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Safety

System Safety Management Guide

By Order of the Secretary of the Army:

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History. This publication is a major revision. The portions affected by this major revision are listed in the summary of change.

Applicability. This pamphlet applies to the Regular Army, the Army National Guard/Army National Guard of the United States, and the U.S. Army Reserve, unless otherwise stated. It also applies to Department of the Army civilian employees and all Department of Defense personnel and foreign military personnel working with and under Army operational control. It applies to all Army materiel systems and facilities during all phases of the life cycle. The concepts also apply to smaller procurement and acquisition programs, such as those done at installation level. Medical-related materiel may require more intensive management, including coordination with other Government agencies.

Proponent and exception authority. The proponent of this pamphlet is the Director of the Army Staff. The proponent has the authority to approve exceptions or waivers to this pamphlet that are consistent with controlling law and regulations. The proponent may delegate this approval authority, in writing, to a division chief within the proponent agency or its direct reporting unit or field operating agency, in the grade of colonel or the civilian equivalent. Activities may request a waiver to this pamphlet by providing justification that includes a full analysis of the expected benefits and must include formal review by the activity's senior legal officer. All waiver requests will be endorsed by the commander or senior leader of the requesting activity and forwarded through their higher headquarters to the policy proponent. Refer to AR 25–30 for specific guidance.

Suggested improvements. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to usarmy.pentagon.hqda-aso.mbx.army-safety-office@army.mil.

Committee management approval. AR 15–39 requires the proponent to justify establishing/continuing committee(s), coordinate draft publications, and coordinate changes in committee status with the Office of the Administrative Assistant to the Secretary of the Army, Special Programs Directorate at email usarmy.pentagon.hqda-hsa.mbx.committee-management@army.mil. Further, if it is determined that an established "group" identified within this regulation later takes on the characteristics of a committee as found in AR 15–39, then the proponent will follow AR 15–39 requirements for establishing and continuing the group as a committee.

Distribution. This pamphlet is available in electronic media only and is intended for the Regular Army, the Army National Guard/Army National Guard of the United States, and the U.S. Army Reserve.

*This pamphlet supersedes DA Pam 385-16, dated 13 August 2013.

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Chapter 1
System Safety Management

1–1. Purpose
This pamphlet identifies system safety procedures required by AR 385–10 for program executive officers (PEOs); program, project, or product managers (PMs); capability developers (CAPDEVs); materiel developers (MATDEVs); testers; independent evaluators; and system safety engineers. This pamphlet provides guidance to establish and manage system safety programs to minimize risks throughout the system life cycle. This pamphlet covers how to conduct hazard identification, system safety, hazard tracking procedures, and risk management during all phases of the life cycle.

1–2. References, forms, and explanation of abbreviations
See appendix A. The abbreviations, brevity codes, and acronyms (ABCAs) used in this electronic publication are defined when you hover over them. All ABCAs are listed in the ABCA database located at https://armypubs.army.mil/abca/.

1–3. Associated publications
Policy associated with this pamphlet is found in AR 385–10.

1–4. Records management (recordkeeping) requirements
The records management requirement for all record numbers, associated forms, and reports required by this publication are addressed in the Records Retention Schedule–Army (RRS–A). Detailed information for all related record numbers, forms, and reports are located in Army Records Information Management System (ARIMS)/RRS–A at https://www.arims.army.mil. If any record numbers, forms, and reports are not current, addressed, and/or published correctly in ARIMS/RRS–A, see DA Pam 25–403 for guidance.

1–5. Participants and key players
The effectiveness of the system safety program can be directly related to the proactive and cooperative spirit of the participants. No program can be effective without aggressive pursuit of safety as a program goal nor can it be effective without the active support and cooperation of the following players:

a. Capability developer. The CAPDEV has a vital role in the success of any system safety effort in all stages of a system's life cycle. During materiel solution analysis, the CAPDEV should ensure that system safety is considered an integral component. The CAPDEV (for example, U.S. Army Futures Command cross functional teams and appropriate U.S. Army Combat Capabilities Development Command elements in coordination with U.S. Army Training and Doctrine Command (TRADOC) system safety engineer) will seek the appropriate system safety engineering expertise (for example, 0803 safety engineer) as soon as it is determined a new system is the appropriate solution to correct deficiencies identified during the mission area analysis. If a modification or a doctrine change is the solution for a fielded system, then the CAPDEV will also seek system safety expertise to determine the potential safety impact of the selected solution. Some CAPDEVs have system safety expertise within their organizations; however, for those who do not, the secondary sources of help are at the CAPDEV's Army command (ACOM), Army service component command (ASCC), or direct reporting unit (DRU) safety office. The CAPDEV is the integrator of system safety until a PM is chartered, usually after Milestone B. The principle system safety responsibility of the CAPDEV is to seek system safety expertise and to articulate the user's safety requirements throughout the system life cycle. Inadequate or poorly designed equipment exposes users to an increased safety risk and a higher potential for loss of combat resources. The CAPDEV must incorporate system safety performance objectives into the concept formulation package. Historical lessons learned should be considered in concept studies and trade off analyses (TOAs). CAPDEVs—

(1) Identify needed safety capabilities to reduce the potential for mishaps.
(2) Integrate safety requirements into capabilities documents.
(3) Develop user safety test issues and criteria.
(4) Participate in the system safety working group (SSWG) to ensure that the system's operational and safety capabilities satisfy the mission needs.

(5) Represent the user throughout the life cycle and coordinate all system safety and risk management issues with their system safety representative.

(6) As the user representative, review all risk acceptance decisions and provide concurrence per DoDI 5000.02.

(7) Ensure their system safety representative attend program integrated product and process team and SSWG meetings, as appropriate.

b. Research, development, and engineering organizations. For a system in the technology base, the research, development, and engineering organizations must—

(1) Charter and maintain a technology safety working group. The technology safety working group is responsible for reviewing emerging technologies and assessing and recommending steps to be taken to ensure safety.

(2) Provide qualified system safety personnel (such as the research, development, and engineering safety personnel) to conduct safety analyses and safety assessments appropriate for technologies that are going to be tested or fielded.

(3) Provide the safety analyses and safety assessments to a program office when technology is transitioned.

(4) Ensure hazard analyses are conducted and the resulting safety and health requirements are included in standard operating procedures (SOPs) and enforced when performing research; development; and engineering, testing, or industrial operations.

(5) Ensure research, development, and engineering project efforts include safety criteria, critical items, and hazards identified as part of the project documentation.

c. Program executive officers; program, project, or product managers; materiel developers; life cycle management commands; or direct reporting program, project, or product managers. The PEO, PM, MATDEV, life cycle management command (LCMC), or direct reporting PM ensures that hazards associated with the design, operation, maintenance, servicing, support, and disposal of the system are identified and resolved early in the life cycle through the application of system safety management and engineering. To accomplish this objective, the PEO, PM, or MATDEV sets goals and establishes mechanisms to attain these goals.

(1) PEOs will—

(a) Act as the safety officer for assigned systems with the responsibility for the proper planning and execution of a system safety program per DoDI 5000.02, AR 70–1, and AR 385–10.

(b) Act as risk acceptance authority for risk levels defined in MIL–STD–882E, DoDI 5000.02, AR 70–1, or the approved alternate system safety risk matrix (see chap 2).

(c) Furnish a representative (general officer or senior executive service level equivalent) to serve on the Army Safety Action Team (ASAT) for their programs.

(d) Ensure PMs are personally involved in their system safety programs. PMs are to fully integrate system safety into their programs.

(2) The PM will—

(a) Implement system safety programs as required by DoDI 5000.02 and AR 70–1.

(b) Charter and support with existing resources a SSWG (see app B) to provide the technical expertise needed to manage the system safety effort. PMs will obtain system safety engineering management support through their associated LCMC or research, development, and engineering command safety office.

(c) Maintain a system safety management plan (SSMP) (see app C) to define the system safety activities throughout the system life cycle. The SSMP will be prepared at program initiation and updated prior to each decision review.

(d) Establish and maintain a hazard tracking system (HTS) throughout the system's life cycle, ensuring that there is a formal closed-loop process for managing hazards. No hazards will be closed until the mitigating measure's implementation has been verified and any residual risk accepted by the appropriate authority (see DoDI 5000.02 and MIL–STD–882E). All residual risks must be accepted prior to fielding. Institute procedures to identify and manage hazards that are discovered post-fielding (see para 1–5), document associated risk acceptance decisions, and communicate the risks and required actions to the field as appropriate. The process should include proactive review of user feedback and the maintenance of a permanent record of identified hazards and closeout actions.

(e) Serve as the risk acceptance authority for risk levels defined in MIL–STD–882E, DoDI 5000.02, AR 70–1, and the approved alternate system safety risk matrix (see chap 2). Ensure that all high and serious

risk hazards are addressed at all technical and program reviews. Obtain user representative coordination prior to all risk acceptance decisions.

(f) Integrate the system safety program into the acquisition process. System safety representation should span the program integrated product and process team structure to ensure cross functional interaction.

(g) Request safety release from U.S. Army Test and Evaluation Command (ATEC) Army Evaluation Center (AEC) prior to any hands-on testing, training, demonstration, experimentation, use, or maintenance by Soldiers on new or non-fielded equipment or type-classified items that are to be used in a new or innovative manner.

(h) Assure that engineering changes, alterations, deviations, waivers, and modification proposals are reviewed for impact on safety, including an evaluation of the entire system for new or increased risk (increased risk can result from additional complexity or interactions or as the compounded effect of multiple changes).

(i) Forward copies of system safety program documentation to the appropriate LCMC or U.S. Army Combat Capabilities Development Command, as appropriate.

(j) Ensure that human systems integration (HSI) processes are implemented to design human machine interfaces in compliance with human factors engineering (HFE) standards and criteria (that is, MIL–STD–1472H), to reduce the incidence of human errors, to make systems error tolerant, to reduce the incidence of ergonomic injuries, and to enhance human performance.

(3) LCMCs will—

(a) Establish a responsible command focal point to manage system safety efforts and provide representation to the Department of the Army (DA) System Safety Council.

(b) Provide qualified system safety personnel to support the development and sustainment of Army materiel. Through the LCMC safety office, represent the independent safety position as the safety advisor to the LCMC Commander. The LCMC safety office will provide an independent recommendation for formal risk assessments (see app E).

(c) Provide system safety risk assessment (SSRA) recommendations. The SSRA should identify a concise decision point describing the hazard, mitigations considered through the SSWG, and resulting alternatives with each associated risk.

(d) As the materiel release authority, ensure the materiel is safe for fielding per AR 770–2 and AR 770–3 (that is, as documented in a safety and health data sheet (SHDS) (see app H) or programmatic environment, safety, and occupational health evaluation (PESHE)).

(e) Serve as release authority for safety messages, per AR 750–6.

d. Tester. The tester supports the system safety process by structuring tests based upon test planning documentation (for example, test and evaluation master plan (TEMP), system evaluation plan, test design plan, and so forth). Testing will provide data to assess the effectiveness of system designs and processes implemented to eliminate or control identified hazards, and it may identify new hazards. Hazards identified by the tester will be provided to the decision maker (for example, PEO, PM, MATDEV, CAPDEV, and so forth) for risk management. A safety confirmation is developed by ATEC AEC or the Army Medical Department (AMEDD) Board and provided to the PM and to the independent evaluator, the latter copy to be used to support development of the independent evaluation. The sources of data can be contractor testing, technical testing, or user testing. The safety confirmation is a stand-alone document required at each milestone review and may identify unresolved hazards and risks.

e. Evaluator. An evaluator is an individual in a command or agency, independent of the MATDEV and the user who conducts overall evaluations of a system's operational effectiveness, suitability, and survivability (see para 4–8). The evaluator consolidates test data from all available sources to address the technical and user test issues and requirements developed for a system. As a part of continuous evaluation (CE), the evaluator should assess and report the cumulative impact of unresolved hazards on the system's effectiveness.

f. User. The users are the equipment operators and maintainers.

(1) Initial activity occurs during early technical development and continues through the life cycle of the system. Two major roles are—

(a) Identification of hazards to improve the safety of existing systems (for example, by submitting an equipment improvement report or SF 368 (Product Quality Deficiency Report (PQDR)) and by participation in the conduct of post-fielding training effectiveness analysis).

(b) Development of historical data that can be used by the CAPDEV, PEO or PM, and LCMC to produce safer systems through hazard identification in the future.

(2) Provide tactical use feedback to the CAPDEV, PM, and LCMC during deployment and after fielding. Communicate the following to the CAPDEV and MATDEV:

(a) Changes to mission requirements, operating spectrum, and tactical and doctrinal revisions.

(b) Early identification of new mission requirements.

(3) Regardless of the development activity that identifies a new operational requirement, the procurement authority or rapid equipping or fielding force is responsible for assessing, identifying, and documenting hazards; identifying residual risks to users; and obtaining risk acceptance. This requirement applies to developmental or prototype items (including software and hardware), commercial off-the-shelf (COTS) or non-developmental item (NDI) procurement items, and integration of COTS or NDI components and software. Risk acceptance will be in accordance with this pamphlet, MIL–STD–882E, the Joint Software Systems Safety Engineering Handbook, and DoDI 5000.02 (if applicable).

(a) If the expedited, rapid, or urgent materiel (to include software) acquisition does not go into a full material release status, the user must perform the role of the CAPDEV, MATDEV, and tester or independent evaluator. The user will use the procedures contained in this pamphlet for identifying operational and materiel risks involved with the equipment's configuration, operation, maintenance, and disposal or reclamation. Safety and occupational health (SOH) requirements should address growth over time to achieve an acceptable level of risk for training outside the operational theater.

(b) AR 770–2 and AR 770–3 provide applicable safety documentation requirements for urgent materiel release, tests, demonstrations, and training that will also be applied to rapid equipping and or middle tier acquisition actions.

(c) Consideration must be given that equipment often classified as "prototype" may be used for many years.

(4) TRADOC capability manager and appropriate U.S. Army Futures Command cross functional teams are the user representative and will coordinate with the end users.

g. Commanders. Commanders who acquire materiel outside the acquisition process (that is, COTS, NDI, and local purchases) will apply system safety processes to identify and control hazards created by use of the materiel (see para 3–13).

1–6. Army Safety Action Team

a. Army Safety Action Team purpose. The ASAT is an ad hoc group of senior leaders across the Army Staff who meet when there are serious safety issues with a major system. Their main objective is to provide recommendations to the Chief of Staff of the Army on corrective measures that maximize Army readiness, safety, and training (see AR 385–10).

b. Army Safety Action Team reporting requirements. The chairperson will maintain and distribute a list, by name, of principal ASAT members and action officers for use in coordination of safety messages (see AR 750–6).

c. Reporting functions. The PM will provide hazard alert information to the MATDEV and CAPDEV commands and the appropriate staffs within Headquarters, DA for the timely management of the associated risks. They will provide updates in accordance with the overall procedures outlined in this paragraph, as supplemented by the MATDEV to address commodity-specific requirements. Ammunition and explosives malfunctions covered by established surveillance procedures in AR 75–1 are excluded from these procedures and the Army Equipment Safety and Maintenance Notification System process outlined in AR 750–6. Medical supplies, equipment, drugs, and biological concerns covered in AR 40–61 are also excluded from the Army Equipment Safety and Maintenance Notification System process.

(1) When a hazard is identified that has a potentially significant impact upon Army training or operations, the PM, in conjunction with the cognizant MATDEV agency, will immediately alert the ASAT chairperson. This notification will be in the form of a hazard executive summary (EXSUM). This hazard EXSUM will normally include a description of the problem, a preliminary determination of risk, the potential operational impact, the current logistical status, and the get-well concept. However, it should not be delayed if this data is not yet available. It is understood that the accuracy and completeness of this initial assessment will be dependent upon the technical and operational data available at that point. The intent is to provide an early hazard alert to provide the basis for a timely and collective assessment of the risks and potential controls as more information is gained on the nature and extent of the problem. Update hazard EXSUM as additional technical and operational knowledge become available.

(2) Significant hazards will normally be eliminated or minimized by immediate materiel modifications or changes to operational or maintenance procedures. If it is not feasible to eliminate the hazard, the PM will initiate a SSRA to coordinate the decision on the controls to be implemented and the acceptance of any residual risk. The PM will recommend options that mitigate the hazard or recommend acceptance of the residual risk. The SSRA will evolve from the hazard EXSUM as outlined above. SSRAs on fielded systems will be processed as follows:

(a) High-level risks. If a hazard has been validated (that is, the analysis for Part I of the SSRA has been completed by the program office or equivalent managing activity (MA)) and there are no resources available to reduce the risk to a lower level, the high-risk SSRA will be brought before the ASAT for coordination. The ASAT will meet without delay. Telephonic or electronic notification of a proposal to accept a high-level risk should precede written notification of the ASAT members.

(b) Serious-level risks. If a hazard has been validated as a serious-level risk and available controls cannot reduce the risk to a lower level, a SSRA will be staffed within 21 calendar days from initiation (Part I) to completion (Part V). Concurrent processing by multiple agencies is encouraged when one organization's evaluation is not dependent on someone's input.

(c) Medium-level and low-level risks. Medium- and low-level risk hazards are managed by the responsible PM or other MA and will be documented and tracked. Implementation of controls and decisions to accept residual risk will be made as quickly as possible, consistent with accurate assessment of the hazard and potential options.

d. Fielded system or materiel Army Safety Action Team. For fielded systems or materiel, MATDEVs will establish procedures for alerting the ASAT chairperson of impending safety issues with significant risk or that have the potential for significant impact upon operations and training. If such changes require transmission of safety information to the field, the MATDEV agency will develop and coordinate a safety of flight or safety of use message (see AR 750–6 for policies on developing and coordinating these messages for aviation and ground systems).

Chapter 2
Risk and Hazard Management

Section I

Risk Management

Risk management is the process of identifying, eliminating or mitigating, and accepting residual risk associated with a mission; design of a system, facility, equipment, or process; or their operation. Use risk assessment levels and acceptance decision authority levels in MIL–STD–882E, DoDI 5000.02, and AR 70–1 in all programs unless a modified matrix has been approved per AR 70–1.

2–1. Process

The Army uses risk management to mitigate risks associated with all hazards that have the potential to injure or kill personnel, damage or destroy equipment, or otherwise impact mission effectiveness. The five-step process is outlined in ATP 5–19 and DA Pam 385–10 and is shown in figure 2–1.

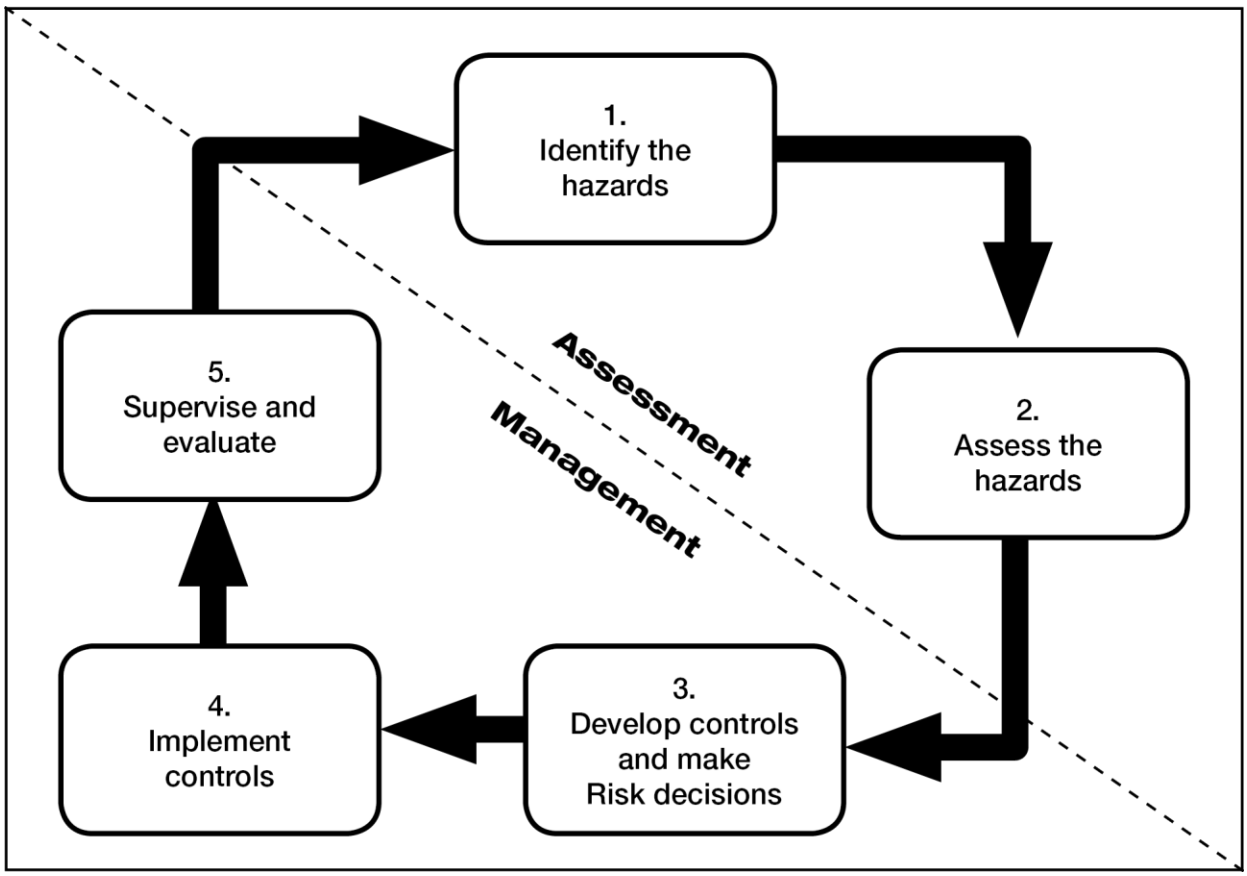


Figure 2–1. The risk management process

2–2. Risk management in system safety

Within the context of this pamphlet, risk management is a means for capturing hazards and providing a communication forum, via the HTS. Additionally, it provides hazard closeout methods and criteria within the five-step process by which hazards can be officially closed. Development of the mechanics and criteria to capitalize on this concept for the overall benefit to the Army is a dynamic process and requires real-time communication among all concerned to ensure its application.

2–3. Identify hazard

a. The standard for hazard identification is a concise statement containing a source, mechanism, and outcome capturing relevant man, machine, and environment conditions that can lead to a mishap. By definition, a hazard is any real or potential condition that can cause injury, illness, or death to personnel; damage to or loss of a system, equipment, or property; or damage to the environment. To effectively describe a hazard, the hazard statement must consist of three basic components—

(1) Source (an activity, condition, or environment where harm can occur).

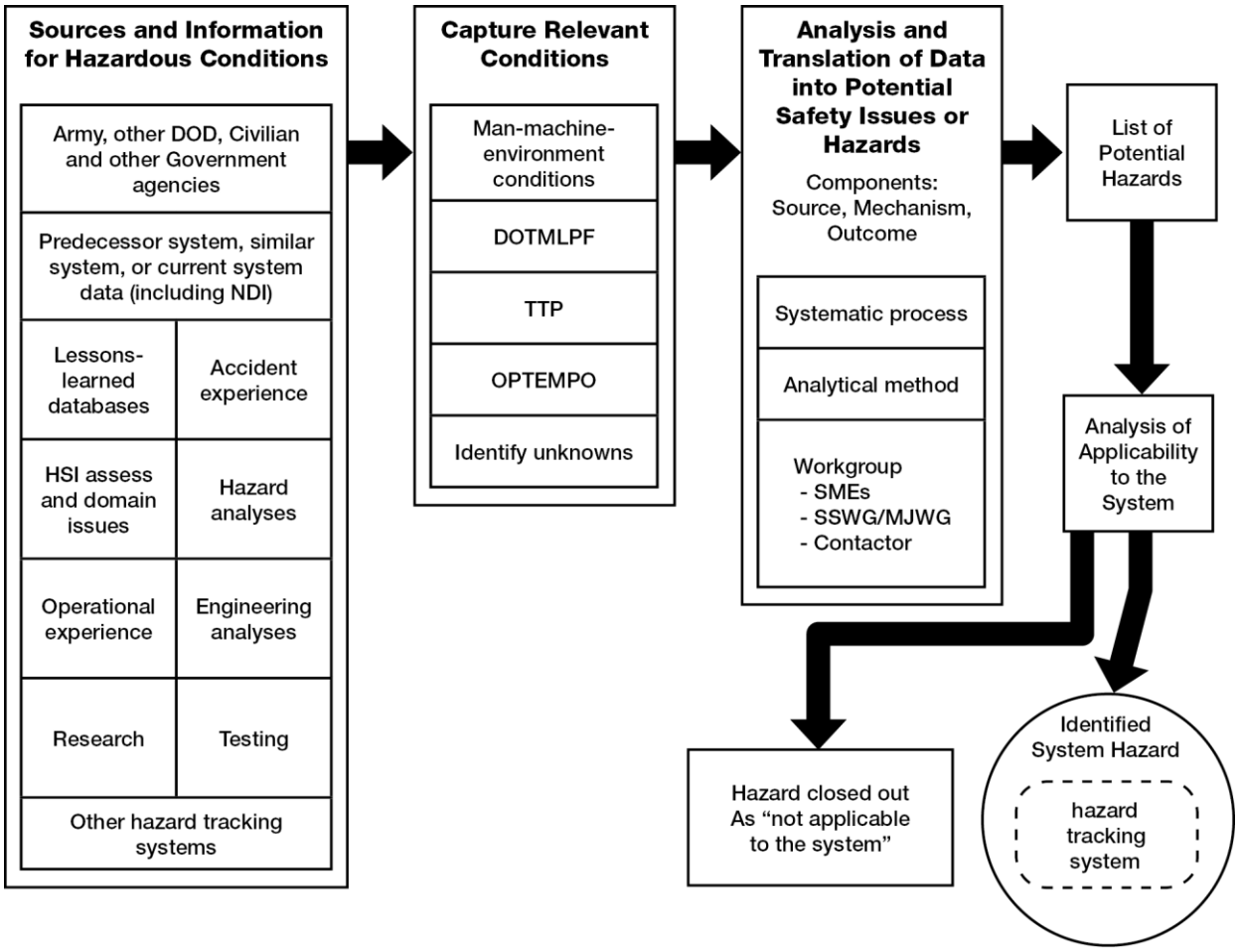
(2) Mechanism (means by which a trigger or initiating event can cause the source to bring about harm).

(3) Outcome (the harm itself that might be suffered, expressed as a severity).

b. Express the hazard at the system level. It begins with the gathering of information and produces viable hazards for which follow-on actions may influence the design, modification, or use of the system.

c. Information collection is inclusive of all sources and not limited to the receipt of accident reports. The effort should extend outside the Army to include other Services, Federal agencies, and private industry. Aggressive information collection looks for sources of potential hazardous conditions (see fig 2–2 for the hazard identification process).

d. The sources of these potential or real hazards might be lessons learned, hazards analyses, accident experience, technology base development data, operational experience, testing, Government studies, or information from nonmilitary usage of similar technology. These hazards include any issues which have the potential to result in losses or damage to materiel or the environment or injury (accidental or health-related) to any personnel. Potential causes of losses must be translated (if possible) into a potential system hazard. For example, a human error cause of an accident may have been induced by a system design hazard. All potential system hazards are then added to the HTS. Once a real or potential hazard is identified, it is handled and treated as a real hazard. It will be formally considered, tracked in the HTS, and reviewed. Several activities and analyses performed by the Government or the contractor can contribute to the HTS, such as design and program reviews, test and evaluation (T&E) reports, safety assessment reports (SARs) (initial and updates), health hazard assessment reports (HHARs), safety releases and safety confirmations, preliminary hazard lists (PHLs), and preliminary hazard analyses (PHAs). Related disciplines, such as those listed in chapter 3, will identify hazards or other information that must be evaluated to identify hazards.



DOD – Department of Defense
DOTMLPF – Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel and Facilities
HSI – Human Systems Integration
MJWG – Manpower and Personnel Integration Joint Working Group
NDI – Non-developmental Item
OPTEMPO – Operations tempo
SME – Subject Matter Expert
SSWG – System Safety working group
TTP – Tactics, Techniques, and Procedures

Figure 2–2. Hazard identification process

e. Once a PM receives notification of a potential safety issue, the PM will validate the issue to identify the hazard. When conditions are identified that have potentially significant impacts on Army training or operations, the conditions must be documented and translated into a hazard. This requires a narrative description of the human, machine, and environmental conditions leading to a mishap. These conditions are parlayed into three elements to express the hazard (source, mechanism, and outcome). The outcome is the potential consequence of the hazard (such as damage to equipment, environment, injury, or death). Outcomes will be considered at the system level. Hazard statements containing multiple sources, mechanisms, or outcomes represent a family of multiple hazards. Each hazard within the family will have its own hazard statement containing a single source, mechanism, and outcome. Once a real or potential hazard is identified, it is processed and treated as a real hazard. It will be formally considered, tracked in the HTS, and reviewed. The PM will ensure that the hazard is completely identified.

f. Although hazard identification goes on continuously throughout the life cycle of a system, it is of paramount importance when considering an acquisition strategy (AS). The presence of system hazards

should be one of the determining factors when considering accelerated acquisition or use of NDI subsystems.

(1) Early hazard identification can influence MA decisions on source selection for types of NDIs to utilize. Also, this hazard identification can drive effective TOAs, as well as identify other required testing to assure materiel in these types of acquisitions deliver the maximum operational effectiveness to the Army.

(2) Certain accelerated acquisition programs may not allow a period to discover hazards in time to initiate an alternate acquisition program. This reinforces the importance of identifying hazards early.

(3) MATDEVs may choose or be required to use NDIs (for example, Government-furnished equipment, COTS items, and so forth) in the development of their systems. Regardless, proponent MATDEVs are required to consider hazards associated with NDIs, including the interfaces of the NDI with other components. All identified hazards associated with the NDIs will be documented and tracked in hazard analyses and the HTS.

g. During hazard identification, a hazard can only be closed out as being "not applicable to the system." This approach identifies those potential hazards that are not applicable to the system in the acquisition process. Closeout by this method requires a thorough evaluation of the hazard relative to the system design and the planned or potential usage in the operation, training, maintenance, storage, and transportation to disposal environment.

(1) However, if the exact system configuration and operational factors are not sufficiently known to identify the hazard's applicability to the system, the hazard remains open to continue in the risk management process.

(2) Address the inherent safety characteristics of major pieces of NDI selections early in the design process during TOAs to ensure the safest possible NDI is selected, consistent with mission accomplishment. This is the proactive method whose ends would apply the "not applicable to the system" approach to hazard closeout.

2–4. Assess hazard

This step of the risk management process begins with a viable system hazard and assesses the risk of the hazard. The output of the hazard assessment step is a risk assessment of the viable system hazard.

a. Hazard assessment. In establishing priorities for correcting a system's hazards, evaluate hazards to determine their probability levels and severity categories. Categorize hazard risk, probability, and severity according to MIL–STD–882E. When necessary, a program may propose an alternate risk assessment matrix that is based on MIL–STD–882E. Develop, coordinate, and approve alternate matrices, per AR 70–1.

(1) Hazard and risk assessments can be either qualitative or quantitative. Factors to consider when developing a qualitative risk assessment include engineering judgement, experience with similar systems, criticality of artificial intelligence (AI) and machine learning (ML) decision making, test results, and the worst case scenario of a potential mishap's severity.

(2) The risk associated with a hazard is a function of its severity and probability. When severity categories and probability levels are combined, they provide a matrix for assigning a code to the risk associated with a hazard. These codes are known as risk assessment codes (RACs). Do not create single-digit RACs by using numerical rather than alphabetical rankings of probability, then multiplying probability by severity. Avoid this method because the use of single-digit codes presumes that the lower the product, the higher the risk associated with the hazard. This presumption is not always true, and common products (such as 1 x 4 and 2 x 2) mask prioritization.

b. Non-developmental items assessment. Previously identified and documented hazards associated with fielded NDI are normally considered acceptable, provided no unique hazard are created, due to interfaces with the new system. A hazard caused by NDI is considered unique to the new system interface if—

(1) Verification indicates the environment of the proposed NDI use exceeds the environment for which the NDI is designed.

(2) The severity of a potential accident that could result from the identified NDI hazard when used with the new system is materially greater than when used as originally designed.

(3) The probability of a potential accident that could result from the identified NDI hazard when used with the new system is materially greater than when used as originally designed.

c. Closeout criteria during risk assessment. During this step of the risk management process, the only way a hazard can be closed out is by meeting or exceeding acceptable standards. This method requires careful consideration by system safety practitioners and PMs, as abuses of the process may occur. MAs

are encouraged to consider all hazard fixes that derive a level of safety that is in concert with program cost and schedule, as well as maximize warfighting capability. System safety programs that consider all programmatic assets can provide the leading edge for quality.

(1) *Design meets or exceeds applicable standards.* The goal is to recognize appropriate application of consensus standards. For example, any pressure vessel presents a hazard; however, if it is designed to meet or exceed American Society of Mechanical Engineers, American National Standards Institute, and MIL–STD–1522A, and it is used in an environment appropriate to these standards, then it may not require formal acceptance.

(a) Identify and define the root cause of the hazard.

(b) Determine and review the standard for applicability and sufficiency for the equipment design.

1. Is the standard applicable and sufficient as applied to the system design?
2. Is the standard current and state of the art?

(c) Analyze the operational environment of the system to ensure that the standard is applicable to the envisioned environment.

(2) *Non-developmental items hazard closeout.* The assessment of NDI hazards as outlined above mirrors the "design meets or exceeds applicable standards" approach. To closeout NDI hazards, previous type classification of NDI will be considered to have constituted acceptance by the Army of risks inherent in the NDI in its previous application. For applicable hazards, the hazards analysis or HTS needs to annotate "type classification" as the rationale for closing the hazard.

2–5. Develop controls and make risk decisions

During the first two steps of the risk management process, the MA could agree that the design meets or exceeds all applicable consensus or military design standards (or is verified through testing, where standards do not exist) and that the environment in which it will operate is consistent with that envisioned by the design. Hazards which cannot be eliminated by design during hazard identification or the hazard assessment processes are defined as residual hazards. The goal of this step is to develop alternatives for risk reduction controls and obtain a decision by the appropriate decision authority.

a. With the risk of the hazard assessed, the next task is to develop alternatives for controls. Develop alternatives using the system safety design order of precedence per MIL–STD–882E, determining which control or combination of controls will be applied given the program's resource constraints. Identify cost and other programmatic impacts with each alternative. While effectiveness of specific controls may vary, the system safety order of precedence for mitigating identified hazards generally is—

(1) *Eliminate hazards or reduce hazard risk through design selection.* If unable to eliminate an identified hazard, reduce the associated risk to an acceptable level through design selection or alteration.

