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Sensing & Exploration Systems Safety & Health Plan

30 March 2009

**Sensing & Exploration Systems
Lockheed Martin Space Systems Company
Denver Operations
Safety & Health Plan**

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LOCKHEED MARTIN 

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Sensing & Exploration Systems Safety & Health Plan

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REVISION LOG

Change Number	Change Date	Pages Affected	Remarks	Authority Reference
New	January 2003	All	Initial Release	For SES Programs
1	April 2003	6,12	Records Management procedure number change	Aerocapture contractual update
2	January 2004	All	Changes to accommodate Phoenix	Phoenix contractual update
3	June 2004	All	Changes to accommodate Hubble Robotic Vehicle Deorbit Module and Hubble Disposal Vehicle; No deletions or changes of intent impact previous approvals	Hubble Robotic Vehicle Deorbit Module and Hubble Disposal Vehicle proposal submittals
4	October 2004	5, 7, 8, 19, 21, & 24 Attachment 1, 2, & 4	Update to accommodate multiple NASA contracts, including AID.	AID contract
5	April 2006	All	Update to accommodate Juno; overall document update for clarification and currency	Juno contract
6	March 2009	All	Update to accommodate MAVEN; overall document update for clarification and currency	MAVEN contract NNG09EK34C

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1.0 INTRODUCTION

1.1 PURPOSE

The Safety and Health Plan provides a detailed discussion of the policies, procedures, and techniques used during Lockheed Martin (LM) performance of Sensing & Exploration Systems contracts to enable the protection of life, health, and well being of NASA and LM Team personnel, property, and equipment. The plan summarizes LM safety and health processes and describes the interface with the safety content described in the NFS Clause 1852.223-73, Safety and Health Plan and associated applicable safety processes. GSFC Clause 52.223-91 requirements are included and are applicable when invoked by contract.

1.2 DOCUMENT OVERVIEW

LM Environment, Safety, and Health (ESH) and Program System Safety provide a comprehensive system for hazard identification and control throughout the program life cycle. The combined ESH and System Safety programs increase customer value by integrating ESH and System Safety in all contract phases, from design through test, production, and launch, thus providing an efficient mechanism for early identification and mitigation of risk to personnel, environment, and product. The Safety and Health Plan includes specific interfaces with NASA customers for safety data management.

S&ES operates within the LM ESH management system (ESHMS) to ensure personnel safety and protection of the environment. The management system implements the ESH program and complies with federal, state, and local requirements. The ESHMS consists of hazard identification, implementation of mitigating controls, vigilant assessment, and continuous improvement. Employee communication, training, management reviews, and a rigorous root cause determination and corrective action process focus on mitigating risks and preventing injuries. The management system also provides compliance with contractual requirements; thus, it ensures compliance with NPR 8715.3, NASA Safety Manual.

The Safety and Health Plan applies to LM S&ES operations and summarizes how LM ensures the safety and health of its personnel in accordance with the LM ESH policy and ESHMS.

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2.0 DOCUMENTS

2.1 APPLICABLE DOCUMENTS

The following government documents are cited as compliance documents per the Safety and Health Plan data item description.

Document Number	Description	Version	Date
NFS Clause 1852 223-73	Safety & Health Plan	-	November 2004
GSFC 52 223-91	Safety & Health—Additional Requirements	-	November 2005

2.2 REFERENCE DOCUMENTS

The following documents are cited as references in the Safety and Health Plan.

Document Number	Description	Version	Date
CPS-015	Lockheed Martin Corporate Policy Environment, Safety & Health	Most current	-
CPS-002	Lockheed Martin Environment, Mission Assurance	Most current	-
1 3 3-T1-ESH-1 0-D	Lockheed Martin Environment, Safety & Health Directive	Most current	-
NPD 8700 1	NASA Policy for Safety & Mission Success	C	October 13, 2002
ESH-01	Lockheed Martin ESH Management System	Most current	-
1 3 3-T1-ESH-11 0-S	Lockheed Martin Contractor Safety	Most current	-
29CRF1910	Occupational Safety & Health Administration, Department of Labor	Most current	-
FED-STD-313	Material Safety Data, Transportation Data & Disposal Data for Hazardous Materials Furnished to Government Activities	D	March 21, 2000
1 3 3-T1-ESH-30 0-S	Lockheed Martin Hazard Communication Standard	Most current	-
40 CFR	Code of Federal Regulations, Protection of Environment	Most current	-
2 3 8 1-T1-Test-1 0-P-W3	Lockheed Martin Test Procedures Work Product Description	Most current	-
1 3 3-T1-ESH-56 0-S	Lockheed Martin Personal Protective Equipment	Most current	-
1 3 3-T1-ESH-18 0-S	Lockheed Martin Monthly/Quarterly Self-Inspections	Most current	-
3 1-T1-CDM-2 1-S	Lockheed Martin Configuration Identification Functional Reviews	Most current	-
2 3 8 1-T1-Test-1 0-P	Lockheed Martin Test Engineering Process	Most current	-
3 6-T1-SysSaft-3 0-D	Error Prevention	Most current	-
1 3 3-T1-ESH-59 0-S	Lockheed Martin Radioactive Material Safety	Most current	-
ESH-04	Lockheed Martin Incident Reporting	Most current	-
1 3 3-T1-ESH-69 0-S	Lockheed Martin ESH Self Assessment	Most current	-
1 3 3-T1-ESH-1 0-P	Lockheed Martin Environment, Safety & Health Management System	Most current	-
10 CFR	Energy	Most current	-
49 CFR	Transportation	Most current	-
1 3 3-T1-ESH-29 0-S	Lockheed Martin Waste Management	Most current	-
1 3 3-T1-ESH-1 0-S	Lockheed Martin Accessory Hoisting Equipment	Most current	-
1 3 3-T1-ESH-12 0-S	Lockheed Martin Overhead Cranes	Most current	-
3 6-T1-MSuccess-1 3-P	Lockheed Martin Mission Success Bulletin Processing	Most current	-
3 6-T1-SysSaft-3 2-G	Lockheed Martin Mission Mishap & Near Miss Investigation Guidebook	Most current	-
2 4-T1-OPS-1 1-S	Lockheed Martin Drop Mitigation	Most current	-
3 6-T1-ProdAssr-2 4-D	Lockheed Martin Stop Work Command	Most current	-
2 3 4-T1-SpecEng-1 0-S	Lockheed Martin Failure Modes & Effects Analysis (FMEA) for Design, Processes & Equipment	Most current	-
1 3 3-T1-ESH-26 0-S	Lockheed Martin Portable Hand & Power Tools	Most current	-
3 6-T1-MSuccess-1 3-P	GIDEP & Mission Success Bulletin Processing	Most current	-
NPR 8621 1	NASA Procedural Requirements for Mishap & Close Call Reporting, Investigating & Recordkeeping	B	May 23, 2006
NPR 8715 3 Appendix E	Sample Safety & Health Plan for Service or Operations Contracts	B	April 4, 2007

