



# SYSTEMS MANAGEMENT STANDARD

SAE1008™

REV. A

Issued 2022-02  
Revised 2026-05

Superseding SAE1008

Standard Practice for Force Protection and Survivability

## RATIONALE

The purpose of this standard is to define for industry the standard practice required for procurement activities with regard to Force Protection and Survivability (FPS) analysis and related activities. This standard has been written to address a need within the U.S. Department of Defense (DoD), but its applicability is not limited to the DoD.

## FOREWORD

This standard describes best practices for conducting FPS activities in support of a system acquisition or sustainment contract. FPS domain activities ensure that the environments provided for system operators, maintainers, trainers, and support personnel are safe, comfortable, and conducive to high levels of human performance, safety, and morale.

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 DoD, U.S. Army, U.S. Navy, U.S. Marine Corps, U.S. Air Force, U.S. Coast Guard, NASA, and Department of Homeland Security (DHS), and representatives from industry.

FPS activities are often conducted in support of HSI. FPS is one of the seven HSI domains recognized by the DoD and other Federal agencies. While HSI responsibility comprises tasks to plan, manage, and integrate the HSI domains, it does not include the activities of the FPS domain itself. It is important to distinguish between HSI and domain responsibilities. The purpose of this standard is to describe the FPS domain responsibilities and how they ultimately may also support minimizing fatigue and workload, maximizing situation awareness, and better enabling task performance.

FPS activities and processes may be performed by a variety of personnel, depending on factors that are unique to the particular acquisition program and contractor organization. These factors include acquisition category, system complexity, operational environment, budget, and expertise availability, among others. Whereas large-scale, complex systems may require a dedicated FPS professional, smaller acquisitions may have a human factors engineer or safety practitioner fulfill the FPS role. Regardless of who has the responsibility for FPS, it is important that the analyses and processes defined in this standard are applied with an appropriate level of rigor and professionalism.

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## BACKGROUND

Until recently, personnel-related FPS considerations were rarely addressed comprehensively by prime contractors during system development. This was based primarily upon an assumption that the acquisition customer and Design Integrated Product Teams (IPTs) had the great majority of responsibility for conducting analyses in this area. However, prime contractor FPS analysis results can contribute significantly to system design and system employment decisions and the ability to meet affordability goals. To date, there has not been a best practice standard to guide contractor activities in planning and executing FPS activities in support of system acquisition programs.

The DoD established an HSI Standard Working Group on June 28, 2012, to research and develop a new standard for HSI to provide additional guidance to industry. In late 2015, after surveying dozens of possible source documents, the DoD requested several Standard Development Organizations (SDOs) to propose leading an industry standard development effort. In February 2016, the DoD selected the SAE International G-45 HSI Committee to lead this task. SAE International executed a multiyear effort beginning in May 2016 that resulted in the development, release, and DoD adoption of a Best Practice standard (SAE6906).

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 2018, military and/or industry standards existed in just three of the HSI domains: Human Factors Engineering (HFE), Training, and Safety and Occupational Health (SOH). In the course of developing the HSI standard, it became apparent that best practice standards were needed in the other four HSI domains as well: Habitability, Manpower, Personnel, and FPS. If no FPS activities are required by an acquisition contract, for example, including an HSI program requirement would not result in the addition of any FPS activities.

The SAE G-45 committee initiated a project to develop a Best Practice standard in FPS in early 2018. This standard drew from previous work on the HSI Standard (SAE6906). The format and content of the FPS standard were developed to be consistent with and complement SAE6906.

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## 1. SCOPE

According to SAE6906, Force Protection and Survivability (FPS) is the Human Systems Integration (HSI) domain that facilitates system operation and personnel safety during and after exposure to hostile situations or environments. Force protection refers to all preventive measures taken to mitigate hostile actions against Department of Defense (DoD) and Department of Homeland Security (DHS) (e.g., U.S. Coast Guard, Customs and Border Patrol, Immigration and Customs Enforcement, etc.) personnel. Survivability denotes the capability of the system and/or personnel manning the system to avoid or withstand man-made hostile environments without suffering an abortive impairment of his/her ability to accomplish its designated mission. Damage due to enemy or fratricidal action, or even equipment failure, will endanger the warfighters' well-being and place them into a life-threatening situation.