(2) *Incorporate safety devices.* If unable to eliminate the hazard through design selection, reduce the risk to an acceptable level using protective safety features or devices.

(3) *Provide warning devices.* If safety devices do not adequately lower the risk of the hazard, include a detection and warning system to alert personnel to the particular hazard.

(4) *Develop procedures and training.* Where it is impractical to eliminate hazards through design selection or to reduce the associated risk to an acceptable level with safety and warning devices, incorporate special procedures and training. Procedures may include the use of personal protective equipment. For hazards assigned catastrophic or critical mishap severity categories, avoid using warnings, cautions, or other written advisory as the only risk reduction method.

b. The decision-making task involves selecting the alternatives identified in the develop controls portion of this step, as shown in figure 2–3. Document formal acceptance of any residual risk that exists after the controls are implemented.

c. The residual hazards in figure 2–3 refer to the risk remaining after corrective actions are applied. For example, a hazard is identified and assigned a RAC of IIA. The PM allocates additional funds for the contractor to apply an engineering fix to the system, which would reduce the RAC to IID. The cost to further reduce the risk is prohibitive in the judgment of the PM; however, given the matrix in MIL–STD–882E and the program SSMP, the PM must decide whether to accept the risk for this residual hazard. If the decision authority decides that the risk is acceptable, then the engineering fix should be applied and tested. In another example, an IIA hazard is identified, but the PM's recommended engineering fix will only reduce the RAC to IIC. The PM cannot accept that level of risk; therefore, the PEO must decide on risk acceptability. If the decision authority decides that IIC is an unacceptable level, then the PM will have to take necessary actions to further reduce the risk.

d. Determining which alternative controls to apply is important. The decision to accept the risk of a residual hazard must be at a level appropriate to the priority of the residual hazard. From a safety standpoint, the goal is to achieve the lowest level of risk in concert with mission effectiveness. The residual hazard control alternatives in paragraph 2–5a are listed in order of effectiveness to reduce risk. Designing for minimum risk, incorporating safety devices, and providing warning devices usually require engineering design changes. Because such changes become increasingly more expensive later in the life cycle, early hazard identification is essential. Take caution when relying on procedures or training as controls.

e. The residual hazard closeout procedures during the "develop controls and make risk decisions" step of the risk management process are—

(1) *Design approach.* The goal of this approach is to implement design changes that would result in the elimination of the hazard or minimization and control of any residual hazards.

(a) Review and define the source, mechanism, and outcome of the hazard.

(b) Develop a design eliminating or controlling the root cause.

(c) Complete an adequate test program to verify the fix with favorable results.

(2) *Devices, training, and procedures approach.* The goal of this approach is the identification and implementation of procedures that reduce the probability of the hazard and subsequent acceptance of any residual risk.

(a) Review and define the source, mechanism, and outcome of the hazard.

(b) Develop devices, training, or procedures that reduce the probability of the hazard.

(c) Complete an adequate test program to verify the procedures.

(d) Identify the residual risk associated with the device, training, or procedural fix. These fixes generally reduce the probability, but do not eliminate the hazard entirely and do not affect the hazard severity.

(e) Develop and coordinate a SSRA for the residual risk.

(3) *Risk acceptance.* The final step is the risk acceptance approach. The goal of this approach is associated with a residual hazard not controlled by one of the preceding alternatives. During this step, residual hazards are closed out by—

(a) Reviewing and defining the source, mechanism, and outcome of the hazard.

(b) Conducting studies to identify potential design options, if available, to eliminate the hazard and the associated program cost.

(c) Documenting rationale for not eliminating the hazard.

(d) Identifying the residual risk associated with the hazard.

(e) Developing and coordinating a SSRA for the hazard (see app E).

(f) Obtaining a decision by the appropriate decision authority to accept the residual risk associated with the hazard.

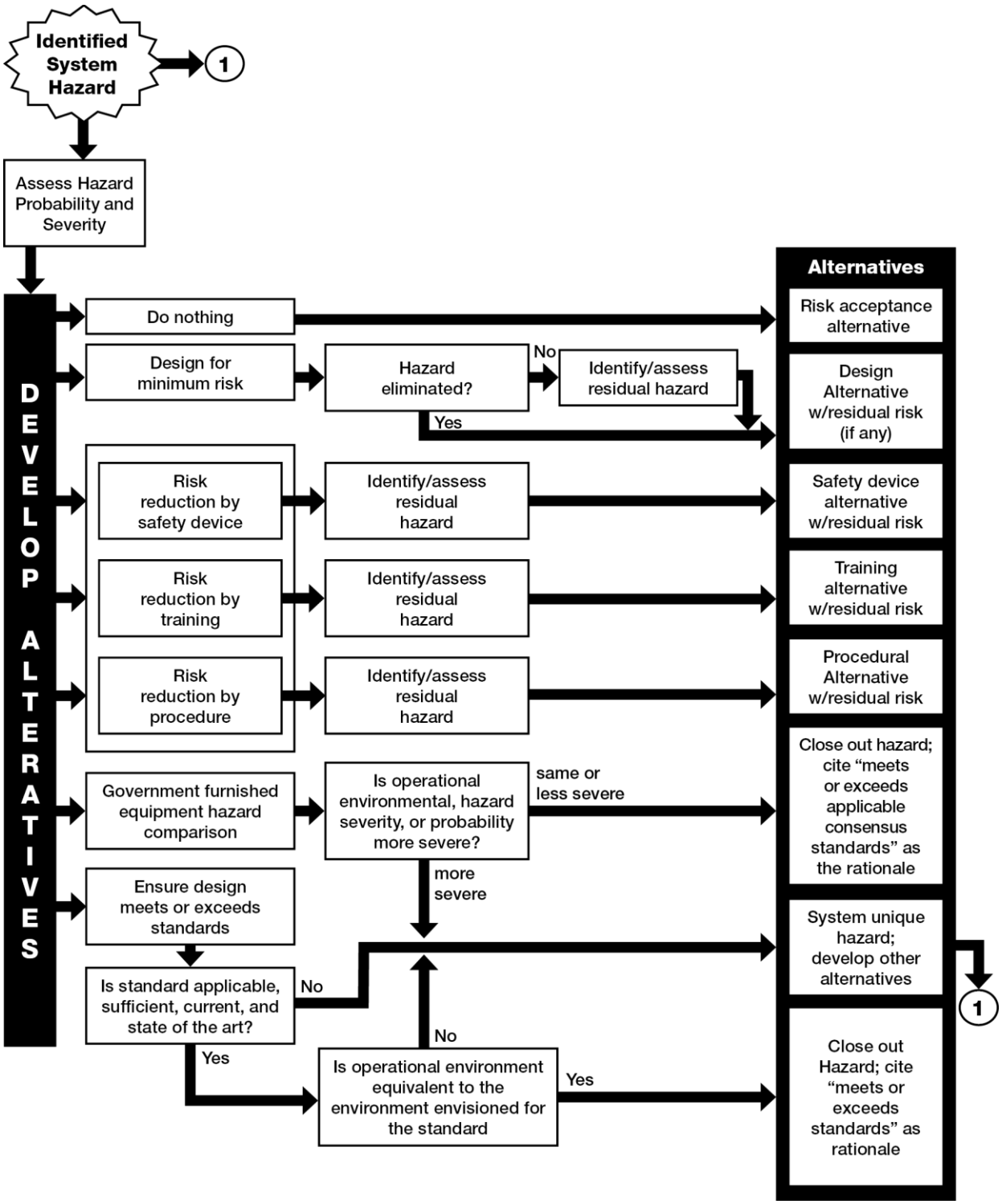


Figure 2–3. Process for developing alternatives

f. Perform acceptance decisions at a level of management authority commensurate with the risk. The Army uses MIL–STD–882E risk decision matrix as established by AR 70–1 and in accordance with DoDI 5000.02 (see DA Pam 385–10).

(1) Should program requirements dictate a different decision authority, document and submit the changes for approval to the highest affected level of authority. Submit the recommended matrix for approval per AR 70–1 and current guidance. The PM will include the alternate matrix in the SSMP (see app C).

(2) Identify each potential control and the residual risk if it is applied. For each alternative control, express the consequences of residual risks in terms of deaths, injuries, system damage, and program delay.

2–6. Implement controls

Step four of the risk management process is actual implementation of the risk decision made on the residual hazards in step three, “develop controls and make risk decisions.” During this step, the following actions are accomplished:

a. Designate or obtain funding for the fix.

b. Develop and implement an action plan for implementation of the risk decision.

(1) Production and retrofit.

(2) Follow-up plan for monitoring corrective action and implementation status.

(3) Implement devices, training, or procedures.

(4) Publish the procedures in the appropriate manuals.

c. Develop and execute a follow-up plan to verify anticipated or assigned hazard severity or probability and adequacy of the fix in the operational environment.

d. Verify that implementation of selected controls does not result in creating another hazard.

e. Testing is the primary method of verifying the effectiveness of the hazard controls implemented as described in chapter 4.

2–7. Supervise and evaluate

a. Step five of the risk management process is supervising and evaluating the implementation of the risk decision made on the residual hazards in step three, “develop controls and make risk decisions.” It is during this process that the effectiveness of the risk decision is ensured and that standards are being maintained at the highest level possible. Also during this step, the evaluation of the system safety program efforts are reviewed, and the risk management process is reentered at the step that is required to maintain the high safety standard of the system.

b. Only when the above criteria have been met, including the addressing of the residual risk and the effectiveness of the system safety effort has been determined or evaluated during this step, can a hazard be officially closed out in the HTS. The closure of a hazard does not eliminate the requirement to retain the hazard in the HTS. The hazard and its disposition should always be retained to provide future program visibility and as an audit trail of the actions. Also, the closed out actions, including implementation status and accident data, are necessary to determine if further action is required.

2–8. Hazard tracking

a. The HTS tracks the status of all identified hazards throughout the life cycle of the system. Perform a PHL and PHA (see app D) on each technology or conceptual system and then use that as the basis for establishing the HTS, if the technology matures into a concept. The data elements for an automated hazard tracking record format are shown in table 2–1. The status will reflect approval by the appropriate decision authority and whether the control or mitigation measure has been applied. Do not remove identified hazards from the HTS during the life cycle of the hardware and successor systems.

b. The PM will prepare SSRAs (see app E), coordinate with the CAPDEV, and keep this documentation on file. Since thousands of hazards may be identified over the life of a major system, automation of the HTS is essential.

Table 2–1
Hazard tracking system—sample format for a hazard tracking record

Item description	Definition
HTS log number	An alphanumeric code identifying hazards.
Type, model, and series	The type, model, and series of the equipment for which the hazard is affecting.

Table 2–1
Hazard tracking system—sample format for a hazard tracking record—Continued

Subsystem	The subsystem name.
System description	The narrative for describing the system in which the hazard is located.
Date hazard identified	The date the hazard was identified.
Hazard tracking item revised date	The date that additional information has been added to the information on the hazard.
Status	The status of the hazard and its processing stage. The stages of the status could be proposed, open, monitor, recommended closed, or mitigated (designed out or managed).
Hazard classification RAC	The RAC for the hazard during the life cycle. May be initial, current, or final.
Hazard classification RAC source	A single code describing the source of determination of the RAC, based upon the equipment damage, system damage, or personal injury.
Hazard classification severity	Projected or expected worst creditable severity information.
Hazard classification probability	The projected or expected probability of occurrence for the RAC.
Life cycle cost	The projected cost of the initial hazard, if not corrected.
Life cycle deaths	The expected or projected deaths if the hazard is not corrected.
Hazard type	Field for organizing the hazards into groups.
Hazard description	The hazard described in full detail.
Life cycle occurrence	The expected mission, time, or period where the hazard would exist.
Failure mode	How the hazard would manifest itself during the life cycle.
Engineering mitigation alternatives	The various engineering and design changes that, if applied, would reduce or eliminate the hazard. The solutions should be numbered and contain the resulting residual RAC. Cost of the engineering solutions should be projected.
Procedural mitigation alternatives	The procedural changes that, if applied, may reduce the probability of the occurrence. The solutions should be numbered and the solution would contain the resulting residual RAC. Cost of application should be projected.
Warnings, cautions, and notes mitigation alternatives	The warnings, cautions, and notes in the technical manuals (TMs) which could reduce the probability of occurrence. The solutions should be numbered and contain the resulting residual RAC. Cost of application should be projected.
Status of engineering mitigation alternatives	The status of all the engineering solutions.
Status of procedural mitigation alternatives	The status of all the procedural changes.
Status of warnings, cautions, and notes mitigation alternatives	The status of all the warnings, cautions, and notes mitigation alternatives.
SSRA required (yes or no)	Indicates the need for a SSRA.
SSRA completed (yes or no)	Indicates whether the SSRA is complete.
SSRA signature date	Date the SSRA was finalized.
Signature fields	The necessary signature fields for the SSRA.

2–9. Hazard closeout

a. The SSWG plays a key role in making recommendations to the PM on specific hazard or risk issues and initiating the coordinating process for risk management decisions. The SSWG also determines when it is appropriate to initiate a hazard closure recommendation and officially close a hazard in the HTS. Five methods or approaches exist for recommending hazard closeout—

(1) Not applicable to the system.

(2) Eliminated by design modification.

(3) Design meets or exceeds applicable Federal, Department of Defense (DoD), DA, and recognized national consensus standards or regulations for the operating environment.

(4) Review and certification by the appropriate authority (for example, Army Fuze Safety Review Board, Insensitive Munitions (IM) Board, Ignition System Safety Review Board, or DoD Explosives Safety Board).

(5) Risk acceptance.

b. The criteria for determining the appropriateness and timeliness for submitting a hazard closure recommendation and subsequent closeout in the HTS are highlighted in the description of each step of the risk management process.

2–10. System safety risk management objectives

a. The PEO or PM will maximize operational readiness and mission effectiveness through accident prevention by ensuring—

(1) Hazards and associated risks are identified and managed for each system throughout its life cycle and all mission variations.

(2) Hazards are eliminated through design or controlled to acceptable levels, and risk associated with residual hazards is formally identified, accepted by the appropriate management decision level, and documented.

(3) Hazards associated with new technology or operations are identified for consideration in later applications.

(4) Safety performance capabilities are established addressing hazards with similar legacy systems.

(5) Safe systems are sustained throughout the life cycle.

b. The CAPDEV will—

(1) Establish safety performance capabilities addressing hazards with similar legacy systems.

(2) Integrate system safety into technology maturation and risk reduction prior to Milestone B.

(3) Ensure risk mitigation and acceptance decisions for developmental systems are coordinated with users and CAPDEV system safety expertise.

(4) Ensure users' perspectives on the acceptability of residual risk is incorporated into any modification.

c. Testers will—

(1) Identify potential and real hazards.

(2) Verify the effectiveness of the correction imposed.

(3) Determine test event risk level.

(4) Risk assess hazards identified during test.

d. Independent evaluators will—

(1) Provide an independent evaluation for materiel acquisition decision process reviews.

(2) Receive from the PM copies of the appropriate documents for evaluation prior to the materiel acquisition decision process review date.

e. Life cycle managers will—

(1) Maintain continuity and capability for system safety engineering and management.

(2) Maintain system safety expertise for support to the PM throughout the life cycle.

(3) Assist the PM in ensuring all hazards are managed and laws and regulatory requirements are met throughout the life cycle.

(4) Ensure materiel release environment, safety, and occupational health (ESOH) requirements are completed per AR 770–2 and AR 770–3.

Section II

System Safety Program Management Activities within the Life Cycle

2–11. Program elements

Army leader involvement, creation of a SSMP, and the acquisition of dedicated system safety expertise are the key ingredients of a successful program. Direct the major effort toward identifying, tracking, assessing, and resolving hazards. An effective system safety program established early in the system's life cycle will result in the identification and resolution of most hazards before the system's maturity makes production design or material changes extremely costly.

2–12. Adapting the system safety program

a. A major step in establishing an effective system safety program is to get the PEO or PM involved early in the system's life cycle. Early recognition of hazard identification is achieved by front-end loaded system safety efforts and documentation. The positive implications of this approach are as follows:

(1) It requires an early on system safety program, which equates to a more effective program.

(2) It eliminates redundancy in system safety documentation.

(3) It provides a tailored approach for system safety documentation.

(4) It provides for management input and review of system safety documentation and decision milestone reviews.

b. Evolutionary acquisition is DoD's preferred strategy for rapid acquisition of mature technology for the user. An evolutionary approach delivers capability in increments, recognizing, up front, the need for future capability improvements. The success of the strategy depends on the consistent and continuous definition of requirements and the maturation of technologies that lead to disciplined development and production of systems that provide increasing capability towards a materiel concept.

c. The approaches to achieve evolutionary acquisition require collaboration between the user, tester, and developer. They include—

(1) *Spiral development.* In this process, a desired capability is identified, but the end-state requirements are not known at program initiation. Those requirements are refined through demonstration and risk management. There is continuous user feedback and each increment provides the user the best possible capability. The requirements for future increments depend on feedback from users and technology maturation.

(2) *Incremental development.* In this process, a desired capability is identified, an end-state requirement is known, and that requirement is met over time by development of several increments, each dependent on available mature technology.

d. Representatives from the user, tester, and developer communities will assist in the formulation of broad, time-phased, operational goals and describe requisite capabilities in the capability development document (CDD). They will examine multiple concepts and materiel approaches to optimize the way these capabilities are provided. The examination will include robust analyses that consider affordability, technology maturity, and responsiveness.

e. A successful system safety effort requires adaptation to fit the particular materiel acquisition program. This is particularly true for NDIs and other programs with accelerated acquisition cycles. This is also true when a materiel system interfaces with a facility. Ensure the life cycles of the two are connected. The best document for this is the support facility annex of the logistic support analysis (LSA). The PM's system safety advisor will recommend activities that are necessary for this system. The selected activities are then included in the SSMP.

f. Maintain and update the HTS and risk management requirements during all phases of the life cycle.

2–13. System safety integration with systems engineering

a. DoDI 5000.02 describes the Defense Acquisition Framework for materiel acquisition. DoDI 5000.02 also directs the PM to integrate ESOH risk management into the overall systems engineering (SE) process for all developmental and sustaining engineering activities. To understand how the system safety process works within the overall acquisition structure, it is customary to view the process as a waterfall structure as shown in figure 2–4. The figure includes major milestones, reviews, and related technical baselines. It is DoD policy to integrate ESOH and HSI into SE throughout the acquisition framework.

System safety is a major subset of both these programs and also includes some efforts and products unique to system safety.

b. This chapter includes a description of ESOH tasks in relation to the SE v-charts. V-charts depict when ESOH activities are performed to influence the SE process. SE v-charts are shown for each phase, followed by a list of program inputs and outputs. ESOH activities that support each phase are listed following the SE v-charts in relation to the individual inputs, outputs, and SE activities for each phase.

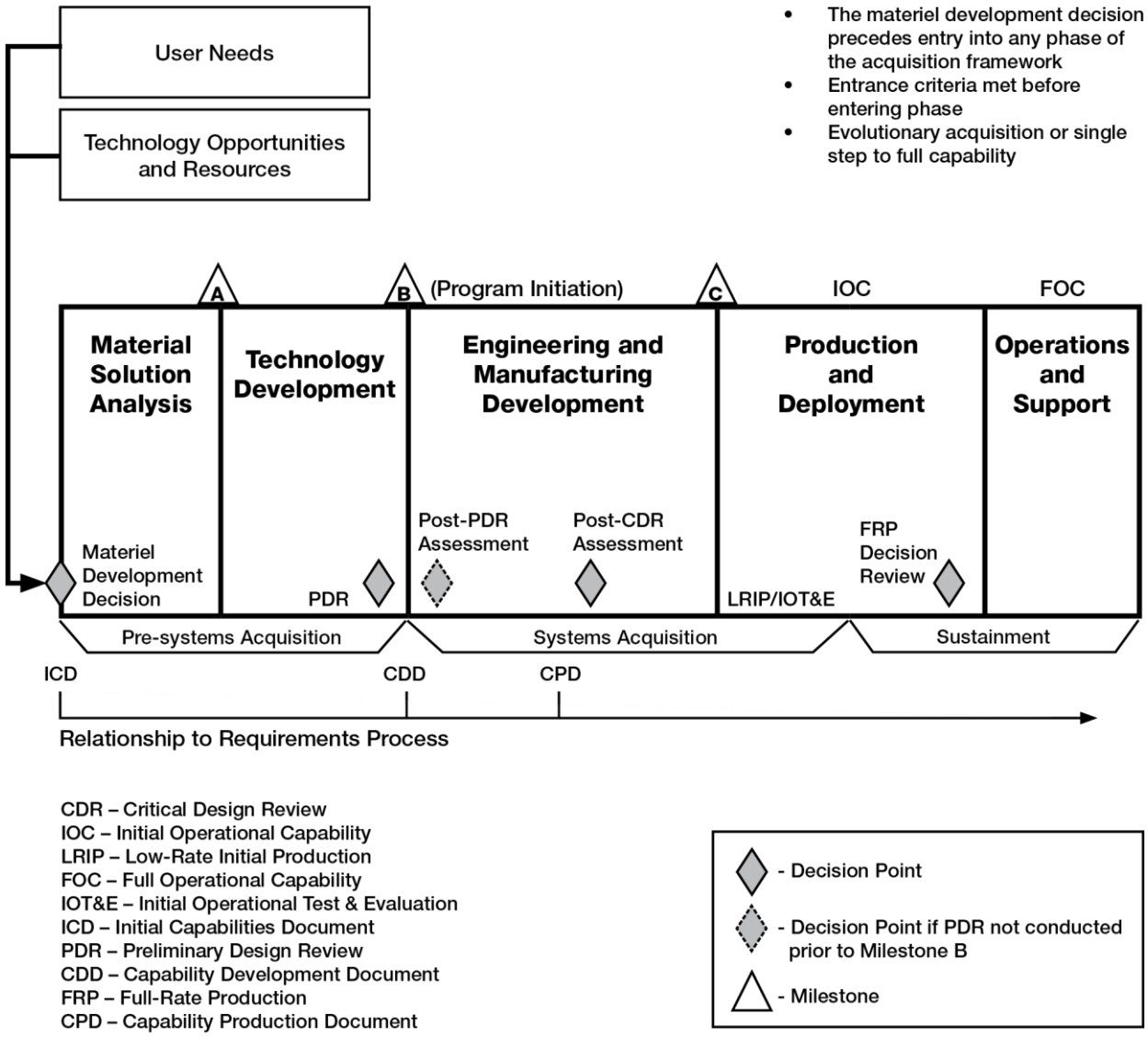


Figure 2–4. Defense Acquisition Framework

2–14. Materiel solution analysis

The purpose of this phase is to assess potential materiel solutions and to satisfy the phase-specific entrance criteria for the next program milestone designated by the milestone decision authority (MDA). Figure 2–5 depicts the integration of system safety efforts into the SE process that begins during the materiel solution analysis phase. Table 2–2 lists the inputs of the materiel solution analysis phase, table 2–3 lists the steps of the materiel solution analysis phase, and table 2–4 lists the outputs of the materiel solution analysis phase. The significant system safety activities are—

a. Initiate development of top-level hazards analyses.

b. Identify applicable ESOH considerations and constraints, as part of the system-level trade studies.

c. Review and provide inputs to initial capabilities document (ICD).

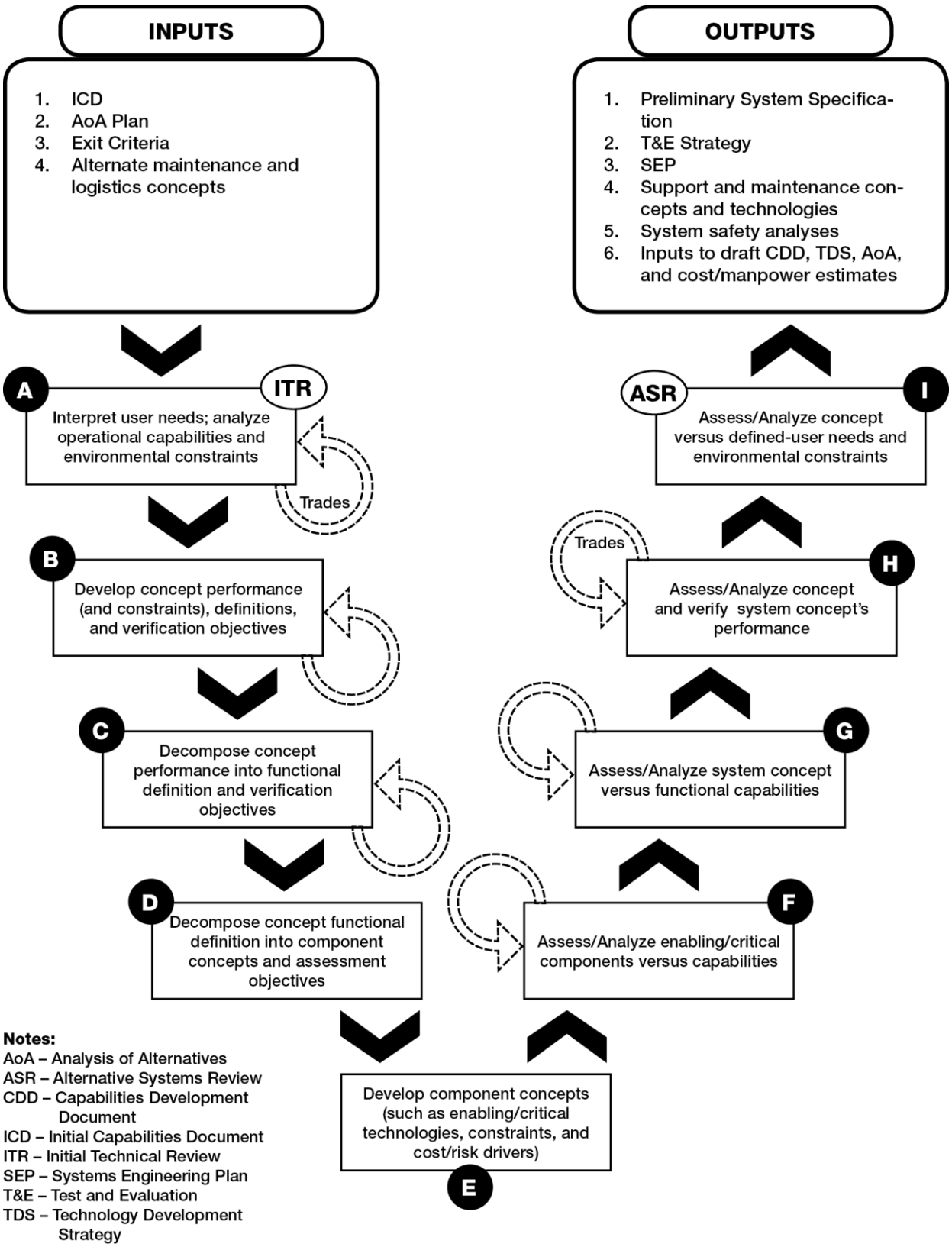


Figure 2–5. Materiel solution analysis v-chart

Table 2–2
Inputs of the materiel solution analysis phase

Inputs	System safety should—
ICD	Provide ESOH characteristics as part of the capability definition.
Analysis of alternatives (AoA) plan	Participate in AoA development.
Exit criteria	Provide the following exit criteria: -PHL. -Strategy for integrating ESOH risk management into the systems engineering plan (SEP).
Alternative maintenance and logistics concepts	Provide ESOH inputs.

Table 2–3
Steps of the materiel solution analysis phase[1]

Step[2]	System safety should—
A	Review the system threat assessment. Identify applicable ESOH criteria and asset requirement.
B	Assess each system concept against identified ESOH criteria and requirements.
C	Translate concept-level ESOH criteria (such as air emissions, noise, hazardous material, effluents, and discharges) into functional requirements. Identify applicable verification objectives.
D	Initiate the PHL.
E	Prepare the PHL. Initiate identification of component ESOH constraints. Recommend ESOH input into projected system attrition rates. Review historical ESOH information (such as successes, mishaps, and lessons learned) from similar or related legacy systems.
F	Identify ESOH requirements against critical component capabilities. Evaluate component test results against identified system constraints.
G	Evaluate ESOH functional requirements for the system concept based on component test and analysis results.
H	Evaluate the system concept's ability to meet performance capability requirements within identified ESOH constraints.
I	Finalize the PHL for each system concept. Recommend the preferred ESOH approach for system concept.
Initial technical review	Identify applicable ESOH criteria for the systems.
Alternative systems review	Prepare results of the PHL for each alternative and recommend ESOH level of effort required for the technology maturation and risk reduction phase.
Trades	Participate in trade studies to identify potential top-level hazards and ensure ESOH criteria are included in the trade studies throughout this phase.

Notes.

Table 2–3
Steps of the materiel solution analysis phase[1]—Continued

[1] Assess ESOH efforts using the system safety ESOH management evaluation criteria for DoD acquisition.

[2] The letters in this column correspond with the letters in figure 2–5 and are associated with the v-chart step boxes.

Table 2–4
Outputs of the materiel solution analysis phase

Outputs	System safety should—
Preliminary system specification	Provide PHL and ESOH criteria. Identify ESOH requirements, constraints, and performance attributes for the system. Incorporate ESOH requirements, as applicable.
T&E strategy	Provide approach to ESOH planning and the National Environmental Policy Act (NEPA) (Title 42, United States Code, Chapter 55 (42 USC Chapter 55)) and Executive Order (EO) 12114 compliance schedule. Provide ESOH hazard risk mitigation test and verification methodologies and approach toward obtaining safety releases and ESOH risk acceptance.
SEP	Participate in developing the strategy for integrating ESOH risk management into SE using MIL–STD–882E. Identify responsibilities for integrating ESOH into SE.
Support and maintenance concepts and technologies	Identify potential ESOH operations and maintenance issues and identify emerging ESOH technologies and hazards.
System safety analysis	Ensure PHL has been completed for each system concept.
Inputs to draft CDD, technology maturation and risk reduction strategy, AoA, and cost and manpower estimates	Provide ESOH inputs.
SSMP	Initiate plan.
SSWG	Establish a chartered SSWG.
Hazard tracking log	Establish a HTS.
Lessons learned	Collect lessons learned from predecessor systems to be used for mishap prevention.

2–15. Technology maturation and risk reduction

The purpose of this phase is to reduce technology risk, determine and mature the appropriate set of technologies for integration into the system, and demonstrate critical technology elements on prototypes. Technology maturation and risk reduction is a continuous technology discovery and development process reflecting close collaboration between the science and technology community, the user, and the system developer. It is an iterative process designed to assess the viability of technologies, while simultaneously refining user requirements. Figure 2–6 depicts the integration of system safety efforts into the SE process during technology maturation and risk reduction. Table 2–5 lists the inputs of the technology maturation and risk reduction phase, table 2–6 lists the steps of the technology maturation and risk reduction phase,

and table 2–7 lists the outputs of the technology maturation and risk reduction phase. In this phase, the integration of system safety efforts into the SE process involves—

a. Continuing development of the requirements.

b. Identifying top-level hazards as part of participation in the trade studies.

c. Anticipating applicable system-level requirements for ESOH as the technologies are integrated into the system.

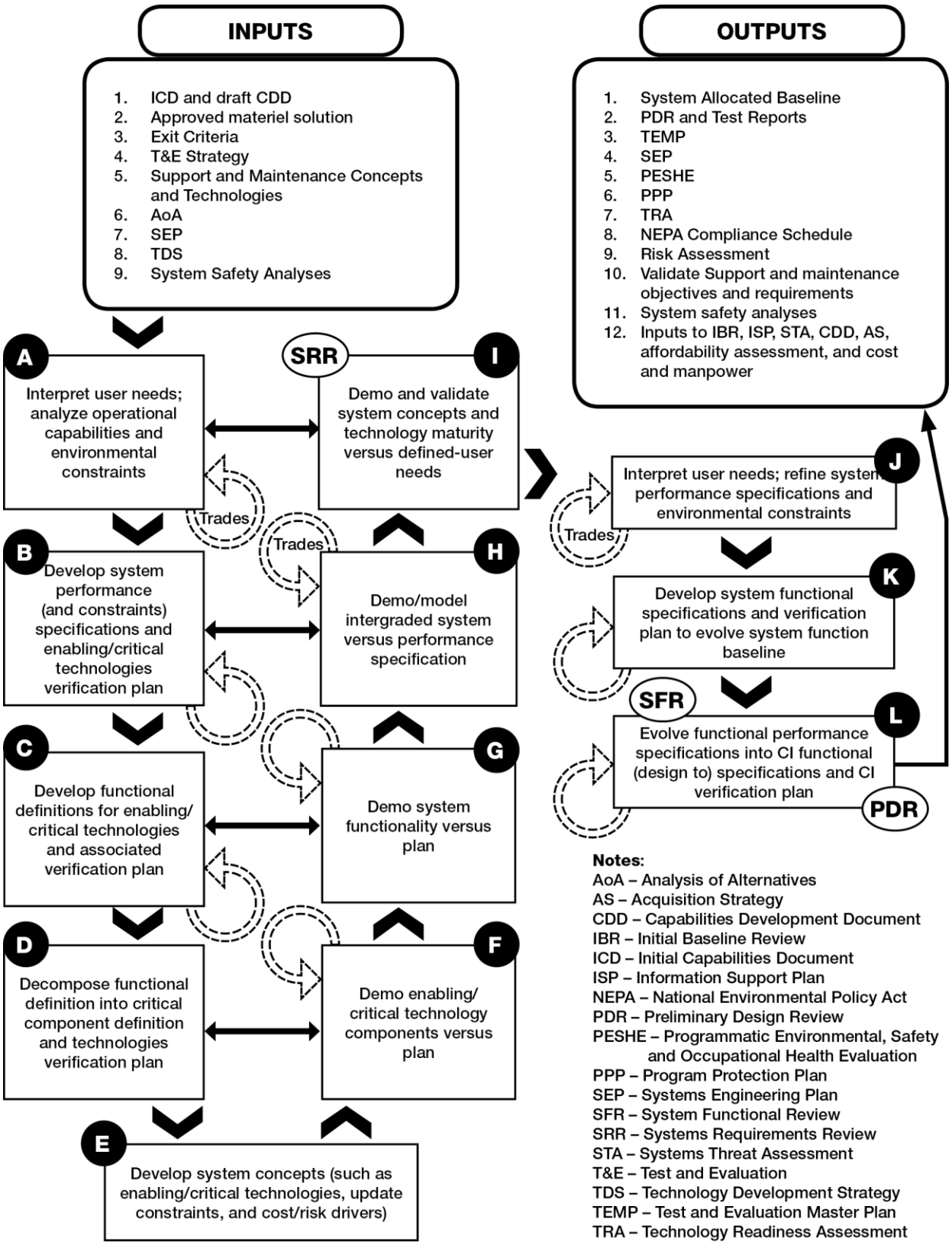


Figure 2–6. Technology maturation and risk reduction v-chart

Table 2–5
Inputs of the technology maturation and risk reduction phase

Inputs	System safety should—
ICD and draft CDD	Develop or coordinate ESOH criteria and requirements. Identify ESOH constraints and performance attributes for the system.
Approved materiel solution	Evaluate the approved materiel solution identified ESOH criteria.
Develop exit criteria	Provide the following exit criteria: Update the PHL. Update strategy for integrating ESOH risk management into SE.
T&E strategy	Incorporate ESOH hazard risk mitigation test and verification methodologies and work towards obtaining safety releases and ESOH risk acceptance. Include the ESOH planning strategy and requirements to support T&E (to include NEPA and EO 12114 compliance).
Support and maintenance concepts and technologies	Provide ESOH inputs, as requested.
AoA	Characterize ESOH footprints and risks for AoA development.
SEP	Update the strategy for integrating ESOH risk management into SE.
Technology maturation and risk reduction strategy	Include strategy to identify hazards and needed ESOH technology maturation and risk reduction.
System safety analyses	Initiate safety requirements analysis (SRA) and update PHL for preferred concept.