3.0 S&ES SAFETY AND HEALTH PROGRAM

3.1 POLICY

Corporate policy statement (CPS)-015, Environment, Safety and Health, states, "Lockheed Martin Corporation is committed to conducting its operations in a manner that prevents accidents and environmental, safety, and health incidents; ensures the safety of employees, contractors, and the public; protects the environment; and conserves natural resources." CPS-002 adds product safety considerations as follows, "Lockheed Martin will apply the principles of Mission Success, Quality, and System Safety to all activities affecting its products and services, including but not limited to research, business development, design, manufacture, test, operation, service, and disposal, regardless of whether such activities are performed by Lockheed Martin, its suppliers or subcontractors, or, to the extent practicable, its customers." Accordingly, LM:

- Institutes an ESHMS that reduces risk to at least the level deemed acceptable by NASA, ensures ongoing compliance with applicable laws and regulations, and promotes continued improvement of the ESH performance and the management system
- Integrates ESH considerations into business operations, including, but not limited to, product design, services, procurement, manufacturing, product testing, joint ventures, property renovation/rearrangement, and business and property acquisitions, consolidations, and divestitures
- Shares ESH best practices and lessons learned among LM business units and entities
- Ensures employees are aware of ESH responsibilities in their jobs and encourages every employee to take responsibility for ESH performance
- Responds to employee, community, customer, and regulatory agency concerns regarding potential ESH impacts from operations, as appropriate
- Participates in public policy processes to promote development of ESH laws and regulations that protect human health and the environment and are consistent with sound science and risk assessment principles

LM ESH directive 1.3.3-T1-ESH-1.0-D states, "All LMSSC operation units and remote sites shall conduct its business activities and operations in a manner that:

- protects public and personnel safety and health,
- protects the environment,
- minimizes risk and liabilities to the company,
- utilizes safe and environmentally sound processes to develop products for its customers,
- protects facilities, products and resources from damage and losses,
- complies fully with applicable federal, state and local environmental, safety and health laws,
- pursues continual performance improvement and Mission Success and
- integrates ESH considerations throughout the enterprise."

Both the corporate policy and the LM directive are consistent with NASA and OSHA safety objectives. LM safety policy is consistent with NASA policy for safety and mission success detailed in NPD 8700.1. NASA safety and mission assurance policy includes the objectives to protect the public from harm, ensure the safety of employees, and affect positively the overall success rate of missions and operations through preventing damage to high-value equipment and property. This Safety and Health Plan describes the method of compliance to NASA Safety Manual NPR 8715.3 requirements applicable to S&ES contracts. The LM command media described herein provides specific direction to employees for the implementation of the LM ESH policies. This Safety and Health Plan provides an overview of the LM directives, processes, and standards as they relate to safety.

3.2 GOALS AND OBJECTIVES

LM launched the corporate-wide target zero initiative that sets an aggressive goal of zero lost-time, OSHA-recordable, and first-aid injuries. To work toward the zero injury goal, LM set a target 0.28 day-away case rate in 2009 and a recordable case rate of 1.17 in 2009. LM is committed to further reductions to approach zero injuries in later years.

LM’s objectives regarding the ESH program are to develop strategies and programs and provide services that enable the company to cost-effectively achieve regulatory compliance and mission success. In partnership with our customers, including NASA, LM integrates ESH programs with business processes. Essential program philosophies include:

- Evaluating various programs, such as fall protection, hazardous waste management compliance, etc, using the ESHMS, at least annually—this includes review of requirements, objectives, policies, and procedures, to ensure goals are met
- Providing a safe and healthful workplace and maintaining facilities in a manner that satisfies regulatory requirements
- Reviewing and evaluating new or modified equipment, processes, procedures, and substances for safety before operation
- Performing operations in a manner that protects the environment
- Complying with federal, state, local, corporate, and applicable NASA requirements
- Providing safety education, worker qualifications and certifications, and training programs consistent with applicable laws, regulations, contractual requirements, and good practices
- Periodically review programs for compliance with regulatory requirements through the audit process
- Reporting and investigating injuries, illnesses, and accidents (mishaps), and near misses (close calls) pertaining to safety, without retribution to the employee—LM places emphasis on understanding the root-cause that allows an unwanted sequence of events to occur, rather than assigning blame. The reporting and investigating sequence facilitates instituting corrective action to prevent recurrence.

The annual ESH program evaluation and status cycle begins with the ESH risk assessment. ESH programs listed as high risk drive the development of objectives to improve those programs. This dynamic process ensures compliance with new or revised regulations and NASA requirements. ESH Self Assessment, 1.3.3-T1-ESH-69.0-S, contains key elements and milestone schedule for evaluating ESH performance (table 3.2-1). Section 3.8 describes in detail the LM ESHMS, which depicts how the ESH program implements performance criteria from the safety Performance Evaluation Profile (PEP).

3.3 MANAGEMENT LEADERSHIP

Managers and supervisors have the primary accountability for maintaining a safe and healthful workplace for their employees and for ensuring their operations are conducted in a manner that protects the environment. This responsibility started with Mr Tom Marsh, former president of LM. Mr Marsh had demonstrated his commitment to the target zero goal of driving out workplace injuries by stating, “I expect everyone to work safely and look out for the well-being of their fellow employees. A zero injuries mindset is absolutely essential to Mission Success, and for Space Systems, it is an operational imperative.” This commitment to target zero is continued with Joanne Maguire, executive vice president of LM. In a communication to all

Table 3.2-1 ESH Self-Assessment Key Elements and Milestones

Self-Assessment Element	Milestone
ESH management system review	Annual
Office area self-inspection	Quarterly
Operational area self-inspection	Monthly

employees on February 14, 2007, Joanne Maguire provided a perspective defining the importance of workplace safety: “Our number one job is to satisfy our customers by giving them Mission Success and meeting our cost and schedule commitments. Our number one tool for achieving those commitments is you. You are our most valuable asset, and therefore workplace safety is critical--both to our success and to your livelihood and future.” The commitment to safety on S&ES is implemented through Regina Palmer, S&ES Line of Business Quality Assurance Manager, as indicated in her statement as follows: “I fully endorse the safety plan and take personal responsibility for its implementation.”

The LM director of ESH is the point of contact for implementing target zero. In working toward the goal of zero injuries, Denver ESH management has increased resources with an emphasis on creating greater awareness of personnel safety in the workplace. Operations managers, such as the ESH manager, are required to establish workplace visibility by performing monthly walk-through inspections of work areas, quarterly walk-through inspections of office areas, and monthly management-by-walking-around fact-finding sessions with employees.

The management structure ensures requirements are communicated, understood, and implemented across LM (fig. 3.3-1).