## 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 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 (U.S. and Canada only) or +1 724-776-4970 (outside U.S. and Canada), [www.sae.org](http://www.sae.org).

SAE6906          Standard Practice for Human Systems Integration

EIA-649C          Configuration Management Standard

GEIA-859B          Data Management

#### 2.1.2 Code of Federal Regulations (CFR) Publications

Copies of these documents are available online at [www.ecfr.gov](http://www.ecfr.gov).

45 CFR Part 46          Protection of Human Subjects

#### 2.1.3 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

MIL-HDBK-1908          Definitions of Human Factors Terms

MIL-STD-1472          Human Engineering

#### 2.1.4 Other Publications

DoDD 5000.71          Fulfillment of Combatant Commander Urgent Operational Needs and Other Quick Action Requirements

DoDI 5000.02          Operation of the Adaptive Acquisition Framework

DoDI 5000.74          Defense Acquisition of Services

DoDI 5000.75          Business Systems Requirements and Acquisition

DoDI 5000.80          Operation of the Middle Tier of Acquisition

DoDI 5000.81      Urgent Capability Acquisition

DoDI 5000.85      Major Capability Acquisition

DoDI 5000.87      Operation of the Software Acquisition Pathway

Booher, H. (Ed.). (2003). *Handbook of Human Systems Integration*. John Wiley and Sons.

Reason, J. (1997). *Managing the Risks of Organizational Accidents*. Aldershot: Ashgate.

USAAVSCOM TR 89-D-22D, Aircraft Crash Survival Design Guide, Volume IV: Aircraft Seats, Restraints, Litters and Cockpit/Cabin Delethalization, December 1989.

USAAVSCOM TR 89-D-22E, Aircraft Crash Survival Design Guide, Volume V: Aircraft Post-crash Survival, December 1990.

U.S. Army Regulation 70-75, Survivability of Army Personnel and Materiel, created by United States Department of the Army, May 2, 2005.

## 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 Other Publications

*Air Force Human Systems Integration (AFHSI) Handbook: Planning and Execution of Human Systems Integration*. January 2009.

Ball, R. (2003). *The Fundamentals of Aircraft Combat Survivability Analysis and Design, Second Edition*. American Institute of Aeronautics and Astronautics (AIAA).

## 2.3 Acronyms and Definitions

### 2.3.1 Acronyms

|        |                                                 |
|--------|-------------------------------------------------|
| AAF    | Adaptive Acquisition Framework                  |
| AFHSI  | Air Force Human Systems Integration             |
| AoA    | Analysis of Alternatives                        |
| AR     | Army Regulation                                 |
| ASAP   | Aircrew Systems Advisory Panel                  |
| ASTM   | American Society for Testing and Materials      |
| CBRN   | Chemical, Biological, Radiological, and Nuclear |
| CDD    | Capability Development Document                 |
| CDR    | Critical Design Review                          |
| CFR    | Code of Federal Regulations                     |
| CONEMP | Concept of Employment                           |

|         |                                                       |
|---------|-------------------------------------------------------|
| CONOPS  | Concept of Operations                                 |
| COTS    | Commercial Off-the-Shelf                              |
| CSWG    | Crew Systems Working Group                            |
| DAG     | Design Advisory Group                                 |
| DHS     | Department of Homeland Security                       |
| DoD     | Department of Defense                                 |
| DoDI    | Department of Defense Instruction                     |
| EMD     | Engineering and Manufacturing Development             |
| FOC     | Full Operational Capability                           |
| FPS     | Force Protection-Survivability                        |
| GEIA    | Government Electronic Industries Association          |
| GFE     | Government Furnished Equipment                        |
| GFI     | Government Furnished Information                      |
| GFP     | Government Furnished Property                         |
| HDBK    | Handbook                                              |
| HEDAD-M | Human Engineering Design Approach Document-Maintainer |
| HEDAD-O | Human Engineering Design Approach Document-Operator   |
| HESAR   | Human Engineering Systems Analysis Report             |
| HFE     | Human Factors Engineering                             |
| HSI     | Human Systems Integration                             |
| HSIPP   | Human Systems Integration Program Plan                |
| IEEE    | Institute of Electrical and Electronics Engineers     |
| ILA     | Independent Logistics Assessment                      |
| ILSP    | Integrated Logistics Support Plan                     |
| IMP     | Integrated Master Plan                                |
| IMS     | Integrated Master Schedule                            |
| IOC     | Initial Operational Capability                        |
| IPS     | Integrated Product Support                            |
| IPT     | Integrated Product Team                               |