Table 2–6
Steps of the technology maturation and risk reduction phase[1]

Step[2]	System safety should—
A	Update identification of ESOH constraints. Develop ESOH criteria (such as air emissions, noise, hazardous materials, effluents, and discharges). Identify ESOH-critical technology needs.
B	Update ESOH criteria. Include ESOH-critical specifications in the verification plan. Identify ESOH requirements in any system or subsystem performance specification, solicitation, contract, and evaluation criteria.
C	Update system ESOH criteria. Develop requirements for verification of risk mitigation controls.
D	Update system ESOH criteria. Develop requirements for verification of component risk mitigation controls.
E	Update PHL. Update ESOH constraints.

Table 2–6
Steps of the technology maturation and risk reduction phase[1]—Continued

	Identify potential operational and maintenance ESOH training and staffing requirements. Refine ESOH input for system attrition rates. Identify ESOH hazard mitigation, IMs, mishap reduction, and safety technology requirements.
F	Evaluate enabling or critical technologies from an ESOH perspective. Review demo results for new technology component ESOH hazards.
G	Evaluate enabling or critical technologies from an ESOH perspective. Review demo results for new ESOH hazards.
H	Evaluate enabling or critical technologies from an ESOH perspective. Review demo results for new ESOH hazards.
I	Evaluate enabling or critical technologies from an ESOH perspective.
J	Develop life cycle ESOH footprint and system boundaries. Develop more detailed ESOH criteria (for example, air emissions, noise, hazardous materials, effluents, and discharges). Identify and develop ESOH-critical requirements, and verify they are included in the requirements tracking system. Provide ESOH activities for inclusion in the integrated master schedule.
K	Initiate development of PHA and threat hazard analysis. Update ESOH criteria. Verify ESOH-critical functional specifications are included in the requirements tracking system and system verification plan. Verify NEPA and EO 12114 requirements are met at proposed testing and training locations. Identify ESOH requirements in any system or subsystem solicitation or contract.
L	Finalize PHA. Update ESOH criteria for component, subsystem, and system to include test requirements. Expand and update SRA to include functional specifications as detailed design specifications evolve. Verify that ESOH-critical design specifications are included in the requirements tracking system, detailed design specifications, and configuration item verification plan.
System requirements review	Prepare and present ESOH performance criteria at system requirements review.
System functional review	Present ESOH-critical requirements and risk status at system functional review.
Preliminary design review (PDR)	Present PHA and identify ESOH hazards and risk status at PDR; ensure ESOH requirements are in product specifications and the integrated master schedule.
Trades	Participate in trade studies to evaluate options against identified ESOH criteria throughout this phase.

Notes.

[1] Assess ESOH efforts using the system safety ESOH management evaluation criteria for DoD acquisition.

[2] The letters in this column correspond with the letters from figure 2–6 and are associated with the v-chart step boxes.

Table 2–7
Outputs of the technology maturation and risk reduction phase

Outputs	System safety should—
System allocated baseline	Include ESOH criteria and requirements, SRA data, and applicable specifications. Require concurrence and approvals from the applicable safety boards.
PDR and test reports	Provide ESOH inputs (such as ESOH risks status, new hazards identified, and effectiveness of mitigation measures).
TEMP	Document safety releases and specific ESOH test requirements, to include verification of risk mitigation measures and risk acceptance. Include ESOH planning strategy and requirements to support T&E, to include NEPA and EO 12114 compliance.
SEP	Update strategy for integrating ESOH risk management into SE. Identify applicable safety boards and process for concurrence and approval.
PESHE	Identify ESOH responsibilities. Develop strategy for integrating ESOH considerations into SE. Identify preliminary ESOH risks and status. Describe method for tracking hazards. Develop NEPA and EO 12114 compliance schedule. Identify applicable safety boards and processes for concurrence and approval. Ensure ESOH effort is resourced.
Program protection plan	Provide ESOH inputs, as requested.
Technology readiness assessment	Update ESOH risk mitigation technology readiness levels (for example, IM technology).
NEPA compliance schedule	Include all actions that may trigger NEPA and EO 12114 and assess applicability and compliance.
Risk assessment	Document and report risk status and risk acceptance decisions. Document concurrence and approval of applicable safety boards.
Validated system support and maintenance objectives and requirements	Provide preliminary ESOH input.
System safety analyses	Ensure completion of SRA and update PHL for the approved materiel solution. Initiate or update safety requirements and analysis. Participate in design reviews. Update HTS. Identify all residual risks and prepare the required SSRAs.
Inputs to integrated baseline review, information support plan, system threat assessment, CDD, AS, affordability assessment, and cost and manpower estimates	Provide ESOH hazard mitigation, IM, mishap reduction, and safety technology requirements. Incorporate NEPA and EO 12114 compliance schedule and summary of the PESHE in the SEP.

Table 2–7
Outputs of the technology maturation and risk reduction phase—Continued

	Identify ESOH requirements, constraints, and attributes for the system.
SSMP	Initiate or update plan.
Developmental tests (DTs)	Provide ATEC required ESOH information.
Surface danger zone (SDZ)	Conduct modeling and simulation. Develop initial SDZ.
Explosive hazard classification	Prepare interim hazard classification. Final hazard classification. Conduct subsystem tests.
HFE analyses	Provide applicable safety input.
Radiation authorizations and licenses	Coordinate with the commodity command radiation safety officer and Nuclear Regulatory Commission (NRC).
Health hazard assessment (HHA)	Coordinate with U.S. Army Public Health Center (USAPHC).
Air worthiness statement	Obtain an air worthiness release in accordance with AR 70–62.
Army Fuze Safety Review Board approval	Ensure Army Fuze Safety Review Board review, when required, in accordance with MIL–STD– 1316F.
Army Ignition System Safety Review Board approval	Ensure Ignition System Safety Review Board review, when required, in accordance with MIL–STD–1901A.
Safety release or confirmation	Obtain a safety release or safety confirmation from ATEC in accordance with AR 70–1.
Explosive ordnance disposal (EOD) supportability statement	Obtain an EOD supportability statement, when required in accordance with AR 75–15.
Energetic Material Qualification Board certification	Obtain certification when required in accordance with North Atlantic Treaty Organization Standardization Agreement (NATO STANAG) 4170.
TMs	Ensure the system safety review of TMs prior to the materiel release of a system in accordance with AR 770–2 and AR 770–3.
Software safety statement	Prepare a software safety statement prior to the release of software upgrade or updates in accordance with AR 770–2 and AR 770–3.
Equipment safety inspections and analyses	Conduct safety inspections to identify compliance to specification and potential hazards.
Lessons learned	Collect lessons learned to be used in follow-on procurements and other system developments.

2–16. Engineering and manufacturing development

a. The purpose of the engineering and manufacturing development phase is to develop a system or an increment of capability; complete full system integration (technology risk reduction occurs during technology maturation and risk reduction); develop an affordable and executable manufacturing process; ensure operational supportability with particular attention to minimizing the logistics footprint; implement HSI; design for production and affordability; protect critical program information by implementing appropriate techniques, such as anti-tamper; and demonstrate system integration, interoperability, safety, and utility. The majority of system safety activities occur in this phase, relying heavily on the planning and analysis conducted in materiel solution analysis and technology maturation and risk reduction.

b. The integration of system safety efforts into the SE process continues in the engineering and manufacturing development phase as depicted in figure 2–7. Table 2–8 lists the inputs of the engineering and manufacturing development phase, table 2–9 lists the steps of the engineering and manufacturing development phase, and table 2–9 lists the outputs of the engineering and manufacturing development phase.

c. It is important that system safety engineering personnel are active participants in both trade studies and technical reviews conducted during this phase, such as the PDR where the final PHA is presented, and at the critical design review (CDR) when the following documents are discussed:

(1) The subsystem hazard analysis and system hazard analysis.

(2) The operating and support hazard analysis (O&SHA).

d. After the CDR, continue to update these analyses along with the execution of safety verification activities. The analyses will influence engineering plans, requirements, and specifications; trade studies; T&E; technical reviews; and production and operational planning.

e. Update the PESHE to support the Milestone C and full-rate production review processes.

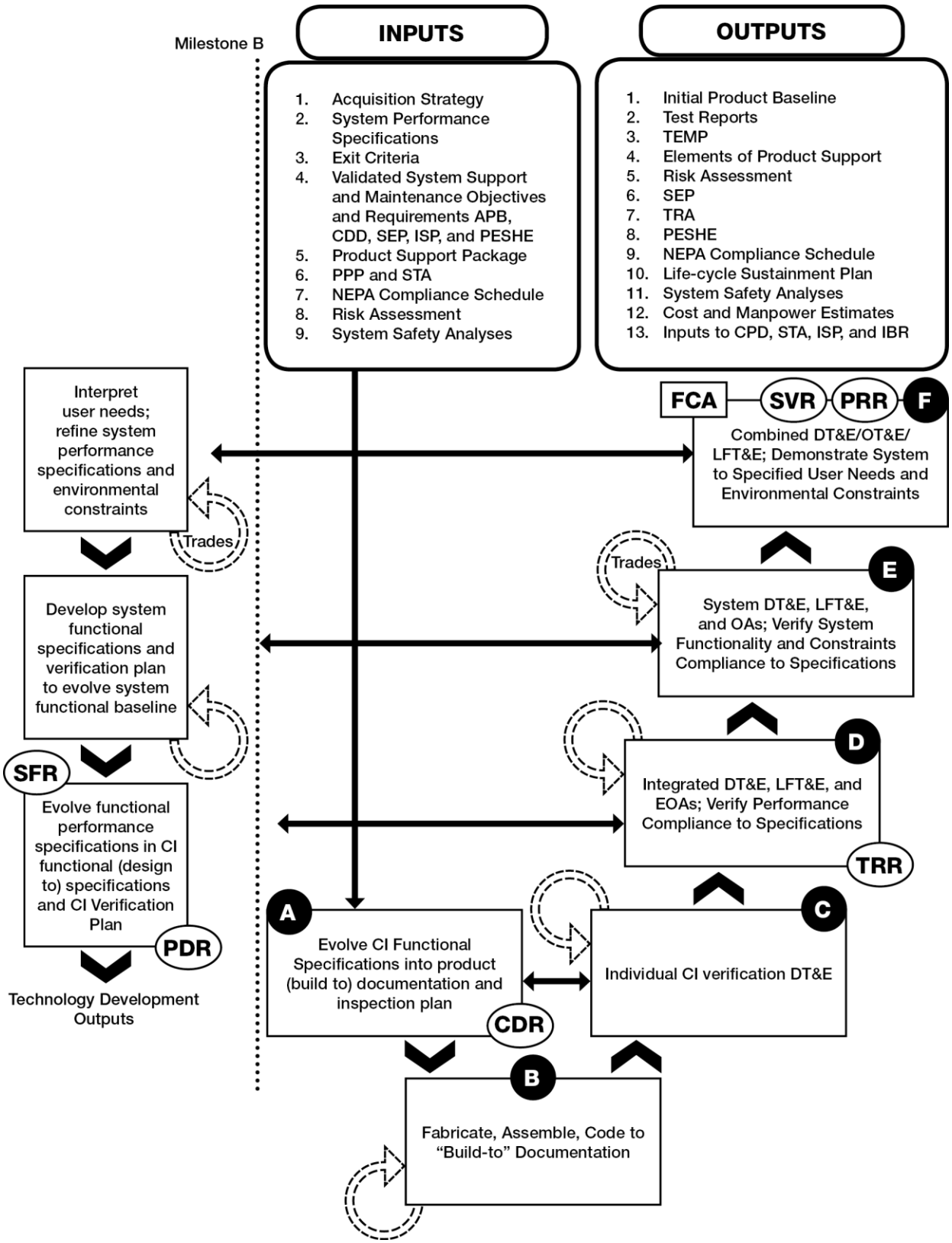


Figure 2–7. Engineering and manufacturing development v-chart

Notes:

APB – Acquisition Program Baseline
CDD – Capabilities Development Document
CDR – Critical Design Review
CI – Configuration Intent
CPD – Capability Production Document
DT&E –Developmental Testing and Evaluation
EOA – Early Operational Assessment
FCA – Functional Configuration Audit
IBR – Initial Baseline Review
ISP – Information Support Plan
LFT&E – Live Fire Test and Evaluation
NEPA – National Environmental Policy Act
PPP – Program Protection Plan
OA – Operational Architecture
OT&E – Operational Test and Evaluation
PDR – Preliminary Design Review
PESHE – Programmatic Environmental, Safety and Occupational Health Evaluation
PRR – Product Readiness Review
SEP – Systems Engineering Plan
SFR – System Functional Review
SVR – System Verification Review
STA – Systems Threat Assessment
TEMP – Test and Evaluation Master Plan
TRA – Technology Readiness Assessment
TRR – Technology Readiness Review

Figure 2–7. Engineering and manufacturing development v-chart–continued

Table 2–8
Steps of the engineering and manufacturing development phase[1]

Step[2]	System safety should—
A	Prepare subsystem hazard analysis, system hazard analysis, O&SHA, and update the SRA. Update ESOH criteria for component, subsystem, and system, to include test and inspection requirements. Identify ESOH input for demilitarization and disposal planning. Identify ESOH critical process for product build-to-documentation (such as safety-critical items list). Include system ESOH-critical processes and components in inspection plan (for example, component screening and testing). Participate in component design selections. Initial presentations to system safety boards, as appropriate. Verify system ESOH-critical design specifications are included in the requirements tracking system and detailed in design specifications.
B	Evaluate, process, and design changes, as necessary. Review and recommend ESOH updates to the TEMP. Ensure configuration item verification developmental T&E procedures include ESOH requirements and verification testing. Initiate safety releases based on the SAR and ESOH risk acceptance documentation, as appropriate, for user tests.
C	Ensure that ESOH tests were conducted and results were reviewed for effectiveness of mitigation measures. Update hazard status. Verify that integrated developmental T&E, live fire T&E, and early operational assessment procedures include appropriate tests derived from system safety analyses and environmental reviews. Recommend ESOH hazard closure based on test results. Obtain safety releases based on the SAR, HHA, and ESOH risk acceptance documentation, as appropriate, for user tests.

Table 2–8
Steps of the engineering and manufacturing development phase[1]—Continued

	Ensure NEPA and EO 12114 compliance is completed prior to testing.
D	Ensure that tests were conducted and results were reviewed for effectiveness of hazard mitigation measures. Update hazard status, hazard analyses, and threat hazard analysis, based on configuration changes. Assess configuration changes for test and document results. Continue to provide ESOH input for demilitarization or disposal planning. Verify system developmental T&E, live fire T&E, and early operational assessment procedures include appropriate tests derived from system safety analyses and environmental reviews. Recommend ESOH hazard closure based on test results. Obtain safety releases based on the SAR and ESOH risk acceptance for upcoming test activities, as appropriate.
E	Ensure that ESOH tests were conducted and results were reviewed for effectiveness of mitigation measures. Update ESOH hazard status and analyses based on configuration changes. Assess configuration changes for testing and document results. Verify combined developmental T&E, operational assessment, and live fire T&E procedures include appropriate tests derived from system safety analyses and environmental reviews. Recommend ESOH hazard closure based on test results, as appropriate. Obtain safety release based on the SAR and ESOH risk acceptance for upcoming test activities, as appropriate. Ensure NEPA and EO 12114 compliance is completed prior to testing.
F	Ensure that tests were conducted and results were reviewed for ESOH considerations, newly identified ESOH hazards, and effectiveness of risk mitigation measures; recommend hazard closure, as appropriate. Update ESOH hazard status and hazard analyses based on configuration changes. Ensure NEPA and EO 12114 compliance is completed prior to testing. Continue to identify and provide ESOH input for demilitarization and disposal planning.
Test readiness review	Assess configuration for testing; document and present results; ensure all safety releases and ESOH risk acceptances are completed; report ESOH risks and their status; and ensure NEPA and EO 12114 compliance.
Production readiness review	Present ESOH-critical requirements, ESOH risks, and their acceptance status.
System verification review	Present ESOH risk to the user.
Functional configuration audit	Review the functional configuration audit for consistency with ESOH requirements.

Table 2–8
Steps of the engineering and manufacturing development phase[1]—Continued

CDR	Present ESOH hazards and risks and their acceptance status; ensure ESOH requirements are in product specifications and the integrated master schedule.
Trades	Ensure ESOH professional participation in the trade studies to evaluate options against established criteria throughout this phase.

Notes.

[1] Assess ESOH efforts using the system safety ESOH management evaluation criteria for DoD acquisition.

[2] The letters in this column correspond with the letters in figure 2–7 and are associated with the v-chart step boxes.

Table 2–9
Outputs of the engineering and manufacturing development phase

Outputs	**System safety should—**
Initial product baseline (integrated baseline review)	Ensure that ESOH-critical items and processes are included in the baseline. Identify inspection requirements.
Test reports	Verify that mitigation measures reduce ESOH hazard risk effectively. Analyze anomalies, incidents, and mishaps.
TEMP	Update specific test and safety release requirements based on the SAR and include requirements for verification of risk mitigation measures. Validate the NEPA and EO 12114 compliance schedule.
Elements and product support	Provide the results of the preliminary O&SHA.
Risk assessment	Document and report risk status and risk acceptance decisions. Document concurrence and approval of applicable safety boards.
SEP	Update the strategy for integrating ESOH risk management into SE.
Technology readiness assessment	Update the ESOH risk mitigation technology readiness levels.
PESHE	Update the PESHE to identify ESOH responsibilities; the strategy for integrating ESOH considerations into SE; identify ESOH risk and status; describe method for tracking hazards; identify hazardous materials and wastes and pollutants used on the system and plans for their minimization or safe disposal; and NEPA and EO 12114 compliance schedule.
NEPA compliance schedule	Update to ensure NEPA and EO 12114 requirements are met at proposed testing, training, and basing locations.
Life cycle sustainment plan	Provide results of O&SHA and other relevant ESOH data.
System safety analyses	Ensure completion of PHA and SRA. Finalize the subsystem hazard analysis, system hazard analysis, and threat hazard analysis. Finalize the preliminary O&SHA. Identify ESOH requirements, constraints, footprint, and performance attributes.

Table 2–9
Outputs of the engineering and manufacturing development phase—Continued

Cost and manpower estimate	Recommend operational and maintenance ESOH training and staffing requirements. Update system attrition rate inputs due to mishaps and ESOH hazard mitigation, IM, safety technology requirements, and mishap reduction requirements.
Inputs to capability production document, system threat assessment, in-service review, and integrated baseline review	Provide ESOH hazard mitigation IM, mishap reduction, and safety technology requirements. Identify ESOH requirements, constraints, and attributes for the system.
System safety analysis	Initiate or update safety requirements and analysis. Participate in design reviews. Update HTS. Identify all residual risks and prepare the required SSRAs.
SSMP	Initiate or update plan.
DTs	Provide ATEC-required ESOH information.
SDZ	Conduct modeling and simulation. Develop initial SDZ.
Explosive hazard classification	Prepare interim hazard classifications. Final hazard classification. Conduct subsystem tests.
HFE analyses	Provide applicable safety input.
Ionizing radiation authorizations and licenses	Coordinate with the commodity command radiation safety officer and NRC.
Radio frequency (RF) radiation study: - hazards of electromagnetic radiation to ordnance (HERO) - hazards of electromagnetic radiation (EMR) to fuel - hazards of EMR to personnel	Coordinate with ATEC and USAPHC for needed data to support analysis.
Laser/optical radiation study	Coordinate with ATEC and USAPHC for needed data to support analysis.
HHA	Coordinate with USAPHC.
Air worthiness release	Obtain an air worthiness release in accordance with AR 70–62.
Army Fuze Safety Review Board approval	Ensure Army Fuze Safety Review Board review, when required, in accordance with MIL–STD–1316F.
Army Ignition System Safety Review Board approval	Ensure Ignition System Safety Review Board review, when required, in accordance with MIL–STD–1901A.
Safety release or confirmation	Obtain a safety release or safety confirmation from ATEC in accordance with AR 70–1.
EOD supportability statement	Obtain an EOD supportability statement, when required, in accordance with AR 75–15.
Energetic Material Qualification Board certification	Obtain certification, when required, in accordance with NATO STANAG 4170.
TMs	Ensure the system safety review of TMs prior to the materiel release of a system in accordance with AR 770–2 and AR 770–3.

2–17. Production and deployment phase

a. The purpose of the production and deployment phase is to achieve an operational capability that satisfies mission needs. Operational T&E will determine the effectiveness and suitability of the system. In this phase, system safety is focused on—

(1) Analyzing deficiencies.

(2) Participating on the configuration control board.

(3) Verifying and validating safety-critical item production configuration.

(4) Reviewing the physical configuration audit to identify potential safety impacts.

b. Continue to identify, assess, mitigate, and track hazards to closure in the HTS.

c. Figure 2–8 depicts the integration of system safety efforts into the SE processes during the production and deployment phase. Table 2–10 lists the inputs of the production and deployment phase, table 2–11 lists the steps of the production and deployment phase, and table 2–12 lists the outputs of the production and deployment phase.

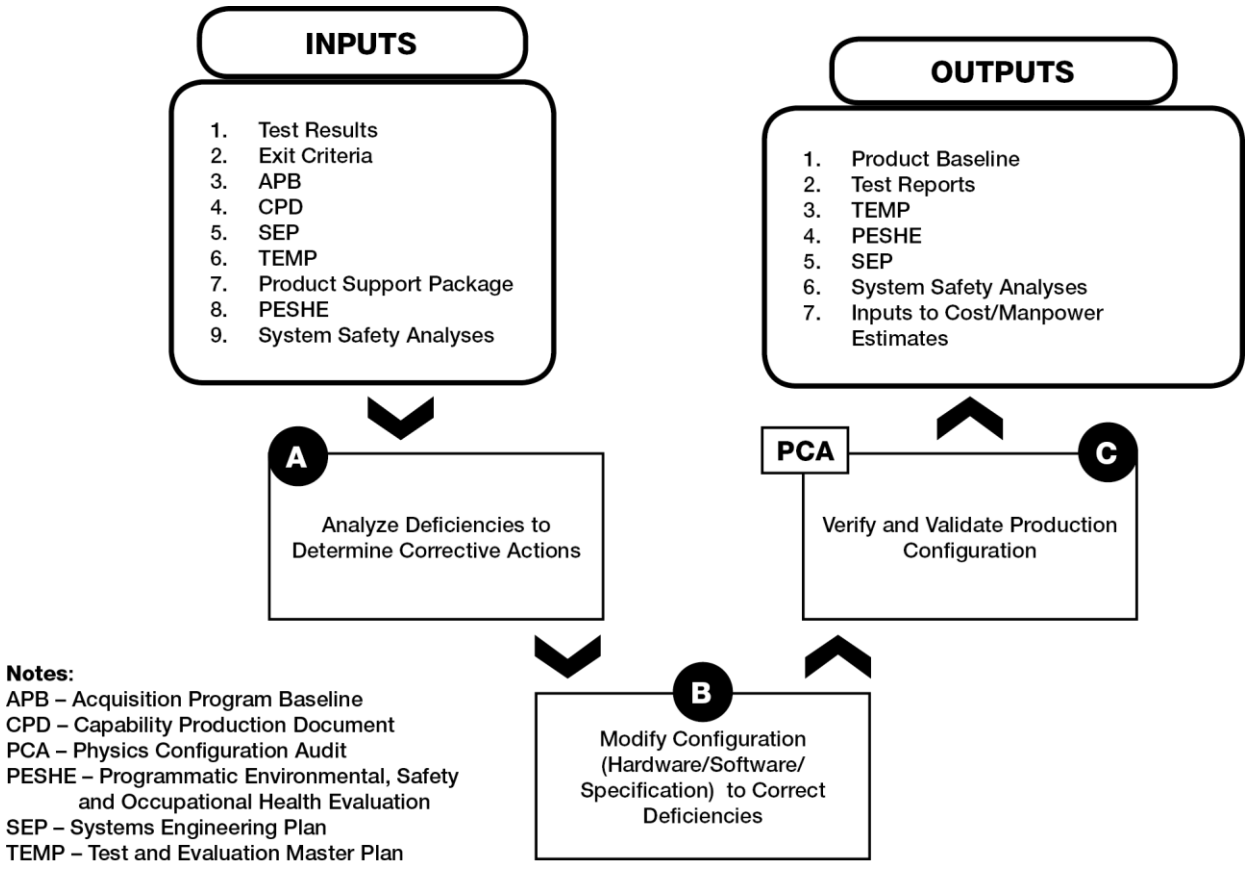


Figure 2–8. Production and deployment v-chart

Table 2–10
Inputs of the production and deployment phase

Inputs	System safety should—
Test results	Review initial operational T&E results for effectiveness of risk mitigation controls. Analyze anomalies, incidents, and mishaps.
Exit criteria	Document formal risk disposition of identified hazards, such as SAR.

Table 2–10
Inputs of the production and deployment phase—Continued

	Obtain concurrence and approval of appropriate safety boards as required (such as Army Fuze Safety Review Board and so forth). Update PESHE. Provide updated inputs for demilitarization and disposal plan.
Acquisition program baseline	Provide inputs as requested for ESOH. PM should be made aware of ESOH issues that could significantly affect acquisition program baseline for cost, schedule, or performance. Provide the PM ESOH assistance, if required, in making tradeoff decisions.
Capability production document	Update hazard mitigation requirements as necessary. Update IM requirements as necessary. Identify mishap reduction requirements as necessary.
SEP	Update strategy for integrating ESOH risk management into SE. Identify applicable safety boards and process for concurrence and approval.
TEMP	Update specific test requirements (such as MIL–STD–2105E, MIL–STD–1316F, MIL–STD–331D, MIL–STD–1901A, Institute of Electrical and Electronics Engineers (IEEE)/International Organization for Standardization (ISO)/Institute of Electrical and Electronics Engineers Computer Society (IEC) 12207, and Section 95, Part 1910, Title 29, Code of Federal Regulations (29 CFR 1910.95)). Update requirements for verification of risk mitigation controls (based upon system safety analysis). Update safety release requirements and documents (for example, SAR, most recently published HHA, and so forth).
Product support package	Include O&SHA results.

Table 2–11
Steps of the production and deployment phase[1]

Step[2]	**System safety should—**
A	Review deficiency reports for system safety implications. Participate in development of corrective actions. Participate in configuration control board, to include reviewing of engineering change proposals.
B	Identify system safety-critical items and inspection requirements. Review and recommend updates to TEMP and test plan based upon system safety analyses. Provide safety release documentation as appropriate.
C	Verify and validate system safety-critical item configuration. Participate in test activities as appropriate.
Operational test readiness review	Update SAR to support the PM's requirement to provide a safety release.
Physical configuration audit	Review physical configuration audit to identify potential system safety implications.

Table 2–11
Steps of the production and deployment phase[1]—Continued

Notes.

[1] Assess ESOH efforts using the system safety ESOH management evaluation criteria for DoD acquisitions.

[2] The letters in this column correspond with the letters in figure 2–8 and are associated with the v-chart step boxes.

Table 2–12
Outputs of the production and deployment phase

Outputs	System safety should—
Production baseline	Identify system safety-critical items and processes. Specify inspection requirements. Document concurrence and approvals of applicable safety boards.
Test reports	Document effectiveness of risk management controls. Document findings from anomalies, incident, and mishaps.
TEMP	Update specific test requirements (such as MIL–STD–2105E, MIL–STD–1316F, MIL–STD–331D, MIL–STD–1901A, IEEE/ISO/IEC 12207, or 29 CFR 1910.95). Update requirements for verification of risk mitigation controls (based upon system safety analysis). Update and obtain safety release for test requirements and documents (for example, SAR, most recently published HHA, NEPA, and so forth).
PESHE	Update hazard status. Update hazard analysis. Identify applicable safety boards and process concurrence and approval.
NEPA and EO 12114 compliance document	Update the NEPA and EO 12114 document (for example, categorical exclusion, environmental assessment, finding of no significant impact, environmental impact statement, record of decision, overseas environmental assessment, and overseas environmental impact statement), which the proponent should complete prior to the proposed action start date.
SEP	Update strategy for integrating ESOH risk management into SE. Identify applicable safety boards and process concurrence and approval.
System safety analysis	Update safety requirements and analysis. Participate in design reviews. Update HTS. Identify all residual risks and prepare the required SSRAs.
Input to cost and manpower estimate	Recommend training and staffing requirements. Update system attrition rate input due to mishaps.
SSMP	Update plan.
Operational tests	Provide ATEC-required ESOH information so that they can prepare safety release for test.

Table 2–12
Outputs of the production and deployment phase—Continued

Materiel release	Document the system safety assessment in a SHDS (in accordance with AR 770–2 and AR 770–3) to support of materiel release.
Type classification	Document the system safety assessment in a SHDS (in accordance with AR 770–2 and AR 770–3) to support type classification.
Safety confirmation	Provide ATEC-required ESOH information so that they can prepare a safety confirmation that supports materiel release, type classification, and milestone decisions.
Materiel fielding plan	Provide applicable safety input.
Lessons learned	Collect lessons learned to be used in follow-on procurements and other system developments.

2–18. Operations and support

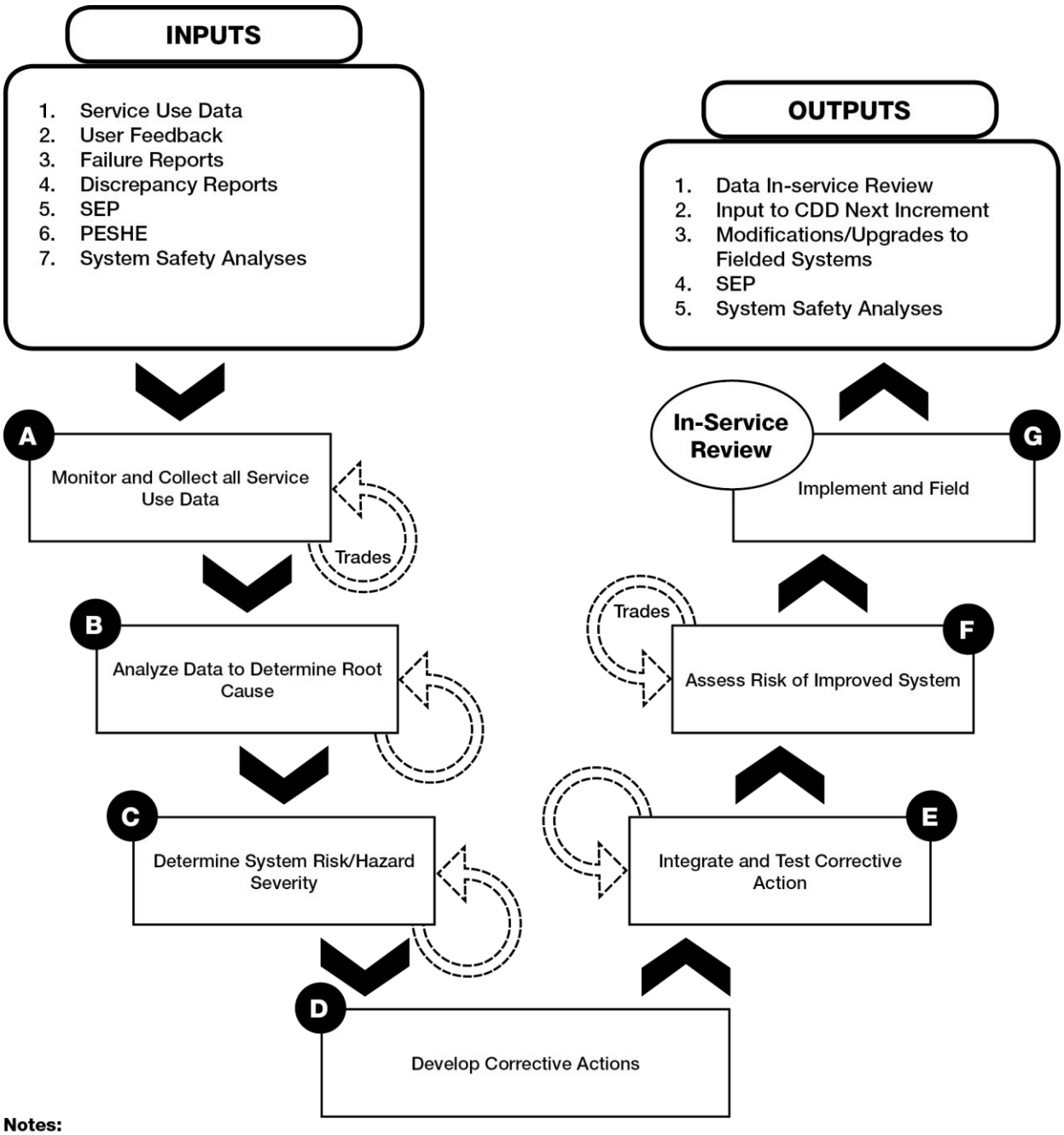
a. The purpose of the operations and support phase is to execute a support program that meets materiel readiness and operational support performance requirements and sustains the system in the most cost-effective manner over its total life cycle. During this phase, system safety is focused on—

(1) Analyzing deficiencies, system health, and mishaps.