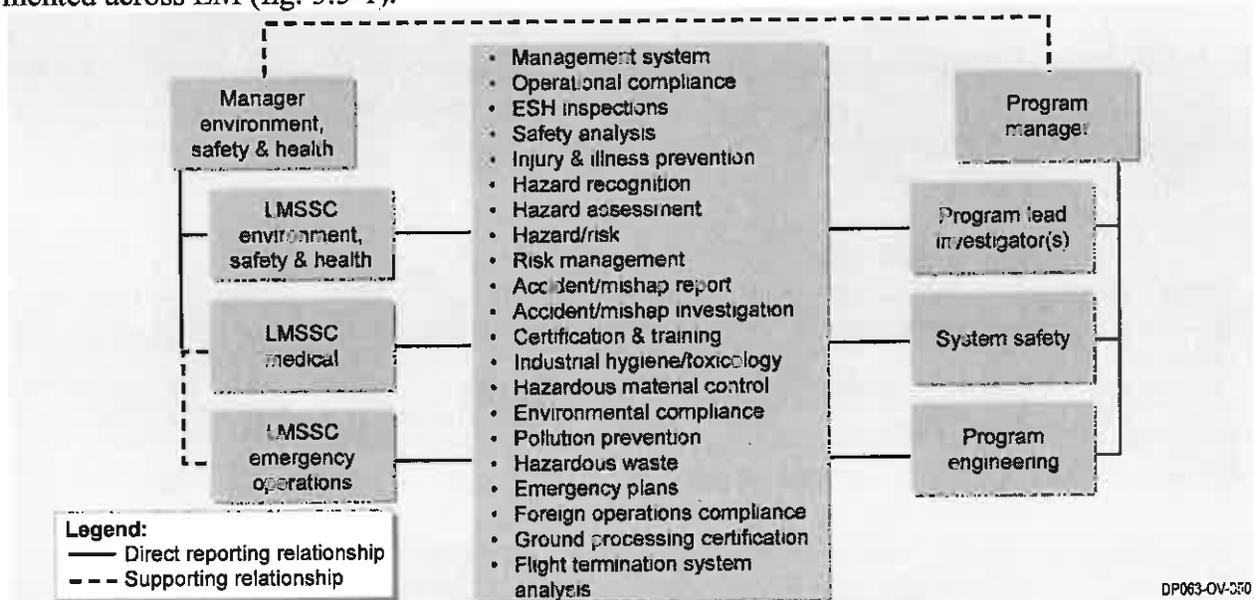


Figure 3.3-1 Lockheed Martin ESH Management Structure

Documented Command Media—OSHA and EPA Programs—A documented hierarchical command media structure that includes ESH requirements is available to management and employees. Management uses this command media to flow down regulatory requirements and management direction, and to distribute requirements to line management, staff organizations, and employees. These command media hierarchies are:

- LM directives (policies)—Documents that describe values, principles, objectives, edicts/declarations and requirements for conducting company business. These documents are usually brief statements that avoid detailed implementation instructions and assign responsibilities to specific organizations or to members of management.
- LM processes—Documents that provide task and step descriptions of required activities that transform specific input into specific output. Processes include: what, directive statements; when and where applicability; how; why process steps; and which roles perform.

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- LM standards—Documents that establish mandatory benchmarks or parameters as a basis for comparison, and can contain guidance material.

Appendix A lists the primary S&ES applicable internal implementing documents for safety management. These documents include OSHA programs that require documented plans and numerous other ESH programs that are implemented at LM. The most current version of these documents is used for work performed by S&ES and can be found on the LM intranet.

Workers contracted by LM to work at LM are monitored by ESH in accordance with LM 1.3.3-T1-ESH-11.0-S, Contractor Safety. Note: Our command media documents do not directly flow down to our subcontractors—they do not receive the entire library of documents and are not directed to follow them. We accept equivalent procedures, and the contractor must be prepared to provide documentation that its procedures comply with LM requirements. Contractors comply with applicable laws and regulations; failure to do so upon recognition by LM staff results in cessation of activity. Onsite rules of behavior also apply such as the drug-free workplace and non-smoking campus requirements. It is the responsibility of escorts to verify visiting and contractor personnel also comply with rules specific to product areas such as clean room and electrostatic discharge protocols.

LM has provision for employee-like personnel, such as NASA personnel assigned to an LM location for an extended period, to receive appropriate safety training and certifications. An employee-like individual must be sponsored by an LM manager, and the manager facilitates key safety-related benefits as follows:

- Password for access to LM intranet that includes LM safety command media
- Assignment of safety training requirements in the individual's learning plan
- Personnel ID number for inclusion and access in the learning system
- E-mail account to where system-generated training due notices are sent
- Monitoring to verify prompt completion of required training

3.4 EMPLOYEE INVOLVEMENT

Employees are expected to work safely at all times and take immediate action if unsafe conditions are known or suspected. Employees have, with no fear of reprisal, the freedom and authority to report any unsafe condition and to suspend operations until the unsafe condition is mitigated. Section 4.3 provides more detailed information about employee reporting of hazards.

All employees are responsible for the following:

- Complying with LM command media
- Adhering to the LM values to do what's right, respect others, and perform with excellence
- Performing at all times, in a manner to ensure maximum safety to self, fellow workers, the public, the environment, and product hardware; and to minimize property loss or damage
- Accepting and demonstrating responsibility for their own and others' safety by not attempting work that they do not feel qualified for or physically able to perform
- Maintaining current safety and health training certifications
- Performing assigned work according to ESH requirements
- Obtaining specific instructions and/or clarifications from the supervisor, manager, or ESH organization before proceeding with assigned work in situations where an ESH requirement or procedure is not completely understood
- Observing and adhering to warning signs, signals, and notices
- Promptly reporting observed hazards
- Immediately reporting work-related injuries, illnesses, and mishaps/near misses, including actual or suspected hardware damage, exposures, or unapproved environmental releases

- Understanding emergency response, notification, and evacuation procedures; understanding hazardous materials and chemicals requirements; and understanding safety risks from operations in the employee's area of responsibility
- Identifying areas in which safety can be improved

3.5 ASSIGNMENT OF RESPONSIBILITY

3.5.1 Lockheed Martin

Mr Robert Stevens, chief executive officer of Lockheed Martin Corporation, is committed to high safety performance throughout the corporation. Mr Stevens stated, "Lockheed Martin is setting a new long-term safety objective: to create a workplace where there are no injuries and all employees develop and maintain a 'zero accidents' mentality."

Mr Ken Meashey, corporate vice president of Energy, ESH, manages emerging federal and state issues concerning ESH in concert with LM's ESH policy. Energy, ESH maintains an intranet homepage that provides important resources to all LM locations.

3.5.2 Lockheed Martin President and Vice President Staff

Ms Joanne Maguire, LM executive vice president, is responsible for championing LM corporate safety objectives. Ms Maguire demonstrates her support of safe operations by committing programs and resources to ensure safe conduct in the workplace. Examples include her support of the Target Zero initiative, her maintenance of human error prevention training for all operational employees, and her endorsement of the Error Prevention Council that is dedicated to process improvement. Ms Maguire's vice president-level staff ensures implementation of her directives in their functional areas of the company. Mr James Crocker, vice president of Sensing and Exploration Systems, is responsible for all S&ES activity at LM. Specific responsibilities include:

- Providing leadership and stewardship for compliance with LM safety programs and compliance with federal, state, local, customer, and corporate requirements
- Ensuring adequate resources to implement ESH programs that minimize risk to personnel, environment, LM customers, contractors, the public, and products.

3.5.3 Lockheed Martin ESH Management

The LM ESH program is administered by the LM ESH director who is responsible for:

- Directing, guiding, coordinating, developing, and implementing the ESHMS, and common processes, procedures, and standards
- Standardizing and integrating ESH programs across LM business units to the greatest extent practical
- Ensuring continual improvement of the ESHMS, programs, and performance
- Ensuring ESH management reviews are conducted, and that, directives, processes, and standards are updated as appropriate
- Representing LM with corporate Energy, ESH and serving as the central point of contact for LM

The LM ESH manager is responsible for the following:

- Ensuring ESH requirements are integrated into operations and processes
- Continually improving ESH processes and standards
- Developing and maintaining performance measurements consistent with the ESHMS
- Planning and directing the LM ESH program
- Reviewing and interpreting federal, state, and local ESH laws and regulations and developing and disseminating ESH requirements—should S&ES be subject to the ESH-related laws and

regulations of another nation or to an international treaty, the LM ESH manager is responsible for review and interpretation of those as well.

