates, 01 December, 2003

Product Support Toolkit and Human Performance Measures. Approved by: AFLCMC/LG, 1 May 2017, 1 May 2017

2.3 Acronyms Used in This Standard

APA Additional Performance Attributes

ASAP Aircrew Systems Advisory Panel

CARD Cost Analysis Requirements Document

CDD Capability Development Document

CDR Critical Design Review

COTS	Commercial Off-The-Shelf
CPD	Capability Production Document
CSWG	Crew Systems Working Group
DAG	Design Advisory Group
DHS	Department of Homeland Security
DOD or DoD	Department of Defense
ECP	Engineering Change Proposal
FOC	Full Operational Capability
GFE	Government Furnished Equipment
GFP	Government Furnished Property
GFI	Government Furnished Information
HFE	Human Factors Engineering
HSI	Human Systems Integration
HSIPP	Human Systems Integration Program Plan
IAW	In Accordance With
ICD	Initial Capabilities Document
ILSP	Integrated Logistics Support Plan
IMP	Integrated Master Plan
IMPRINT	Improved Performance Research Integration Tool
IMS	Integrated Master Schedule
IOC	Initial Operational Capability
IPT	Integrated Product Team
KPP	Key Performance Parameter
KSA	Key System Attribute
LCMP	Life Cycle Management Plan
LCSP	Life Cycle Sustainment Plan
LRIP	Low Rate Initial Production
MAP	Maintainer Advisory Panel
MER	Manpower Estimate Report
MPTP	Manpower Personnel and Training Plan

MSA	Material Solution Analysis
M&P	Manpower and Personnel
NASA	National Aeronautics and Space Administration
NTSP	Navy Training Systems Plan
OBS	Organizational Breakdown Structure
OPSTEMPO	Operations Tempo
OSA	Other System Attributes
OT&E	Operational Test & Evaluation
PDR	Preliminary Design Review
POM	Program Objectives Memorandum
PESHE	Programmatic Environmental Safety and Health Evaluation
PSA	Product Support Analysis
RFP	Request for Proposals
SAE	Society of Automotive Engineers
SDD	System Design and Development (Acquisition Phase)
SDO	Standards Development Organization
SE	Systems Engineering
SEMP	Systems Engineering Master Plan (Contractor)
SEP	Systems Engineering Plan (Government)
SME	Subject Matter Expert
SOW	Statement of Work
STRAP	System Training Plan
TAD	Target Audience Description
TEMP	Test and Evaluation Master Plan
TES	Test and Evaluation Strategy
TMRR	Technology Maturation and Risk Reduction
TPM	Technical Performance Measure
WBS	Work Breakdown Structure

2.4 Definitions

CAPABILITY REQUIREMENTS: A capability which is needed to meet an organization's roles, functions, and missions in current or future operations. To the greatest extent possible, capability requirements are described in relation to tasks, standards, and conditions IAW the Universal Joint Task List or equivalent DoD Component Task List. (Source: CJCSI 5123.01.) Capability requirements serve as the basis for system and specification requirements.

CONTRACTOR: This term refers to the company or organization responsible for fulfilling the system acquisition contract requirements. An alternative could be "solution provider."

CONTRACTOR MANPOWER AND PERSONNEL PRACTITIONER: Qualified personnel responsible for planning, coordinating, and executing the Manpower and Personnel program; serves as the contractor's Manpower and Personnel single point-of-contact.

CONTRACTOR MANPOWER AND PERSONNEL TEAM: The contractor (typically a prime contractor) Manpower and Personnel team responsible for performing Manpower and Personnel activities under a systems acquisition contract. An "extended" Manpower and Personnel team may also include associate contractor, subcontractor, and supplier M&P personnel.

CUSTOMER MANPOWER AND PERSONNEL TEAM: The government Manpower and Personnel team in the organization(s) responsible for providing Manpower and Personnel support. The team may be in the procuring agency or distributed between the procuring agency and one or more other organizations. The team may include Manpower and Personnel support contractors.

DOMAIN-SPECIFIC SYSTEM REQUIREMENTS: System specification/technical requirements impacting the humans (operator, maintainer, supporter, or other type of user) associated with the system, to the extent that human performance, mission effectiveness, and the HSI domain design/implementation considerations may be affected. Specific HSI domains are responsible for the development, configuration management, and verification of these system-based requirements.

HUMAN PERFORMANCE: A measure of human functions and action in a specified environment, reflecting the ability of actual users and maintainers to meet the system's performance standards, including reliability and maintainability, under the conditions in which the system will be employed (excerpt from MIL-HDBK-1908.)

HUMAN SYSTEMS INTEGRATION: Human Systems Integration (HSI) is a comprehensive management and technical approach applied to systems development and integration as part of a wider Systems Engineering process to ensure that human performance is optimized to increase total system performance and minimize total systems ownership costs. The HSI discipline focuses on addressing human considerations within system engineering and logistics processes to optimize total system performance. HSI efforts accomplish this by ensuring that the human is fully and continuously considered as part of the total system in the development and acquisition of all systems. HSI considerations comprise Human Factors Engineering (HFE), Safety and Occupational Health, Habitability, Force Protection and Survivability, Manpower, Personnel, and Training.

MANAGEMENT: Contractor senior managers and/or program manager. The term "management" does not apply to the procuring agency program manager or staff.

MANPOWER: The number and mix of people required, authorized, and available to operate, maintain, support, and train for the system. This number is based on the range of operations during peacetime, low-intensity conflict and wartime, and considers continuous, sustained operations, needed surge capability, and for disposal at the end of the system life.

MANPOWER AND PERSONNEL ACTIVITIES: The management and application of technical disciplines of planning, leading, coordinating, and optimizing all Manpower and Personnel considerations during system design, development, test, production, use, and disposal of systems, subsystems, equipment, and facilities.

MANPOWER AND PERSONNEL ISSUES: Issues are risks that have a likelihood of 100%, or in other words, have been realized. Manpower and Personnel issues are issues that are specific to the Manpower and Personnel domains.

MANPOWER AND PERSONNEL PRACTITIONER(S): Personnel trained and/or experienced in the Manpower and Personnel domains who participate in the execution of the Manpower and Personnel program. May also be called Manpower and Personnel Subject Matter Experts (SME).

MANPOWER AND PERSONNEL PROGRAM: All the planning, analysis, design support, test, and evaluation, coordination, and documentation activities undertaken in response to Manpower and Personnel requirements contained in the system acquisition contract Statement of Work.