(2) Participating on the configuration control board.

b. Continue to identify, assess, mitigate, and track hazards to closure in the HTS.

c. Figure 2–9 depicts the integration of system safety efforts into the SE processes during the operations and support phase. Table 2–13 lists the inputs of the operations and support phase, table 2–14 lists the steps of the operations and support phase, and table 2–15 lists the outputs of the operations and support phase.



Notes:
CDD – Capabilities Development Document
PESHE – Programmatic Environmental, Safety and Occupational Health Evaluation
SEP – Systems Engineering Plan

Figure 2–9. Operations and support v-chart

Table 2–13
Inputs of the operations and support phase

Inputs	System safety should—
Service use data	Review for system safety implications.

Table 2–13
Inputs of the operations and support phase—Continued

User feedback	Review for system safety implications.
Failure reports	Review follow-on operational T&E results for system safety implications. Review failure and mishap reports for causal factors or mitigation failures and recommend alternative mitigation measures. Assist in mishap investigations, as requested.
Discrepancy reports	Review discrepancy reports for system safety implications.
SEP	Update strategy for integrating ESOH risk management into SE. Identify applicable safety boards and process for concurrence and approval.
SSMP	Update plan.

Table 2–14
Steps of the operations and support phase[1]

Step[2]	System safety should—
A	Provide system safety review criteria to engineering and logistics staff. Review data for system safety implications (for example, trend analysis). Identify opportunities for technology insertion to reduce risk (for example, new technologies or obsolescence).
B	Apply appropriate system safety analysis techniques to determine root cause (for example, failure modes, effects, and criticality analysis (FMECA); fault tree analysis). Evaluate data for system safety implications. Update hazard analyses and database as appropriate.
C	Prioritize hazards for risk mitigation. Update hazard analyses and database as appropriate.
D	Apply system safety order of precedence to corrective actions. Update hazard analyses and database as appropriate. Identify requirements for verification of risk mitigation controls (based upon updated system safety analyses).
E	Evaluate test results for risk mitigation effectiveness. Update hazard analyses and database as appropriate.
F	Update hazard analyses and database as appropriate. Recommend hazard closure to appropriate risk acceptance authorities (updated residual risk).
G	Continue to track system health, mishaps, hazards, closure actions, mitigation measure effectiveness, and residual risk.
In-service review	Provide inputs to the in-service review on mishaps. Provide inputs to the in-service review on any newly identified hazards with assessment of risks, selected mitigation measures, verification of mitigation controls, and acceptance of residual risks.

Table 2–14
Steps of the operations and support phase[1]—Continued

Trades	Participate in the trade studies to evaluate options against established system safety criteria.

Notes.

[1] Assess ESOH efforts using the system safety ESOH management evaluation criteria for DoD acquisition.

[2] The letters in this column correspond with the letters in figure 2–9 and are associated with the v-chart step boxes.

Table 2–15
Outputs of the operations and support phase

Outputs	System safety should—
Input to CDD for next increment	Update hazard mitigation requirements as necessary. Update IM requirements as necessary. Update mishap reduction requirements as necessary.
Modifications or upgrades to fielded systems	Recommend an appropriate funding level for system safety. Present updated residual risk to user (such as safety assessment). Update HTS as required. Provide updated inputs for demilitarization or disposal plan. Provide the required SHDS (see app J) to support modification work orders or follow-on release actions.
SEP	Update strategy for integrating ESOH risk management into SE. Identify applicable safety boards and process for concurrence or approval. Update SSMP.
Safety messages	Provide support in the preparation and coordination of safety messages in accordance with AR 750–6.
Field assistance	Provide ESOH field support.
Lessons learned	Collect lessons learned to be used in system modifications, follow-on procurements, and other system developments.
Configuration management safety	Review all configuration changes, deviations, waivers for safety impact.

Chapter 3
Integration of System Safety Associated Disciplines

3–1. General

a. Associated disciplines are integrated into the system safety program by the PM through the SSWG. This integration is extremely beneficial to the safety effort, since hazards are identified through the efforts of an associated discipline. In many cases the boundaries that distinguish between the disciplines are unclear. In fact, difficulties have arisen in previous acquisitions due to isolation of the various disciplines. For example, the assumption by one group that another group will identify a hazard leads to an unresolved hazard.

Note. Regardless of who identifies a hazard, it is the responsibility of the SSWG to track the hazard to or through resolution.

b. The areas discussed in this section are considered an associated discipline, and their representatives must be participants in the system safety program. The SSWG must consider their outputs and actions as the source for identification of hazards.

3–2. Systems engineering

a. System safety is a subset of SE. Rigorous SE discipline is necessary across the acquisition life cycle to ensure that the Army meets the challenge of developing and maintaining needed warfighting capability. SE provides the integrating technical processes to define and balance system performance, cost, schedule, and risk within a family of systems and system of systems (SOS) context. Embed SE into program planning and design it to support the entire acquisition life cycle.

b. An SEP is prepared and updated for each milestone review, beginning with Milestone A. At Milestone A, the SEP supports the technology maturation and risk reduction strategy. At Milestone B or later, the SEP supports the AS. The SEP describes the program's overall technical approach, including key technical risks, processes, resources, metrics, and applicable performance incentives. It details the timing, conduct, and success criteria of technical reviews.

c. The SEP describes how system safety engineering efforts are integrated across disciplines and into SE to determine system design characteristics that can minimize the risks of acute or chronic illness, disability, death, or injury to operators and maintainers; and enhance job performance and productivity of the personnel who operate, maintain, or support the system.

d. Integrate ESOH risk management into the overall SE process for all developmental and sustaining engineering activities. As part of risk reduction, eliminate ESOH hazards where possible and manage ESOH risks where hazards cannot be eliminated. Use methodology detailed in MIL–STD–882E as a guide to this process. Report the status of ESOH risks and acceptance decisions at technical reviews. Acquisition program reviews and fielding decisions will address the status of all high and serious risks and applicable ESOH technology requirements. Prior to exposing people, equipment, or the environment to known system-related ESOH hazards, the associated risks must be accepted by the appropriate acceptance authority (see chap 2). The user representative is part of this process throughout the life cycle and will provide formal concurrence prior to all serious and high-risk acceptance decisions.

e. Programs, regardless of acquisition category (ACAT) level, will develop a PESHE which incorporates the MIL–STD–882E process and includes the following: identification of ESOH responsibilities; the strategy for integrating ESOH considerations into the SE process; identification of ESOH risks and their status; a description of the method for tracking hazards throughout the life cycle of the system; identification of hazardous materials, wastes, and pollutants (discharges, emissions, and noise) associated with the system and plans for their minimization or safe disposal; and a compliance schedule covering all system-related activities for NEPA and EO 12114. The SEP incorporates a summary of the PESHE, including the NEPA and EO 12114 compliance schedule.

f. Programs will support system-related Class A and B mishap investigations per AR 385–10 by providing analyses of hazards that contributed to the mishap and recommendations for materiel risk mitigation measures, especially those that minimize human errors. If specific hazard related mishaps are occurring at greater than the previously assessed severity and probability, the risk assessment must be reassessed and managed at the appropriate level of authority.

3–3. Reliability, availability, and maintainability

a. A reliability, availability, and maintainability program is required for most systems, per DoDD 5000.01.

b. Reliability is the probability that an item will perform its intended function for the duration of a mission or a specific time interval. It is usually stated as a mean time (or distance, rounds, and so forth) between failures. The requirement for a reliability program plan (see GEIA–STD–0009) is normally incorporated in the request for proposal (RFP). Make provisions for the SSWG to examine reliability test reports (for example, Data Item Description Systems Engineering Standards and Specifications (DI–SESS) 81628B) and failed item reports (for example, DI–SESS–80255). Environmental factors, failure rates, failure modes, mean time between failures, and problems associated with major items of system equipment are usually contained in these reports.

c. Availability is the percentage of time an item is in a mission-committable status expressed as inherent, achieved, or operational availability. An FMECA report (DI–SESS–81495) will normally be required as a part of the reliability program. The contractor's integration of the results of the FMECA into their

system safety program will be established as criteria for the system safety engineering plan (SSEP) evaluation during source selection in those cases where the FMECA is required.

d. Maintainability is a measure of the ease with which an item is maintained and repaired. It is usually stated as a mean time to repair. A maintainability program will normally be required per MIL–HDBK–470A. Establish interface between the maintenance program and the system safety program to obtain maintenance-related information for the O&SHA and capture the information in the reliability and maintainability program plan (DI–SESS–81613A).

3–4. Quality engineering

As part of the quality program, the critical items safety program produces data that affects the system safety effort.

a. The objective of the program is to establish policies and responsibilities for the identification and control of critical items throughout the life of the system. Achieve this objective through identification of critical items, development of life cycle control policies, and implementation. Accomplishment of the objective requires that critical items are identified and tracked from design through purchasing, manufacturing, transportation, and maintenance to the user.

b. One key tool in the overall critical items program is the service life surveillance program. Its objective is to assure that design requirements are valid and retained during storage and use. The primary function of the service life surveillance program is to—

(1) Monitor existing product quality.
(2) Detect any safety or other unsatisfactory conditions and trends.
(3) Investigate failures.
(4) Identify improvements.
(5) Encourage disposition of unsatisfactory items.

c. The PM will ensure that the SSWG monitors the critical items and service life surveillance programs. Also, the PM must ensure contractor integration of those programs into the contractor's system safety program by requiring a quality program plan (see Data Item Description Quality Control/Assurance and Inspection (DI–QCIC) 81722) in the RFP and establishing it as evaluation criteria for the SSEP and for the quality program plan during source selection.

3–5. Integrated logistics support

As one of its primary tools, integrated logistics support employs a management science application termed LSA.

a. An LSA is required for all acquisition programs by AR 700–127 and is established per MIL–HDBK–502A. The logistic support analysis record (LSAR) (see SAE–GEIA–STD–0007) is a manual or automated database used to document, consolidate, and integrate the detailed engineering and logistics data generated by the LSA process.

(1) All operator and maintenance tasks are documented on LSAR Data Records C and D (also known as "input data sheets").

(2) Prepare operator and maintenance TMs using LSAR Data Records C and D and related LSAR output report summaries (for example, maintenance allocation charts, repair parts, and special tools lists).

(3) The PM must ensure current facility-related safety and health information are identified and documented in the support facility annex of the integrated logistics support plans.

b. Government LSA review team representatives in the research and development effort will meet on a regular, contractually-established schedule to review the status and content of the LSA and LSAR with the contractor. Identify maintenance tasks before conducting a good maintenance hazard evaluation. Consequently, final safety assessments are not required before completion and Government acceptance of the LSAR Data Records C and D and final drafts of operator and maintenance TMs.

c. Establish evaluation criteria for the SSEP during source selection using the contractor's integration of the results of the LSA and LSAR program into the system safety program.

3–6. Combat survivability

Normally, survivability is a general term used to describe a system's ability to avoid or withstand man-made damage-causing mechanisms. The "avoid" part of the definition is termed "susceptibility," and the "withstand" portion is termed "vulnerability." Areas of mutual interest between system safety and combat survivability are discussed below.

a. Within the area of vulnerability, the disciplines share a desire to eliminate single-point failures and incorporate crashworthiness or other specified safety features.

b. Survivability design features affect both crashworthiness and emergency egress. However, the term survivability has recently been expanded to include both Soldier and equipment, unless otherwise specified. Survivability features of a system and Soldier survivability are designed to be maintainable throughout the system or facility's life cycle. Additionally, when the system is modified, the threat changes, or there is a change in the doctrine of system deployment, a survivability review by the CAPDEV and MATDEV will be required. The CAPDEV and MATDEV consider the threat throughout the entire life cycle of each acquisition program.

c. Survivability analysis is a process that continues throughout the life cycle of the system. Integrate survivability analysis over the full spectrum of battlefield threats to ensure that synergistic threat effects are adequately addressed. Analyses of survivability against each threat, to include TOAs, are done in the context of all threats and balanced across all survivability disciplines to maintain overall mission performance. Maintain the integrated survivability analysis for use as a survivability audit trail of requirements, tradeoff decisions, and quantitative measures of effectiveness. Analysis will include consideration of training, doctrine, tactics, techniques, procedures, and materiel capabilities. Refine training, doctrine, and materiel survivability objectives as the design progresses. The SSMP and HSI management plan will identify and track the resolution of safety and Soldier survivability concerns throughout the system's life cycle.

d. Substantiate shortfalls in the satisfaction of survivability requirements by the MATDEV, in coordination with the CAPDEV (see AR 70–1), and submitted to the MDA during the milestone review process. Rationale for failure to meet requirements, as well as risk analysis and risk mitigation approaches, are included as part of the substantiation process. Shortfalls which introduce safety hazards must enter the system safety risk management process for resolution or acceptance.

e. Consider survivability at the force level, as well as at the system level. Balance and integrate survivability of support items, including mission essential resupply and sustainment assets with the survivability goals of individual systems. Consider force protection, whereby individual systems provide mutual defense by sharing survivability assets.

f. Fratricide due to the collateral effects of friendly systems is a threat. Failure to control fratricide is a safety hazard and is managed in accordance with Army safety risk management requirements specified within this pamphlet.

3–7. Human factors engineering

a. The HFE program is a domain of HSI and a life cycle activity responsible for properly integrating the human element into systems. The Deputy Chief of Staff, G–1 exercises staff responsibility for the HFE program, and U.S. Army Materiel Command (AMC) has the system integration responsibility. AR 602–2 provides policy and guidance for the HSI program and HFE assessments.

b. Making systems error tolerant is one of the most critical tasks to be accomplished to enhance force protection and mission effectiveness. Lessons learned from wartime and peacetime operations indicate that accidents caused by inadequate HSI have been as effective as the enemy in killing Soldiers and destroying equipment. By effectively incorporating HFE lessons learned into our system designs, they will be more error tolerant.

c. Human factors hazard identification and management is an integral part of HFE. Life cycle tests, analyses, and other tasks must include efforts to ensure critical human performance problems (actual or potential) are being systematically identified and managed to reduce risk. Key sources of information include accident and incident data, system hazard analyses, and other information from predecessor and current systems. These analyses will help establish the severity and probability or safety-related human performance problems for risk assessments, management, and tradeoffs.

d. Establish program interfaces between HFE and system safety engineering to assure a continuous dialogue exists throughout the system life cycle. The following actions strengthen the interface between programs:

(1) Participating jointly in HFE and SSWG meetings.

(2) Sharing of program analyses which identify safety-related human performance problems, their relative severity and probability, and mitigating actions.

(3) Requiring HFE manager recommendations on all SSRAs relating to human performance; requiring system safety engineering manager recommendations on all HFE assessments with safety implications.

(4) Requiring HFE manager estimates of the effectiveness for all designs, training, procedures, warnings, and guards used to eliminate or mitigate hazards.

(5) Ensuring program documents clearly delineate roles and responsibilities between HFE and system safety engineering for identifying, managing, and communicating safety-related human performance problems (predecessor or current system) throughout the life cycle.

(6) Ensuring HFE participation in accident investigations and prevention programs.

(7) Providing system safety engineering support to HFE by gathering safety-related information on user problems identified in accidents, incidents, tests, and other sources.

3–8. Health hazards

a. The Surgeon General is the proponent of AR 40–10, maintains staff responsibility for the regulation that implements the Army HHA program, prescribes specific HHA responsibilities for the acquisition and AMEDD communities in support of the Army acquisition process, and describes the HHA Program as an integrated effort throughout the life cycle of a system. Specifically, AR 40–10 considers mission needs, concept analysis, research, development, testing, evaluation, procurement, training, use, storage, system maintenance, and disposal. The Surgeon General also—

(1) Determines if Army materiel presents a health hazard to personnel and provides all medical policies, health standards, exposure limits, and recommendations to control such health hazards.

(2) Designates USAPHC as the lead agency for implementing the AMEDD responsibilities for the Army's HHA program.

(3) Designates the Commanding General, U.S. Army Medical Research and Development Command, as Deputy for Medical Systems to assist the Assistant Secretary of the Army for Acquisition, Logistics and Technology and the Army Acquisition Executive (AAE) with health hazards of medical and non-medical systems acquisitions.

(4) Provides AMEDD review of concept, requirement, and capability documents through the AMEDD Center and School.

(5) Staffs, plans, programs, and budgets for implementation of the AMEDD responsibilities of the Army's HHA Program.

b. The primary objective of the HHA program is to identify and assess health hazards associated with the life cycle management of the following systems and provide recommendations to MATDEVs and CAPDEVs to eliminate or control the hazards: weapons platform, munitions, equipment, clothing, training devices, and other materiel systems. The Army's effort to eliminate health hazards from materiel systems links the HHA program with Army warfighting capabilities and performance. The specific HHA program objectives include—

(1) Preserve and protect the health of individual Soldiers.

(2) Reduce degradation of Soldier performance and enhance system effectiveness.

(3) Design out health hazards to eliminate the need for health hazard-based retrofits.

(4) Reduce readiness deficiencies attributable to health hazards, thereby reducing training or operational restrictions.

(5) Reduce personnel compensation claims by eliminating or reducing injury or illness caused by health hazards associated with the use and maintenance of Army systems.

(6) Reduce environmental and occupational health hazards attributable to Army systems.

c. The health hazard categories addressed by the HHA program include—

(1) Acoustic energy (steady-state noise, impulse noise, and blast over pressure).

(2) Biological substances (pathogenic microorganisms and sanitation).

(3) Chemical substances (weapon or engine combustion products and other toxic materials).

(4) Oxygen deficiency (crew or confined spaces and high altitude).

(5) Radiation energy (ionizing and nonionizing radiation, including lasers).

(6) Shock (acceleration and deceleration).

(7) Temperature extremes and humidity (heat and cold injury).

(8) Trauma (blunt, sharp, or musculoskeletal).

(9) Vibration (whole-body and hand-arm, multiple shocks).

(10) Ultrasonic (exclusive of auditory effects).

d. The HHA is an independent health hazards assessment that addresses materiel system hazards to prevent potential physiological damage to the operator, crew, or maintainer of the system under normal operating conditions. The HHA may change as the system develops. This requires the developers to

request Army system HHAs early on in the process and whenever new data is obtained. These assessments provide complementary information for system safety functions such as hazard analysis, hazard tracking, and risk management. Likewise, system safety hazard analyses can be a primary means of identifying potential health hazards. The SSWG must be prepared to support U.S. Army Medical Command in the area of hazard identification and to develop a coordinated effort for resolution of identified hazards.

e. The PEO, PM, or MATDEV will request an HHA and ensure the SSWG is placed on distribution for related HHAs efforts.

f. The PEO, PM, or MATDEV will ensure the RFP requires contractor information to support the HHA, based on the potential health hazard issues identified in the initial HHA or Human Systems Integration Plan (HSIP).

g. Appropriate health hazard objectives will be established early in acquisition programs (that is, in capabilities documents) and used to guide the health hazard activities and the decision process. Contracts should include language that encourages contractors to design out health hazards associated with their systems.

h. An HHA program that identifies and evaluates health hazards will be integrated and coordinated with the program's system safety, HSI, environmental, and T&E activities. The HHARs provide MATDEVs and CAPDEVs with an estimate of the occupational health risk associated with normal use of materiel items. HHARs are not intended to provide an all-inclusive health hazards assessment or AMEDD approval to use an item. MATDEVs and CAPDEVs must use the risk information in the HHARs to monitor and manage health risks along with safety risks and HSI issues. Mishaps resulting in injuries, although sometimes health-related, do not fall within the scope of the HHA program. The system safety professionals supporting the MATDEV and CAPDEV assess risks associated with mishaps, accidents, or equipment failures. The AMEDD can support the system safety effort when the adverse outcome is health-related.

3–9. System safety in the human systems integration process

Improving HSI to make systems more error tolerant is one of the most critical tasks for enhancing force protection and mission effectiveness. The HSI process provides the vehicle for system safety to influence the human-system integration aspects of materiel design, development, acquisition, and usage in accordance with AR 70–1. AR 602–2 provides the policy and procedures guiding the HSI program.

a. HSI is a comprehensive management and technical effort to ensure optimum human performance and reliability in the operation, maintenance, use of weapon, equipment, and information systems. Its objective is to influence Soldier-materiel system design for optimum total system performance by considering the seven HSI domains of manpower (spaces), personnel (faces), training, HFE, system safety, health hazards, and Soldier survivability before making a functional allocation of tasks between people, hardware, and software. HSI integrates and represents seven previously listed domains at the decision reviews. United under the umbrella of HSI, the domains as a group are expected to gain more influence on the decision-making authority. System safety is not subordinate to HSI. They coexist and must be able to interface with each other.

b. One of HSI's key objectives is to ensure stronger representation for each of the domains at the decision reviews. The HSI joint working group safety representative and reviewers of the HSIP must ensure certain system safety items are included in the document (see app G).

c. The HSI program is tailored for all materiel acquisitions, ranging from major weapon systems to less costly modification and NDI acquisitions (see AR 602–2). The effort given to a system will depend on the type of system. If a system has little man-machine interface, such as an NDI acquisition of a computer printer, very little HSI involvement will be needed. When considering a system, such as a new helicopter system, a major HSI effort will be needed to ensure all interface issues are considered.

d. The HSI program does not incorporate all areas that system safety defines. Certain tasks and processes required to implement system safety must be completed within the system safety function and independent of HSI processes. These areas include, but are not limited to, the following:

(1) Budget requirements.
(2) Facilities safety.
(3) Engineering change proposals and modifications.
(4) Post-fielding safety tracking requirements.
(5) Materiel only safety hazards.

e. System safety will continue with its responsibilities for these areas as defined prior to HSI. HSI has created additional integration responsibilities for system safety. HSI requires two things of system safety—

(1) Ensure that the human is included in safety analyses and tests.

(2) Those system safety acquisition efforts are coordinated with each of the other domains.

3–10. Hazards of electromagnetic radiation to ordnance certification process

a. Scope.

(1) This paragraph establishes the requirements and process used by the Army to provide HERO certification for ordnance (also referred to in DoD as munitions or ammunition and explosives).

(2) HERO certification is the assignment of a HERO classification to an ordnance or ammunition and explosives item by a designated activity using the results of test or analysis.

(3) Obtaining HERO certification ensures HERO information is available on the subject ordnance item used in the field to ensure the maximum possible protection to people and property from the potentially damaging effects of an inadvertent actuation of ordnance containing an electrically initiated device (EID). It also ensures the reliability of the ordnance is not adversely affected by exposure to electromagnetic energy.

(4) Programs and MATDEVs responsible for the design, development, T&E, and sustainment of ordnance will use this process to obtain HERO certification.

b. Hazards of electromagnetic radiation to ordnance certification requirements.

(1) *Department of Defense requirement.* The Defense Explosives Safety Regulation (DESR) 6055.09 requires that military munitions containing EIDs (for example, exploding foil initiators, laser initiators, burn wires, fusible links, hot bridge wires, carbon bridges, and conductive compositions) be designed or protected such that EMR does not cause an inadvertent initiation, degradation, or disablement. Both direct RF induced actuation of the EID or electrical coupling to and triggering of the associated firing circuits can occur, especially in an operational (tactical) electromagnetic environment (EME).

(2) *Army requirement.* AR 385–10 requires HERO certification of all ordnance by considering all the EMEs the ordnance is expected to be exposed to during its life cycle.

(3) *Primary objective.* During acquisition, HERO evaluation and certification of military ordnance will be accomplished, both for routine employment mission profiles and for any anticipated joint or combined operational employment to include all six phases of the stockpile-to-safe separation sequence (S4) in the EME cited in MIL–STD–464D and applies during the disposal of ordnance.

(a) A primary objective of ordnance acquisition is to procure and field HERO safe ordnance.

(b) Although normally classified based on worst case susceptibility, the HERO evaluation and certification process addresses the possibility that different HERO conditions may occur for an individual ordnance item depending on the phase of S4. For example, an ordnance item may be considered HERO safe during storage, but maintenance of the item may defeat shielding, resulting in increased susceptibility to the EME, changing the item's HERO classification.

(4) *Stockpile-to-safe separation sequence.* The progressive stages (phases) that begin at the time the ordnance is manufactured and continue until it is expended or reaches a safe distance from the launch vehicle, platform, or system. This progression is referred to as the S4 and may consist of up to six of the following distinct stages in which varying degrees of susceptibility can result from unique physical configurations or operational EMEs:

(a) Transportation and storage. The phase in which the ordnance is packaged, containerized, or otherwise prepared for shipping or stored in an authorized storage facility. This includes transporting of the ordnance.

(b) Assembly and disassembly. The phase involving all operations required for ordnance buildup or breakdown and typically involves personnel.

(c) Staged. The phase during which the ordnance has been prepared for loading and are prepositioned in a designated staging area.

(d) Handling and loading. The phase during which physical contact is made between the ordnance item and personnel, metal objects, or structures during the process of preparing, checking out, performing built-in tests, programming and reprogramming, installing, or attaching the ordnance item to its end-use platform or system (for example, aircraft, launcher, launch vehicle, or personnel). These procedures may involve making or breaking electrical connections; opening and closing access panels; and removing or

installing safety pins, shorting plugs, clips, and dust covers. This configuration also includes all operations required for unloading (that is, removing, disengaging, or repackaging the ordnance item).

(e) Platform-loaded. The phase during which the ordnance item has been installed on or attached to the host platform or system (for example, aircraft, ground vehicle, and personnel and so forth) and all loading procedures have been completed.

(f) Immediate post-launch. The phase where the ordnance item has been launched from its platform or system, but up to its safe separation distance with regard to the actuation of its explosives, pyrotechnics, or propellants.

(5) *Recertification.* HERO recertification will be accomplished when ordnance are changed or redesigned, or before ordnance is employed in an EME or platform for which they were not previously HERO certified. Ordnance changes that require HERO testing and recertification include—

(a) Electrically initiated device.

1. Lowering fire stimulus response.
2. Changing the type of transducer that converts electrical input to energetic output.
3. Changing the fit or form of the EID.
4. Changes to EMR suppression components.
5. Relocating EID to within 0.667 inches (which is approximately 1/4 λ of the cutoff frequency of the energy that can enter the barrier) of wiring that enters or exits ordnance envelope.

(b) Firing circuit.

1. All non-direct current firing circuits.
2. Relocating firing circuits to within 0.667 inches (which is approximately 1/4 λ of the cutoff frequency of the energy that can enter the barrier) of wiring that carries signal or enters or exits ordnance envelope.
3. Changes to EMR suppression components.

(c) Ordnance envelop.

1. Any added aperture or antenna.
2. Changes to corrosion protection at mating seams.
3. Changes to wiring running outside the ordnance envelope.
4. Changes to EMR absorber coatings or gaskets.
5. Relocating connectors involving ordnance subassemblies that contain an EID.

(d) Stockpile-to-safe separation sequence.

1. Changes in authorized assembly or disassembly spaces for operations that expose EIDs or internal wiring of ordnance subassemblies that contain an EID.
2. Changes in shipping or storage container where container is intended to provide protection from EMR.
3. Change in carriage or launching platform with increased EMR induced voltages on platform.

c. Process.

(1) Ordnance that does not contain EIDs have no HERO requirement.

(a) The MATDEV LCMC or major subordinate command (MSC) designated safety office will update or establish the ordnance Department of Defense identification code (DoDIC).

(b) The LCMC or MSC safety office inputs and updates information concerning the munition in the DA-approved electromagnetic environmental effects (E3) risk assessment database.

(2) Ordnance that contain EIDs require HERO evaluation and certification.

(a) The MATDEV will establish an E3 working group to identify EMEs, establish HERO testing requirements, and coordinate evaluation and test plans with a recognized DoD test facility.

(b) At a minimum, the E3 working group members will consist of subject matter experts (SMEs) from the DoD test facilities, the LCMC or MSC safety office, Government program engineering support, the PM office, AEC safety evaluator or test manager, and the system prime contractor (if applicable).

(c) A member from Joint Commanders' Ordnance Group E3 Ordnance Safety Working Group will be a participant of the E3 working group.

(d) Classification is normally determined through testing; however, analysis may be used when determined appropriate by the E3 working group. When analysis is considered appropriate for the purpose of HERO certification, the E3 working group will complete the analysis, recommend a classification, and coordinate with the MATDEV. The MATDEV will forward the analysis to the LCMC or MSC safety office with recommended classification.

(e) Test plans will be developed by the test centers or facilities based on the requirements of Joint Ordnance Test Procedure (JOTP) 061 and concurred on by the E3 working group.

(f) Testing, analysis, and evaluation will consider all phases of S4.

(g) Test centers or facilities will execute the test plan and forward results to the E3 Working Group with a recommended HERO classification documented on the HERO data sheet. The recommended HERO classification will consider all phases of S4.

(h) The ATEC or AEC will provide a safety confirmation to the LCMC or MSC safety office which will include a recommended HERO classification, maximum allowable environments, and any recommended RAC, considering all phases of S4.

(i) The LCMC or MSC safety office will serve as the certification official and prepare the HERO certification letter and HERO data package based on test center or facility evaluation, analysis, and other data as needed.

(j) The MATDEV will coordinate certification letters and HERO data packages with the LCMC or MSC safety office and the ordnance status updated in DA-approved E3 risk assessment database. The ordnance DoDIC is also updated. Certification letters and data packages for ordnance involving HERO will be maintained by the MATDEV in accordance with AR 25–400–2.

(k) The LCMC or MSC safety office, in coordination with the E3 working group, will develop and assign a RAC and recommend appropriate mitigations for ordnance considered other than HERO safe. PMs or other appropriate risk acceptors will make a risk acceptance decision based on the HERO certification letter, data packages, RAC, and mitigation recommendations.

3–11. Environment

a. Federal law and AR 200–1 require compliance with all Federal, state, and local environmental laws. Laws include those covering environmental compliance, restoration, pollution prevention, and conservation of natural and cultural resources. Environmental requirements cover prevention, remediation, and control of pollutants that may impact air, water, and natural and cultural resources. Pollutants include, but are not limited to, noise, radiation, and hazardous materials and wastes.

b. Documentation in 32 CFR 651 tends to indicate those environmental concerns that already exist in the new system or facility design, test plans, or fielding events. Rather, an environmental hazard evaluation of the new system or facility design must be effectively integrated along with system safety and health hazard analysis to minimize the environmental impacts during the system or facility's life cycle.

c. The best approach is to "design for environment" by designing out the environmental hazards associated with a system or facility as is done for system hazards in the risk management process. The environmental hazard identification and evaluation process is closely related to the system safety risk management process identified in chapter 2.

(1) The environmental hazard analysis process requires a detailed review of existing system or facility design materials to ensure that they do not require the use of materials, such as ozone depleting substances Class I. If ozone depleting substances Class I or other hazardous materials are identified, there are no substitutes, and they are required, then these materials must be evaluated for their potential environmental impacts. The hazards must be identified, a RAC assigned, and any residual risk accepted by the appropriate decision authority. This includes reducing the use of hazardous materials in manufacturing processes and products, rather than simply managing the hazardous waste created.

(2) Where the use of hazardous materials cannot be reasonably avoided, procedures for identifying, tracking, storing, handling, and disposing of such materials and equipment will be developed and implemented, as outlined in DoDI 4715.23 and DoDI 6050.05. The U.S. Army Environmental Command is available to assist as needed.

(3) Life cycle cost estimates must include the cost of acquiring, handling, using, and disposing of any hazardous or potentially hazardous materials during the system or facility's life cycle.

3–12. Software system safety

a. Software system safety is an increasingly critical function within system safety, SE, and software development, particularly as safety-significant (that is, safety-critical or safety-related) software and functions become principal hazard causes and mitigations. A software system safety engineering activity is based on a hazard analysis process, safety-significant software development process, and a level of rigor (LOR) process. These tasks ensure that software is considered in its contribution to mishap occurrence for the system under analysis, as well the overall system's architecture. The safety-significant software development and LOR processes comprise the software system safety integrity process. Emphasis is placed on the context of the "system" and how software contributes to or mitigates failures, hazards, and

mishaps. The Joint Software System Safety Engineering Handbook provides detailed guidance in developing and executing a software system safety program. Within the context of safety-significant software, software system safety will—

(1) Be integrated within the SE, system safety, software development processes, and verification processes.

(2) Assess the system architecture, capabilities, and functions with emphasis on safety-significant functions being performed by software.

(3) Identify software affected system hazards and safety-significant software functions.

(4) Assess software requirements, design, and architecture; identify hazard mitigation requirements; and ensure implementation and verification, per software development and LOR safety requirements.

(5) Produce end-to-end (system definition through design implementation and verification) traceability and evidence.

(6) Assess software contributions to hazard residual risk.

(7) Assess AI and all level of autonomy systems. AI and ML actions are dependent upon the data which it has been trained and, subsequently, associated reliability parameters cannot be estimated in the same manner as hardware. Consideration will be given to the problem of learning when training and test distributions differ, including data scarcity and robustness under distributional shift and dataset shift.

b. MIL–STD–882E requires identification of hazards through a systematic hazard analysis process encompassing detailed analysis of system hardware and software, the environment, and the intended use or application. The Joint Software System Safety Engineering Handbook provides guidance on performing software system safety activities. Each PM should tailor the software system safety program to provide the required levels of hazard mitigation and risk reduction for their program.

c. PMs are responsible for the dissemination of software system safety requirements to contractors and other Government agencies supporting their programs.

d. In the context of software system safety, software includes firmware and programmable logic devices, as well as both developmental software and NDI (COTS items, Government-furnished equipment, and reuse) software.

e. The software system safety tasks are defined by performing a functional hazard analysis to identify safety-significant functions, assigning a software control category to each of the software-related safety-critical and safety-significant software functions, assigning a software criticality index based upon severity and software control category, and implementing LOR tasks for safety-significant software based on the software criticality index. One of the primary purposes of the functional hazard analysis is the identification of mitigating safety requirements that, once implemented and verified, reduce residual hazard risk. These mitigating safety requirements may be from an existing specification or software requirements specification, or they may be newly derived safety requirements that need to be added to the requirements specifications.

f. Once safety-significant software functions are identified, assessed against the software control category, and assigned a software criticality index, the implementing software should be designed, coded, and tested against the approved software development artifacts (for example, software development plan, coding standards and practices, and software test plans and descriptions) containing the software system safety requirements (those derived by safety analyses and the software development process safety requirements) and LOR. These criteria should be defined; negotiated; agreed to by the software developer, PM, LCMC, and ATEC; and documented early in the development life cycle.

g. The successful execution of pre-defined LOR activities increases the confidence that the software will perform as specified to software performance requirements, while reducing the number of contributors to hazards that may possibly exist in the system. Both the safety-significant software development and LOR processes are essential in reducing the likelihood of software initiating a propagation pathway to a hazardous condition or mishap. All software system safety tasks will be performed at the required LOR, based on the safety criticality of the software functions within each software configuration item or software module of code.

h. The documented evidence supports the safety case that hazard controls provide the required level of mitigation, and the resultant residual risks can be accepted by the appropriate decision authority. Failure to execute one or more LOR activities should be assessed for potential residual risk to the associated system-level hazards.