3.5.4 Program Managers

PMs are responsible for the following:

- Selecting and integrating applicable ESH requirements, standards, and programs into operations and processes throughout the program life cycle
- Providing a safe and healthful workplace for personnel, preventing environmental pollution in their operations, protecting product hardware, and ensuring safe and environmentally sound products and services for NASA
- Conducting operations in compliance with applicable laws, regulations, standards, command media, and NASA requirements
- Fostering a culture that encourages personnel to take responsibility for ESH performance
- Seeking opportunities to implement and share LM and industry best ESH practices
- Complying with and advising employees of ESH regulations, policies, programs, processes, and standards that pertain to their operations
- Ensuring safety is appropriately addressed in regularly scheduled meetings and in huddles
- Investigating mishaps and near misses, documenting and reporting them via the NASA required pathway, identifying root causes, and implementing corrective actions
- Identifying and implementing corrective actions to mitigate risks to the public, personnel, the environment, and hardware
- Verifying personnel training is current and appropriate for the work performed
- Recognizing and rewarding exemplary safety behavior and administering coaching, counseling, and initiating disciplinary action, where appropriate, when an employee has not adhered to LM and NASA ESH requirements
- Ensuring recognized hazardous conditions are identified and resolved before operations begin

3.5.5 ESH Engineers

LM ESH engineers report to the LM ESH manager and are responsible for implementing the ESHMS, including:

- Developing and implementing personnel safety and environmental management programs
- Establishing and imposing ESH criteria and requirements applicable to the design, manufacture, assembly, test, service, maintenance, and transportation of flight and ground systems, and supporting equipment, tooling, facilities, and infrastructure
- Ensuring compliance with established ESH requirements by means of formal reviews and assessments
- Reviewing, commenting, and approving manufacturing process instructions; test and operating procedures, including hazardous operations procedures; and critical handling and flight hardware move and transportation procedures
- Performing safety visits of work areas as documented for the facilities on the LM ESH intranet; and monitoring the work area and activities to identify potential hazards, performing hazard assessments, and verifying adherence to safety requirements
- Apprising management of personnel safety performance, and appraising ESH management of S&ES management's ESH performance
- Overseeing procurement, storage, use, and disposal of hazardous and other materials and items of concern
- Developing and disseminating safety data for awareness, training, use, and benefit of other personnel across organizational levels

- Validating that environmental risks are properly managed and operations are conducted in compliance with applicable regulations
- Determining and extending appropriate ESH requirements to S&ES for new locations
- Performing preoperational and preoccupancy field reviews of new S&ES program equipment and locations, focusing on minimizing risk to the public, employees, facilities, and hardware
- Providing the operational ESH function, wherever the S&ES directed work exists, and in close association with the NASA or other host organization's ESH functions, including pad and range safety
- Applying for and obtaining permits and authorizations associated with ESH and/or industrial and environmental safety; or in the case where a host organization has the authority for permitting, providing required information to the host organization
- Performing equivalency reviews of NASA standards, such as the lifting equipment standard and the propellant explosive and pyrotechnic standard, to LM program standards; developing applicable upgrades to LM standards where functional gaps may exist
- Along with System Safety engineer colleagues, collaborating with NASA and other involved government representatives to tailor range safety requirements for S&ES programs and to provide safety reviews with the NASA customer per contract requirements
- Supporting System Safety engineer colleagues in their program-unique hazard analysis efforts and other program personnel in their flight safety casualty analysis and other risk reviews
- Providing expertise in person-related mishap and incident investigations and reporting, and supporting System Safety engineer colleagues in hardware-related mishap and incident investigations and reporting
- Exercising the authority to stop operations deemed unsafe
- Maintaining awareness of vehicle-specific and mission-specific configurations as they relate to protection of people and the environment
- Developing contingency operation plans for flight hardware mishaps, mission failures, or other emergencies relative to public, employee, facility, and environmental safety, and coordinating with similar plans and functions from NASA and other applicable agencies
- Providing employee and environmental safety function anytime, anywhere during actual contingency operations—especially those involving unusual operations, environments, or modes of transportation
- Interfacing with the Quality Assurance organization to ensure product specification integrity is maintained

3.5.6 System Safety

LM System Safety engineers report to the LM PM and are responsible for the safety of product hardware, facilities, and operations related to program activities. System Safety scope begins with contract award and continues to launch or delivery.

System Safety engineer responsibilities include:

- Developing and implementing programs to ensure protection of product hardware, equipment, and facilities
- Establishing and imposing criteria and requirements applicable to the design, manufacture, assembly, test, service, maintenance, and transportation of flight and ground systems; and supporting equipment, tooling, facilities, and infrastructure
- Reviewing, commenting, and approving test, and operating procedures, including hazardous operations procedures, critical hardware handling, flight hardware move, and transportation procedures

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- Apprising management of product safety performance
- Performing hazard analysis to determine risk potential to product hardware, equipment, and facilities
- Identifying risks to product hardware and ensuring mitigation measures have been incorporated into the process to eliminate and/or reduce risk
- Determining and extending appropriate System Safety requirements to programs for new locations, including U.S. government agency test ranges
- Performing preoperational and preoccupancy field reviews of new program equipment and locations, focusing on minimizing risk to hardware
- Collaborating with ESH colleagues, NASA, and other involved government representatives to tailor range safety requirements for programs and to provide safety reviews with the NASA customer per contract requirements
- Performing program-unique hazard analysis efforts and supporting other program personnel in their flight safety casualty analysis and other risk reviews
- Exercising their authority to stop operations deemed unsafe
- Completing hardware-related mishap and incident investigations and reporting
- Developing contingency operation plans for flight hardware mishaps, mission failures, or other emergencies and coordinating with similar plans and functions from NASA, and other applicable agencies
- Assisting the ESH organization and program engineers to provide information and technical data to complete the National Environmental Policy Act analysis when required by contract
- Presenting results of compliance to System Safety program requirements to customers per contract requirement
- Ensuring recognized hazardous conditions related to product hardware, equipment, or facilities that may affect contract performance or progress are identified and resolved before operations begin, over the life of the contract
- Maintaining awareness of product-specific and mission-specific configurations as they relate to protection of product hardware, related facilities, and range safety
- Interfacing with the Quality Assurance organization to ensure product specification integrity is maintained
- Applying for and obtaining permits and authorizations associated with range safety; or in the case where a host organization has the authority for permitting, providing required information to the host organization
- Participation or monitoring of program reviews such as design reviews and readiness reviews.

3.5.7 Program ESH Representative

The program ESH representative is responsible for interfacing with the NASA customer on ESH projects and issues. The Safety and Health Plan is implemented by the ESH representative with assistance from S&ES System Safety, department managers, line managers, supervisors, and other personnel responsible for implementing the elements of the Plan. The ESH representative provides a focal point for OSHA reporting, regulatory matters, and serves as the point of contact with the Center Safety Office. The ESH representative also participates in meetings and other activities related to the customer's ESH program. The ESH staff manages permits such as air and water, hazardous waste, and licensing for the possession of radioactive materials.