MANPOWER AND PERSONNEL PROGRAMMATIC REQUIREMENTS: Statement of Work requirements for Manpower and Personnel tasks for the contractor Manpower and Personnel team to execute. Focus of these requirements is on Manpower and Personnel program planning, coordination, execution, documentation, and reporting.

MANPOWER AND PERSONNEL-RELATED REQUIREMENT: A requirement not directly associated with the Manpower and Personnel domains, but with Manpower and Personnel implications, including capability, system, or lower-level specification, logistical or human performance requirements. These requirements may interface with multiple domains and multiple disciplines. The Manpower and Personnel team does not have formal responsibility for developing, managing, and testing these requirements, but are a significant stakeholder in the fulfilment of these requirements during system design/development and throughout the system lifecycle.

MANPOWER AND PERSONNEL RISK: A condition of potentially adverse impact on humans and/or systems. Manpower and Personnel risks can be technical as well as programmatic. An example of a major Manpower and Personnel risk would be that the assigned personnel, trained in accordance with the training developed, will not be able to safely and effectively operate (or maintain) the system as delivered.

MANPOWER AND PERSONNEL TASK: Any task performed by the Manpower and Personnel team or Manpower and Personnel practitioner that contributes materially to achieving Manpower and Personnel goals of improving Manpower and Personnel integration, improving human performance or reducing personnel-driven ownership costs.

MANPOWER AND PERSONNEL WORKING GROUP: Typically, a chartered organization charged with carrying out all the Manpower and Personnel activities associated with a system acquisition program. The Manpower and Personnel Working Group (or may be called an Integrated Product Team [IPT] depending on the program or service) is typically co-chaired by customer and prime contractor Manpower and Personnel Practitioner. Membership usually includes representatives from the prime contractor and customer. The Manpower and Personnel Working Group may also include representation from major subcontractors, associate contractors, and major suppliers.

PERSONNEL: The skills, grade, aptitudes, physical attributes, and education and training backgrounds of military and civilian people required to operate, maintain, train, and support the system equipment and associated support equipment and facilities in its operational environment.

PROCURING AGENCY: The procuring agency is the organization responsible for system acquisition and as such can be considered the “Customer" (e.g., Naval Air Systems Command).

SENIOR MANAGER OR PROGRAM MANAGER: Refers to the contractor’s Senior Manager or Program Manager.

SHALL: “Shall" indicates normative requirements, those for which compliance with the specific statement is required.

SHOULD: "Should" is used for informative statements, wherever noncompliance with the specific recommendation is permissible.

STANDARD PRACTICE (OR BEST PRACTICE): The recommended process to be followed in implementing and executing work for a program (i.e., HSI efforts for a program) against which other practices are measured. For HSI, best practices are determined by a broad-based group of DoD and contractor SMEs, who are experienced in the practice and application of HSI on a variety of acquisition programs.

USER: People who will operate, maintain, train, and support the equipment, system, or facility.

3. MANPOWER AND PERSONNEL DESCRIPTION AND OBJECTIVES

3.1 Manpower Domain Overview

The Manpower domain includes the number and mix of people required, authorized, and available to operate, maintain, support, and train the system. This number is based on the range of operations during peacetime, low-intensity conflict, and wartime, and considers continuous, sustained operations, and needed surge capability. The determination of the numbers and kinds of personnel for new or modified systems is historically the responsibility of the customer. This includes:

a. Determining the number and mix of military and Department of Defense (DoD) civilian manpower and contract support people necessary to operate, maintain, support, and provide training for the system through its expected life, including disposal.

b. Documenting projections of the Manpower requirements throughout the system's lifecycle.

c. Establishing Manpower parameters (objectives and thresholds) consistent with existing departmental constraints including consideration of any changes required to existing organizational/career structures and their long-term sustainability. If the program is manpower intensive, this may include establishing a manpower Key Performance Parameter (KPP).

Typical Manpower-related products produced by the customer that can be made available to the contractor include:

a. Manpower requirements including the customer's Manpower/mix estimate included as part of the Cost Analysis Requirements Description (CARD) and System Training Plan (STRAP) for the Army, the Navy Training Systems Plan (NTSP) for the Navy, for the Marine Corps Manpower, Personnel and Training Plan (MPTP), Manpower Estimate Report (MER) for the Navy, Marine Corps and Air Force, and the Integrated Logistics Support Plan (ILSP) for the Coast Guard.

b. Manpower Program Objective Memorandum (POM).

c. Actual or implied Manpower requirement from acquisition documents including the Initial Capabilities Document (ICD), Capability Development Document (CDD), Capability Production Document (CPD), or Concept of Operations.

d. Legacy system-specific criteria and data.

e. Documentation of Manpower at required operational readiness levels and operations tempo (OPSTEMPO).

f. Life Cycle Management Plan (LCMP), Life Cycle Sustainment Plan (LCSP), and Integrated Logistics Support Plan (ILSP).

g. Service-specific instructions.

h. System specifications.

i. Government Systems Engineering (SEP) and HSI Plans (HSIP).

Since the majority of Manpower analyses are typically conducted by customer Manpower practitioners, contractor Manpower practitioners **should** frequently communicate and collaborate with customer Manpower personnel. Contractors **should** remain cognizant of customer manpower goals during system design and development so that design decisions and tradeoffs properly support system availability and are consistent with the customer's operational or sustainment cost objectives. Contractors **should** also seek and recommend opportunities for manpower life cycle cost savings through system design approaches such as simplifying user interfaces, automation, built-in-test, increased system reliability, remove/replace maintenance strategies, just-in-time training, that can reduce manpower/personnel demands and costs.

The customer may specify the total Manpower numbers and/or costs constraints and ask the contractor to optimize performance and determine the most effective mix of personnel within those ceilings. In these circumstances, the contractor **should** provide their estimates of the numbers and kinds of people needed to operate, maintain, support, and provide training for a single system (or realistic number of systems, such as would be supported by a single maintainer) that may be scaled to meet the operational capabilities being investigated by the customer.