|           |                                                         |
|-----------|---------------------------------------------------------|
| KPP       | Key Performance Parameter                               |
| LCMP      | Life Cycle Management Plan                              |
| LCSP      | Life Cycle Sustainment Plan                             |
| MANPRINT  | Manpower and Personnel Integration                      |
| MAP       | Maintainer Advisory Panel                               |
| MSA       | Material Solution Analysis                              |
| NASA      | National Aeronautics and Space Administration           |
| OBS       | Organizational Breakdown Structure                      |
| ODASD     | Office of the Deputy Assistant Secretary of Defense     |
| OPNAVINST | Instruction Issued by the Chief of Naval Operations     |
| OT&E      | Operational Test and Evaluation                         |
| PDR       | Preliminary Design Review                               |
| PESHE     | Programmatic Environmental Safety and Health Evaluation |
| PSA       | Product Support Analysis                                |
| PWS       | Performance Work Statement                              |
| RFP       | Request for Proposals                                   |
| ROI       | Return on Investment                                    |
| SA        | Situational Awareness                                   |
| SDD       | System Design and Development                           |
| SDO       | Standard Development Organization                       |
| SME       | Subject Matter Expert                                   |
| SOH       | Safety and Occupational Health                          |
| SOW       | Statement of Work                                       |
| SE        | Systems Engineering                                     |
| SEMP      | Systems Engineering Master Plan                         |
| SEP       | Systems Engineering Plan                                |
| SS        | System Specification                                    |
| TEMP      | Test and Evaluation Master Plan                         |
| TES       | Test and Evaluation Strategy                            |

TMRR Technology Maturation and Risk Reduction

WBS Work Breakdown Structure

### 2.3.2 Definitions

**ACCIDENT:** Uncontrolled release of energy resulting in potential for negative consequence. Also encompasses environmental circumstance.

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

**CONTRACTOR FORCE PROTECTION AND SURVIVABILITY TEAM:** Refers to the contractor (typically a Prime contractor) team responsible for performing personnel-related FPS activities under a systems acquisition contract. An “extended” FPS team may also include associate contractor, subcontractor, and supplier personnel. To distinguish it from the customer team and Design Integrated Product Teams (IPTs), contractor FPS specialists have a goal of ensuring that the system design, as a minimum, meets personnel-related procuring agency FPS requirements. Beyond this, the contractor FPS team attempts to identify and implement design changes that would improve personnel habitability.

**CUSTOMER FORCE PROTECTION AND SURVIVABILITY TEAM:** Refers to the government personnel-related FPS team in the organization(s) responsible to the procuring agency for providing 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 support contractors. Customer team impacts are primarily realized prior to Milestone B by developing FPS requirements and by influencing system acquisition decisions to optimize FPS.

**DESIGNEE:** An individual designated by a decision authority empowered to represent and make decisions on behalf of the decision authority for a specific technical topic area.

**FORCE PROTECTION AND SURVIVABILITY (FPS):** Analysis, design, and verification of system-related survivability characteristics designed to protect personnel from direct threats and accidents, including primary and secondary effects from the events.

**FORCE PROTECTION AND SURVIVABILITY PRACTITIONER(S):** Personnel trained and/or experienced in personnel-related FPS analysis. These practitioners may also be called FPS Subject Matter Experts (SME).

**FORCE PROTECTION AND SURVIVABILITY RISK:** A condition of potentially adverse impact on the vulnerability or survivability of system-related personnel. FPS risks can be technical as well as programmatic.

**HSI:** HSI is a comprehensive management and technical approach applied to systems development and integration as part of a wider Systems Engineering (SE) process to ensure that human performance is optimized to increase total system performance and minimize total system 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 (SOH), Habitability, FPS, Manpower, Personnel, and Training.