3.5.8 Company Physician

The LMSSC physician name, address, and telephone are as follows:

Dr. David Zieg, Medical Director

Medical Department, Mail Stop 1398
Lockheed Martin Space Systems Company
12257 South Wadsworth Blvd
Telephone: (303) 977-7879

The ESH representative is the point of contact for NASA medical clinics during operating periods to arrange transmittal of medical data. However, actual employee medical data are directly communicated to or from the LM physician. This protects the employee's privacy.

Medical staff employees include nurses and case management workers to ensure full and appropriate patient care is provided. This focused care enables the patient to recover as quickly as possible and to return to work without further degradation of his or her condition.

3.5.9 Building Fire Warden/Incident Commander

The LM System Safety engineer or designate serves as the building fire warden in NASA facilities occupied by LM during the course of S&ES processing. The System Safety engineer or designate has the knowledge of project unique hazards that apply to fire protection and emergency response.

LM facilities have written emergency response procedures, posted emergency instructions, and designated building fire wardens/incident commander. In areas with multiple buildings, a single individual may be designated the building fire warden. The ESH representative is the point-of-contact for communicating and coordinating with building fire wardens serving at LM facilities.

Consistent with the individual employee's responsibility for safety, every employee is authorized to conduct emergency response activities within the limits of training, while ensuring individual safety. Practically, this means using a portable fire extinguisher to protect the facility, one's self, other employees, or product, but only if and when the employee is trained and feels able and safe in doing so. Otherwise, employees are instructed to leave the area immediately. In either scenario, employees are instructed to call for assistance from the designated emergency response authority.

3.5.10 Designated Safety Official

The LM director of ESH supporting locations of S&ES activity is responsible for implementing LM ESH command media referenced in this Safety and Health Plan. The director of ESH has primary responsibility for ESH functions and interfaces with civil regulatory agencies such as OSHA, the U.S. Nuclear Regulatory Agency and Environmental Protection Agency. S&ES System Safety is responsible for implementing the System Safety aspects of this plan including the interfaces to NASA Safety, launch site processing host organizations, launch vehicle safety and Range Safety.

3.6 PROVISION OF AUTHORITY

The LM ESHMS requires that company standards be maintained current with applicable federal, state, and local regulations and contractual requirements. This is accomplished by periodically reviewing, and updating as necessary, ESH command media documents that control work and products. These controlling documents are accessed through a Web-based intranet that is updated when document revisions are released. Updates to command media are subject to a review and approval process independent of the LM ESH organization to ensure checks and balances. This Web-based command media system provides for updated documentation throughout the life of the contract.

S&ES System Safety is the point of contact for the flowdown of requirements applicable to S&ES projects from NASA, Range Safety, and the launch vehicle provider. System Safety anal-

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ysis is the primary method to verify implementation of these requirements, and implementation is further supported by monitoring of ground operations.

The primary responsibilities for key ESH regulations applicable to S&ES projects are identified in table 3.6-1. The LM executive vice president is the common point of authority for all applicable safety regulations. The line of authority from ESH is through the vice president of Operations to the LM executive vice president, and the System Safety line of authority is through the vice president of Sensing & Exploration Systems to the LM executive vice president. The basic safety program at LM is dictated through the LM command media and is driven by LM policy. Additional NASA safety requirements applied by the S&ES contracts are in effect through the life of the contract.

Table 3.6-1 S&ES Key Applicable Safety Regulations and Assignment of Primary Responsibility

Regulation	Primary Responsibility
10 CFR, Energy	ESH
29CFR1910, Occupational Safety & Health Administration, Department of Labor	ESH
40CFR, Protection of Environment	ESH
49 CFR, Transportation	ESH
LM command media ESH series	ESH
NPR 8621 1, NASA Procedural Requirements for Mishap & Close Call Reporting, Investigating & Recordkeeping	S&ES System Safety
NPR 8715 3 Appendix E, Sample Safety & Health Plan for Service or Operations Contracts	S&ES System Safety
NFS Clause 1852 223-73, Safety & Health Plan	S&ES System Safety
LM command media SysSaft series	S&ES System Safety

3.7 ACCOUNTABILITY

Management and employees are accountable for implementing safe work practices and safety programs that adhere to command media and that are responsive to requirements of regulatory agencies and to NASA contractual requirements. To ensure management accountability, ESH provides senior management an annual not-to-exceed target rate for injuries. The target is a declining scale intended to achieve a future level of zero injuries. Safety performance for LM lines of business is presented to senior management along with summary incident reports and related corrective actions. Senior management is measured on performance to their target. Each supervisor is held accountable for investigating and taking action to rectify the root cause of any subordinate employee injury that occurs. Accountability is maintained by LM's Standard Injury and Illness (LMSII) investigation system, which automatically creates lines of reporting and approval through the supervisor's own organization and through the ESH organization. These lines of reporting and approval remain in effect until the ESH organization approves a particular supervisor's investigation and archives the investigation record for data reporting and other future uses. Rejection of a particular investigation requires the injured employee's supervisor to reopen the investigation and re-report results until satisfaction is achieved.

Employee training is tracked on individual training plans. Employees have access to their training plan and training status via the LM intranet. Training includes compliance training, which applies to all employee segments, and skills training that is required based on an employee's specific duties. Employees and supervision are responsible to ensure training certifications are kept current. Many skills training requirements are directly related to safe work practices and hardware integrity. The skills training record of all employees is tracked on the LM intranet on a system called LMS/eCard, and the training records of every employee is readily available to all employees through this system to verify applicability of the tasks at hand.

LM procedures are in place to address employee conduct and discipline matters. Where, in LM's judgment, an employee's conduct or performance, including safety, is unacceptable, he or

she may be given a reasonable opportunity to correct the deficiency. However, LM Human Resources, at its sole discretion, may forgo, eliminate, or accelerate any of these procedures; suspend an employee without pay pending further investigation; or demote or dismiss an employee immediately. Discipline is normally progressive, with (1) the initial step being an oral warning, confirmed in writing; followed by (2) suspension without pay; and finally (3) discharging an employee for cause.

LM has numerous reward programs that recognize employee contributions. Those activities associated with the safe completion of hazardous activities are factored into the distribution of these rewards. Rewards include money issued via an employee commendation or spot award, as well as program management letters of appreciation and awards granted at the LM Annual Awards ceremony. Employees also have the opportunity to participate in safety incentive programs (e.g., Work Safe, Safety Pays) that reward safety performance in the work area.

3.8 PROGRAM EVALUATION

The LM ESHMS provides a methodical, uniform, and consistent approach to risk identification, assessment, and management, and complements ESH policies and site-specific processes. After assessing risks and understanding compliance requirements, business units develop a set of business objectives and set measurable targets. For specific program requirements, scheduling the contractor safety effort (e.g., setting milestones for identifying program activities, phasing, integration, and product delivery) is accomplished following the process set forth in the ESHMS. The ESHMS addresses the following management system and process needs:

- Identifying requirements
- Assessing requirements applicability
- Assessing risks
- Establishing and maintaining command media to describe actions that are taken to ensure requirements are met
- Performing to command media and agency or legal requirements
- Assessing performance
- Establishing goals
- Assessing the management system's adequacy (i.e., the management system has a provision to check its own health)
- Revising the management system based on lessons learned from any of the above

The management system process, from identifying requirements, through revising the management system is interactive—business units continually self-assess their performance and take corrective actions, prompting the cycle to begin again. The ESHMS was designed to conform to LM CPS-015, and LM Functional Procedure ESH-01. The following elemental sections provide an overview of the ESHMS.