3.2 Personnel Domain Overview

The Personnel domain includes those attributes (i.e., knowledge, skills, and abilities) of system-related personnel (e.g., operators, maintainers, trainers, and support personnel) that are necessary to master and perform job requirements for all assigned missions across the spectrum of expected mission environments. Personnel requirements to operate, maintain, train and support defense systems over their lifecycle contribute directly to government personnel-related ownership costs, including recruitment/selection, basic and advanced training, housing/berthing, re-training, relocation, promotion, and retirement. The initial determination of the kinds, capabilities, and training of people who will operate, maintain, support, and provide training for new or modified systems is normally the responsibility of the customer. This includes:

a. Development of military occupational specialties (MOS, or equivalent customer classifications).

b. Development of civilian job series of operators, maintainers, trainers, and support personnel.

c. Identification of recruitment/retention trends that could affect the user population characteristics.

d. Verification of associated Personnel policies and their effect on range of target populations.

The customer goals of these efforts include ensuring that systems are:

a. Developed to minimize additional Personnel requirements.

b. Consistent with human characteristics, capabilities, and aptitudes necessary for system operation and maintenance when fielded.

c. Subject to operational testing that includes a representative sample of the target populations.

Typical Personnel-related products produced by the customer which can be made available to the contractor include:

a. Personnel-related requirements

b. Target Audience Description (TAD)

c. System Training Plan

d. Legacy system-specific criteria and data

e. Documentation of personnel types/characteristics to achieve operational readiness levels and operations tempo

f. Test and Evaluation Master Plan (TEMP) and Test and Evaluation Strategy (TES)

g. LCMP, LCSP, and ILSP

h. Service-specific Directives and Instructions, including command level supplements

i. System Specifications

j. Government Systems Engineering (SE) and HSI Plans

Since the majority of Personnel analyses are typically conducted by customer Personnel specialists, contractor Personnel analysts **should** frequently communicate and collaborate with customer Personnel specialists. The Personnel domain provides the contractor with a description of, and access to their end-users or target audiences for the system. During system design and development, the contractor **should** ensure that the characteristics, capabilities, and limitations of these people are accommodated by the design. When they cannot be accommodated, the contractor **should** assess and inform the customer of the impacts on human and system performance, the potential costs and availability of alternate personnel, and costs of modified or additional training. The contractor **should** explore value propositions for system designs such that a wider range of people can be accommodated and reduce system, personnel, and training costs, or increase personnel and system availability.

3.3 Manpower and Personnel Relationship with Human Systems Integration

Figure 1 illustrates how the various HSI domains may interact, exchange information, and hand off data to each domain. In this figure, the key outputs of each domain are shown in relation to the other domains. The Manpower domain is expected to provide the number and mix of personnel, and the Personnel domain is expected to provide the skill and aptitude requirements for personnel to other HSI domains, including Training, HFE, and Force Protection and Survivability to effectively support design requirements, products, and analyses.

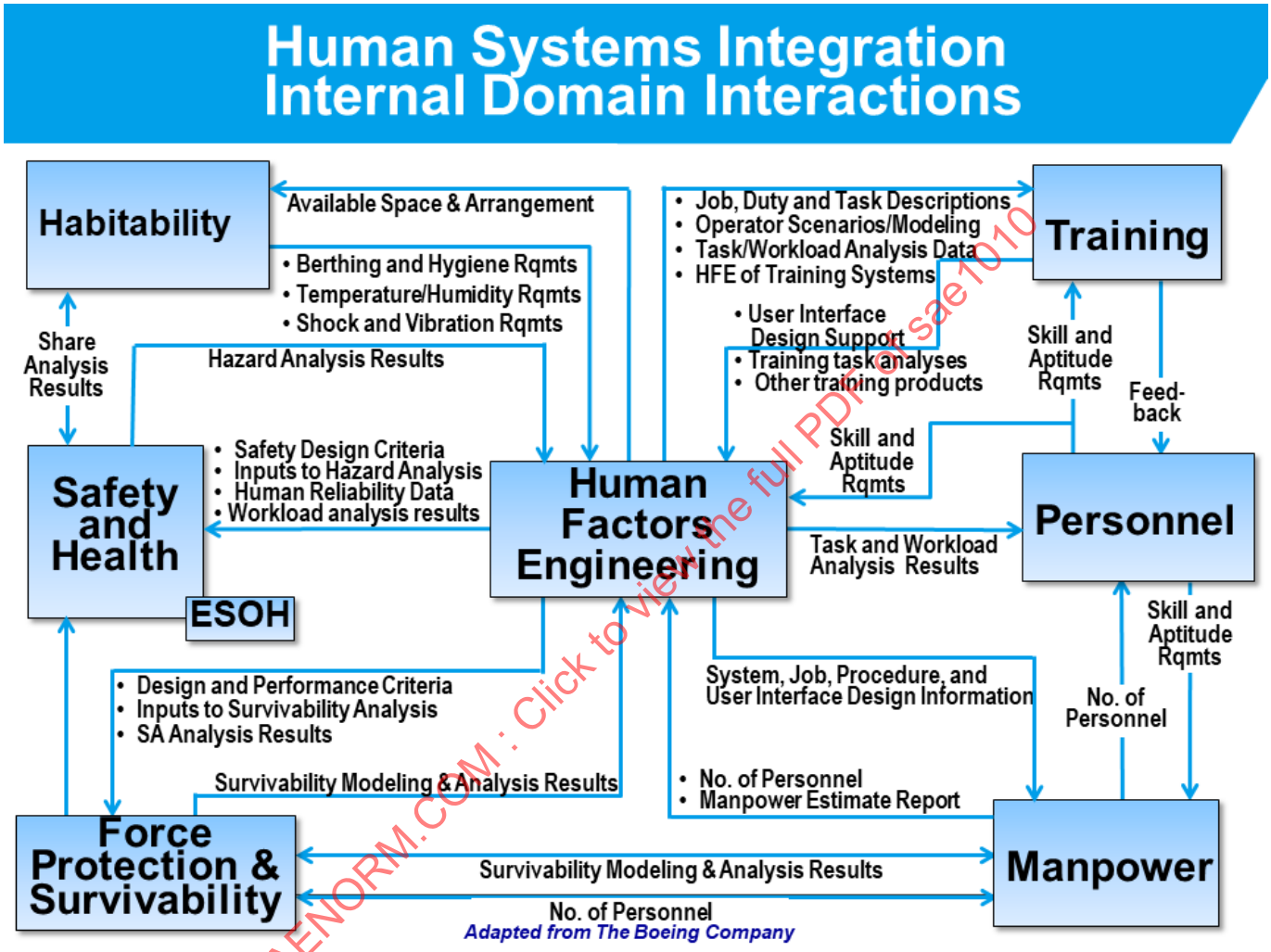

Figure 1 - Notional human systems integration internal interactions

When an HSI program is required by the system acquisition program contract, Manpower and Personnel planning, execution documentation, reporting, coordination, and verification and activities **should** be fully integrated and coordinated with HSI program activities. M&P practitioners **should** participate in all HSI program activities, reviews, working group meetings, and reporting.