**HSI ACTIVITIES:** The management and technical disciplines of planning, leading, coordinating, and optimizing all human integration considerations during system design, development, test, production, use, and disposal of systems, subsystems, equipment, and facilities.

**HSI LEAD:** Contractor person responsible for planning, coordinating, and executing the HSI program; serves as the contractor’s HSI single point-of-contact.

**HSI METRICS:** Quantitative and/or qualitative measures used to estimate the positive impact of HSI and/or HSI domains on design. Alternatively, quantitative or qualitative measures used to impact adverse consequences on the ability of HSI or HSI domains to achieve human integration, human performance, or cost reduction goals.

**HSI PROGRAM:** All the planning, analysis, design support, test and evaluation, coordination, and documentation activities undertaken in response to HSI Programmatic requirements contained in the system acquisition contract statement of work.

**HSI PROGRAMMATIC REQUIREMENTS:** Statement of Work requirements for Human Systems Integration tasks for the contractor HSI team to execute. Focus of these requirements is on HSI program planning, coordination, execution, documentation, and reporting.

**HSI WORKING GROUP:** Typically, a chartered organization charged with carrying out all the HSI activities associated with a system acquisition program. The HSI Working Group (or may be called an IPT depending on the program or service) is typically co-chaired by customer and prime contractor HSI leads. Membership usually includes HSI and HSI domain representatives from the Prime contractor and customer. The HSI Working Group may also include HSI and domain representation from major subcontractors, associate contractors, and major suppliers.

**HUMAN ERROR:** The failure of planned actions to achieve their desired ends - without the intervention of some unforeseen event (refer to Reason, 1997).

**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)

**MANAGEMENT:** Contractor senior managers and/or program manager. Since this standard applies only to contractors, the term "management" does not apply to the procuring agency program manager or senior managers.

**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. FPS best practices are determined by a broad-based group of DoD and contractor SMEs, who are experienced in the practice and application of FPS analysis on a variety of acquisition programs.

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

### 3. FORCE PROTECTION AND SURVIVABILITY DESCRIPTION AND OBJECTIVES

#### 3.1 Force Protection and Survivability Overview

##### 3.1.1 Force Protection and Survivability Considerations

FPS factors are those attributes of systems that may expose system-related personnel to threat events and accidents for all assigned missions across the spectrum of expected mission environments. Since many Survivability analyses are typically conducted by customer specialists and contractor Design IPTs, contractor FPS analysts **should** frequently communicate and collaborate with Design IPTs and customer Survivability specialists.

##### 3.1.2 Force Protection and Survivability Activity Overview

The intent of this best practice standard is to require and recommend FPS activities to execute in support of DoD major acquisition programs. Figure 1 illustrates how capabilities may feed information to FPS. For example, FPS is expected to receive MIL-STD-1472 criteria from HFE to effectively support design requirements, products, and analyses.