Figure 3.8-1 illustrates the ESHMS core elements detailed in LM 1.3.3-ESH-1.0-P, Environment, Safety, and Health Management System, the order of implementation, and the relationship between the respective components. The figure provides a framework to implement ESH programs in a consistent and uniform manner.

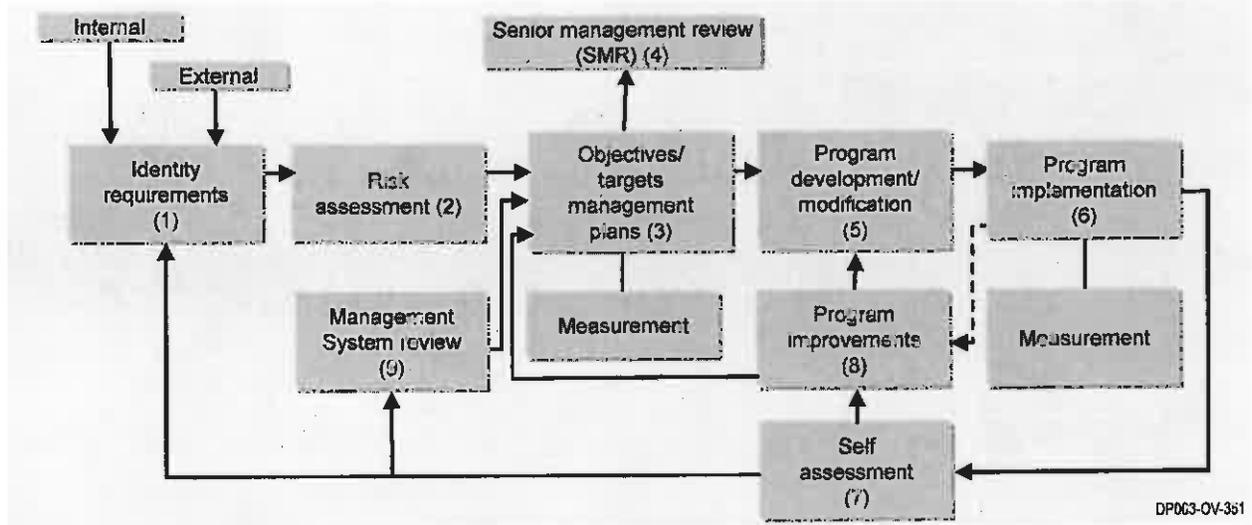


Figure 3.8-1 ESHMS Elements

Element 1: Identification and Review of Applicable ESH Elements and Requirements—This element provides a uniform and consistent approach to ensure ESH programs are current with applicable legal and other requirements.

LM reviews information sources to identify new or modified regulatory, contractual, and other requirements to determine site applicability. When it is determined that existing systems are inadequate, the appropriate control(s) to ensure compliance or conformance with requirements are developed and implemented. Figure 3.8-2 identifies the ESH elements process.

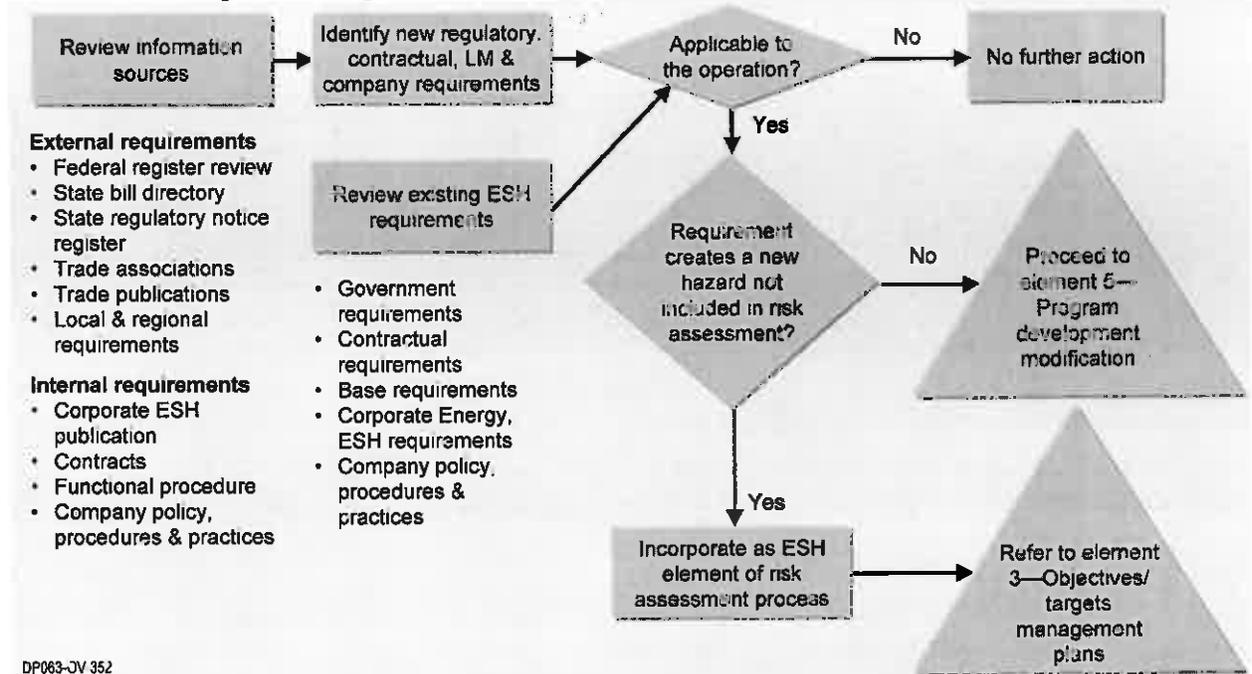


Figure 3.8-2 Element 1.0—Identification and Review of Applicable ESH Elements and Requirements

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Element 2.0: Risk Assessment—The risk assessment process (fig. 3.8-3) identifies, assesses, prioritizes, and mitigates risks to the public, personnel, and environment. The risk assessment identifies and characterizes ESH hazards at the program level resulting in specific risk mitigation objectives. This ranks hazards and requires management direction to identify and implement corrective actions to reduce the potential risk associated with identified hazards. The methodology used to assess risks considers both ESH impacts (e.g., potential for injury and illness and/or degradation of environmental quality) and business impacts associated with ESH hazards (e.g., changing regulations, audits, NASA requirements). Risk reductions identified by ESH with potential impact to S&ES project for which there is no readily available response are referred to the S&ES project Risk Management Board for resolution.

Element 3.0: Objectives, Targets, and Management Plans—This element (fig. 3.8-4) identifies how objectives and targets are used in the management system process to correct a deficiency or enhance a process. Responsibilities, schedules, and resources are identified and updated, as appropriate.