3.4 Manpower and Personnel Relationship with Systems Engineering

M&P domain activities **should** be fully integrated into the overall systems engineering (SE) approach that is applied throughout the full product lifecycle. The number and mix of personnel required to support a system during its lifecycle, and the skills, attributes and aptitudes of personnel required is largely determined by the system design. Alternatively, the system design might be driven by manpower requirements - e.g., to meet a manpower cap the system may demand high levels of automation. Manpower inputs can significantly impact design decisions affecting lifecycle costs. Personnel inputs can significantly impact design decisions affecting lifecycle costs and conversely, design decisions can impact the recruitment, selection, and training of personnel required to utilize or support the system.

M&P support, to be effective, **should** be an integral part of the system acquisition project and interface with SE throughout the system life cycle. During the pre-acquisition phases Materiel Solution Analysis (MSA) and Technology Maturation and Risk Reduction (TMRR), the M&P domains **should** inform system concept/implementation trade analyses and develop/refine personnel number and mix and personnel skills, aptitudes, and availability estimates as these drive affordability. The function allocation between human and technological components of the system and the aggregation of human functions is a key driver of the M&P demands. There is a need for a close working relationship between the Personnel, Manpower, HFE, and Training domains and the wider SE activities. These are often government activities but may involve contractor support or execution as study tasks.

During the system acquisition activities following Acquisition Milestone B, contractor-performed M&P planning and execution activities support system design, integration, and test. This **should** include the assessment of trade-offs between the M&P domains and technology/automation to deliver the most effective and cost effective solutions throughout the system lifecycle. The M&P domains **should** develop and/or refine personnel number and mix and personnel skills, aptitudes and availability estimates; inform system concept/implementation trade analyses; and coordinate results with customer M&P specialists. In the sustainment activities of Operations and Support, the M&P team **should** assess the accuracy of M&P planning estimates and performance for system operations, maintenance, training, and support. Recommendations **should** be made to adjust M&P requirements and estimate based on continuing operation and support.

M&P planning and analysis activities **should** be coordinated with the SE technical processes including: stakeholder requirements definition, requirements analysis, architecture, transition, validation, verification, integration, and implementation, as well as technical management processes including: technical planning, technical assessment, requirements management, risk management, configuration management, technical data management, and interface management. M&P technical activities **should** be coordinated with SE technical processes including: business/mission analysis, stakeholder needs and requirements definition, architecture definition, design definition, system analysis, implementation, integration, verification, transition, validation, operations, maintenance, and disposal.

During programmatic and technical reviews, M&P activities/considerations **should** be addressed within the context of the program's execution. This **should** include M&P program status reporting at programmatic reviews such as program management review, integrated baseline reviews, integrated system reviews and engineering change proposal reviews. M&P technical activities and accomplishments **should** be specifically addressed in the planning, entry/exit criteria development, and conduct of the technical reviews. Likewise, the verification of M&P estimates **should** be carefully coordinated with the overall test program, to ensure that the correct number and mix of personnel are employed.

3.5 Manpower and Personnel Relationship to Logistics

The M&P domains can contribute significantly to the ability to provide required logistics support at the minimum cost. Logistics includes a number of product support elements and requires the accomplishment of a variety of support analyses over the life-cycle of the system. M&P practitioners **should** contribute to logistics planning, analysis, and execution due to its impact on providing cost-effective logistics support, including system maintenance and training.

M&P practitioners **should** support life cycle logistics by assisting in analyzing acquisition products during Product Support Analyses (PSA) in order to design and develop an effective and efficient Product Support Package. This **should** include assessing operator, maintainer, trainer, and support personnel tasks and processes for their impacts on life cycle supportability and life cycle cost, and assisting in their development of logistics products. M&P practitioners **should** support the following major PSA activities (from MIL-HDBK-502).

a. Comparative Analysis (Activity 8)

b. Functional Requirements (Activity 9)

c. Evaluation of Alternatives and Tradeoff Analysis (Activity 11)

d. Task Analysis (Activity 12)

e. Determination of Product Support Resource Requirements (Activity 12 and 13)

M&P practitioners **should** contribute to product support element planning and execution including the analysis and determination of baseline product support strategies. M&P practitioners **should** assure that representative numbers and types of personnel are used during Logistics demonstrations and, through observation, assess user job performance, safety, and training effectiveness. M&P practitioners also **should** provide support to the procuring agency in preparing for pre-acquisition milestone assessments.

M&P practitioners **should** provide support, as appropriate, to assist logistics personnel in analyzing and gathering the following types of logistics analysis data: task inventory and task analysis data, task times and frequencies, tool and support equipment needs, task criticality, personnel number, and type requirements.

M&P practitioners **should** support the government in revising system-related M&P estimates reflected in the customer manpower assessment as the system design, operational, maintenance, and support concepts evolve.

M&P practitioners **should** periodically assess the assumptions in the System Training Plan pertaining to the kinds, duration, timing, and costs of training for both operators and maintainers against the system design and target audience, and the number and types of personnel required to support training activities.

M&P practitioners **should** collaborate, coordinate, and contribute data and documentation at all program Independent Logistics Assessments. The products and data **should** include the status of M&P risks and issues, any M&P concerns being tracked or evaluated, and M&P data impacting logistics plans and efforts.

M&P practitioners **should** collaborate, coordinate, and contribute to assist system engineers to optimize systems design to maximize reliability, availability, and maintainability to achieve supportability objectives.

4. MANPOWER AND PERSONNEL PROCESS REQUIREMENTS

The purpose of this section of the standard is to provide programmatic requirements to contractors for activities and products during an effective M&P program in support of a systems acquisition contract. Depending on contract phase and/or complexity of the program, tailoring **should** be applied. When HSI is required by the contract, M&P **should** support HSI planning, execution, coordination, verification, documentation, and reporting activities.