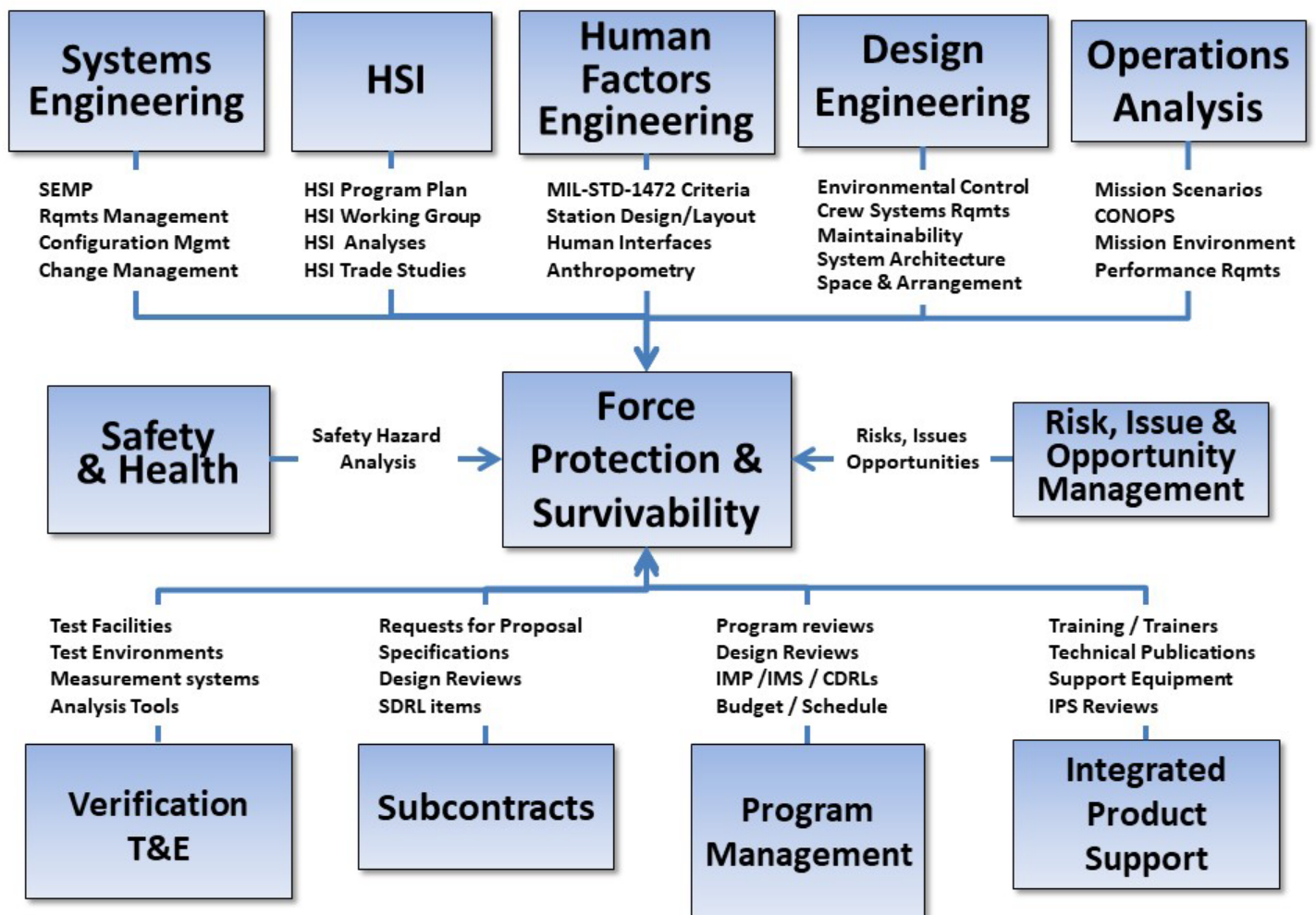


**Figure 1 - Notional human systems integration internal interactions**

### 3.2 Force Protection and Survivability Relationship with Human Systems Integration

When a Human Systems Integration program is required by the system acquisition contract, FPS planning, execution, documentation, reporting, coordination, and verification and activities **should** be integrated and coordinated with HSI program activities. FPS specialists **should** participate in HSI program activities, reviews, working group meetings, and reporting. Subsection 4.2 provides additional guidelines and requirements for FPS support to HSI.

### 3.3 Force Protection and Survivability Relationship with Systems Engineering

FPS activities **should** be fully integrated into the overall SE approach that is applied throughout the full product life cycle. The skills, attributes, and aptitudes of personnel required to support a system during its life cycle is largely determined by the system design. Inputs by FPS analysts can significantly impact design decisions, which affect life cycle costs.

FPS support **should** be an integral part of the system acquisition project and interface with SE (including via Decision Analysis, Technical Planning, Risk Management, and other activities) throughout the system life cycle. During the pre-acquisition Material Solution Analysis (MSA) and Technology Maturation and Risk Reduction (TMRR) phases, the role of the FPS specialist is to support system concept/implementation trade studies and develop/refine survivable designs, defensive measures, etc., as these drive affordability. These are often government activities but may involve contractor support or execution of study tasks.

During contractor-performed system acquisition activities following Acquisition Milestone B, FPS planning and execution activities are conducted in support of system design, integration, and test. In sustainment activities of Operations and Support, the role of FPS is to assess the vulnerability and survivability of system operations, maintenance, training, and support. Recommendations **should** be made to adjust FPS requirements based on continuing operation and support.

FPS 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. FPS 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. FPS planning, activities, analysis/simulation results, etc., **should** be coordinated with other program-related Survivability and operations analysis activities.