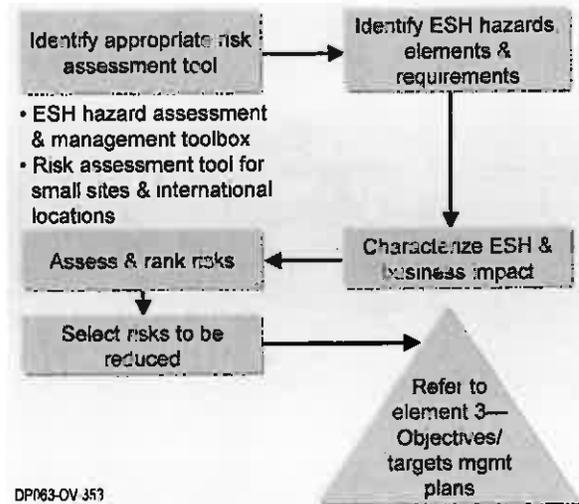


Figure 3.8-3 Risk Assessment Process

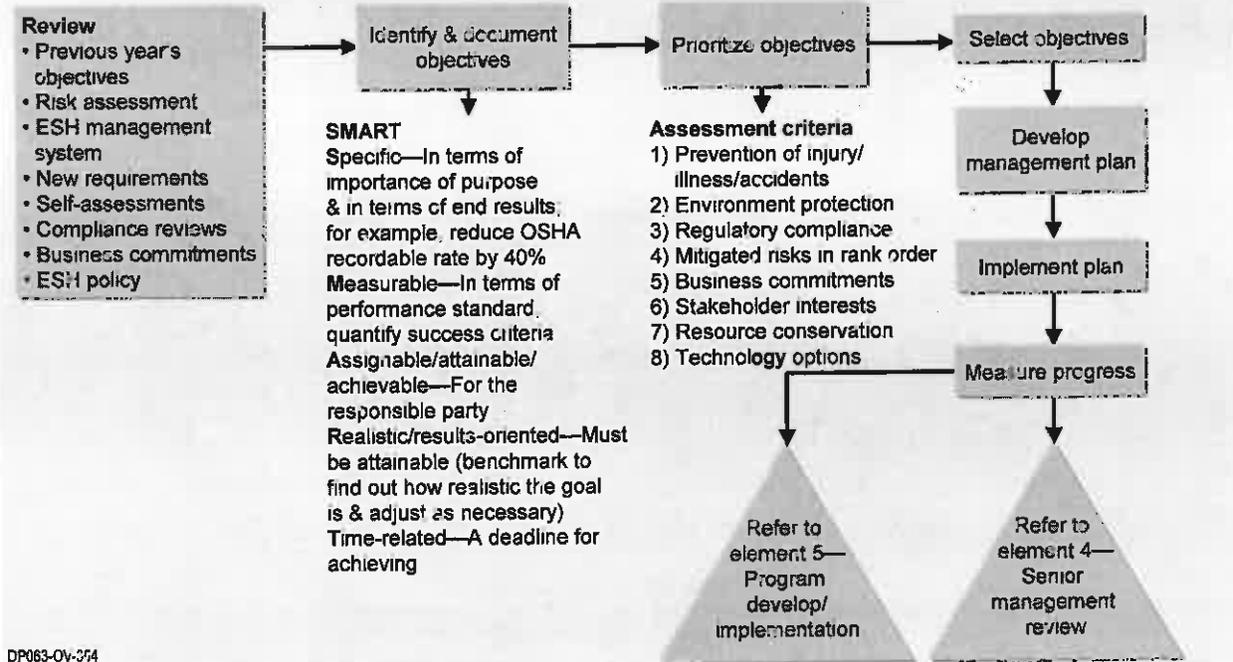


Figure 3.8-4 Objectives, Targets, and Management Plan

Element 4.0: Senior Management Review—A senior management review is performed at least annually and provides management with information on ESH performance, improvement plans, and other information necessary to integrate ESH considerations into the unit’s business plan. The review includes assessment of ESH performance to objectives, targets, and continual improvement progress.

Element 5.0: Program Development/Implementation Process—This element describes the process for design or modification of ESH programs. This process is used for S&ES program-specific development, implementation, and maintaining currency with both regulatory and NASA requirements. Figure 3.8-5 shows a diagram of the program development and implementation process.

Element 6.0: Program Implementation—This element describes the process used for ESH program implementation (fig. 3.8-6), taking into consideration organizational structure, responsibilities, and delivery methods. Program performance is measured, and the program is periodically reviewed and modified as necessary to ensure continual improvement.

Element 7.0: Self Assessment—This element describes the assessment process (fig. 3.8-7) used to assess the effectiveness of the ESHMS, evaluate progress in meeting objectives, and assess regulatory compliance. The self-assessment process also reveals hazards at the individual workplace level. The self-assessment program defines frequency, locations, and operations to be assessed.

Element 8.0: Program Improvements—This element focuses on enhancing the entire management system. Enhancements are identified through requirement reviews, the self-assessment process, program implementation experience, and performance metrics. Improvements typically include modifying an existing program or developing a new program (e.g., modifying the existing crane safety standard or developing a new standard to cover program unique requirements). Major program improvements are usually established as ESH objectives, while minor improvements are commonly handled through the corrective action process or other appropriate means.