For the purposes of this standard, M&P domain activities are viewed as separate technical inputs that contribute to HSI, Systems Engineering, or Logistics. M&P domain activities may be performed as a dedicated program, or may be integrated with HSI, Systems Engineering, or Logistics based on the contractors technical and management approach, or contractual requirements. If M&P activities are integrated rather than executed as a dedicated M&P program, the intent of this section still applies and must be integrated.

Figure 2 illustrates the contractor M&P planning process conducted at each phase of the system acquisition.

4.1 Manpower and Personnel Program Initiation

During Program Initiation, the contractor **shall** establish an M&P program.

4.1.1 Manpower and Personnel Program Planning

The contractor **shall** plan the M&P program, including a clear definition of the technical objectives, the scope, the processes, and the end product(s), consistent with the terms of the contract, the system requirements, and the phase of acquisition. In addition, if Systems Engineering, Human Systems Integration, and/or Lifecycle Sustainment programs are established for the overall program, the M&P program **shall** be coordinated with the activities, schedules, and budgets included in those programs.

M&P assumptions and limitations **shall** be factored into analytical assumptions and constraints as early as possible to ensure the human is included as a critical component of the system as the technology, design, and support planning evolves. The contractor **shall** coordinate M&P planning with the procuring agency. If a separate M&P program plan is required by the contract, it **shall** be placed under configuration management for contractual execution. Tailoring of the M&P program activities **should** be consistent with the Request for Proposal (RFP)/contract. Data item description DI-HFAC-81743A describes HSIPP content elements necessary for sound HSI program planning and **should** be used as guidance for M&P program planning.

The contractor **shall** provide the following inputs to Manpower planning and execution:

a. Numbers and mix of people who must be available to operate, maintain, train, support, and sustain the system

b. Anticipated manpower-stressing operations and support scenarios

c. Resource requirements (e.g., staffing, facilities, budgets) for Manpower activities

d. A time-phased schedule and level of effort for Manpower activities

e. Manpower products, documentation, and deliverable data items (if any)

The contractor **shall** provide the following inputs to Personnel planning and execution:

a. Human aptitudes (i.e., cognitive, physical, and sensory capabilities)

b. Knowledge, skills, and abilities

c. Experience levels

d. Occupational specialties required or anticipated

e. Selection and assignment of personnel

f. Anticipated personnel-stressing operations and support scenarios

g. Resource requirements (e.g., staffing, facilities, budgets) for Personnel activities

h. A time-phased schedule and level of effort for Personnel activities

i. Personnel products, documentation, and deliverable data items (if any)

M&P programmatic requirements and technical requirements are defined by the customer and provided in contractual documentation. As one of the first steps in scoping and planning the contractor's M&P program, the contractor **should** document customer-provided requirements. The contractor **should** evaluate the requirements to determine adequacy and M&P-related risks. The contractor's review and evaluations **should** consider the following:

Manpower Domain:

- Is there a legacy system to use as a manpower baseline?
- Do the manpower levels need to be constrained to the same level as the predecessor system?
- Will the manpower mix (military, civilian, contractors) change significantly?
- Is there a mandate to optimize or reduce manpower authorizations?
- Have manpower authorizations been justified and/or modified to meet mission needs including system availability?
- Will an increase in in the total number of people to operate, maintain, or support the system above government targets be required?
- Will work be shifted among military, civilian, or contractor personnel that is inconsistent with government expectations?
- Approximately how many authorizations will it take to operate, maintain, train, and support the full capability? (Full capability includes all operational and maintenance [local and remote] components.)
- What manpower estimate was used for the affordability assessment?

- How does the manpower estimate compare to current requirements and authorizations?
- How much could manpower grow before it would impact the affordability decision?
- If the manpower estimate is greater than authorizations, what is the resource sponsor's position regarding funding?