3–13. Commercial off-the-shelf, non-developmental items, and local purchases

a. COTS, NDI, and local purchases can pose potential problems concerning operational support and maintenance. These problems result because the item was built to commercial standards. As a result, the product may introduce hazards in the military environment. The purchaser must compare the commercial application with the tactical battlefield environment.

b. Prior to purchasing, consider the following:

(1) Has the system been designed and built to meet applicable or any safety standards?

(2) Has a hazard analysis been performed?

(3) What is the accident history for the system?

(4) Are any protective equipment or actions needed during operation, maintenance, storage, or transport of the system?

(5) Does the system contain or use any hazardous material (including radioactive substances), have potentially hazardous emissions (for example, laser), or generate hazardous waste or materials?

(6) Are special licenses or certificates required to own, store, or use the system?

(7) Is the system similar to previous military systems? Is there a history of accidents involving a similar system?

(8) Is the purchase attempting to resolve problems with previous equipment? Does it create new hazards?

(9) Will it interfere with operating or using other military equipment?

(10) Are there any interoperability or connectivity issues that cause safety hazards with the equipment?

(11) Is COTS electrical equipment used in Army workplaces listed or labeled by a Nationally Recognized Testing Laboratory such as Underwriters Laboratories? Military equipment released to the field under the auspices of AR 770–2 and AR 770–3 will be considered as equivalent to listed.

c. AMC and ATEC are resources to contact for assistance in determining if there are potential interoperability or connectivity issues with locally purchased equipment.

Chapter 4
System Safety for Testers and Evaluators

Section I

Introduction

4–1. General

a. Purpose. Army T&E has the following three purposes:

(1) To help the PEO, PM, or MATDEV uncover system problems for correction.

(2) To help the decision authorities determine whether development is progressing satisfactorily and whether the system is likely to meet operational needs.

(3) To verify the elimination or control of safety and health hazards.

b. Information. This chapter provides the tester and evaluator the information needed to develop and conduct a system safety test or evaluation. The key to this effort is the formulation of a TEMP (see AR 73–1 and DA Pam 73–1), which should address the identification of new hazards and the evaluation of the fixes made to previously identified hazards. The major effort of safety testing should be directed toward identifying, evaluating, and tracking these hazards (see chap 2). Hazard resolution will be accomplished by the PEO, PM, or MATDEV. System safety evaluations should focus on deficiencies in the system safety program, as well as hazards.

c. Application. T&Es apply to both developmental and NDI acquisition strategies. Testers' system safety requirements by phase during the materiel acquisition life cycle are covered in chapter 2.

4–2. Definition

a. Testing is the gathering and summarizing of empirical system data under controlled conditions. Technical testing of materiel systems is conducted in factory, laboratory, and proving ground situations to assist the engineering design and development process. This and other data are used by the technical evaluator to verify attainment of technical performance specifications and objectives.

b. User testing of materiel systems is conducted with representative operators, maintainers, crews, and units under realistic combat conditions. The evaluator uses these and other data to—

(1) Estimate the operational effectiveness and suitability of the system.

(2) Identify the need for modifications.

(3) Examine the adequacy of concepts for doctrine, tactics, organization, and training.

c. In addition to test data, evaluations can be based on results of analytical or logical modeling, such as computer simulations and war games. Information entered into the models may include combat data, experimental data, assumptions, and data generated by other models.

Section II

Test Planning and Conduct of Test

4–3. Test planning

a. A successful system safety T&E effort requires adaptation to fit the particular system test. Not every test event need be performed for every system. The test agency may consult the SSWG on which tests are necessary for a particular system. The selected tests or assessments are then included in the TEMP and the safety subsection of the test design plan or detailed test plan.

b. Distribution of test plans is made by ATEC, who is responsible for the initial placing of published documents into Versatile Information Systems Integrated Online (available at https://vdls.atec.army.mil/), an ATEC initiative to integrate data across test centers to provide a common web-based user interface. Published documents are also distributed into the Defense Technical Information Center.

c. System safety tests for critical devices and components will be incorporated into tests required for other disciplines. This is accomplished through the T&E working-level integrated product team. The PM will ensure adequate safety representation in this group.

4–4. General

a. There are some tradeoffs between safe testing and safety tests. The tradeoffs are between the benefits to be gained from safety testing versus the risk and cost associated with a particular test. The test risk management and safety release processes are used to resolve any conflicts in this area.

b. Safety testing can be used to—

(1) Identify hazards, determine appropriate corrective actions, and establish corrective action priorities.

(2) Determine and evaluate appropriate safety design and procedural requirements.

(3) Determine and evaluate operational, test, and maintenance safety requirements.

(4) Determine the degree of compliance with established qualitative objectives or quantitative requirements, such as technical specifications, operational requirements, and design objectives.

4–5. Developmental tests

a. DTs are primarily concerned with determining whether the system or equipment has attained the technical performance specifications and objectives called for in the supplier's contract with the PEO, PM, or MATDEV and to determine if the system is ready for user or operational testing.

b. It is imperative that the tester obtain the hazard tracking list before starting DTs. The list is used along with the SAR to identify the remedies that have been applied to correct previously identified hazards. Safety tests within DTs are then performed to verify the adequacy of the remedy.

c. During technical testing, specific safety and human health tests are also performed on critical devices or components to determine the nature and extent of materiel hazards. Requirements for such tests will be found in the TEMP and independent evaluation plans and are usually performed during DTs, when contractor testing and data are not sufficient to make a hazard assessment. Special attention is directed to—

(1) Evaluating special safety and health hazards listed in paragraph 3–8.

(2) Verifying the adequacy of safety and warning devices and other measures employed to control hazards.

(3) Analyzing the adequacy of hazard warning labels on equipment and warnings, precautions, and control procedures in equipment publications.

(4) Verifying the adequacy of safety and health guidance and controls in the SAR, TMs, and HHAR.

(5) Considering hazard-mitigating recommendations in reviewing or developing test center SOPs.

(6) Including and coordinating any unique data requirements in the safety or human health test designs that are implied in test documentation (for example, SAR, initial HHAR, and so forth).

(7) Identifying new hazards in reports and test incident reports when the risk assessment is inaccurate or requires revision.

4–6. User tests

The operational evaluator estimates total system performance of a materiel system when it is put to use, maintained, and supported by the Soldiers, crews, and units who will be expected to make the system work successfully in combat. The testing must occur in a realistic combat situation with as little interference with the conduct of the operation as feasible. Furthermore, a safety release must be provided for Soldier use under the conditions or limitations specified before any user testing begins. Therefore, operational testing is less systematic and less technical than that conducted during DTs. It is possible, however, for unanticipated hazards to occur when a system is placed in the hands of Soldiers and put in operation. Therefore, test planning must include disciplined observation and other data collection procedures to ensure that such hazards are identified and added to the HTS.

4–7. Non-developmental items tests

a. Contrary to Government system development efforts, most NDI acquisition efforts effectively preclude the Army from obtaining detailed safety engineering evaluations or assessments from the prime contractor. Safety testing will be oriented to tests that are specifically required to fill gaps that have not been satisfied by contractor data. Specific test issues will be determined during the market survey and incorporated into the TEMP (see AR 70–1 for more information on market surveys).

b. NDI tests frequently require as much testing as a pure development item because of utilization in an unplanned environment and assembly of parts in a new configuration. The SARs and safety releases are required for NDI testing.

Section III

Evaluations

4–8. Evaluators

a. ATEC, by means of the AEC, conducts CE on all assigned systems. CE is a process that provides a steady flow of evaluation information to the combat and MATDEVs on a proposed acquisition, even as the acquisition evolves from a laboratory or experiment to an identified and recognized program or project. CE, conducted by ATEC, will be employed on all acquisition programs. CE is a strategy that ensures responsible, timely, and effective assessments of the status of a system's performance throughout its acquisition process. CE can begin as early as the battlefield functional mission area analysis and continue through system post-deployment activities. The CE process includes system evaluation and system assessment. System evaluation focuses on issues of system technical and operational characteristics, performance, and safety as a part of system operational effectiveness, suitability, and survivability. The system evaluation report focuses on the capability of the system to accomplish its mission in its intended environment and is provided to the MDA.

b. In addition, other organizations assess the system's demonstrated logistics supportability, cost effectiveness, performance in a threat countermeasure environment, and ease of operation and maintenance by troops.

c. One element of analysis that is common to all independent evaluations is system safety. A system safety evaluation focuses on the existing status and impact of any hazards or program deficiencies in terms of the system's overall effectiveness.

d. System safety issues enter the CE process through continual dialogue among the PEO, PM, MATDEV, CAPDEV, and technical and operational testers and evaluators, these organizations' system safety personnel, and other members of the acquisition team. Key activities for input of system safety issues to CE are the developed TEMP issues and criteria. Again, the forum for coordination of acquisition team activities is the T&E working-level integrated product team. The SSWG ensures that the updated SSMP is used throughout the development process by the T&E working-level integrated product team for updating the TEMP and by ATEC for updating the system evaluation plan.

4–9. Director of Army Safety independent system safety assessment

The Director of Army Safety will provide an independent safety assessment (ISA) of ACAT I and II major defense acquisition programs, as requested by a stakeholder at the colonel or general schedule (GS)-15 level, at the program milestone decision review to the AAE and the Army Systems Acquisition Review Council or designated acquisition program MDA to contribute to the decision for the program to enter the next phase of acquisition. The ISA is an evaluation of a specific identified issue that has not been able to be resolved at lower levels. The ISA is conducted by an SME on the system and may include a thorough review of system safety technical documentation for the system program and communications with representatives from the applicable offices of the PEO or PM and supporting LCMC.

Chapter 5
Weapon System Safety Reviews

5–1. Introduction

This chapter provides implementing guidance in support of DoDI 5000.69, DoDM 5000.69, AR 385–10, AR 770–2, and AR 770–3. It describes and provides guidance for the joint weapon safety review process and the Army Weapon System Safety Review Board (AWSSRB). The AWSSRB is chartered as a subgroup of the DA System Safety Council. The AWSSRB charter is maintained by the Office of the Director of Army Safety.

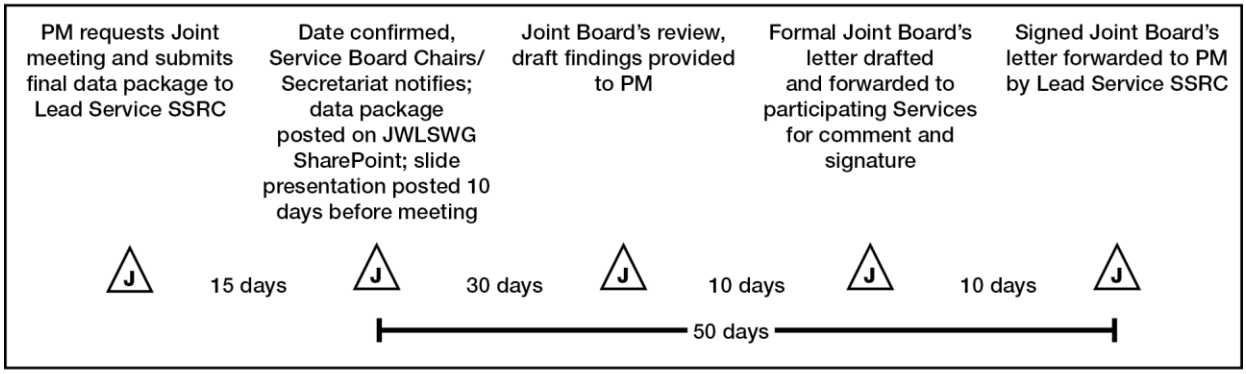
5–2. Joint weapon reviews and the Army Weapon System Safety Review Board

a. DoDI 5000.69 requires joint Service safety reviews of weapon and laser systems that will be used by two or more services. Figure 5–1 is a notional timeline for scheduling and conducting reviews with the AWSSRB and joint boards, including responsibilities of the service safety review coordinator and interaction with the Joint Weapon and Laser Safety Working Group.

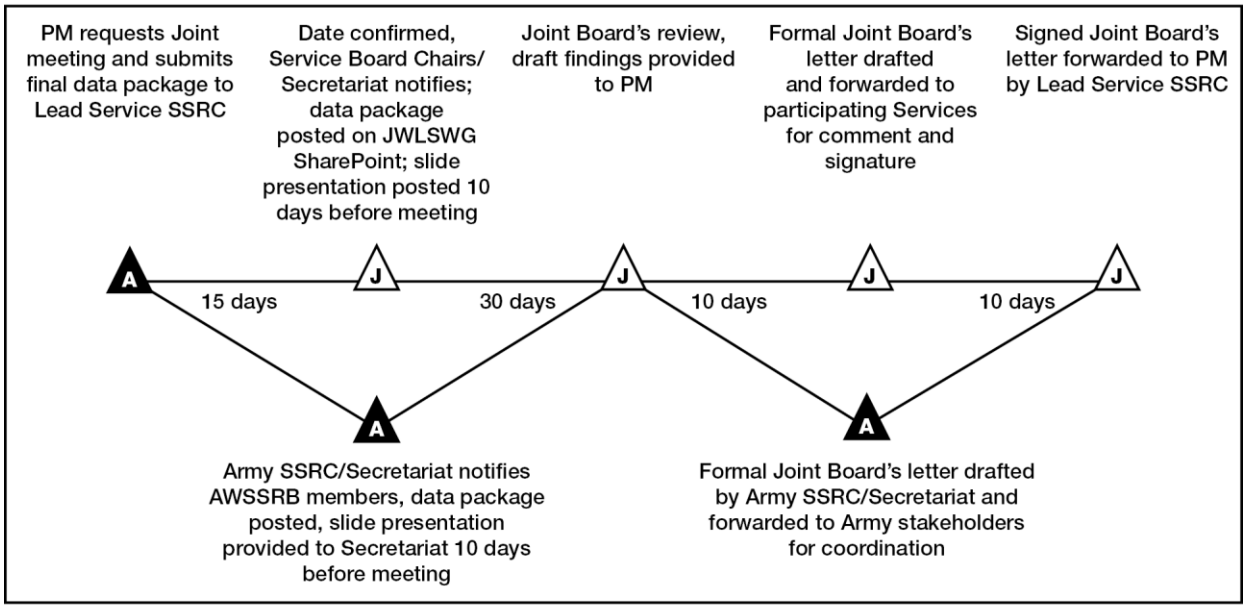
b. Figure 5–2 identifies the weapon system safety boards, organizations, and processes that currently exist within the Services. The Air Force's Nonnuclear Munitions Safety Board and the Navy's Weapon System Explosives Safety Review Board serve as the single point of contact for joint reviews within their respective Services. Similarly, the AWSSRB serves as the DA's single point of contact to coordinate and facilitate joint Service safety reviews within the Army.

c. Figure 5–3 provides a notional depiction of the organizational relationships between the AWSSRB, other Army safety boards and organizations, and the joint weapon safety review process.

Joint Process



Joint Process, Army Lead Service



J **Joint Action** A **Army Action**

Figure 5–1. Notional timeline for joint weapon safety reviews

Joint Process, Army Participant

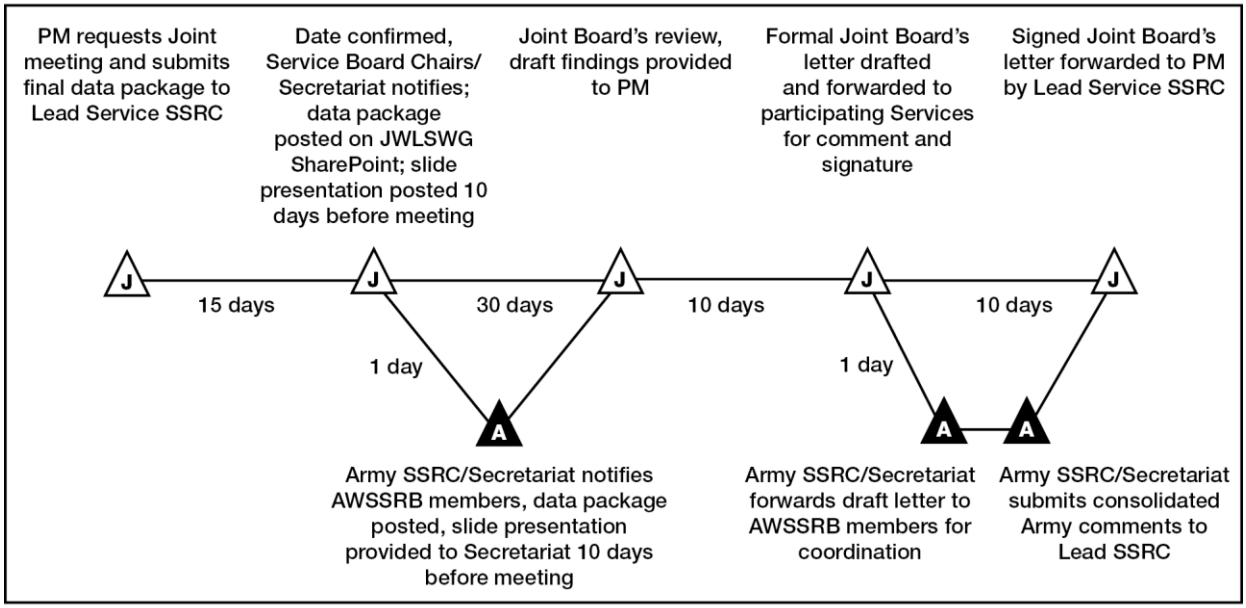


Figure 5–1. Notional timeline for joint weapon safety reviews–continued

Figure 5–2. Existing Services' weapon safety review organizations and processes

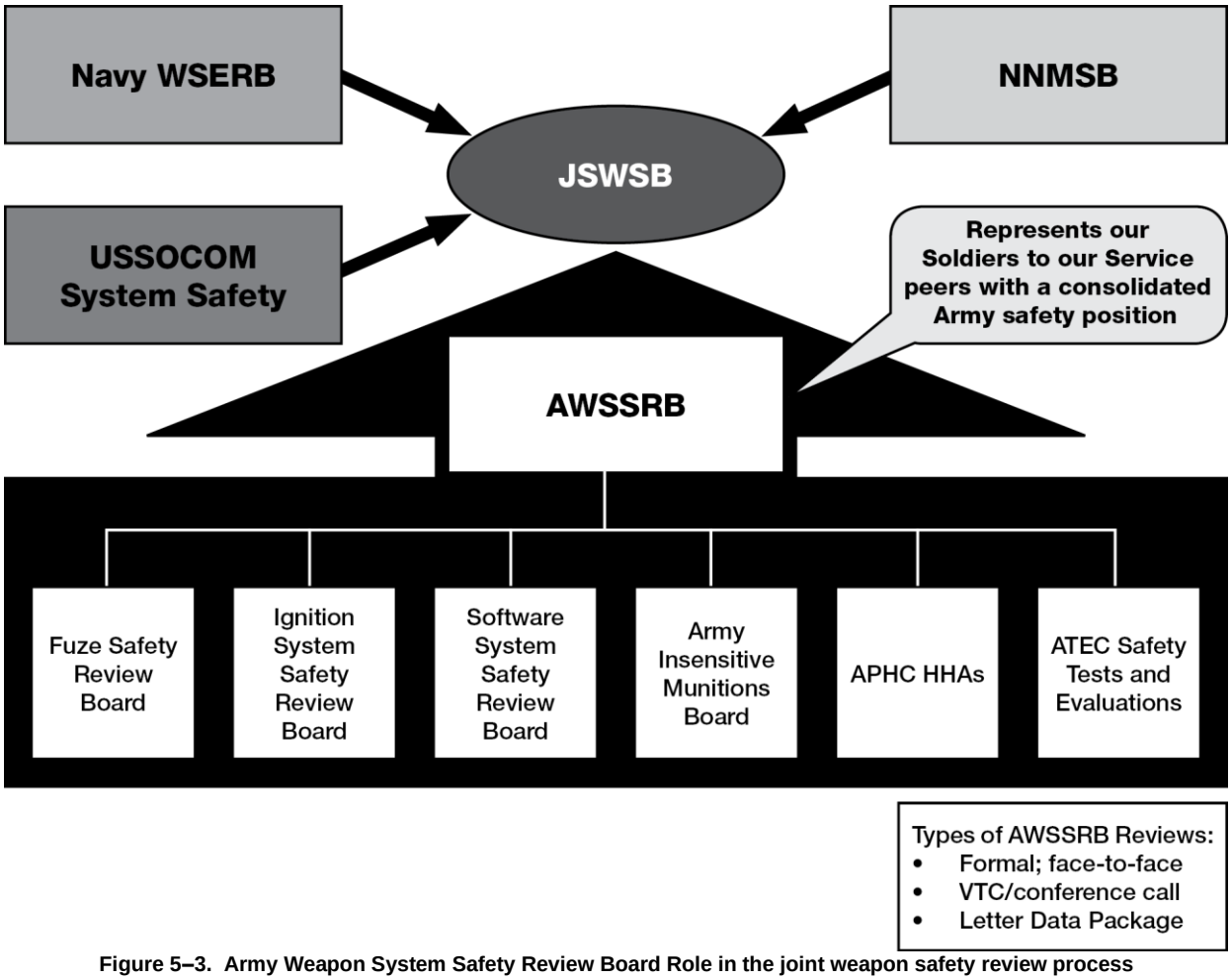


Figure 5–3. Army Weapon System Safety Review Board Role in the joint weapon safety review process

5–3. Applicability

a. The Joint weapon safety review process is applicable to PMs who are responsible for the development or acquisition of new or modified weapons and weapon systems and associated items as defined below, to include COTS and NDI, that are issued to Army personnel and members of at least one other Service—

(1) All military munitions, ordnance items, explosive systems, weapon systems, and conventional components of nuclear weapon systems containing energetic materials, specifically excluding the Department of Energy portion of the weapon.

(2) Ancillary, handheld, portable, or related devices (for example, fire control systems) used to input data into fire control or combat systems for targeting, commanding, controlling, directing, launching, or firing weapons.

(3) Related devices or systems used for checkout, testing, training, stimulating, simulating, or reprogramming that may affect weapons safety or control.

(4) Unmanned or remotely piloted aerial, ground, or underwater vehicles that contain or deliver weapon systems.

(5) Directed energy weapons (see the glossary).

(6) Operator safety associated with the use of non-lethal weapons, including effects on operator ordnance and weapon systems.

(7) Integration or use of weapon systems or combat systems on Army platforms.

(8) Software or firmware in safety-related (including safety-critical and safety-significant) roles in weapons and related systems.

(9) Those items as directed by higher authority.

b. The provisions of this process are not applicable to—

(1) Weapon systems tested or used at research, development, T&E facilities for experimental tests only.

(2) The adoption or issue of man portable small arms weapons (less than 20 millimeters) that meet both of the following conditions:

(a) The weapon uses approved small arms ammunition that do not contain incendiary or high explosive projectiles and are not electrically initiated.

(b) The weapon and ammunition are type classified by a U.S. military service or the weapon is a variant of a type-classified system with no alterations that affect the weapons functional and safety characteristics.

(c) Man portable small arms (less than 20 millimeters) mounts integrated on vehicles that meet all the following conditions:

1. No fire control is involved.
2. Mount has been qualified or certified with the intended weapon.
3. Vehicle program office certifies that system safety personnel have approved the structural integrity of mounting installation and established no-fire zones incorporating appropriate weapons stops.

(3) Effects of non-lethal munitions and weapons on intended targets.

5–4. Requirements

All joint weapon system programs, regardless of ACAT level or non-ACAT status, will obtain a joint weapon safety review board approval in conjunction with major acquisition milestone decisions and prior to materiel release. Figure 5–4 is a notional depiction as to when AWSSRB reviews, in support of joint reviews, will be conducted as part of the acquisition cycle.

a. Prior to test firings or operations involving developmental or unqualified joint weapons or munitions by Soldiers, all weapon system programs will obtain an appropriate joint review and approval when the system being tested directly affects or employs explosive ordnance or when the system being tested will potentially leave software code or routines resident on a host system that directly or indirectly can change the operational intent of weapons, weapon systems, or combat systems.

b. Safety-related changes or upgrades to previously fielded joint weapon systems will obtain an appropriate joint review prior to materiel release. This includes non-ACAT programs and engineering change proposals, as well as programs that directly acquire NDI and COTS items and seek to introduce them for operational use with or without modification.

c. The MDA, PEO, and PM will ensure all applicable acquisition programs and modified weapons or weapon systems programs include all network systems and interface elements required to integrate the weapon systems or adapt them to the platforms.

d. At the program's request, the AWSSRB will provide technical assistance to science and technology projects proposed for transition to a joint acquisition program (for example, prior to Milestone A) to ensure appropriate safety considerations involving Army units are included in the design for weapons systems proposed for installation or testing.

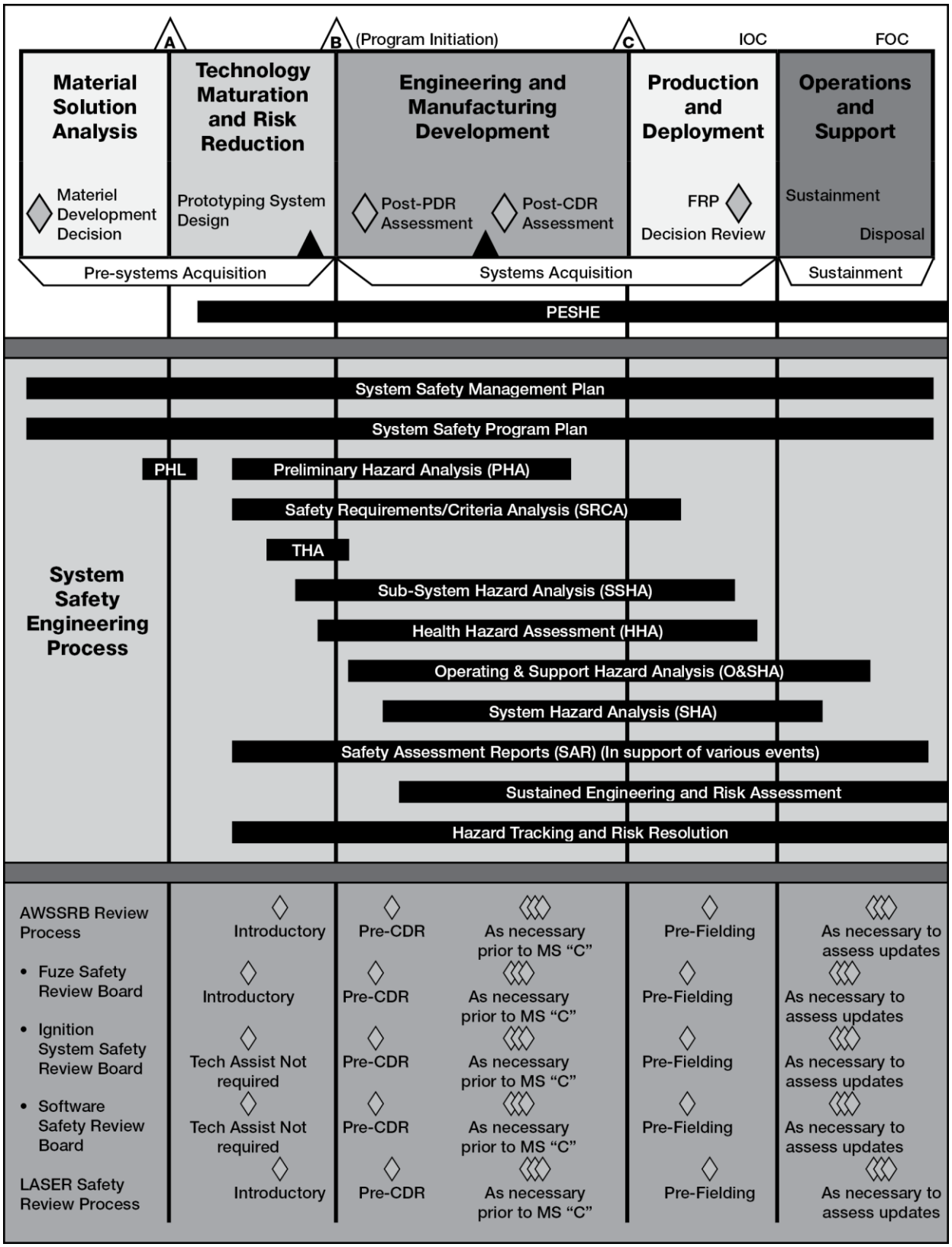


Figure 5–4. Army Weapon System Safety Review Board reviews in support of the acquisition cycle

5–5. Procedures

a. PEOs, PMs, and research and development activities will—

(1) Submit documentation, as described in appendix I and AWSSRB SOPs, to the AWSSRB and joint boards to support system safety reviews.

(2) Respond to the board's written findings and requests with actions taken or planned. Responses will be submitted through formal correspondence from the program office. Any PMs who are unable to comply with findings will, as soon as possible, present written justification through formal program office correspondence, to the AWSSRB.

(3) Execute a system safety program, to include T&E, in coordination with the safety organizations representing all identified users to fully characterize the hazardous aspects associated with weapon systems used in joint warfighting environments.

b. The AWSSRB will—

(1) Provide DA, MDAs, PEOs, and PMs an assessment of the adequacy of the safety program and recommendation on the advancement of the item to the next stage in the acquisition cycle as required by DoDI 5000.02.

(2) Review the overall safety aspects of each joint weapon system, explosives system, and related system to assess and ensure compliance with existing safety criteria.

(3) Provide safety recommendations, concurrences, or non-concurrences to the MDA, as appropriate, for major milestone decisions and to materiel release authorities for joint weapon systems.

(4) Participate in joint weapon safety reviews and meet to perform AWSSRB-related tasks, as required.

c. The AWSSRB chairperson will—

(1) Request nominations from the member organizations for primary and alternate representatives to serve as AWSSRB members, as required.

(2) Convene AWSSRB meetings. Based on the system safety program, determine the type of reviews necessary to assure a thorough assessment of the system safety program.

(3) Document and report AWSSRB findings as appropriate.

d. As the designated point of contact for safety matters for the program, the program's system safety lead (SSL) will—

(1) Act as the program's point of contact for the joint boards and AWSSRB.

(2) Demonstrate the effectiveness of the program's system safety and report system safety engineering status, mitigation reports, and residual risk assessments during reviews.

(3) Request the joint reviews and related meetings appropriate to the weapon system life cycle.

(4) Represent the program during reviews as necessary.

(5) Coordinate preparation and review of the data package and presentation materials to ensure that they conform to appendix I.

(6) Prepare and coordinate responses to findings and action items from the AWSSRB and joint boards. Provide the responses, via letter from the program office, for review and acceptance. The program office and the SSL are not required to take any action on a dissenting opinion if one is included in the formal findings letter.

(7) Determine, in consultation with the AWSSRB, the appropriate scope of AWSSRB reviews. The AWSSRB may elect to expand the scope beyond that recommended by the program. Any such request will be made to the appropriate PEO or PM with information concerning the additional areas of focus and relevant safety considerations.

(8) Inform the AWSSRB of pertinent safety-related incidents or significant hazards in a timely manner. This will be accomplished outside of the formal AWSSRB review process.

Chapter 6
Facility System Safety

6–1. Purpose of facility system safety

Construction, engineering, operations, research and development, and maintenance activities on Army property range from self-help projects performed by unit or organization personnel and housing residents to multimillion dollar U.S. Army Corps of Engineers (USACE) major construction projects performed by civilian contractors (including civil works projects). The objectives of the facility system safety (FASS) management program are—

a. Conducting system safety programs to minimize risks throughout the facility system life cycle.

b. Conducting hazard identification, FASS risk management, and hazard tracking procedures during facility development, construction, operation, and disposal.

c. Maximizing operational readiness and mission protection by ensuring that cost-effective hazard controls are efficiently designed and constructed.

d. Ensuring that hazards inherent to the design, equipment, and intended use of the facility are eliminated or the resultant risks of the hazards are controlled to an acceptable degree.

e. Reducing SOH retrofit and modification requirements after the design stage.

6–2. Facility system safety participants

The effectiveness of the FASS program can be directly related to the aggressive and cooperative spirit of the participants. No program can be effective without aggressive pursuit of safety as a program goal, nor can it be effective without the active support and cooperation of the following participants:

a. Using activity or installation. The importance of active and meaningful participation by the user community cannot be overstated. As it is elsewhere in facility planning and design, appropriate input from the user during the initial planning stages is critical to the FASS program. Without such input, the effectiveness of any system safety effort is seriously degraded, while at the same time the cost of the effort becomes prohibitive. The using installation is responsible for identifying overall facility hazard level, including funding for the necessary FASS effort and initiating the FASS management program.

b. Engineering organization. The engineering organization (USACE or installation engineering organization) is responsible for the design and management of military construction (MILCON) and civil works projects. While USACE districts serve as the engineering organization for the majority of MILCON projects, these projects may also be designed and managed by the installation engineering activity. In either case, the engineering organization, with input from the using activity, establishes the scope of the FASS effort and incorporates any appropriate and necessary system safety tasks into the project design requirements. During construction, the engineering organization assures that design features for the control of hazards are properly installed in the project. The engineering organization will be the prime collaborator with the using activity for planning, executing, controlling, and closing the design project.

c. Design agent. Design of a project is carried out by an architect or engineer firm under contract or by the in-house USACE district or installation or activity personnel. In all cases, the designer is responsible for conducting and documenting any hazard analyses that are required during the design phase. The designer is responsible for completing any system safety tasks required by the FASS program or contract specifications; utilizing the output from hazard analysis as input to the design; and developing, evaluating, and implementing appropriate hazard controls. During the design process, the design agent will review all proposed design changes for impact to FASS. The design agent will document residual hazards and initiate action to obtain risk acceptance decisions, as required. The design agent should interface with the using activity and engineering organization to identify design impacts to and from the installation (for example, siting, utilities, hazardous materials, traffic patterns, adjacent facilities, and so forth).

d. U.S. Army Corps of Engineers divisions and direct reporting units. USACE divisions and DRUs have responsibility for supervision and oversight of the system safety activities carried out by their subordinate organizations.

e. Headquarters, U.S. Army Corps of Engineers. USACE develops and maintains overall facility or project system safety policy and program guidance.