During programmatic and technical reviews, FPS activities/considerations **should** be addressed. This **should** include FPS status reporting at programmatic reviews such as program management review, integrated baseline reviews, integrated system reviews, and engineering change proposal reviews. FPS technical activities and accomplishments **should** be addressed in the planning, entry/exit criteria development, and conduct of technical reviews. Likewise, the verification of FPS requirements **should** be coordinated with the overall test program to ensure the safety, resilience, and survivability of system-related personnel.

### 3.4 Force Protection and Survivability Relationship to Logistics

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

#### 3.4.1 Force Protection and Survivability Role in Supporting Logistics

FPS specialists **should** assist in analyzing acquisition products, operator and maintainer tasks, and processes for their impacts on life cycle supportability and life cycle cost and assist in their development of logistics products.

#### 3.4.2 Force Protection and Survivability Documentation as Source Data for Technical Manuals and Training

FPS specialists **should** act as SMEs in the development and review of technical manuals and training materials since they are familiar with the survivability-related system design features and associated procedures.

#### 3.4.3 Force Protection and Survivability Support to Independent Logistics Assessments

Independent Logistics Assessments (ILA) are periodically conducted to validate a program's planning and implementation of Integrated Product Support (IPS) and the ability of the logistics program to meet established performance requirements. Preferably, ILAs are conducted by an independent and impartial team of SMEs not directly associated with the program being assessed. Results of these assessments provide a primary input to acquisition milestone and other decision reviews, including the corresponding gate reviews.

Government and contractor FPS specialists **should** collaborate, coordinate, and contribute data and documentation at program ILAs. The products and data **should** include the status of FPS risks and issues, any FPS concerns being tracked or evaluated, and FPS data impacting Logistics plans and efforts.

## 4. FORCE PROTECTION AND SURVIVABILITY PROCESS REQUIREMENTS

### 4.1 Force Protection and Survivability-Related Activities - General

During Program Initiation, the contractor **shall** establish an FPS program. While the following may not be specifically referenced in the contract, the contractor **should** review the following documents and consider for applicability:

- The Fundamentals of Aircraft Combat Survivability Analysis and Design, Second Edition
- USAAVSCOM TR 89-D-22D, Vol.4
- USAAVSCOM TR 89-D-22E, Vol.5
- U.S. Army Regulation 70-75

Prior to Milestone B, the government may conduct exploratory research, assessment of Commercial Off-the-Shelf (COTS) products, existing systems or facilities, and development of system or subsystem prototypes as part of their risk reduction and requirements development efforts. The contractor may be tasked to support these efforts by providing analyses, providing access to existing systems or facilities, or developing and testing alternative FPS approaches. In these circumstances, the contractor **should** provide information on FPS assumptions, considerations, and constraints related to the systems, facilities, equipment, or capabilities being investigated by the government.

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

The contractor **should** recommend FPS requirements for the System Design and Development (SDD) program phase and contract documents such as Organizational Breakdown Structure (OBS), Work Breakdown Structure (WBS), Integrated Master Plan (IMP), Integrated Master Schedule (IMS), Statement of Work (SOW), Performance Work Statement (PWS), System Specification (SS), Systems Engineering Management Plan (SEMP), and (if required) Human Systems Integration Program Plan (HSIPP).

The contractor **shall** ensure that planning for the identification and capture of FPS risks and issues have been satisfactorily addressed, in accordance with the program's risk management plan, consistent with contract requirements, prior to Milestone B.

#### 4.1.1 Force Protection and Survivability Requirements Assessment

The contractor **should** review the program Concept of Operations (CONOPS), Concept of Employment (CONEMP), SOW, PWS/SS, and other documents and document any FPS concerns. The contractor **shall** assess government-provided FPS estimates and assumptions for accuracy and realism and interface with the customer to identify any inconsistencies or potential issues or risks. The contractor **shall** ensure that FPS-related system requirements are identified, refined, decomposed, allocated (flowed down), and tracked. The contractor **shall** ensure FPS requirements are allocated to associate contractors, subcontractors, and suppliers and their efforts/products are integrated. This often includes educating them about FPS expectations and assumptions and verifying that the expected inputs/products included in their contracts support those expectations and assumptions.