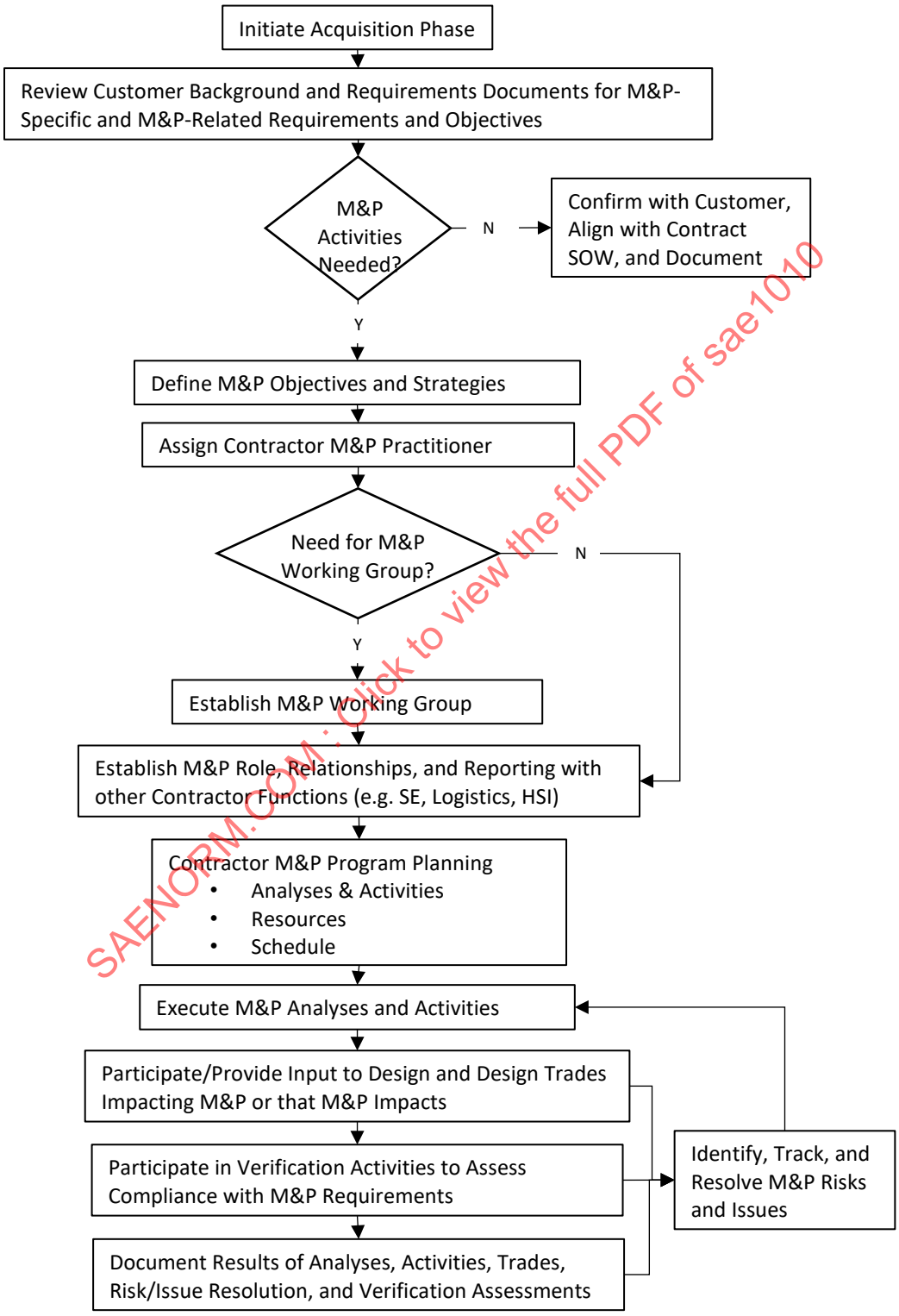

Figure 2 - Contractor manpower and personnel (M&P) planning process
NOTE: This process is repeated for each acquisition phase.
NOTE: Process should comply with DI-HFAC-81743 when applicable.

Personnel Domain:

- Are there any current or projected recruiting, retention, and/or career development issues for the personnel who are most likely to be required to operate, maintain, and support the capability?
- Are there any current or projected pay/bonus/incentives required for the personnel communities who are most likely to be required to man the capability? Does this affect cost estimates and affordability assessments?
- Are there any career path implications based on staffing concepts being considered?
- Are there any implications for rotation, deployed time, turnover/detailing based on the staffing strategy discussed?
- Will significantly new skill sets, knowledge bases, and abilities be required to support the capability?
- Is there a need for increased experience or pay grades?
- Is there a desire and/or need for unique combinations of skill sets, knowledge bases, and abilities?
- Are the skill sets, knowledge base, and abilities required by the new capability projected to be available in sufficient numbers in the timeframe required?
- Are there anticipated to be societal or workforce changes that might impact the availability of people with the skills, knowledge, and capabilities required by the new capability?
- Are there any known or projected changes to gender mix and/or cognitive abilities, physical characteristics, psychomotor skills, and/or experience level?
- Does the materiel solution take into account the projected personnel pool?
- Does the materiel solution require a change in the skill structure?
- Are new skills required? Can the skills be combined?
- Are current accession screening methods (i.e., ASVAB scores) sufficient to ensure the new capability can be operated, maintained, and supported?

For every customer-provided Key Performance Parameter (KPP), Key System Attribute (KSA), Additional Performance Attribute (APA), or Other System Attribute (OSA), the contractor **shall** identify and document anticipated M&P impacts and the M&P activities that **should** be accomplished to address and mitigate those impacts. The contractor **shall** review M&P and M&P-related requirements at all levels (i.e., capability, system, specification, logistical, and human performance) and identify those with potential to create risks, issues, and opportunities.

The contractor **should** assess legacy system (or like system) lessons learned to ensure that known M&P issues are not repeated in the new system or increment. If it is determined that gaps in requirements, risks, or issues exist, the contractor **should** document gaps and provide recommendations for mitigation as applicable. The contractor **should** assess existing M&P and M&P-related standards, guidelines, and handbooks for citation in the M&P plan and for use during the M&P program effort.

The contractor **shall** review proposed contract documents for adequacy and completeness of M&P and M&P-related programmatic requirements and inform the procuring agency of significant M&P risks, issues, or opportunities.

The contractor **shall** document the M&P activities that will be conducted in support of requirements analysis, flow down, translation, alignment, and derivation, as well as in the determination of requirement verification methods.

The contractor **shall** establish a M&P plan consistent with the customer's M&P planning such as the HSIPP, SEP, and the LCSP. The contractor may review and provide input to other acquisition documents such as the systems training plan, the PESHE, and the manpower estimate to formulate the approach.

4.1.1.1 Manpower and Personnel Objectives, Strategy, Major Activities, and Products Consistent with Requirements

The contractor **shall** develop M&P program objectives and strategy based on the contractual documents and requirements, customer SEP, HSIP, and customer logistics plans and estimates as available. The contractor **shall** document the M&P program objectives and strategy. The contractor **shall** document how system affordability and performance requirements are addressed within the M&P program. The contractor **shall** integrate M&P planning with the contractor Human Systems Integration Program Plan (HSIPP), Systems Engineering Management Plan (SEMP), Integrated Program Plan (IMP), and Integrated Master Schedule (IMS) if they are included as part of the overall systems development program.

4.1.1.2 Manpower and Personnel Organization, Organizational Relationships, Working Groups, and Customer Interactions

The contractor **shall** identify a contractor M&P practitioner to oversee the execution of the M&P program. The contractor **shall** define how M&P leadership relates to contractor program team structure. The contractor M&P practitioner **shall** plan the M&P program and prepare required planning documentation. The contractor M&P practitioner **shall** oversee the execution of the M&P program, and modify the plan as needed. The contractor M&P practitioner **shall** support coordination of activities across the HSI domains, seeking to maximize resource sharing and use of common data as appropriate. The contractor M&P practitioner **shall** represent M&P interests and concerns to HSI, Systems Engineering, and Program management as appropriate to the organization of the overall program. The contractor M&P practitioner **should** ensure that the M&P program includes provision of adequate support to M&P planning, analysis, modeling and simulation, design/procedure development support, risk/issue management, requirement verification, activity coordination, product, and deliverable data development and distribution.

The contractor **shall** document organizational relationships among M&P domains, HSI, the HSI domains, and other program disciplines and groups. Contractor personnel responsible for executing the M&P program **shall** document activities, schedules, handoffs with Procuring Agency and data products in the M&P Program Plan, if required. The contractor **shall** support the HSI Working Group, or other working groups that address M&P, if established.

The contractor **should** develop and maintain clear communication with customer M&P counterparts. The contractor **should** understand how input from customer user groups will be gathered and communicated. The contractor **should** coordinate with customer M&P managers and technical personnel to maintain compatibility with customer M&P plans and schedules throughout the contract period of performance.