Chapter 7
Facility System Safety Program Management

7–1. General

The purpose of this chapter is to present the procedures used in the FASS effort. These procedures are required to be performed by the responsible FASS participants identified in paragraph 6–2 in the planning, design, and construction phases of MILCON-funded and civil works facilities.

7–2. Background

The FASS process is structured to concentrate user and designer resources on the identification and control of hazards in the criteria development and design stages of projects. Further, the FASS process is

structured to emphasize hazards that are not covered by codes and standards. The FASS process examines the specifics of the hazards involved, the level of risk, and the appropriate control mechanisms. The FASS effort is intended to vary from project to project in scope and complexity. The FASS effort must be tailored to the project, and the effort expended must be commensurate with the degree of risk involved. This is accomplished through a facility risk assessment process during the project's programming and planning stage.

7–3. Using or activity installation responsibilities

a. Appointment of a system safety project team. The system safety project team (SSPT) is the body that accomplishes those initial system safety tasks performed by the using installation or activity. Appointment of this team should be accomplished upon initiation of project planning. While membership and the level of participation may vary from organization to organization and from project to project, it is recommended that the initial SSPT be comprised of at least the following representatives:

(1) Representatives from the appropriate MILCON stakeholders should be included in any MILCON SSPT.

(a) Member of the activity that will occupy the facility. This individual must have a detailed knowledge of the mission and function of the project and of specific hazards introduced by the work activities to take place within the structure and the impacts of the structure to and from adjacent activities.

(b) A representative from the Directorate of Public Works, or equivalent, or the appropriate U.S. Army Corps of Engineers agency. This individual will provide the group with information regarding the project schedule, planning data, and background information on the MILCON process. The Directorate of Engineering and Housing or Directorate of Public Works representative will normally serve as the SSPT chairperson in the initial SSPT.

(c) A representative from the installation or using activity safety office. This individual will provide background information and knowledge in the system safety process, address SOH standards applicable to the project design and construction, and provide information related to accident and injury data regarding like or similar structures.

(d) A representative from the installation medical activity or clinic. This member is generally an industrial hygienist or environmental health officer who has detailed knowledge of the health hazards associated with the installation's mission and functions.

(e) A fire protection engineer or specialist. This member brings detailed knowledge of fire hazards and fire protection or suppression system requirements. A fire protection specialist brings detailed knowledge of various fire hazards (that is, structural, aircraft, hazardous materials, rescue, and confined spaces), fire prevention measures, fire protection requirements, and operational and mitigation strategies.

(f) An environmental engineer or environmental protection specialist. This member brings knowledge of environmental requirements and hazards as related to facility or project design considerations.

(g) The facility system safety point of contact for the engineering activity. This member is responsible for oversight and coordination of the SSPT activities.

(2) Representatives from the appropriate civil works stakeholders should be included in the SSPT for civil works projects.

(a) Member of the activity that will occupy the project. This individual must have a detailed knowledge of the mission and function of the project and of specific hazards introduced by the work activities to take place within the structure and the impacts of the structure to and from adjacent activities.

(b) A representative from the requesting agency and the U.S. Army Corps of Engineers for a civil-funded facility or project.

(c) Applicable state, local, and Federal entities or other stakeholders.

(d) A fire protection engineer or specialist. This member brings detailed knowledge of fire hazards and fire protection or suppression system requirements. A fire protection specialist brings detailed knowledge of various fire hazards (that is, structural, aircraft, hazardous materials, rescue, and confined spaces), fire prevention measures, fire protection requirements, and operational and mitigation strategies.

(e) An environmental engineer or environmental protection specialist. This member brings knowledge of environmental requirements and hazards as related to facility or project design considerations.

(3) Appropriate stakeholders should make up the SSPT for other projects (for example, environmental, superfund, base realignment and closure, formerly used defense sites, and so forth).

b. Preparation of a preliminary hazard list. The SSPT will initially prepare or oversee the preparation of a PHL. The PHL is a high-level document upon which the system safety effort is based. As such, it must

be completed in time to influence planning, design, and funding documents. The PHL is used to initially identify hazards to be controlled; uncertainties to be resolved; and other safety, health, and fire protection concerns of the user that will require special attention in the design process. A well-prepared and documented PHL helps to ensure design and construction of a facility acceptable to the user. The PHL is included as part of the DD Form 1391 (FY Military Construction Project Data) funding documents. By requiring the PHL to accompany the funding documentation, funding for system safety tasks becomes an integral part of the budget process. If the scope of the system safety effort is to be extensive, funding for this effort will be obtained as part of the design or construction funds. The initial PHL will generate a list of safety-critical areas. Areas that need special safety emphasis (for example, hazard analysis) will be identified. Also, special requirements can be written into the detailed functional requirements to address these areas. This input may be in the form of specific design features that the facility must include, or it may be requirements for hazard analyses to be performed as part of the design process. Once included in the design contract, safety is integrated into the design of a facility starting with concept design.

c. Facility risk categorization. After completion of an initial PHL, the SSPT's next action is the categorization of the facility into one of the three general risk categories. This categorization is based on several factors, such as number of people exposed, type and degree of hazard of operation, criticality of the facility to defense readiness, and cost. This designation should be a direct reflection of the working group's concern regarding operational safety and health risks presented by the facility and its mission. The three general risk categories and typical system safety level of effort are—

(1) *Low-risk facilities (for example, housing, warehouses, and administrative buildings).* In these kinds of facilities, risks to building occupants are low and limited to those normally associated with everyday life. Accident experience with similar structures is acceptable and no additional hazards (for example, flammable liquids, toxic materials, and so forth) are to be introduced by the building occupant. Except in special cases, no further hazard analysis will be required.

(2) *Medium-risk facilities (for example, maintenance facilities, heating plants, and laboratories).* These kinds of facilities present industrial-type hazards to the building occupants. Accidents are generally more frequent and potentially more severe. A PHA will normally be required of the designer. More sophisticated hazard analyses are normally not required. The engineering organization will actively participate in design reviews.

(3) *High-risk facilities (for example, explosives plants, Department of Defense chemical agent facilities, and high energy facilities).* The SSPT should be heavily involved in the planning and design of this category of facility since it usually contains unique hazards of which only the user of a facility will have detailed knowledge. Because of this, it will often be appropriate for the user to specify preparation of additional special purpose system safety tasks during facility design. MIL–STD–882E should be used to identify the additional efforts required. The user will take an active role in the design review process.

d. Facility system safety cost estimation. For medium- or high-risk facilities where additional analyses are anticipated, include the analysis cost in estimates of overall project cost. Funding data for FASS efforts will be included in the DD Form 1391 package.

e. Provide data regarding facility intended use. Include in planning documents, hazard data regarding development or procurement of any equipment intended to be installed, utilized, or housed within the facility. Since the design and the construction of facilities often precedes the design and the manufacture of specialized equipment to be used in the facility, it is important to ensure that the facility can accommodate the equipment without compromising the safety or requiring modification of the facility. This is accomplished by defining equipment needs early in the planning process. The equipment needs criteria can include information, such as dimensions, power requirements, weight, access requirements, clearance requirements, definitions of energy outputs (for example, noise, heat, fumes, and so forth), energy shielding requirements, and environmental requirements. Provide the engineering organization with updated information as necessary for use in facility design.

f. Project design review. The SSPT should participate in the design review process, reviewing and commenting on specification, design drawings, and designer-prepared hazard analyses.

g. Interface with lessons learned database. Where facility hazards are identified after occupancy, provide appropriate lessons learned data to the project lessons learned database.

7–4. Engineering organization responsibilities

a. Assist the user. Often a user will request that the engineering organization assist in the development of facility planning documentation. The engineering organization's roles in assisting the user

develop initial system safety planning documents (for example, PHL) should be limited to that of a facilitator. The active participation of the user community is critical to the process, and the user's intimate knowledge of the facility utilization is essential to the development of design planning documents.

b. Review user-prepared system safety documentation. Conduct a thorough review of the user-prepared PHL and any other safety data contained within the planning documents. Request clarification as necessary.

c. Prepare project system safety management plan. This is a plan tailored to the specific project which establishes management policies and responsibilities for execution of the design system safety effort. It is based upon the PHL and associated recommendations from the user regarding risk and design safety analysis needs. The minimum elements of the SSMP are as follows:

(1) Designation of the engineering organization point of contact for system safety issues. This point of contact will be a military personnel, civilian, or contractor in an engineering series with training in system safety as defined in MIL–STD–882E. The system safety point of contact will have oversight responsibility of the activity's system safety effort and report as appropriate within their organizational chain of command.

(2) Establish the project risk acceptance criteria based on consideration of the user's recommendations. The acceptable level of risk in a facility is an expression of the severity and frequency of a mishap type that the using organization is willing to accept during the operational life of the facility. This is a function of the mission. For instance, the goal is to identify all hazards and to eliminate those exceeding the defined level of acceptable risk. While this is not always possible, the analysis conducted will provide the information upon which to base risk acceptance decisions.

(3) A specific listing of all tasks, including hazard analyses, that are a part of the design system safety effort. Designate the responsible parties or organizations for each task. The responsible parties for each task will be well qualified to perform the task as identified in MIL–STD–882E. Optional tasks should be designated as such, listing conditions which would trigger these tasks.

(4) Establish the system safety milestone schedule, bearing in mind that the purpose of the hazard analysis is to beneficially impact design and that timely completion of the analysis is vital. The schedule for analysis completion must complement the overall design effort.

(5) State any special rules for Government (engineering organization and user installation) and contractor interaction regarding the system safety effort.

(6) Establish procedures for hazard tracking and documenting residual risk and risk acceptance decisions. HTSs are used in the FASS program in lieu of the SARs. The PHL should be used to create the initial list of hazards in the hazard tracking log. Initially, all hazards will remain open. New hazards identified throughout the design process are entered into the log. As the design progresses, corrective actions are included and hazards are eliminated or controlled. The status of these hazards is updated in the hazard tracking log. Hazards should be tracked throughout the facility life cycle. The hazard tracking log should be provided to the user when the facility is turned over for operation. Hazards should continue to be tracked by the user during the life of the facility. In many cases, these hazards will rely upon administrative controls such as SOPs, limiting conditions of operation, and so forth.

(7) Identify method for incorporating lessons learned into the system safety effort. Outline procedures for documenting and submitting significant safety data as lessons learned.

(8) Establish procedures for evaluating proposed design changes for safety impact during the later stages of design after safety analysis is complete or as a result of value engineering proposals, engineering change proposals, and so forth.

(9) Where equipment to be installed or utilized within the facility is being developed or procured separate from the facility design, establish a communication system that will provide timely equipment safety data to the designer. Of course, the SSMP must give consideration to overall project time constraints, manpower availability, and monetary resources. For example, the degree of system safety effort expended will depend on whether the project is replacing an existing facility, creating a new facility, involves new technology, or is based on standard designs. The options for hazard analyses are many, and project managers will need to specify the design system safety tasks tailored to facilities' acquisition in the SSMP.

d. Incorporate system safety requirements in contract documents. These requirements are structured from the project tailored SSMP. To provide an understanding of potential contractor's system safety capabilities, candidate contractors will be requested to provide their proposed approach to the system safety requirements in their written or oral presentations to Government contractor selection boards. Consider

including the requirement for a SSEP in the statement of work (see para 7–4 for the key elements of a SSEP; see AR 385–10 and DA Pam 385–10 for policy and standards for integrating safety into the contracting process).

e. Review and accept design hazard analyses submitted by the design or systems contractor. Assure the quality of the analyses required by the SSMP and the SSEP through a submittal review process.

f. Engineering change proposal analysis. Review each engineering change proposal for potential impact on project safety, and verify that such impact is minimized by appropriate design measures.

g. Document risk acceptance decisions. In accordance with the SSMP, track hazard resolution and obtain and document residual risk acceptance decisions.

h. Construction quality assurance. During the construction phase, assure that design safety features are properly installed or constructed. Review any engineering changes after final design to minimize impact on FASS.

7–5. Design agent functions

a. Complete all system safety tasks as required by the SSMP and SSEP or contract documents. Utilize the output from hazard analysis as input to the design, developing, evaluating, and implementing appropriate hazard controls.

b. Review engineering change proposals before forwarding to the engineering organization for impact on FASS.

c. Document residual hazards and initiate action to obtain risk acceptance decisions, as required.

7–6. Standard designs

a. FASS is an integral part of a standard design. Each standard design will include a set of standard FASS documents prepared using the requirements contained in chapter 8.

b. The effort required to complete the FASS program for a standard design should not be duplicated for each application of the design. Local analysis of the design application will be performed to identify specific hazards associated with the impact of the structure to and from its intended siting (for example, utilities, activities, adjacent structures, and so forth).

c. For each application of the standard design, deviations from the standard design will be analyzed to identify any new hazards or increased risk introduced in the facility. This effort should be performed by the engineering organization responsible for the standard design and included with the standard FASS package for the design application.

d. Standard designs will have a HTS, to include hazards associated with deviations from the standard design. Each standard design will include a lessons learned database. Any HTS or lessons learned database will be available to the users of the standard design.

7–7. Self-help projects

a. Self-help projects consist of work that can be performed using Army training, materials, equipment, and supervision. These projects include minor maintenance (for example, painting a room), improvements (for example, landscaping and fencing), and Soldier-sponsored projects (for example, renovation of barracks).

b. Self-help projects, if not properly managed, can increase the risk to a facility, project, or personnel. For example, failure to use the appropriate fire retardant building materials or the construction of a wall in the hallway of a barracks building increases the risk of fire and injuries to personnel in the event of a fire.

c. SOH personnel should provide input to the system safety point of contact at the engineering activity for the establishment of strict policies and procedures for the authorization and performance of self-help projects. These policies and procedures should address, as a minimum, scope of work or projects authorized to be performed, development of project proposals, selection and requisition of supplies and materials, training in use of equipment and procedures, supervision, and inspection or quality assurance.

7–8. Construction facility system safety

a. Safety features. During the construction phase, two activities involving FASS will take place. Change orders will be reviewed to ensure changes do not degrade safety features already incorporated in the design. This is an area that will take considerable effort, as configuration control has historically been poor in facility construction. Also, arrangement with the engineering organization may be made for site visits to check on the progress of the facility.

b. Occupancy inspection. This inspection should take place immediately, before the user takes over control of the facility. This inspection will verify the presence of critical safety features incorporated into the design. At this point, the HTS is important. Review of the tracking system will identify safety features that should be looked at during the inspection. The hazard tracking log should be used to generate a checklist for safety items that should be a part of the inspection.

7–9. Facility or project operation and maintenance

a. Procedure development. After a facility or project design is completed, risks have been controlled or accepted, and the construction phase has begun, it is time to begin the process of developing facility or project operating, maintenance, and emergency procedures. The output of the design system safety effort should be used as the point of departure for procedure development. The primary focus should be on residual risks and assuring that critical safety features of the structure are included in maintenance plans. Plans to deal with natural and man-made emergencies must also be developed at this time. In addition, necessary training programs for instructing building occupants in the use of these procedures and plans should commence.

b. Change analysis. After building occupancy, any proposed building mission changes must be analyzed to detect changes that could introduce a new hazard or change the attributes or nature of an existing hazard or hazard control. A determination must be made of whether new mission tasks can be safely performed in the facility or project as originally designed and to identify any modifications necessary to ensure the SOH of building occupants.

c. Facility, project, or site maintenance and repairs. Maintenance and repair of existing facilities or sites must comply with applicable standards and procedures. Maintenance is the work required to preserve and maintain a facility or project or site in such condition that it may be effectively used for its designated functional purpose. Maintenance includes cyclic work done to prevent damage or work performed to sustain components. Repair is work performed to restore a project or facility. Repair may be overhaul, reprocessing, or replacement of deteriorated component parts or materials. All new work performed as repairs must meet new construction standards.

Chapter 8
Facility System Safety Program Contracting

8–1. General

The level of system safety effort for each program is tailored to ensure implementation of a cost-effective program based on the level of risk involved.

8–2. Contractor selection

To help develop an understanding of the potential contractor's system safety capabilities and experience, candidate design contractors will be required to include their proposed approach to system safety requirements as extracted from the initial SSEP in their written or oral presentations to Government contractor selection boards. Elements addressed will include—

a. Qualifications of personnel to perform tasks.

b. The procedures by which the contractor will integrate and coordinate system safety considerations into the design effort.

c. The process through which contractor management decisions will be made, including timely notification of unacceptable risks, changes impacting safety, program deviations, and so forth.

8–3. Task selection

Commensurate with the SSMP, additional system safety tasks may be required of the design contractor. Tasks should be selected in accordance with the requirements contained in MIL–STD–882E.

8–4. System safety engineering plan

a. General. The purpose of the facility SSEP is to bring together in one document the design agent's plan for conducting the system safety program for a specific project from the concept design phase to the acceptance of the completed facility. Based on the FASS tailoring concept, the plan describes in detail how each applicable element of FASS is to be implemented.

b. Program plan prerequisites. The designer will require certain documents to write the facility SSEP. These documents include the following:

(1) The PHL.

(2) The contract documents.

(3) The list of FASS tasks required.

(4) The statement of work.

c. Timing of delivery. Because the program plan is used to document the designer's plan for the system safety tasks required in the statement of work, an initial SSEP must be completed for inclusion in the bid proposal. An update to the SSEP may be provided, if required early in the design phase to allow for review, redrafting, and final approval without affecting the timeliness of safety input into the project.

d. Team review. Because the facility SSEP is used to describe the designer's plan for meeting the system safety requirements specified in the contract, the engineering organization must review and accept the SSEP, ensuring a system safety approach consistent with contract specifications.

e. Facility system safety engineering plan. Each facility SSEP, regardless of level of system safety effort involved in the project, will address each area listed below. An approach will be provided for each area by the designer, or provide rationale as to why the area is not applicable, and will describe in detail the proposed approach to the requirement, the content, and format of the deliverables, and indicate the level of effort for each area. Each facility SSEP will be an individually tailored approach based on the contract-specified requirements, the anticipated hazards identified in the PHL, and the level of risk involved with the facility in question.

(1) *Program scope and objectives.* This section must describe the scope of the overall FASS project, the objectives and supporting tasks and activities of system safety management and engineering, and the interrelationships between FASS and other functional elements of the overall facility design, addressing as a minimum the four elements of an effective FASS program—

(a) A defined set of objectives and supporting tasks.

(b) A planned approach for objective or task accomplishment.

(c) Qualifications of system safety personnel.

(d) Authority to implement the system safety program through all levels of management.

(2) *System safety organization.* The program plan will describe—

(a) The designer's organization or functional alignment for accomplishing the system safety portion of the program. The responsibility and authority of the designer's system safety personnel, other contractor organizational elements involved in the FASS effort, and subcontractors. The program will identify the organizational unit responsible for executing each task and the line of authority for the resolution of all identified hazards. The plan will also include the name, address, and telephone number of the individual responsible for system safety input.

(b) The staffing of the system safety effort for the duration of the contract, including manpower loading, control of resources, and the qualifications of key system safety personnel assigned.

(c) The procedures by which the designer will direct the FASS efforts, including assignment of FASS requirements to action organization and subcontractors, coordination of subcontractor system safety programs, integration of hazard analyses, program and design reviews, and program status reporting.

(d) The process through which management decisions will be made, including timely notification of unacceptable risks, changes to FASS or other SOH requirements, program deviations, and so forth.

(3) *System safety program milestones.* The program plan will—

(a) Identify the system safety program milestones, including delivery dates as specified in the contract.

(b) Provide a program schedule of FASS tasks, including start and completion dates, reports, reviews, and estimated manpower loading in the scope of the overall program.

(c) To preclude duplication, identify integrated system activities (for example, design analyses, tests, and demonstrations) applicable to the FASS program, but specified in other facility engineering studies. This includes any required studies of user equipment to be installed in the facility.

(4) *General system safety requirements and criteria.* The program plan will describe—

(a) The general engineering requirements and design criteria for FASS, including FASS requirements for all appropriate phases for the life cycle up to and including disposal.

(b) The designer's procedures to comply with the required FASS risk assessment, hazard control development and evaluation, and risk acceptance requirements. Also, any quantitative measures of safety to be used for risk assessment must be described, and any system safety definitions used must be included.

(c) The procedures for addressing identified hazards, including those involving NDI and off-the-shelf equipment.

(5) *Hazard analyses.* The program plan will describe—

(a) The analyses needed to meet specified requirements.

(b) The degree to which each technique will be applied, including hazard identification associated with the facility, facility systems, subsystems, components, personnel, requirements, and NDI.

(c) The integration of the overall system hazard analyses.

(d) Efforts to identify and control hazards associated with the facility during the facility's life cycle.

(e) The boundaries and key assumptions for hazard analyses and the limits of the analyses. These typically include hostile intentions, basic structural integrity, areas sufficiently covered by applicable codes and standards, and so forth. The analysis will have a limit of resolution. The limit is dependent on the facility and details of the hazard.

(6) *System safety data.* The program plan will—

(a) Describe the specific approach for researching, distributing, and analyzing pertinent historical hazard or mishap data, including lessons learned.

(b) Identify deliverable data.

(c) Identify non-deliverable system safety data, and describe the procedures for accessibility and retention of data with historical value (lessons learned).

(7) *Safety verification.* The program plan will describe—

(a) The verification (test, analysis, inspection, and so forth) requirement for making sure that safety is adequately demonstrated. The plan will identify certification requirements for safety devices or other special safety features.

(b) A procedure for making sure any safety information is transmitted for review and analysis.

(8) *Audit program.* The program plan will describe the procedures to be employed by the contractor to make sure the objectives and requirements of the system safety program are being accomplished.

Appendix A

References

Section I

Required Publications

AR 40–10
Health Hazard Assessment Program in Support of the Army Acquisition Process (Cited in para 3–8a.)

AR 70–1
Army Acquisition Policy (Cited in para 1–5c(1)(a).)

AR 385–10
The Army Safety Program (Cited in para 1–1.)

AR 602–2
Human System Integration in the System Acquisition Process (Cited in para 3–7a.)

AR 770–2
Materiel Fielding (Cited in para 1–5c(3)(d).)

AR 770–3
Type Classification and Materiel Release (Cited in para 1–5c(3)(d).)

DoDI 5000.02
Operation of the Adaptive Acquisition Framework (Available at https://www.esd.whs.mil/dd/.) (Cited in para 1–5a(6).)

MIL–STD–464D
Electromagnetic Environmental Effects Requirements for Systems (Available at https://quicksearch.dla.mil/.) (Cited in para 3–10b(3).)

MIL–STD–882E
System Safety (Available at https://quicksearch.dla.mil/.) (Cited in para 1–5c(1)(b).)

Section II

Prescribed Forms

This section contains no entries.

Appendix B

Preparation Guidance for a System Safety Working Group Charter

B–1. Purpose
Briefly describe the SSWG's purpose.

B–2. Scope
Describe the scope of the SSWG's activities.

B–3. Authorizations
The SSWG gains its authority through the PM by virtue of the program charter.

B–4. References
References will contain publications to be used in the charter.

B–5. Tasks
a. List the major tasks the SSWG should perform. These tasks will be broad in scope. Paragraphs 2–14 through 2–18 include descriptions of ESOH tasks for each phase of the acquisition framework and can be used as a check against omission of important tasks.

b. Every charter will contain a task to develop a SSMP. The SSMP must contain the specific tasks necessary to accomplish the broad ones listed in the charter.

B–6. Operation
a. Membership. Membership should be divided into principal and advisory members. Membership is confined to organizations rather than individuals. Principal members must attend every meeting of the SSWG and advisory members only when required (see para B–8).

b. Meetings. Frequency of meetings and composition of SSWG must be described.

c. Administration.

(1) Describe procedure for developing agendas, preparing minutes, and making formal recommendations to the PM.

(2) Forward minority opinions, as well as consensus to the PM.

(3) Ensure provisions are made for updating the charter.

B–7. Term
Specify the period of time for which the SSWG is chartered.

B–8. Example of a system safety working group charter
The following is an example of a SSWG charter:

a. Purpose. To establish a technically qualified advisory group for the (system name) PM for system safety management as a means to enhance the design and safe operation effectiveness of the (system name).

b. Scope. The (system name) SSWG will function as an element of program management to monitor the accomplishment of system safety tasks including—

(1) Validating system safety tasks.

(2) Identifying system safety requirements, to include crashworthiness and crash safety.

(3) Organizing and controlling those interfacing Government efforts that are directed toward the elimination or control of system hazards.

(4) Coordinating with other program elements.

(5) Analyzing and evaluating the contractor's system safety program to provide timely and effective recommendations for improving program effectiveness.

c. Authorizations. Program charter, (system name), ACOMs, ASCC, and DRUs.

d. References. MIL–STD–882E.

e. Tasks. The (system name) SSWG will be responsible to the (system name) PM for the following:

(1) Review of (system name) requirements documents, such as CDD and letters of agreement.

(2) Review and evaluation of the best technical approach.

(3) Recommendations to the (system name) PM for establishing new or revised requirements, based on existing system safety regulations.

(4) Response to requests from the (system name) PM for recommendations on program matters potentially influencing system safety.

(5) Coordination with other elements of the (system name) PM's office to identify and evaluate those areas in which safety implications exist.

(6) Review of the (system name) RFP.

(7) Development of source selection evaluation board selection criteria for system safety.

(8) Evaluation of contractor proposals for system safety, to include crashworthiness.

(9) Development of an HTS to identify, eliminate (if possible), rank, estimate a likelihood of occurrence, and track hazards throughout the life cycle of the system. Recommendations for corrective action will be provided to the (system name) PM, as appropriate.

(10) Development of a SSMP.

(11) Review and evaluation of the contractor's SSEP.

(12) Assistance to the (system name) PM during safety system safety analyses reviews at the contractor's facility. Comments or recommendations for corrective action should be provided to the (system name) PM, as appropriate.

(13) Development of a PHL.

(14) Collection and evaluation of lessons learned pertaining to (system name) system safety.

f. Operation.

(1) Membership.

(a) The principal voting members to be appointed from the MATDEV's organizations are—

1. (System name) PM's office.
2. Supporting safety office (LCMC matrix support).
3. Engineering representative.
4. CAPDEV safety representative (for example, TRADOC system safety engineer).
5. HSI representative.
6. Installation safety manager, if applicable.
7. Prime contractor's system safety manager, if appropriate.

(b) Advisory members will be appointed from the following organizations:

1. ACOMs, ASCCs, or DRUs safety offices (LCMC, CAPDEV, or user).
2. User test organization.
3. Representatives from ACOMs, ASCCs, or DRUs developing subsystems.
4. Technical test organization.
5. ATEC AEC.
6. Army Research Laboratory Human Research and Engineering Directorate.
7. DA observer (for example, U.S. Army Combat Readiness Center (USACRC)).
8. Other organizations as required.

(c) Advisory members will be invited to attend meetings on an as-required basis when their expertise, opinions, or comments are required or solicited.

(d) The DA observer will be a representative from the USACRC. The observer's responsibility will be to participate in the SSWG meetings and provide any technical safety input to the SSWG through its chairperson.

(e) Chairmanship is vested jointly in the (system name) PM's office member and the supporting safety office member.

(f) Changes in membership will be as required to fulfill the purpose of the (system name) SSWG. Such changes will be subject to approval of the chairmanship.

(2) Meetings of the (system name) SSWG will be held before safety reviews and at other times when required by the PM. Principal members will attend all meetings. Advisory members will attend meetings at the invitation of the chairmanship when their specialized expertise is required.

(3) Administration.

(a) The SSWG chairperson will establish the agenda for scheduled meetings no later than 2 weeks prior to the meeting.

(b) Proposed agenda items may be submitted by any member of the SSWG.

(c) Minutes will be prepared for each meeting. A summary of action items, action agencies, and suspense dates will be prepared before the end of the meeting. Formal minutes of each meeting will be prepared and distributed by the PM's office.

(d) The SSWG does not have the authority to accept risks associated with identified hazards. All hazards identified by any source will be entered in the HTS and recommendations for their elimination or mitigation will be provided through the PM to the appropriate decision authority.

(e) SSWG recommendations to the PM will include any minority opinions.

(f) All items from previous meetings will be reviewed to determine that the action is closed or adequate progress is being made.

(g) Accident or incident experience will be reviewed at each meeting to identify trends and to monitor and evaluate the corrective actions taken.

(h) Implementation of the provisions of this charter will be governed by the SSMP, developed by the SSWG, and approved by the PM.

(i) This charter and the SSMP will be reviewed at least annually and updated or modified, as required.

g. Term. The (system name) SSWG will function during the life of the PM's office.

Appendix C

System Safety Management Plan

C–1. General program requirements

a. Purpose.
b. References.
c. Scope.
d. Objectives. The objective of the system safety program, found in the SSWG charter, should be listed.

C–2. System safety organization

a. Program, project, or product management office.
b. LCMC matrix support safety office.
c. Integration of associated disciplines.

C–3. Tasks

The specific tasks to accomplish the objectives in paragraph C–8d should be listed with the responsible action agency. The activities described in paragraphs 2–14 through 2–18 can be tailored for use in the SSMP. It can also be used as a check against omission of important tasks.

C–4. Milestones

A milestone schedule that parallels the overall program schedule will be established. Specific start and completion dates should be developed for the activities or tasks referenced in paragraph C–3 (see fig C–1).

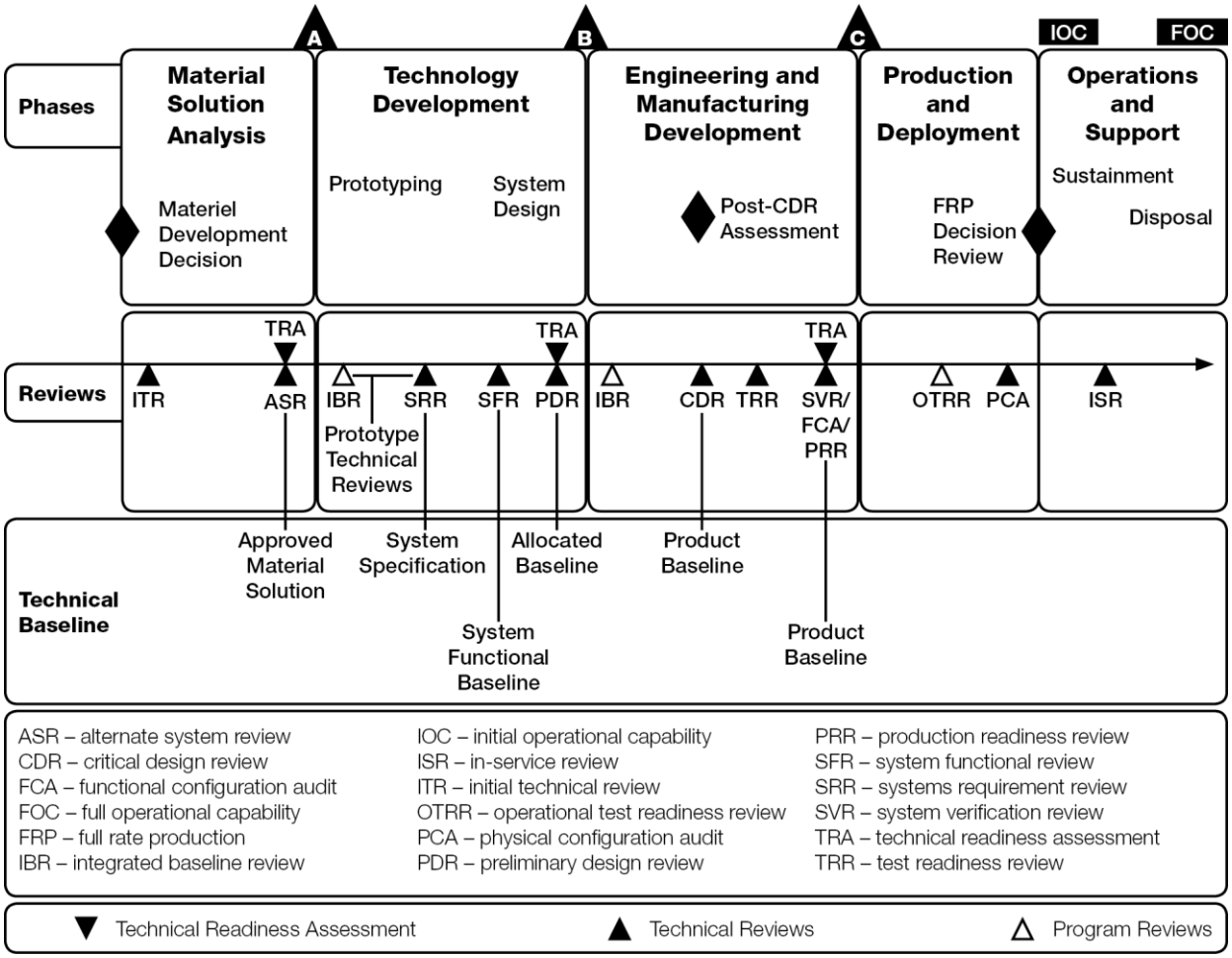


Figure C–1. Milestones

C–5. Risk management

Procedures for hazard identification, categorization, tracking, and elimination must be discussed. The decision authority for action or inaction on a hazard and for acceptance of residual risk should be defined for this program. The decision authority matrix should be incorporated (see chap 2).

C–6. Administration

Administrative details not covered in the SSWG charter should be discussed in this section. Typical items include the details of the HTS and procedures for distribution of deliverable data from the contractor.

C–7. Resources

a. Budget. Specific budgets will be prepared annually. This section will cite funds available from the PM's office for accomplishment of the system safety program. It should also project future funding requirements to aid in preparation of annual budget requests.

b. Manpower. Manpower resources available to the PM to accomplish the system safety program objectives will be described.

c. Authority. The authority for implementation of the SSMP comes from the PM. Specific actions (for example, taskings and so forth) will be conducted with the PM's approval.

Note. The sample SSMP in paragraph C–8 amplifies the preparation guidance provided in this appendix. It has been prepared for a generic major system and must be tailored before use, as organizations and responsibilities will be different for each program.

C–8. Sample system safety management plan

General program requirements—

a. Purpose. This plan establishes management policies, objectives, and responsibilities for execution of a system safety program for the life cycle of (system name) system.

b. References.

(1) MIL–STD–882E.

(2) Program charter, (system name), ACOM, ASCC, or DRU.

c. Scope. This plan establishes ground rules for Government and contractor interaction with respect to system safety. It applies to the (system name) SSWG, functional areas within the command supporting the (system name) program; (system name) program, project, or product management office; and (system name) contractors. The plan establishes the methodology by which the (system name) PM may oversee and evaluate the execution of contractor SSEPs.

d. Objectives.

(1) Assure all hazards associated with the (system name) system are identified and formally tracked and that risks associated with those hazards are properly managed.

(2) No hazard is accepted without formal documentation of associated risks.

(3) Historical safety data (lessons learned) is included in the (system name) system safety program.

(4) Safety consistent with mission requirements is included in the (system name) system safety program.

(5) Risk acceptance decisions are documented.

(6) Retrofit actions required to improve safety are minimized through the timely inclusion of safety features early in the life cycle of the (system name).

(7) Changes in design, configuration, or mission requirements are accomplished in a manner that maintains risk level acceptable to the decision authority.

(8) Significant safety data is documented as lessons learned and will be submitted to appropriate data banks (see para C–8f(2)(e)) or as proposed changes to applicable design handbooks and specifications.

(9) Consideration is given in system design, production, and fielding to safety, ease of disposal, and demilitarization of any hazardous materials.

e. System safety organization integration of associated disciplines. The SSWG is the focal point for integration of other design and testing disciplines. The chairperson of the SSWG will develop lines of communication and information exchange with the following:

(1) The (system name) manpower and personnel integration joint working group (MJWG) and test integration working group.

(2) Army Research Laboratory Human Research and Engineering Directorate and USAPHC to integrate the HFE analysis and the HHA into the (system name) system safety program.

(3) ATEC to obtain results of operational evaluations of the (system name) system and to ensure incorporation of key safety issues into the test, evaluation, analysis, and modeling plan.

(4) Environmental considerations.

f. Tasks.

(1) The PM will—

(a) Charter and guide a SSWG.

(b) Designate the program system safety manager.

(c) Establish decision authority levels for the acceptance of residual risk associated with system hazards.

(d) Establish ground rules for Government and contractor interaction. Assure contracts stipulate these rules. Assure a SSWG representative attends appropriate (system name) system reviews (for example, mock-up reviews, PDRs, CDRs, and pre-first-flight reviews).

(e) Assign budget and manpower resources to accomplish system safety management tasks (see para C–7).

(f) Establish and update system safety milestone schedule (see para C–4).

(g) Identify risk for residual hazards and provide recommendations of risk acceptance or resolution at each milestone review.

(h) Establish procedures for evaluation of product improvements for safety impact.

(i) Integrate hazards and safety issues identified by associated disciplines and input data into HTS.

(j) Prepare SSRA for each hazard. The SSRA will be sent to the CAPDEV for review no later than 60 days before each decision authority review.

(k) Assure that adequate source selection evaluation board safety criteria are established to evaluate the contractor's proposals and simplified acquisition procedures.

(l) Establish and maintain documentation of all risk acceptance decisions.

(m) Request a HHAR from the USAPHC (per AR 40–10) at each major milestone and provide the most recent version to ATEC 60 days prior to the start of all testing. HHA subject matter assistance to support safety events may be provided by contacting the USAPHC HHA Program.

(n) Sixty days prior to fielding, provide the gaining commands with all relevant system safety documentation developed during the acquisition process that provides supporting rationale for operational procedures, safety-critical maintenance and other support actions, and unit-level training requirements. As a minimum, these documents will include updated SARs, SSRAs, hazard classification data, and range SDZs. As system fielding is expanded to other commands, update the system safety documentation with lessons learned by initial users. Provide hazard analyses and SSRAs to the CAPDEV as they are developed.

(2) Supporting safety office will—

(a) Coordinate development of computerized HTS. System will be operational no later than (date or program milestone).

(b) Coordinate with test agencies to assure that system safety issues identified by the SSWG are included in test plans. As a minimum, have safety representation at the (system name) test integration working group meetings to accomplish this task.

(c) Act as executive manager or agent for system safety for the PEO, PM, or MATDEV.

(d) Review procurement documentation for compliance with DoD and U.S. Army system safety policy.

(e) Establish and maintain a system safety lessons learned file for the (system name) system. Submit lessons learned on an annual basis (September) to USACRC and Defense Technical Information Center throughout the system's life cycle. Make recommendations, as appropriate, for changes to military specifications and standards.

(f) Review and comment on system safety portions of the (system name) RFP.

(3) PEO, PM, MATDEV, or LCMC organizations will—

(a) Engineering. Provide description of hazards identified during development, production, and fielding to the SSWG. Include recommendations for controlling or eliminating the hazard.

(b) Product assurance. Provide description of hazards identified during development, production, and fielding to the SSWG. Include recommendations for controlling or eliminating the hazard.

g. Risk management.

(1) *Risk assessment.* The risk associated with a hazard is a function of its severity and probability. Therefore, all hazards will be evaluated by the SSWG to determine or verify severity and probability. Specific definitions of these terms are in MIL–STD–882E.

(2) *Risk resolution.*

(a) Once a hazard has been identified and a RAC assigned, the SSWG will identify the potential actions or methods of eliminating or controlling a hazard and the expected effectiveness of each option. Based on the RAC, not all hazards are severe enough or occur often enough to warrant the expenditures required to eliminate or control them. Regardless, the hazard will be tracked in the HTS. The SSWG will submit a written report to the PM stating risk assessment results and hazard control recommendations—

1. Within 14 calendar days after each SSWG meeting.
2. Immediately when a high-risk hazard is identified.

(b) The PM will comment in writing on the recommendations submitted by the SSWG. These comments will constitute the basis upon which hazard resolution actions are to be taken and will serve as initial documentation for risk acceptance decisions. The risk decision matrix defines the command level to which each hazard must be reported and the decision authority for accepting the risk associated with each hazard.

(c) The consequences of risk acceptance of the proposed configuration and alternative actions will be expressed using projected costs due to deaths, injuries, and equipment damage. Information concerning application and projected costs will be obtained from the contractor by the SSWG. The SSWG will calculate personnel death and injury costs using DA Pam 385–40. The decision to accept the risk will also consider other factors, such as impact on schedule and operational effectiveness. The CAPDEV will provide a recommendation as to which corrective measure will be taken and the impact of other alternative corrective measures.

(3) *Hazard tracking.*

(a) An HTS will be established jointly by the supporting safety office and the (system name) PM using the format in table 2–1.

(b) The status of a hazard will be listed as "closed" only if written approval from the appropriate decision authority has been given for acceptance of the residual risk. The hazard will be monitored, even if closed, so that accident data can be compared to the accepted RACs, to the projected deaths and injuries, or to the projected costs. The (system name) accident experience will be periodically compared to the projections to determine whether or not previous risk management decisions should be reevaluated and other corrective measures proposed.

(4) *Preparation for Army Systems Acquisition Review Council.* The PM is responsible for preparation and presentation of a SSRA for each hazard that requires Army Systems Acquisition Review Council-level decision authority. The format guidance found in this document will be used for the SSRA. The hazard tracking list generated by the SSWG and the SAR will be used to identify the appropriate hazards.

h. Administration. The PM's representative to the SSWG will accomplish the following:

(1) Prepare minutes for each SSWG meeting and distribute a copy of minutes to each SSWG principal member within 14 calendar days. The contractor will be responsible for preparing and distributing minutes of SSWG meetings held at contractor locations.

(2) Ensure distribution of contractor deliverable system safety documents to SSWG principal members within 14 calendar days of receipt by the program, project, or product management office.

i. Resources. The PM is to maintain the following resource areas:

(1) *Budget.* To be established by PM.

(2) *Manpower.* To be established by PM.

(3) *Authority.* The (system name) PM is the authority for implementation of this plan. Taskings and requests for action to implement the system safety program will be forwarded to the PM for disposition.

C–9. Key considerations

Key considerations of the SSMP include—

a. Documenting the system safety engineering approach.

b. Designating in writing a SSL for each program.

c. Ensuring the contractor-led system safety effort is integrated into the Government system safety program. This teaming arrangement does not preclude the responsibility to ensure and verify contractor performance.

d. Ensuring organizational structures and resources are adequate to perform required system safety program actions. This should include establishing a SSWG comprised of Government and contractor representatives who are responsible for implementing specific safety program requirements.

e. Ensuring the identification of recommended critical safety items.

f. Including the system safety program requirements and criteria in acquisition documentation, requests for proposals, specifications, and statements of work.

g. Reviewing the status of safety-related modifications periodically. Conducting periodic equipment improvement reports, PQDRs, and accident reviews gets the PMs personally involved. This demonstrates a shared concern with the user for the safe performance of the system, provides a forum for discussing the appropriateness of material and procedural fixes, and provides an excellent opportunity to solicit support for safety-related modifications. Periodic review of safety-related modifications for fielded systems is an indicator of the success of the original safety program conducted during development. Large numbers of such changes may indicate a weak program or poor management participation and safety emphasis. Regardless, if safety problems are allowed to be created and remain undetected until late in development, the fixes can wreak havoc with budgets and schedules.

Appendix D

Preliminary Hazard List and Preliminary Hazard Analysis

D–1. Definition

PHL and PHA involve making a study during concept or early development of a system or facility to determine the hazards that could be present during operational use. The PHA should, as a minimum, identify the hazard, estimate its severity, provide the likelihood of occurrence, and recommend a means of control or correction. The PHL is only a list of the hazards. Resource constraints and data availability are the factors used to determine whether a PHL or a PHA would be appropriate. A PHL can be the basis for an analysis that becomes a PHA. A properly completed PHL and PHA have the following advantages:

a. Their results may help develop the guidelines and criteria to be followed in a system or facility design.

b. Since they indicate the principal hazards as they are known when the system is first conceived, the PHL and PHA can be used to initiate actions for hazard elimination, minimization, and control almost from the start.

c. They can be used to designate management and technical responsibilities for safety tasks and be used as a checklist to ensure task accomplishment.

d. They can indicate the information that must be reviewed in codes, specifications, standards, and other documents governing precautions and safeguards to be taken for each hazard.

D–2. Basic elements

The PHL and PHA should include at least the following activities:

a. A review of pertinent historical safety experience and lessons learned data bases. This involves discovering problems known through past experience on similar systems or facilities to determine whether they could also be present in the system or facility under development.

b. A categorized listing of basic energy sources.

c. An investigation of the various energy sources to determine provisions that have been developed for their control.

d. Identification of the safety requirements and other regulations pertaining to personnel safety, environmental hazards, and toxic substances with which the system or facility will have to comply.

e. Recommended corrective actions.

D–3. Sources of data

Obtain historical safety information from predecessor systems.

D–4. Preliminary hazard analysis chart (sample)

There are several formats that may be used when performing a PHA (see table D–1 for a sample format of a functional PHA).

Table D–1
Sample format of preliminary hazard analysis (typical)

Program: Agent Formulation Simulation
System: Binary Lethal Agent Reactor

Part	Hazard	Cause	Hazard effect	Corrective category or prevention action
Glove box	Ignition of flammable fluid	Flammable solutions within the glove box when electrically functioning of the sampling and injection solenoids	Fire and burn injuries to the operator	Remove all flammable solutions from glove box prior to electrically functioning of the solenoids.
Glove box	Agent exposure	Ventilation failure causing loss of negative pressure within hood	Operator exposure and injury due to agent escaping from hood	Install alarms and train lab workers to stop operations, don masks,

Table D–1
Sample format of preliminary hazard analysis (typical)—Continued

				containerize agent, and evacuate.
Aluminum foil burst disk	Agent exposure	Leak due to improper installation of or damage to disk	Operator exposure and injury due to premature formation of agent	Stop filling operations when thermal recorder readout shows temperature increases.
Automatic relief valve	Chemical release	Spring-loaded relief valve does not actuate at the preset pressure	Operator exposure due to pressure buildup and rupture of reactor	Increase valve reliability by replacing automatic relief valve with a burst disk. If increased pressure is observed, operator will actuate manual relief valve.
Tank T–12	Chemical release	Degradation of tank	Environmental contamination	Monitor level of tank. Install secondary containment. Require spill plan.

D–5. Instructions for completion of the preliminary hazard analysis

a. The example in paragraph D–5b outlines the procedure for completing a PHA. In this example, engine repair operations are a subsystem of a vehicle maintenance repair facility.

b. The first step in performing a PHA on this facility is to obtain all available information about the functional and operational requirements of the facility. This is also the time to obtain historical data on potential hazards at similar facilities from sources such as accident reports, equipment or operation maintenance logs, or inspection reports.

(1) The facility should then be broken down into subsystems or component operations. Once this is completed, the PHA chart may be completed.

(2) Hazards are defined as conditions that are prerequisites to accidents; therefore, they have the potential for causing injury or damage. Hazards may be described as energy sources that generate this condition. For example, one hazard of engine repair operations in the vehicle repair facility would be carbon monoxide. Therefore, carbon monoxide is the energy source that generates the hazard. Proper hazard identification requires consideration of the following:

(a) Hazardous components that are energy sources such as fuels, propellants, lasers, explosives, toxic substances, hazardous construction materials, and pressure systems.

(b) Safety-related interface considerations among various elements of the system to include material compatibilities, electromagnetic interference, inadvertent activation, fire or explosion initiation, and hardware or software controls.

(c) Environmental constraints such as shock, vibration, extreme temperatures, noise, exposure to toxic substances, health hazards, lightning, and both ionizing and nonionizing radiation.

(d) Operating, test, maintenance, and emergency procedures such as HFE; human error analysis of operator functions, tasks, and requirements; effect of factors such as equipment layout, lighting requirements, potential exposures to toxic materials; effects of noise or radiation on human performance; life support requirements and their safety implications in manned systems; and crash safety, egress, rescue, survival, and salvage.

(e) Facilities and support equipment with appropriate training for proper use should be carefully examined. These could include provisions for storage, assembly, and testing hazardous systems and making sure personnel who will handle these systems or assemblies are properly trained.

(3) Cause factors are those items that create or significantly contribute to the existence of the hazard. In this case, failure to provide adequate exhaust ventilation is one potential cause factor. Another might be failure to control generation of carbon monoxide by running internal combustion engines or failure to provide workplace monitoring to detect carbon monoxide levels.

(4) Potential effects are described in terms of the path or flow the energy takes between the source and the object that requires protection. The effect of personnel inhaling carbon monoxide, which enters the bloodstream and interferes with the delivery of oxygen to the tissues, can lead to death or serious injury.

(5) The hazard category, which is the assigned RAC, is a determination of the hazard's severity and probability of occurrence. For this example, a RAC of IIA would be assigned based upon the high severity and probability factors associated with this hazard.

(6) Recommendations on controlling the hazard should be prioritized by concentrating on the energy source first and then following points along the flow or path of the energy. In this way, last efforts are directed at the item or person requiring protection. This form of prioritizing might be reflected in the example by first recommending that internal combustion engines be replaced by electric motors, which remove the energy source (and hazard) altogether. Next, exhaust ventilation provided directly at the source through use of below-floor or overhead systems with hoses attached directly to vehicle exhausts could be installed to contain the energy source. Finally, carbon monoxide detection equipment could provide audio and visual alerting, when carbon monoxide concentrations reach action level.

Appendix E

System Safety Risk Assessment Preparation Guidance

E–1. Part I

a. Item-system identification.

b. Hazard topic.

c. Hazard description and consequences of risk acceptance of the proposed configuration.

d. Hazard classification (severity and probability according to MIL–STD–882E).

e. Source document reference.

f. Alternative actions that could eliminate or control hazard level. Include residual risk level for each action.

g. The SSRA should be prepared as a stand-alone document.

E–2. Part II

SSWG or safety manager recommendation regarding risk acceptance. Include minority views and rationale.

E–3. Part III

Recommendation by the CAPDEV.

E–4. Part IV

Recommendation by the LCMC.

E–5. Part V

Approval by the appropriate risk decision authority.

E–6. System safety risk assessment process

See figure 2–3 for the SSRA process flow.

Appendix F

Manpower and Personnel Integration Joint Work Group System Safety Checklist

F–1. Coordination for the manpower and personnel integration joint work group system safety checklist process

a. The MJWG will meet to write the HSIP.

b. The safety representative and the MJWG must ensure that the HSIP will be passed to the associated and interested safety officers for comments.

c. Ensure the appropriate CAPDEV's and MATDEV's system safety representative is a voting member and present at all MJWG meetings.

d. Ensure all HSI safety issues brought to the MJWG are passed to the SSWG for evaluation and determination of a risk assessment per MIL–STD–882E.

e. Coordinate with the MJWG health hazard or system health hazard representative to ensure health hazard issues are consistent.

F–2. System safety checklist items

The MJWG safety representative and reviewers of the HSIP should ensure certain system safety items are included in the document. This includes, but is not limited to, the following:

a. The system safety goals in Section 3, HSI Strategy.

b. A SSMP as part of Section 4, Data Sources/Availability, Planned Level of HSI Analysis Effort.

c. The data sources used by the developers of the lessons learned are included in Tab A (Data Sources).

d. The established level of tradeoff authority for all HSI issues. This tradeoff authority must be consistent with the risk acceptance decision authority established under the SSMP.

e. List the SSWG and MJWG interface responsibilities in the SSEP and HSIP, especially as related to obtaining and analyzing data to identify the hazards.

f. MJWG chairperson will ensure the HSI assessment is coordinated with the SSWG chairperson.

Appendix G

Non-Developmental Items System Safety Market Investigation or Survey Questions

G–1. Non-developmental items market investigation or survey questions

The following are some basic system safety questions extracted from MIL–STD–882E that should be included in any NDI market investigation or survey:

a. Has the system been designed and built to meet applicable safety standards?

b. Have any hazard analyses been performed? Request copies.

c. What is the accident history for the system? Request specifics.

d. Is any protective equipment or action needed during operation, maintenance, storage, or transport of the system? Request specifics.

e. Does the system contain or use any hazardous materials (to include radioactive substances), have potentially hazardous emissions (such as from a laser), or generate hazardous waste?

f. Are special licenses or certificates required to own, store, or use the system?

g. Is the system similar to a previous military system? If so, what are the lessons learned from the previous system?

h. If the new system attempts to resolve problems with the previous system, what are the new hazards created with the new system?

G–2. Guidelines

Guidelines are according to MIL–STD–882E, unless Army requirements dictate otherwise.

Appendix H

Safety and Health Data Sheet Sample Format

The following is a sample format for an SHDS per AR 770–2, AR 770–3, and this pamphlet.

H–1. Sample format

a. Item/system identification. Name/nomenclature.

b. Safety confirmations and reports.

(1) Safety confirmations. Include safety risk assessment and safety findings addressed in safety confirmations for each acquisition milestone decision point to include materiel release.

(2) SARs.

(3) Special safety studies and assessments, including SSRAs.

c. Radioactive materials. Item does/does not contain radioactive materials, and if it does, it is properly licensed by NRC (number) and/or DA authorization (number), as appropriate. If NRC license or headquarters authorization has not been obtained, provide status of current effort with an approximate approval date prior to these items.

d. Explosives/hazardous materials. Item does/does not contain explosives/hazardous materials, and if it does, the following activities should be addressed:

(1) Interim/final hazard classifications. Provide hazard classifications for the item and all of its explosive components, which require a separate shipping configuration and dates when final hazard classifications were/will be approved. Interim and final hazard classifications data will include the following:

(a) Hazard class and division (1.1, 1.2, 1.3, 1.4, and so forth).

(b) Storage compatibility group (A, B, C, D, E, F, and so forth).

(c) Department of Transportation (DOT) class (class 1.1, 1.2, 1.3, and so forth).

(d) DOT container marking which consists of proper shipping name (49 CFR 172.101), the national stock number, or part number.

(e) Net explosive weight.

(f) Net propellant weight in pounds and kilograms.

(g) Explosive weight for quantity, distance, and purpose (based on trinitrotoluene equivalency tests, if propellant contribution is involved).

(h) DOT ex number (if applicable).

(i) United Nations serial number.

(j) DOT label (Explosive l.1E. Explosive 1.2G. and so forth).

(2) Range safety data.

(a) Maximum range and ordinate (as determined by test or analogy).

(b) Drift and probable errors (as determined by test or analogy).

(c) Ricochet characteristics (as determined by test or analogy).

(d) Sound pressure levels (as determined by test or analogy).

(e) Fragmentation radius (as determined by test or analogy).

(f) Rearward debris and/or blast and overpressure (as determined by test or analogy).

(g) Laser range safety criteria (as determined by test or analogy).

(h) Meteorological limitations (as determined by test or analogy).

(i) Approved range safety fan which incorporates the above data, as necessary.

(3) EOD procedures for safe rendering of explosive items developed (yes/no).

(4) Demilitarization and disposal procedures for disposal of hazardous, unserviceable, excess, or obsolete munitions.

(5) Safety certification from the Army Fuze Safety Review Board, as applicable (date and restrictions).

e. Munitions. Item does/does not contain munitions. If it does, compatibility for each component which may be stored as a separate item must be established. The following list applies:

(1) Component list.

(2) SDZ has been developed including fragmentation data (where appropriate) and will be provided to AMC for incorporation into guidance to the field. If the SDZ has not been finalized, provide the status and approximate approval date for the final SDZ.

f. Health hazards. Item does/does not produce health hazards (for example, noise, toxic fumes, radioactive, and laser emissions) to user, maintenance, or other personnel. If it does, an HHA or special study has been performed by the USAPHC and the following corrective actions were/will be implemented

(including the HHA report as an addendum or reference The Surgeon General memorandum exempting system from HHAR).

H–2. Risk assessment

Perform a risk assessment of identified high-, serious-, and medium-risk level safety and health hazards, based upon the decision authority matrix contained in the SSMP per AR 70–1, MIL–STD–882E, and DoDI 5000.02. This assessment will address hazards that are being fixed, or are yet to be fixed, or residual hazards that will not be eliminated by design. This assessment will define decisions regarding resolution of each identified hazard; design features and controls being or to be implemented for elimination or reduction of associated risks to acceptable levels; and describe any residual hazards concerning safety risks to user personnel and Government equipment or facilities that have not been eliminated through design. Provide program milestones for planned corrective actions on hazards yet to be resolved during next acquisition phase. If a formal SSRA (decision authority matrix of SSMP) is required, it will be included as an addendum to this SHDS. If no residual hazards exist, so state.

H–3. Summary and conclusions

Summarize the results of the above identified safety letters and reports. Identify any outstanding safety problems and indicate what corrective actions are planned and when they will be implemented and verified. Identify specific procedural controls and precautions (if any) that should be followed. Conclude with a statement as to whether or not the system is safe to test, operate, or proceed to the next acquisition phase. If used for a materiel release, the SHDS will identify the remaining safety problems in the system (safety problems identified in the safety confirmation will be included in the summary or referenced) and briefly what is being done to control them. It will conclude with a statement that the system is suitable for conditional release from a safety standpoint.

Appendix I

Data Requirements and Technical Appendices Recommended for Army Weapon System Safety Review Board Data Packages

Note. The following data package requirements may change. Contact the AWSSRB Secretariat for the most current information.

I–1. Assessing system safety

Sufficient data will be provided to allow AWSSRB members to assess the overall safety of the system. The following information is typical data that the PM should consider for presentation. The data should support the purpose of the AWSSRB review and should include those data package contents identified below.

I–2. Army Weapon System Safety Review Board data package requirements

a. Content. Several considerations affect the content of the AWSSRB data package and presentation. These include—

(1) The complexity of the item being presented.

(2) The point in the life cycle at which the review is conducted.

(3) The history of previous AWSSRB meetings on the system.

(4) The history or severity of mishaps associated with the system or similar systems.

(5) The results of hazard assessment tests and hazard analyses conducted on the system or similar systems.

b. Data package formulation. Generally, reviews occurring later in the acquisition or life cycle and reviews of complex systems have more data available for presentation. Technical data packages consist of a SAR, with additional data as specified herein. Where items in the SAR or in this appendix are not pertinent to a particular program or development phase, the paragraph heading should so state. Data packages and presentations should be dated to reflect the latest revisions as they are presented to the AWSSRB. Paragraph I–5 provides a link to a generic quick reference checklist as to the items that should be included in a joint Service technical data package, provided the items are germane to the program under review.

c. Completeness. The data package should be developed to provide documentation of a system safety program executed in accordance with MIL–STD–882E. The information provided should be complete enough to allow the AWSSRB to thoroughly review the system safety program and its results prior to the programs formal AWSSRB presentation. It should completely describe and discuss the following:

(1) *The design of the system.* A full set of design drawings is not required for this review; however, documents such as block diagrams, assembly drawings, explosive loading drawings, explosives specifications, firing circuits, or sketches that describe the system may be required. Emphasis should be placed on explosive components and other hardware affecting weapon system safety. The interaction between hardware, system software, and personnel with the safety-critical aspects of the system must be described.

(2) *The life cycle of the system.* Include a concise but thorough description of the intended use of the system. Address such subjects as storage and stowage areas, usage environment, handling equipment and methods of use, replenishment methods, packaging and transportation methods, launching platform, operational sequence, maintenance, quality evaluation, and demilitarization and disposal methods. Include any training and special safety procedures required to respond to potential malfunctions.

(3) *Safety features of the system.* Report the system's compliance with relevant design safety requirements, standards, and specifications, and special safety features implemented in the system designs.

(4) *Results of the system safety program.* Include a listing of all hazard tests and analyses conducted. Show test parameters and results as well as type and scope of analyses. Address the rationale for test and test parameter selection. Report experiences in the development, test, and evaluation process that bear on safety aspects, especially anomalies noted during explosives qualification or final type qualification testing. Describe all safety devices incorporated in the system as well as precautionary measures to be invoked. Review the analyses conducted and their results, noting any unresolved or open hazards.

I–3. System safety programmatic information

In addition content listed in AWSSRB SOPs for each review type, the following information should be provided when applicable:

a. Program background and overview.

(1) Purpose of AWSSRB meeting.

(2) Background.

(3) Integrated program and safety schedule and milestone chart.

(4) Program organizational structure.

(5) ACAT level.

(6) Safety program management organization.

(7) Past AWSSRB meetings: comments, action items, and findings assigned resolution of action items.

b. System description. In addition to the data in the SAR, this should provide a description of the operations and functions of the hardware, software, and personnel components in the system.

(1) System life cycle (include environmental profile).

(2) Explosive components.

(3) Special facility requirements.

(4) Containers to be used for the handling, storage, and transportation of explosive components.

(5) Ordnance handling equipment for handling of bare and containerized explosive components.

c. System safety program.

(1) Introduction and objectives.

(2) Safety risk management and hazard tracking processes.

(3) Planned and completed safety hazard analyses.

(4) Review of safety concerns, to include a summary of high and serious mishap risks.

d. Hazard test program, plans, and results.

(1) Hazard test plans and results.

(2) Comparison of test limits to environmental profile and safety analyses.

e. Special hazard tests.

f. HSI.

g. E3, for example, HERO, electrostatic discharge, and lightning test results.

h. Nomenclature, DoDIC, or national stock number.

i. Safety engineer's interpretation of test results.

I–4. Technical appendices

The nature of the program and its acquisition phase drive the type of technical appendices that may be required to be submitted as part of the data package. Provide only the pertinent analyses and technical information material as delineated herein. The following description of data package appendices provides some examples of the type and amount of information required. System description and other boilerplate may be eliminated from these attachments.

a. Appendix A. System Safety Program Plan or System Safety Management Plan. Applicable to new starts, first introduction of a system to the AWSSRB, or major program milestones, in accordance with MIL–STD–882E.

b. Appendix B. Hazard Analyses (examples).

(1) PHA (always include updated analysis).

(2) Facilities PHA (if applicable).

(3) FMECA (if performed).

(4) System and subsystem hazard analyses.

(5) Fault tree analysis (if performed).

(6) O&SHA (if applicable).

(7) Software hazards analyses (if applicable).

(8) Analysis of the integration of the weapon system with the platform (for example, interface/aircraft integration safety analysis) (if applicable).

(9) Other safety analyses and assessments (if applicable).

(10) Hazardous materials or toxic substances material data sheets.

(11) Status of all high and serious risks and catastrophic and critical severity mishaps.

c. Appendix C. Other Reference Material (examples).

(1) Safety-related test results to include sequential environmental tests and hazard specific tests.

(2) Explosive qualification test results; for applications of new explosives or changes of existing explosives.
(3) Final type qualification letter.
(4) Final hazard classification test results.
(5) Insensitive munitions test results.
(6) Hardware safety test results.
(7) Software safety test results.
(8) Performance-oriented packaging test results.
(9) Container qualification test results.
(10) Vertical replenishment test results or comparison data.
(11) Handling equipment design requirements and test results.
(12) Manuals or germane extracts from manuals pertinent to the assessment of the system's safety, such as technical training manuals or videos.
(13) Non-standard reference data, if cited as supporting information to safety or safety-related data.
(14) Letters and memos (pertinent to the assessment of the system's safety).
(15) Accident or incident reports.
(16) Truck, rail, or ISO container load plans.
(17) Description of range SDZ and airspace reservation requirements.

I–5. Safety data package checklist
The checklist, available at https://ac.cto.mil/, can be used by the SSL to identify applicable safety data package elements.

Glossary of Terms

Acceptable risk
That part of identified risk that is allowed by the MA to persist without further engineering or management action.

Acquisition phase
Provides a logical means of progressively translating broadly stated mission needs into well-defined system-specific requirements and ultimately into operationally effective, suitable, and survivable systems. All the tasks and activities needed to bring the program to the next milestone occur during acquisition phases.

Acquisition plan
A formal written document reflecting the specific actions necessary to execute the approach established in the approved AS and guiding contractual implementation (see Federal Acquisition Regulation (FAR) 7.1, Defense Federal Acquisition Regulation Supplement (DFARS) 207.1, and the definition of acquisition strategy).

Acquisition program
A directed funded effort that provides a new, improved, or continuing materiel, weapon or information system, or service capability in response to an approved need.

Acquisition strategy
Documents the appropriate planning process and provides a comprehensive approach for achieving goals established in materiel requirements. Serves as a principal long-range document, charting the course of a major acquisition program over its life cycle.

Army acquisition executive
Senior acquisition executive responsible for administering acquisition programs in accordance with established policies and guidelines. Also the senior procurement executive.

Army Systems Acquisition Review Council
Top-level DA review body for ACAT I and ACAT II programs. Convened at formal milestone reviews or other program reviews to provide information and develop recommendations for decision by the AAE.

Artificial intelligence
Software and system functionality with the capacity to learn, understand, reason, plan, cognate, or problem-solve.

Automated information system
A combination of computer hardware and software, data, or telecommunications that performs functions such as collecting, processing, transmitting, and displaying information. Excluded are computer resources, both hardware and software, that are physically part of, dedicated to, or essential in real time to the mission performance of weapon systems.

Capability developer
Command or agency that formulates and documents operational doctrine, concepts, organizations, or materiel requirements for assigned mission areas and functions. Serves as the user representative during acquisitions for their approved materiel requirements as well as doctrine and organization developments. The command or agency that formulates warfighting requirements for doctrine, organization, training, materiel, leadership and education, personnel, and facilities. May be used generically to represent the user and user maintainer community role in the materiel acquisition process (counterpart to generic use of MATDEV).

Capability development
The process of analyzing, determining, and prioritizing Army requirements for doctrine, training, leader development, organizations, Soldier development, and equipment; and executing solutions (or initiating solutions in the case of doctrine and training and materiel) within the context of the force development process.

Capability development document
A document that captures the information necessary to develop a proposed programs, normally using an evolutionary AS. Outlines an affordable increment of militarily useful, logistically supportable, and technically mature capability.

Capability production document
A document that addresses the production elements specific to a single increment of an acquisition program.

Combat load of ammunition
The quantity of conventional ammunition authorized by the command to be on hand in units. The basic load is carried by unit members or organic vehicles; it enables the unit to accomplish its mission until resupply can be affected.

Combat system
An integrated set of elements capable of accomplishing the plan, detect, control, and engage functions across all warfighting mission areas.

Combat system element
A weapon control system, weapon, or component that is necessary for the completion of one or more of the system's warfare missions. Exchanges information with other combat system elements via a digital or analog interface.

Combat system mishap
A failure or phenomenon within the combat system that causes death or injury to own system personnel, equipment damage, or environmental damage.

Combat system operational failure
A failure or phenomenon within the combat system that results in the degradation or inability to complete one or more mission essential functions.

Combat system safety
An effort to reduce the risk of combat system mishaps to the greatest extent possible while not compromising mission needs.

Commercial off–the–shelf item
An existing item determined by a material acquisition decision process review (DoD, military component, or subordinate organization, as appropriate) to be available for acquisition to satisfy an approved materiel requirement with no expenditure of funds for development, modification, or improvement (such as commercial products or materiel developed by other countries). May be procured by the contractor or furnished to the contractor as Government-furnished equipment or Government-furnished property.

Computer software (or software)
A combination of associated computer instructions and computer data definitions required to enable the computer hardware to perform computational or control functions.

Condition
An existing or potential state such as exposure to harm, toxicity, energy source, procedure, and so forth.

Continuous evaluation
A process that provides the continuous flow of information regarding system status to include planning, testing, data compilation, analysis, evaluation, conclusions, and reporting to all members of the acquisition team from the drafting of the initial mission need statement through deployment reviews and assessment. All members of the acquisition team will perform the CE.

Contractor
A private sector enterprise or the organizational element of DoD or any other Government agency engaged to provide services or products within agreed limits specified by the MA.

Cost (total ownership cost)
Defense systems total ownership cost is defined as life cycle cost. Life cycle cost (per DoDI 5000.73) includes not only acquisition programs direct costs, but also the indirect costs attributable to the acquisition program (that is, costs that would not occur if the program did not exist). For example, indirect costs

would include the infrastructure that plans, manages, and executes a program over its full life and common support items and systems.

Cut–up tailoring
Disjointed, fragmented system safety requirements that result when deleting, without system safety manager coordination, significant numbers of safety requirements for a revised, shorter, and cheaper safety contract.

Damage
The partial or total loss of hardware caused by component failure; exposure of hardware to heat, fire, or other environments; human errors; or other inadvertent events or conditions.

Dataset
Group of information records.

Dataset shift
The resulting divergence or shift when training and test joint distribution of inputs and outputs differs.

Deductive analysis
An analysis that reasons from the general to the specific to determine how a system may fail or meet a given set of conditions (for example, fault tree analysis).

Department of the Army System Safety Council
An advisory group established per AR 385–10 to provide technical guidance and support to the Director of Army Safety, Army Staff, ACOMs, ASCCs, and DRUs and assist them in fulfillment of the system safety management, policy and standards development, and oversight responsibilities.

Directed energy weapon
Devices or systems that radiate or concentrate EMR or atomic particles with the primary intent of permanently damaging or destroying enemy personnel or material.

Distribution
The distribution of a data set (or population) is a listing of all possible values (or intervals) of the data and how often they occur (their frequency of occurrence).