4.1.1.3 Manpower and Personnel Activities, Processes, Procedures, Metrics, and Management

The contractor **shall** ensure that M&P participates in system analysis, system design, procedure development, and verification. The contractor **shall** document activities regarding M&P-related Technical Performance Measures (TPM). The contractor **should** plan contracted M&P program activities so that they can be executed on or ahead of schedule and on or under budget with high quality.

The contractor **shall** ensure that M&P planning, activities, and products are summarized and referenced in the HSIPP or SEMP and other applicable technical plans and schedules. Consideration also **should** be given to including M&P information in logistics, maintainability, modeling and simulation, affordability, risk and issue management, verification, and other plans as appropriate.

The contractor **shall** document M&P activities (including subcontractor activities), purchases, need dates for Government resources, deliverable data submissions, product handoffs (to and from the M&P team), major events, consistent with contract requirements in schedule form, indicating interdependencies as appropriate. The contractor **shall** include M&P activities in the IMP and IMS. M&P activities, handoffs and schedules **shall** be aligned with SEMP, logistics plans, IMP/IMS, and other planning documents as appropriate.

The contractor **shall** document M&P needs for government personnel, Government Furnished Property (GFP), Equipment (GFE), Information (GFI), services, or facilities. Government Furnished Property might include customer-developed tools such as workload models (e.g., IMPRINT (Improved Performance Research Integration Tool)), operator/maintainer models, or personnel clothing/equipment lists.

The contractor **shall** document resource requirements (e.g., staffing, facilities, budgets) for the entire contractual M&P effort required by the contract statement of work. The contractor **shall** document a time-phased schedule and level of effort. The contractor **should** coordinate M&P budget and schedule through appropriate program management activities to ensure program manager support and to resolve any issues over product developments, product handoffs, task interdependencies, and timing.

If subcontractors are involved, the (prime) contractor **shall** document M&P processes, tasks, and relationships with subcontractors, associate contractors, and suppliers.

4.2 Manpower and Personnel Analysis

M&P analyses identify and measure M&P considerations and impacts across the system lifecycle. These activities can be conducted by both the customer and the contractor. The contractor **should** contribute M&P-related inputs to the planning and execution of program-level analyses in the following areas:

- HSI Domain Tradeoff Analysis
- Risk, Issue, and Opportunity Analysis
- Technology Analysis
- Cost Estimates and Affordability Analysis

The contractor **shall** perform M&P analyses in accordance with contract requirements, and any approved gap analysis findings. The contractor **shall** coordinate planning, execution, and results of M&P analyses with HSI and Program activities and other disciplines including maintainability, systems engineering, product IPTs, program management, logistics support, manufacturing planning, test organizations, and subcontract management organizations to determine if they have identified a need to conduct M&P analyses. The contractor M&P practitioner **should** have access to and review program plans to ensure coordination with analyses by other disciplines.

The contractor **should** identify M&P analyses outcomes that are anticipated to significantly impact program decisions regarding system design, operation, maintenance, training, and/or logistics support. The contractor **should** use M&P analysis processes, methods, and tools to identify the impacts of system design and logistics decisions on the humans involved with system operation, maintenance, training, and support to reduce duplication. The contractor **should** coordinate with the HSI domain SMEs and other related discipline SMEs to ensure that the required analyses are appropriately planned and scheduled.

The contractor **shall** ensure that M&P considerations are included in tradeoffs, technology assessments, contract requirements, and any approved gap analysis findings. The contractor **shall** ensure that M&P analysis results are documented, analyzed, and coordinated with results from other HSI domains.

The contractor **shall** ensure that M&P considerations are included in Program risk, issue and opportunity analyses in accordance with the SEP/SEMP, contract requirements, and any approved gap analysis findings. The contractor **shall** ensure that M&P considerations are included in supportability assessments, System Affordability analyses, contract requirements, and any approved gap analysis findings.

The contractor **shall** document performance metrics, decision criteria, and schedule for each planned M&P analysis. Metrics **should** be traceable to the objective(s) for conducting the analysis and system KPP, KSA, APA, or Other System Attributes (OSA) as applicable. Decision criteria **should** have good face validity with relevant SMEs.

The contractor **should** assess the following for each planned M&P analysis:

a. Resource requirements (e.g., cost, staffing, training, special analytical software, tools, fixtures)

b. Government-Furnished Property or Information (GFP/GFI/GFP)

c. Variables of interest and metrics

d. Time and costs required to conduct analyses

e. Scheduling and coordination required with other disciplines and subjects/users

f. How M&P and M&P-related requirements, system designs, and major program decisions might be affected by results

The contractor **should** coordinate M&P analyses with other disciplines including maintainability, systems engineering, product IPTs, program management, logistics support, manufacturing planning, test organizations, and subcontract management organizations to determine if they have identified a need to conduct M&P analyses. The contractor M&P practitioner **should** have access to and review program plans to ensure coordination with analyses by other disciplines.

The contractor **shall** ensure that M&P support is provided to the following key technical analyses:

- Mission Analysis: Examine the role(s) and activities of humans in system operations, maintenance, and support, in a mission/threat environment, across a range of operationally realistic scenarios.
- Task Analysis: Examine the ability of humans to perform the tasks (physical, cognitive, etc.) assigned to them considering human capabilities and limitations as well as the resources that are available for the task.
- Function Analysis: Identify and evaluate the appropriateness and feasibility of human-allocated functions and functions shared with system hardware and software to achieve mission goals, including the appropriate level of automation.
- Job Analysis: Examine the allocation of human functions into logical system roles and jobs, considering existing job specialties and training organizations. This includes analysis of the job demands relative to personnel physical and cognitive capabilities, and knowledge, skills, and abilities for the target populations.
- Manning and Personnel Analysis: Examine the numbers, skill level, training level, experience, and mix of personnel planned to support the system in operation, maintenance, training, and support.
- Workload Analysis: Examine the ability of humans to reliably perform assigned tasks to the level of performance required within visual, physical, cognitive, and physiological workload limits. This should include the assessment of both short-duration acute workload and longer duration sustained workload.

4.3 Compliance with Programmatic Manpower and Personnel and M&P-Related System Requirements

The contractor **shall** coordinate with the other HSI domains on verification activities to facilitate efficiencies across domains and related disciplines. The contractor **shall** ensure that the results of verification activities related to M&P estimates/requirements are shared with other HSI domains, any other appropriate disciplines, and/or groups. The contractor M&P practitioner or designee **shall** ensure proper protection of human subjects in accordance with 45 CFR 46 or equivalent.

The contractor **shall** document any M&P shortfalls in domain verification activities such as the number/mix, the capabilities and limitations, comfort, safety, and well-being of the humans in the system (i.e., operators, maintainers, trainers, support personnel). The contractor **shall** provide feedback to program management regarding the results of development verification activities.

The contractor **shall** integrate verification of M&P estimates/requirements with developmental and/or operational testing. This **should** include consideration and assessment of the scenarios and environments that may stress system availability or effectiveness due to limitations in M&P readiness, including those from the Concept of Operations. The contractor **shall** ensure that M&P requirements are verified in accordance with the program verification plan. Verification of these requirements **should** be through the typical methods of conducting appropriate assessments such as test, inspection, analysis, and demonstration.

The contractor **should** coordinate with the government on the inclusion of M&P considerations in contractor, associate contractor, subcontractor, vendor, and government test activities.

As required by the contract, the contractor **shall** support validation of the system M&P characteristics by performing the following activities:

a. Coordinate with systems engineering, system test organizations and laboratories, to integrate M&P validation into overall program verification planning. Planning includes identifying the needs for resources, facilities (e.g., simulation systems, test benches, prototype equipment, and actual equipment), and personnel.

b. Maximize efficiencies, such as using existing equipment, facilities, and demonstrations (e.g., logistics demonstrations) to the greatest extent feasible in order to minimize costs.

c. Provide feedback to program management regarding the results of operational validation activities, such as the ability of the humans in the system (i.e., operators, maintainers, trainers, support personnel) to conduct operations, maintain the system, or provide training and logistic support in required scenarios and under required conditions.

4.4 Material Solutions Analysis and Technology Maturation and Risk Reduction Manpower and Personnel Activities

4.4.1 Define and Conduct Activities

The contractor may support pre-Milestone B efforts by providing analyses, providing access to existing systems or facilities, or developing and testing alternative M&P approaches. When required by the Pre-Milestone B contract:

a. The contractor **shall** coordinate M&P risks, issues, and opportunities with the program management. The contractor **should** consider the following: human operational, maintenance and support roles, functions, and performance; manpower, personnel and training; safety, occupational health, habitability, force protection, and survivability.

b. The contractor **should** coordinate plans, activities, products, and documentation, prototyping, and test results with program management.

c. The contractor **shall** conduct M&P analyses and provide input as to the Analysis of Alternatives.

d. The contractor **shall** assess if the capability requirements are realistic and consistent with M&P estimates/requirements.

e. The contractor **shall** analyze and research emergent technologies for their potential in mitigating identified M&P risks and issues or realizing identified M&P opportunities.

f. The contractor **should** assist with technology selection decisions and management of identified M&P risks and issues.

g. The contractor **shall** document and report M&P findings, conclusions, implications, and recommendations for system development, including operational and support concepts, consistent with Pre-Milestone B contract requirements.

h. The contractor **should** provide feedback to the customer's M&P organization, to include recommended changes to draft System Design and Development (SDD) contract requirements, with accompanying rationale and recommend M&P requirements for the SDD program phase documents (such as, Organizational Breakdown Structure (OBS), Work Breakdown Structure (WBS), IMP, IMS, Statement of Work (SOW), System Specification, and HSIPP).

4.5 Engineering Manufacturing and Development Manpower and Personnel Activities

During systems development, M&P activities can provide insight and feedback from their end users and target audiences including:

1. Job, occupation, or personnel descriptions

2. M&P constraints or limitations

3. Application and employment of M&P considerations in real-world operational context

This insight and feedback may come from:

1. Current operators, maintainers, and support personnel (target audience)

2. Surrogate users such as line managers, Subject Matter Experts (SMEs) or trainers

3. Military occupational classification advocates or managers

The contractor **shall** ensure that developing system concepts, specifications, preliminary designs and final detailed baseline designs take into account M&P considerations and that M&P considerations are appropriately balanced across other HSI domains, and consistent with customer-provided M&P requirements/estimates/assumptions, especially any M&P-related KSAs.

The contractor **shall** ensure that Manpower numbers and mix and Personnel capabilities and limitations are addressed in early design assessments (e.g., test bench assessments of preliminary user interface concepts) and that significant results are presented at Preliminary Design Review (PDR) and Critical Design Review (CDR).

The contractor **shall** ensure that M&P requirements are addressed in logistics plans and in the design and development of logistics equipment, support equipment, computer-based, and other training systems.

The contractor **shall** ensure that M&P requirements are addressed in the design and development of system facilities, such as warehouses, training facilities, mission planning centers, and data analysis facilities.

The contractor **shall** ensure that M&P requirements are addressed in the design of manufacturing equipment, tools, processes, and personnel workspaces, especially regarding personnel ergonomics, safety, comfort, and efficiency.

The contractor **shall** communicate to program management opportunities for refinement of M&P requirements that may result in improved system performance, reductions in training/recruitment costs or timelines, manning/system availability, or reduced manning/system operations or sustainment costs.

The contractor **shall** ensure that M&P concerns, risks, issues, and opportunities are addressed in customer SME reviews which may include Crew Systems Working Groups (CSWGs), Design Advisory Groups (DAGs), Aircrew Systems Advisory Panels (ASAPs), or Maintainer Advisory Panels (MAP).

The contractor **shall** ensure that M&P is considered in all aspects of change management including: selection of candidate solutions, selection of the preferred solution, implementation of the selected solution, and verification of the effectiveness and suitability of the selected solution.

The contractor **shall** ensure that the total ownership costs of the system, including both M&P and technological elements are considered and risks identified and managed appropriately, particularly as they relate to demands of sustained operations and M&P-stressing operational scenarios.

The contractor **shall** ensure that M&P-related entrance, accomplishment, and exit criteria for PDR are satisfied.

The contractor **shall** ensure that the M&P-related entrance, accomplishment, and exit criteria for CDR are satisfied.

The contractor **should** ensure that M&P issues are addressed in resulting HSI action items from CDR prior to the next major program review and Milestone C.

The contractor **shall** provide M&P domain support to planning and conduct of program reviews, management reviews, financial reviews, audits and other major assessments of contractor performance against contract requirements. The contractor **should** keep their management informed of M&P activities, progress, and risks.

The contractor **shall** ensure that M&P-related risks and issues are mitigated in accordance with the program's risk management plan prior to Milestone C.