Distribution shift
Data used to train the AI or ML that does not accurately reflect the real-world data, causing the AI or ML algorithm to draw wrong conclusions (incorrect actions or recommendations).

Effectiveness
The overall degree of mission accomplishment by a system under realistic conditions (tactics, threat, personnel, battlefield and natural environments, and so on).

Electrically initiated device
A single unit, device, or subassembly that uses electrical energy to produce an explosive, pyrotechnic, thermal, or mechanical output. Examples include electroexplosive devices (such as hot bridgewire, semiconductor bridge, carbon bridge, and conductive composition), laser initiators, exploding foil initiators, burn wires, and fusible links.

Electroexplosive device
Any single discrete unit, device, or subassembly whose actuation is caused by the application of electric energy which, in turn, initiates an explosive, propellant, or pyrotechnic material contained therein. Does not include complete assemblies that have electric initiators as subassemblies, but includes only subassemblies themselves. Synonymous with electric initiator.

Electromagnetic environment
The resulting product of the power and time distribution in various frequency ranges of the radiated or conducted electromagnetic emission levels that may be encountered by a military force, system, or platform when performing its assigned mission in its intended operational environment (in the case of ordnance, during its S4). Dynamically comprised of electromagnetic energy from a multitude of natural sources, such as lightning, precipitation static (p-static), electrostatic discharge, galactic and stellar noise, and so forth, and man-made sources, such as electrical and electronic systems, RF systems, electromagnetic devices, ultra-wideband systems, high-power microwaves systems, and so forth. When defined, the

EME will be for a particular time and place. Specific equipment characteristics, such as operating frequencies and EMR emitter power levels, operational factors, such as distance between items and force structure and frequency coordination, all contribute to the EME.

Electromagnetic environmental effects
The impact of the EME upon the operational capability of military forces, equipment, systems, or platform. It encompasses all electromagnetic disciplines, including electromagnetic compatibility; electromagnetic interference; electromagnetic vulnerability; electromagnetic pulse; electronic protection; electrostatic discharge; and hazards of EMR to personnel, ordnance, and volatile materials such as fuel; and includes the electromagnetic effects.

Electromagnetic Environmental Effects Working Group
A formally chartered group of persons, representing organizations associated with the system acquisition program, organized to assist the MATDEV in achieving E3 objectives and HERO certification. As a minimum, the group will include SMEs from the test facilities, the LCMC or MSC safety office, Government program engineering support, the PM office, AEC safety evaluator or test manager, and the system prime contractor (if applicable). A member from the Joint Commanders' Ordnance Group will be a participant of the E3 working group.

Electromagnetic radiation
The emission of electromagnetic energy from a finite region in the form of unguided waves.

Environment, safety, and occupational health
All of the individual, but interrelated, disciplines that encompass the processes and approaches for addressing laws, regulations, EOs, policies, and hazards associated with environmental compliance, environmental impacts, system safety, occupational safety and health, hazardous materials management, and pollution prevention. The system safety methodology is used across the ESOH disciplines to identify hazards and mitigate risks through the SE process.

Equipment
See definition for system.

Explosive ordnance disposal
The detection, identification, field evaluation, rendering safe, recovery, and final disposal of unexploded explosive ordnance. It may also include the rendering safe or disposal of explosive ordnance that have become hazardous by damage or deterioration when the disposal of such explosive ordnance is beyond the capabilities of personnel normally assigned the responsibility for routine disposal. In this case, this includes applicable weapon systems, all munitions, all similar or related items or components explosive, energetic, or hazardous in nature. This includes explosive ordnance training aids and items, items that could be misidentified as explosive ordnance or bombs, remotely piloted vehicles, and Army aircraft and vehicles.

Explosive system
A type of ordnance installed on Army ground or aircraft systems that has non-weapon functions. Includes all the hardware and software required for its operation and support through its life cycle. A countermeasure system, an ejection seat, and a cable cutter are examples of explosive systems.

Explosives
Any chemical, compound, or mechanical mixture that, when subjected to heat, impact, friction, detonation, or other suitable initiation, undergoes a very rapid chemical change with the evolution of large volumes of highly heated gases which exert pressures in the surrounding medium. Applies to high explosives, propellants, and pyrotechnics that detonate, deflagrate, burn vigorously, or generate gases, heat, light, smoke, or sound.

Explosives safety
The process used to prevent premature, unintentional, or unauthorized initiation of explosives and devices containing explosives and to minimize the effects of explosions, combustion, toxicity, and any other deleterious effects. Explosives safety includes all mechanical, chemical, biological, electrical, and environmental hazards associated with explosives or E3s. Equipment, systems, or procedures and processes whose malfunction would put the safe manufacturing, handling, transportation, maintenance, storage, release, testing, delivery, firing, or disposal of explosives at risk are also included.

External interface
Information exchange between system program office personnel and those outside the program office.

Fail safe
A design feature that ensures that the system remains safe or will cause the system to revert to a state that will not cause a mishap.

Family of systems
A set or arrangement of independent systems that can be arranged or interconnected in various ways to provide different capabilities. The mix of systems can be tailored to provide desired capabilities, dependent on the situation. An example of a family of systems is a unit of action that included armor, infantry, artillery, and combat support systems.

Fielding command
The subordinate command, matrix support, or contracted organization, agency, or activity responsible for the fielding of a materiel system.

Firmware
Software stored in read-only memory or programmable read-only memory. Easier to change than hardware, but harder than software stored on disk, firmware is often responsible for the behavior of a system when it is first switched on. A typical example would be a monitor program in a microcomputer that loads the full operating system from disk or from a network and then passes control to it.

First unit equipped
The scheduled date system or end item and its agreed upon support elements are issued to the designated initial operational capability unit and training specified in the new equipment training plan has been accomplished.

First unit equipped date
The first scheduled date for handoff of a new materiel system in a gaining command.

Fit
The ability of an item to physically interface or interconnect with or become an integral part of another item.

Form
The shape, size, dimensions, mass, weight, and other physical parameters that uniquely characterize an item. For software, form denotes the language and media.

Function
The actions an item is designed to perform.

Functional authority
The policy proponent or office with responsibility for certifying that the activity has been performed verified and accepted when appropriate.

Functional requirement
Administrative requirements, reports, and plans that do not directly prescribe the operational performance of a system, but are used to support a program. These fall into two general categories: those that are generated by statute (the FAR and its supplements) and DoD directives and those that are generated by ARs, handbooks, pamphlets, or local policy. The second category, those generated at DA-level and below, may be exempted. The term does not include the operational requirements established by the CAPDEV.

Fuze (fuzing system)
A physical system designed to sense a target or respond to one or more prescribed conditions such as elapsed time, pressure, or command and initiate a train of fire or detonation in a munition. Safety and arming are primary roles performed by a fuze to preclude ignition of the munition before the desired position or time.

Gaining command
The ACOM, ASCC, DRU, or a subordinate organization designated to receive the system being fielded.

Government–furnished equipment
Property in the possession of or acquired directly by the Government and subsequently delivered to or otherwise made available for use.

Hardware
The physical, touchable, material parts of a computer or other system. Distinguishes these fixed parts of a system from the more changeable software or data components it executes, stores, or carries. Computer hardware typically consists chiefly of electronic devices (central processing unit, memory, and display) with some electromechanical parts (keyboard, printer, disk drives, tape drives, and loudspeakers) for input, output, and storage.

Hazard
Any real or potential condition that can cause injury, illness, or death to personnel; damage to or loss of a system, equipment, or property; or damage to the environment.

Hazardous material
See AR 385–10.

Hazards of electromagnetic radiation to ordnance
The situation in which exposure to external EME results in specified safety or reliability margins of EIDs or electrically powered ordnance firing circuits to be exceeded or EIDs to be inadvertently actuated.

Hazards of electromagnetic radiation to ordnance margin
The difference between the maximum no-fire stimulus and the permissible EID response level. For EIDs with a safety consequence, the margin is defined in MIL–STD–464D as 16.5 decibels; for EIDs with a reliability consequence, the margin is defined as 6 decibels.

Hazards of electromagnetic radiation to ordnance safe
Any ordnance item that is sufficiently shielded or otherwise so protected that all EIDs contained by the item are immune to adverse effects (safety and reliability) when the item is employed in the RF environment delineated in MIL–STD–464D. The general HERO requirements defined in the hazards from EMR manuals must still be observed.

Hazards of electromagnetic radiation to ordnance susceptible
Any ordnance item containing EIDs proven by test or analysis to be adversely affected by EMR to the point that the safety or reliability of the system is in jeopardy when the system is employed in the EME delineated in MIL–STD–464D.

Hazards of electromagnetic radiation to ordnance unsafe
Any ordnance item containing EIDs not certified as HERO safe or HERO susceptible as a result of a HERO analysis or test. Additionally, any ordnance item containing EIDs (including those previously certified as HERO safe or HERO susceptible) that has its internal wiring exposed; when tests are being conducted on that item resulting in additional electrical connections to the item; when EIDs having exposed wire leads are present and handled or loaded in any but the tested condition; when the item is being assembled or disassembled; or when such ordnance items are damaged causing exposure of internal wiring or components or destroying engineered HERO protective devices.

Health hazard assessment
The Army's formal process to identify, control, or eliminate health hazards associated with the development and acquisition of new materiel. Health hazard categories addressed by the HHA program include, but are not limited to, acoustic energy, biological and chemical substances, oxygen deficiency, ionizing and nonionizing radiation, shock, temperature, trauma, vibration, and ultrasound (see AR 40–10).

Human systems integration
A comprehensive management and technical strategy to ensure that human performance (the burden the design imposes on manpower, personnel, and training), and safety and health aspects are considered throughout the system design and development processes. The Army accomplishes the HSI goals through the HSI program.

Identified risk
That risk which has been determined through various analysis techniques.

Independent system safety assessment
An evaluation of the PEO or PM safety program management and technical issues, problems, and hazards before a milestone decision review to enter an acquisition (see para 4–9).

Inductive analysis
Analysis that reasons from the specific to the general to determine what failed states or other outcomes are possible given certain conditions (for example, failure modes and effect analysis).

Initial capabilities document
Documents the need for a materiel approach to a specific capability gap derived from an initial analysis of materiel approaches executed by the operational user and, as required, an independent analysis of materiel alternatives. Defines the capability gap in terms of the functional area, the relevant range of military operations, and desired effects and time. Summarizes the results of the doctrine, organization, training, materiel, leadership and education, personnel, and facilities analysis and describes why nonmaterial changes alone have been judged inadequate in fully providing the capability.

Initial operational capability
The first attainment of the capability (as declared by the initial operational capability organization) by a modified table of organization and equipment unit and supporting elements to operate and effectively maintain a production item or system provided. The item or system has been type-classified standard or approved for limited production; the unit and support personnel have been trained to operate and maintain the item or system in an operational environment; and the unit can be supported in an operational environment in such areas as special tools, test equipment, repair parts, documentation, and training devices.
Note. This designation is usually applied at a point in the Defense Acquisition Model that is after the full-rate production decision review and implies that the unit is combat ready.

In–process review
Review of a project or program at critical points to evaluate the status and make recommendations to the decision authority.

Insensitive munitions
Munitions designed to fulfill their performance, readiness, and operational requirements on demand, while minimizing the violence of their response to unplanned stimuli such as heat, shock, and impact.

Installation
An aggregation of contiguous or near contiguous, common, mission-supporting real property holdings under the jurisdiction of the DoD or a state, the District of Columbia, territory, commonwealth, or possession, controlled by and at which an Army unit or activity is permanently assigned.

Integrated concept team
An integrated team made up of people from multiple disciplines formed for the purposes of developing operational concepts, developing materiel requirements documents, developing other requirements documents, when desired, and resolving other requirements determination issues.

Integrated logistics support
A unified and iterative approach to the management and technical activities to influence operational and materiel requirements, system specifications, and the ultimate design or selection (in the case of NDI and COTS items); define the support requirements best related to system design and to each other; develop and acquire the required support; provide required operational phase support for best value; and seek readiness and cost improvements in the materiel system and support systems throughout the operational life cycle (see AR 700–127).

Integrated product and process development
A management technique that simultaneously integrates all essential activities through the use of multidisciplinary teams to optimize the design, manufacturing, and supportability processes. Facilitates meeting cost and performance objectives from product concept through production, including field support. One of the key integrated product and process development facilitates tenets is multidisciplinary teamwork through integrated product teams.

Integrated product and process team
A working-level team of representatives from all appropriate functional disciplines working together to build successful and balanced programs, identify and resolve issues, and provide recommendations to facilitate sound and timely decisions. May include members from both Government and industry, including program contractors and subcontractors.

Internal interface
Information exchange between various members of the system program office.

Interoperability
The ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces and to use these services to enable them to operate effectively together.

Level of autonomy
The degree of freedom a function can act without influence of an external entity.

Life cycle
All phases of the system's life including design, research, development, T&E, production, deployment (inventory), operations and support, and disposal.

Life cycle management
A management process applied throughout the life of a system that bases all programmatic decisions on the anticipated mission-related and economic benefits derived over the life of the system.

Low–rate initial production
The first effort of the production and deployment phase. The purpose of this effort is to establish an initial production base for the system, permit an orderly ramp-up sufficient to lead to a smooth transition to full-rate production, and to provide production representative articles for initial operational T&E and full-up live fire testing. This effort concludes with a full-rate production decision review to authorize full-rate production and deployment. The minimum number of systems (other than ships and satellites) to provide production representative articles for operational T&E, to establish an initial production base, and to permit an orderly increase in the production rate sufficient to lead to full-rate production upon successful completion of operational testing. For major defense acquisition programs, low-rate initial production quantities in excess of 10 percent of the acquisition objective must be reported in the Selected Acquisition Report. For ships and satellites, low-rate initial production is the minimum quantity and rate that preserve mobilization.

Machine learning
The ability of computer systems to improve performance by exposure to data without the need to follow specific programmed instruction by automatically spotting patterns in data to make predictions and more informed decision making. ML is a subfield of AI and has several learning type subfields (supervised, unsupervised, semi-supervised, reinforcement, and deep learning).

Major change
Changes that introduce new system functional capabilities or upgrades to existing system functionality that require changes to system requirements documents (for example, system specification, system requirements specification, or interface design document).

Major defense acquisition program
An acquisition program that is not a highly sensitive classified program (as determined by the Secretary of Defense) and that is designated by the Under Secretary of Defense for Acquisition and Sustainment as a major defense acquisition program or estimated by the Under Secretary of Defense for Acquisition and Sustainment to require an eventual total expenditure for research, development, test, and evaluation of more than $525 million in fiscal year (FY) 2020 constant dollars or, for procurement, of more than $3.065 billion dollars in FY 2020 constant dollars.

Major system
A combination of elements that will function together to produce the capabilities required to fulfill a mission need, to include hardware, equipment, software, or any combination thereof, but excluding construction or other improvements to real property. A system will be considered a major system if it is estimated by the DoD component head to require an eventual total expenditure for research, development, test, and evaluation of more than $200 million in FY 2020 constant dollars or for procurement of more than $920 million in FY 2020 constant dollars.

Managing activity
The original element of DoD assigned acquisition management responsibility for the system, or prime or associate contractors or subcontractors who wish to impose system safety tasks on their suppliers.

Materiel developer
The research, development, and acquisition command, agency, or office assigned responsibility for the system under development or being acquired. The term may be used generically to refer to the research, development, and acquisition community in the materiel acquisition process (counterpart to the generic use of CAPDEV).

Materiel development
The conception, development, and execution of solutions to materiel requirements identified and initiated through the capability developments process, translating equipment requirements into executable programs within acceptable performance, schedule, and cost parameters.

Materiel fielding
The entire process of preparing, taking inventory, and issuing new materiel systems to gaining units.

Matrix support
All categories of functional support provided to the MATDEV necessary to execute or attain the acquisition objective, excluding the core office (tables of distribution and allowances) capability.

Milestone
The major decision point that initiates the next phase of an acquisition program. For example, major defense acquisition program milestones may include the decisions to begin engineering and manufacturing development or to begin either low-rate initial or full-rate production. Major automated information system program milestones may include the decision to begin program definition and risk reduction.

Milestone decision authority
The person in whom is vested the authority to make milestone decisions. This may be the Defense Acquisition Executive, the component acquisition executive (for the Army, this is the AAE), or the PEO.

Military munitions
All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the DoD, the Coast Guard, the Department of Energy, and the National Guard (as defined in 10 USC 101(e)(4)) together with firing, launching, and controlling systems (including safety-critical software).

Minor change
Change to existing approved baselines that resolve an issue or collection of issues associated with known deficiencies in existing designs. Minor changes do not involve the addition of new functionality or safety-critical functions.

Mishap
An unplanned event or series of events resulting in death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment.

Mishap probability
The aggregate probability of occurrence of the individual events or hazards that create a specific hazard.

Modeling and simulation
The development and use of live, virtual, and constructive models including simulators, stimulators, emulators, and prototypes to investigate, understand, or provide experiential stimulus to either conceptual systems that do not exist or real life systems that cannot accept experimentation or observation because of resource, range, security, or safety limitations. This investigation and understanding in a synthetic environment will support decisions in the domains of research, development, and acquisition and in advanced concepts and requirements or will transfer necessary experiential effects in the training, exercises, and military operations domain.

New equipment
New or improved equipment introduced into the Army. Applies to developed, modified, and non-developmental, and commercial items.

New equipment training
The identification of personnel, training, and training aids and devices and the transfer of knowledge gained during development from the MATDEV or provider to the trainer, user, and supporter.

No hazards of electromagnetic radiation to ordnance requirement
A category of ordnance that does not contain EIDs. The ordnance may be totally inert or it may contain explosive material that cannot be initiated by RF energy. These items are not subject to HERO testing or analysis or the HERO requirements of Services' publications. These items may be included in the ordnance databases as no HERO requirement ordnance.

Non–developmental items
Items (hardware, software, communications and networks, and so forth) that are used in the system development program, but are not developed as part of the program. NDIs include, but are not limited to, COTS items, Government-off-the-shelf, Government-furnished equipment, reuse items, or previously developed items provided to the program as is.

Operational architecture
Contains text; graphic models to show functions and information required; graphic representations of how the Army organizes and equips to execute command, control, communication, and computer processes, and a database to provide detailed characteristics about information exchanges, such as format voice, data, or imagery, speed of service, perishability, and criticality. The operational architecture will show relationships among organizations and functions in terms of the information they need, use, and exchange.

Ordnance
Military material such as combat weapons of all kinds with ammunition and equipment required for their use. Includes all the things that make up a ground vehicle's or aircraft's armament including guns, ammunition, and all equipment and ordnance-related software needed to control, operate, and support the weapons.

Ordnance item
All items containing explosives, nuclear fission or fusion materials, or DoD biological or chemical agents. This includes bombs and warheads; guided and ballistic missiles; artillery, mortar, rocket, and small arms ammunition; all mines, torpedoes, depth charges, and demolition charges; pyrotechnics; submunitions or dispensers; cartridge or propellant actuated devices; electroexplosive devices; improvised explosive devices; and all similar or related items or components explosive in nature.

Overarching integrated process and product team
A team appointed by the MDA, commensurate with the ACAT level, to provide assistance, oversight, and independent review for the MDA, as the program proceeds through its acquisition cycle.

Preplanned product improvements
Planned future evolutionary improvement of development systems for which design considerations are effected during development to enhance future applications of projected technology. Includes improvements planned for ongoing systems that go beyond the current performance envelope to achieve a needed operational capability.

Probability
See the definition of mishap probability.

Program manager
The designated individual with responsibility for and authority to accomplish program objectives for development, production, and sustainment to meet user's operational needs.

Program, project, or product manager
A Headquarters, Department of the Army board-selected manager for a system or program. A PM may be subordinate to the AAE, PEO, or a materiel command commander. Refers to the management level of intensity the Army assigns to a particular weapon system or information system. As a general rule, a program manager is a general officer or senior executive service personnel; a project manager is a colonel or GS–15; a product manager is a lieutenant colonel or GS–14.

Programmatic environmental, safety, and occupational health evaluation
The program office's acquisition documentation of the ESOH aspects of the program. Required at program initiation for ships, Milestones B and C, and full-rate production decision review. It is recommended that the PESHE be updated for the CDR.

Qualitative
Relative evaluation methodology using nonmathematical processes.

Quantitative
Evaluations based on numerical values and mathematical calculations.

Radio frequency environment
An electromagnetic field. The magnitude of electromagnetic fields at communication frequencies (100 kilohertz to 1.0 gigahertz) is referred to in terms of vertical electric field strength in units of volts per meter. The magnitude of electromagnetic fields at radar frequencies (100 megahertz to 100 gigahertz) is referred to in terms of the average power density in units of milliwatts per square centimeter.

Residual risk
The risk that remains after all planned risk mitigations have been implemented.

Reusability of software modules
The extent to which a program unit is discrete and identifiable with respect to compiling, combining with other units, and loading and can be used as source code in multiple applications (for example, a message parsing module or mathematical equation module).

Risk
An expression of the impact and possibility of a mishap in terms of potential mishap severity and probability of occurrence.

Risk assessment
The process of characterizing hazards within risk areas and critical technical processes, analyzing them for their potential mishap severity and probabilities of occurrence, and prioritizing them for risk mitigation actions.

Safety
Freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment.

Safety assessment report
A formal, comprehensive safety report summarizing the safety data that has been collected and evaluated during the life cycle before a test of an item. Expresses the considered judgment of the developing agency on the hazard potential of the item and any actions or precautions that are recommended to minimize these hazards and to reduce the exposure of personnel and equipment to them.

Safety confirmation
A formal document that provides the MATDEV and the decision maker(s) with the test agency's independent safety findings and conclusions, based on testing and/or analysis that quantifies the known hazards. It includes a risk assessment for hazards in accordance with MIL–STD–882E.

Safety critical
A condition, event, operation, process, or item of whose proper recognition, control, performance, or tolerance is essential to safe system operation or use, such as safety-critical function, safety-critical path, and safety-critical component.

Safety release
A formal document issued by ATEC in accordance with MIL–STD–882E before any hands-on testing, use, or maintenance by Soldiers. A safety release is issued for a specific event at a specified time and location under specific conditions. It is a standalone document that describes system safety hazards and operational limitations for that event to reduce risk to the lowest level for the system to be used and maintained by Soldiers. It describes the specific hazards of the system based on test results, inspections, and system safety analysis. The safety release must be available before start of testing or Soldier familiarization events to include new equipment training.

Safety–critical combat system element
A combat system element that directly or indirectly controls, has the potential to control ordnance, or provides information necessary to the safe selection, arming, release, firing, or jettisoning of an ordnance item with respect to a specific event (that is, missile test firing or deployment).

Safety–related combat system element
A combat system element that interfaces to a safety-critical combat system element, whose failure would result in the increased risk of an ordnance-related mishap. Determination is made based on engineering judgment utilizing the SSWG and the documented combat system safety-critical functions and potential combat system related mishaps.

Severity
An assessment of the consequences of the worst credible mishap that could be caused by a specific hazard.

Software
The instructions executed by a computer, as opposed to the physical device on which they run (the hardware). Programs stored on nonvolatile storage built from integrated circuits (for example, read-only memory or programmable read-only memory) are usually called firmware. Software can be split into two main types: system software and application software or application programs. System software is any software that is required to support the production or execution of application programs, but that is not specific to any particular application. Examples of system software include the operating system, compilers, editors, and sorting programs. Examples of application programs include an accounts package or a computer-aided design program. Software also includes any security information assurance vulnerability alert patches.

Software support activity
An organization assigned the responsibility for post-production software support.

Special tool
A tool designed to perform a specific task for use on a specific end item or a specific component of an end item and is not available in the common tool load that supports that end item or unit. Authorized by the repair parts and special tool list located within that end item's TM.

Standardization
The process of developing concepts, doctrines, procedures, and designs to achieve and maintain the most effective levels of compatibility, interoperability, interchangeability, and commonality in the fields of operations, administration, and materiel. The process by which nations achieve the closest practicable cooperation among forces, the most efficient use of research, development, production resources, and items.

Stockpile–to–safe separation sequence
The progressive stages (phases) that begin at the time the ordnance is manufactured and continue until it is expended or reaches a safe distance from the launch vehicle, platform, or system. This progression is referred to as the S4 and may consist of up to six of the following distinct stages in which varying degrees of susceptibility can result from unique physical configurations or operational EMEs:
a. Transportation and storage: the phase during which the ordnance is packaged, containerized, or otherwise prepared for shipping or stored in an authorized storage facility. This includes transporting of the ordnance.
b. Assembly and disassembly: the phase involving all operations required for ordnance buildup or breakdown and typically involves personnel.
c. Staged: the phase during which the ordnance has been prepared for loading and is prepositioned in a designated staging area.
d. Handling and loading: the phase during which physical contact is made between the ordnance item and personnel, metal objects, or structures during the process of preparing, checking out, performing built-in tests, programming or reprogramming, installing, or attaching the ordnance item to its end-use platform or system (for example, aircraft, launcher, launch vehicle, or personnel). These procedures may involve making or breaking electrical connections; opening and closing access panels; removing or installing safety pins, shorting plugs, clips, and dust covers. This configuration also includes all operations required for unloading (that is, removing, disengaging, or repackaging the ordnance item).

e. Platform-loaded: the phase during which the ordnance item has been installed on or attached to the host platform or system, (for example, aircraft, ground vehicles, personnel, and so forth) and all loading procedures have been completed.
f. Immediate post-launch: the phase during which the ordnance item has been launched from its platform or system, but up to its safe separation distance with regard to the actuation of its explosives, pyrotechnics, or propellants.

Subsystem
An element of a system that in itself may constitute a system.

Suitability
The degree to which a system can be supported when employed by Soldiers in an operational environment. Includes reliability, availability, and maintainability, transportability, operational tempo, HSI, safety, logistics, and so on.

Support items
The various classes of supply that encompass test, measurement, diagnostic equipment, special tools and test equipment, technical manuals, training devices, and spare or repair parts used with or on a materiel system.

Supporting command
An AMC LCMC, Defense Logistics Agency, General Services Administration, or other wholesale MA that provides any materiel, services, or support equipment for the system being fielded.

Survivability
The capability of a system and crew to avoid or withstand a man-made hostile environment without suffering an abortive impairment of its ability to accomplish its designated mission. Considers ballistic effects; nuclear, biological, and chemical weapons; information assurance; countermeasures; E3s; obscurants; atmosphere; and vulnerability.

Susceptibility
The property of an ordnance item that describes its capability to function acceptably when subjected to unwanted electromagnetic energy. The degree of susceptibility is dependent upon the amount of induced energy, the characteristics of the electroexplosive device, and the environment (such as field strength, orientation of weapon system, weapon configuration, and so forth).

System
A composite, at any level of complexity, of personnel, procedures, materials, tools, equipment, facilities, and software. The elements of this composite entity are used together in the intended operational or support environment to perform a given task or achieve a specific production, support, or mission requirement.

System evaluation plan
Documents integrated T&E planning. The detailed information contained in the SEP supports parallel development of the TEMP and is focused on evaluation of operational effectiveness, suitability, and survivability. While the documents are similar, the TEMP establishes what T&E will be accomplished and the SEP explains how the T&E will be performed (see AR 73–1).

System of systems
A set or arrangement of interdependent systems that are related or connected to provide a given capability. The loss of any part of the system will degrade the performance or capabilities of the whole. An example of a SOS could be interdependent information systems. While individual systems within the SOS may be developed to satisfy the peculiar needs of a given user group, the information they share is so important that the loss of a single system may deprive other systems of the data needed to achieve even minimal capabilities.

System safety
The application of engineering and management principles, criteria, and techniques to optimize all aspects of safety within the constraints of operational effectiveness, time, and cost throughout all phases of the system life cycle.

System safety engineer
An engineer who is qualified by training or experience to perform system safety engineering tasks.

System safety engineering
An engineering discipline requiring specialized professional knowledge and skills in applying scientific and engineering principles, criteria, and techniques to identify and eliminate hazards or reduce the associated risk.

System safety engineering plan
A description of the planned methods to be used by the contractor to implement the tailored requirements of this standard, including organizational responsibilities, resources, methods of accomplishment, milestones, depth of effort, and integration with other program engineering activities and MAs and related systems.

System safety lead
A qualified safety professional who serves as the program office's single point of contact for safety-related matters. Designated in writing by the program office and serves as the principal liaison with the AWSSRB.

System safety management
A management discipline that defines system safety program requirements and ensures the planning, implementation, and accomplishment of system safety tasks and activities consistent with the overall program requirements.

System safety management plan
A plan that documents how MATDEVs identify, track, and manage system hazards (see app C).

System safety manager
A person responsible to program management for setting up and managing the system safety program.

System safety program
The combined tasks and activities of system safety management and system safety engineering implemented by acquisition project managers.

System safety risk assessment
A comprehensive evaluation of the risk and its associated impact.

System safety working group
A formally chartered group of persons, representing organizations associated with the system acquisition program, organized to assist the MA system PM in achieving the system safety objectives. Regulations of the military components define requirements, responsibilities, and memberships.

Systems architecture
The physical layout, depicted graphically, showing the relationship of the information exchange and connectivity requirements. Identifies components and capabilities; and establishes interconnections among command, control, communication, and computer components of systems. Can be developed for an individual system or at higher levels to depict the integration of numerous systems into a SOS architecture.

Systems engineering
The overarching process that a program team applies to transition from a stated capability to an operationally effective and suitable system. Encompasses the application of SE processes across the acquisition life cycle (adapted to each and every phase) and is intended to be the integrating mechanism for balanced solutions addressing capability needs and design considerations and constraints, as well as limitations imposed by technology, budget, and schedule. SE processes are applied early in concept definition, and then continuously throughout the total life cycle.

Systems engineering plan
A description of the program's overall technical approach including processes, resources, metrics, applicable performance incentives, and the timing, conduct, and success criteria of technical reviews.

Technical architecture
Comparable to a building code, not telling what to build (operational architecture) nor how to build (system architecture), but rather delineating the standards to build to and to pass inspection. Identifies a

framework of standards and includes top-level system specifications and architectural diagrams for technical interface specifications.

Technique
A specific method for analysis using specific engineering expertise (for example, fault tree and failure mode and effect analysis).

Test, measurement, and diagnostic equipment
Any system or device used to evaluate the operational condition of an end item or subsystem thereof or used to identify or isolate any actual or potential malfunction. Includes diagnostic and prognostic equipment, semiautomatic and automatic test equipment (with issued software), and calibration test and measurement equipment.

Threat
Ability of an enemy or potential enemy to limit, neutralize, or destroy effectiveness of current or projected mission, organization, or item of equipment. Statement of that threat is prepared in sufficient detail to support Army planning and development of concepts, doctrine, training, and materiel. Statement of a capability prepared in necessary detail in context of its relationship to specific program or project to provide support for Army planning and development for operational concepts, doctrine, and materiel.

Total risk
The sum of identified and unidentified risks.

Training developer
Command or agency that formulates, develops, and documents or produces training concepts, strategies, requirements (materiel and other), and programs for assigned mission areas and functions. Serves as user (trainer and trainee) representative during acquisitions of their approved training materiel requirements and training program developments.

Training device (embedded)
Training that is provided by capabilities designed to be built into or added on to operational systems to enhance and maintain the skill proficiency necessary to operate and maintain that system. Embedded training capabilities encompass four training categories. Category A (individual/operator): to attain and sustain individual, maintenance, and system orientation skills. Category B (crew): to sustain combat ready crews or teams. This category builds on skills acquired from Category A. Category C (functional): to train or sustain commanders, staffs, and crews or teams within each functional area to be utilized in their operational role. Category D (force level (Combined Arms Command and battle staff)): to train or sustain combat ready commanders and battle staffs utilizing the operational system in its combat operational role.

Training device (nonsystem)
A training aid, device, simulator, and simulation not defined as a system training aid, device, simulator, and simulation.

Training device (simulations)
A training medium designed to replicate or represent battlefield environments in support of command and staff training. Simulations may stand alone or be embedded.

Training device (simulators)
A training medium that replicates or represents the functions of a weapon, weapon system, or item of equipment generally supporting individual, crew, or crew subset training. Simulators may stand alone or be embedded.

Training device (stand–alone)
An autonomous item of training equipment designed to enhance or support individual or collective training.

Training device (system)
A training aid, device, simulator, or simulation item that supports a specific materiel system or family of systems program.

Training devices
Training aids, devices, simulators, and simulations which simulate or demonstrate the function of equipment or weapon systems. These items are categorized as follows: embedded, nonsystem, simulations, simulators, stand-alone, and system.

Unacceptable risk
That risk which cannot be tolerated by the MA. It is a subset of identified risk. Unacceptable risk is either eliminated or controlled.

Unidentified risk
The risk that has not been determined. It is real. It is important. But it is not measurable. Some unidentified risk is subsequently determined when a mishap occurs. Some risk is never known.

User
Command, unit, element, agency, crew, or person (Soldier or civilian) operating, maintaining, or otherwise applying products in accomplishment of a designated mission.

User representative
An individual who presents the user viewpoint during requirements determination, documentation, and acquisition processes.

Validation
The review of documentation by an operational authority other than the user to confirm the need or operational requirement. As a minimum, the operational validation authority reviews the mission need statement, confirms that a non-materiel solution is not feasible, assesses the joint service potential, and forwards a recommendation to the MDA for Milestone A action.

Weapon system
A weapon and those components required for its operation and support. Includes all conventional weapons, ammunition, guns, missiles, rockets, bombs, flares, powered targets, mines, unmanned vehicles that launch weapons or are themselves launched using a ground vehicle or aircraft, and explosives-operated devices. Includes all explosive items, packaging, handling, stowage, test equipment, simulators, guidance systems, fire control systems and launchers and their components. Software and firmware related to monitoring, arming, initiation, or deployment of a weapon is included. Also encompasses the manufacturing, processing, packaging, handling, transport, and storage of explosive items and related components.

Weapon system safety
The aggregate of analytical and testing processes, procedures, training, and management policy used to ensure that the risks associated with weapons and related systems are reduced to the lowest extent practical throughout the system’s life cycle.

SUMMARY of CHANGE

DA PAM 385–16
System Safety Management Guide

This major revision, dated 24 July 2023—

- Changes manpower and personnel integration to human systems integration (para 3–9).
- Adds hazards of electromagnetic radiation to ordnance certification process (para 3–10).
- Updates guidance on commercial off-the-shelf, non-developmental items, and local purchases (para 3–13).
- Updates independent safety assessment process (para 4–9).
- Adds guidance on weapon system safety reviews (chap 5 and app I).