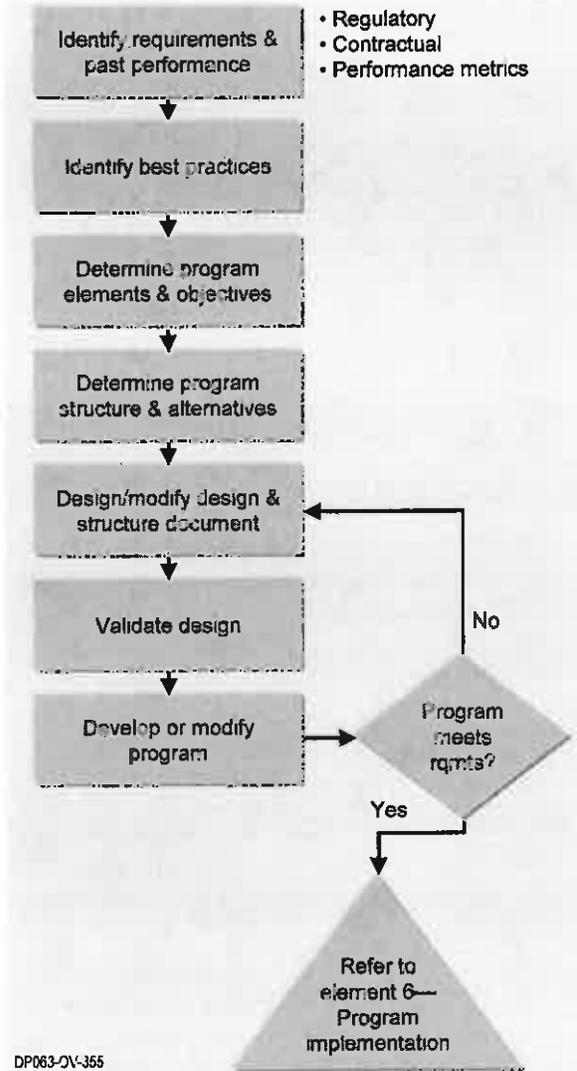


Figure 3.8-5 Program Development/Implementation Process

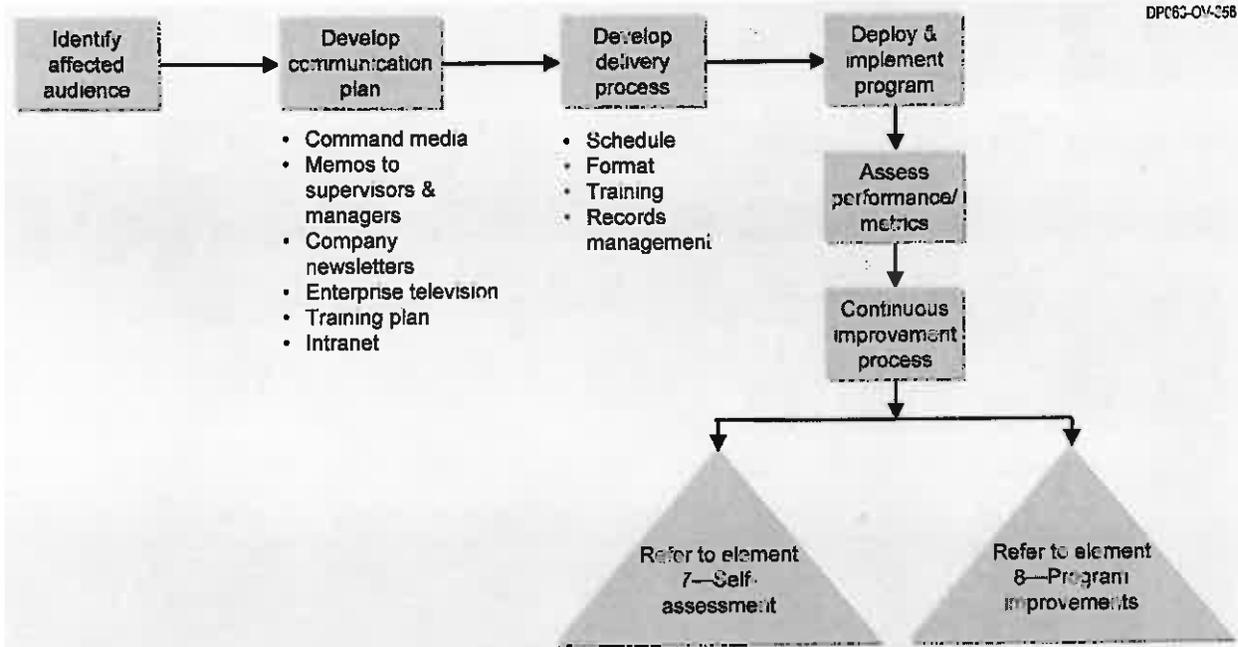


Figure 3.8-6 Program Implementation Process

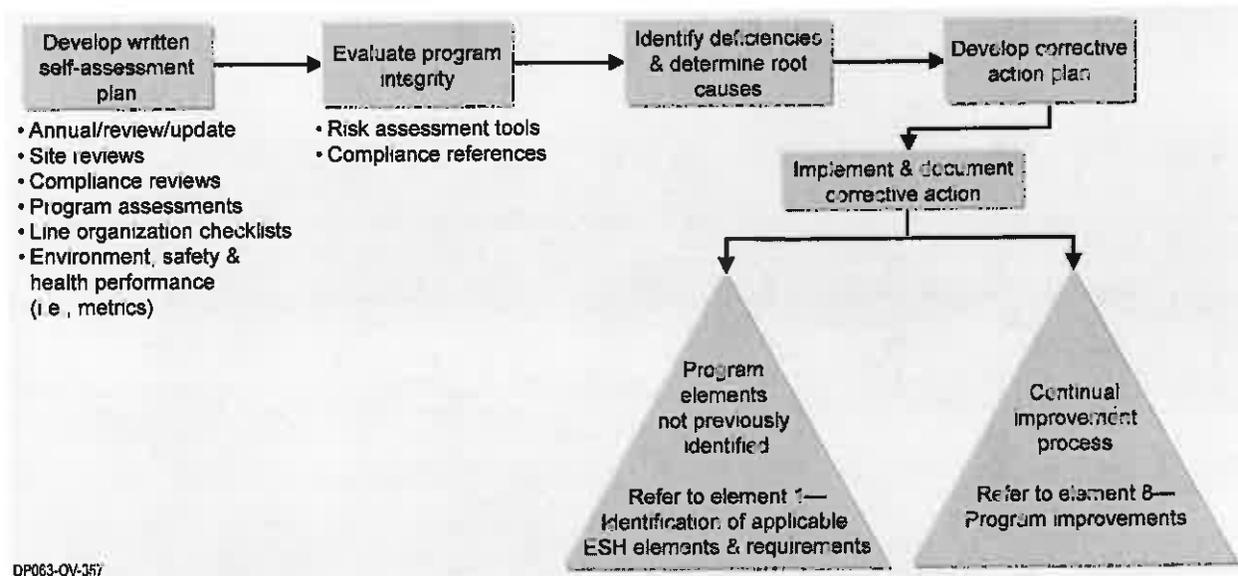


Figure 3.8-7 Self-Assessment Process

Table 3.8-1 depicts how LM's integrated Safety and Health Plan implements elements outlined in the safety Performance Evaluation Profile (PEP). The PEP can be used as performance criteria for program evaluation. The six elements scored in the PEP are listed in table 3.8-1, with the corresponding Safety and Health Plan section(s). We use PEP level 5 (outstanding rating) as a guideline to ensure a fully integrated ESH program.

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Table 3.8-1 PEP Elements

PEP Element	Safety & Health Plan Section/Reference Document
• Management leadership & employee participation	
– Visible management leadership	3.1, 3.5.1–3.5.6
– Employee participation	3.1, 3.4, 3.5.7–3.5.9, 4.1, 4.3
– Implementation	3.5.3–3.5.7, 3.6, 3.7, 3.8
– Contractor safety	3.3
• Workplace analysis	
– Survey & hazard analysis	4.0, 4.1
– Inspection	4.1, 4.2
– Reporting	3.3, 4.2, 4.3
• Accident & record analysis	
– Investigation of accidents & near-miss incidents	5.1, 5.1.1, 5.1.2, 5.1.3
– Data analysis	3.9, 5.2
• Hazard prevention & control	
– Hazard control	6.1, 6.1.3
– Maintenance	6.2, 6.3
– Medical program	3.5.8, 6.4
• Emergency response	
– Emergency preparedness	7.0
– First aid	6.4
• Safety & health training	8.0

Element 9.0: Management System Review—The management system review assesses the effectiveness of the management system and identifies opportunities for improvement. The review is conducted annually. Figure 3.8-8 shows the management system review process.

3.9 DOCUMENTATION OF PERFORMANCE

The following list includes, but is not limited to, statistics, reports, and checklists used by LM to describe its approach to documenting safety and health performance:

- OSHA recordable injury or illness
- Injury and illness incidence rates to include day away cases, recordable cases, and severity
- Accident/incident investigation completed in accordance with the LMSII investigation process
- Safety inspections of work areas

For LM activities conducted on NASA property, statistics, reports, and checklists generated are made available to NASA upon request. LM also acknowledges the following as standing requests of the government to be handled as described below for activities performed onsite at NASA centers.

- Roster of terminated employees at NASA centers—LM employees terminated following a permanent assignment on S&ES projects at a NASA center are identified and reported to the Center Occupational Health Program Office. The report is sent to the occupational health officer no later than 30 days after the end of each contract year or at the end of the contract, whichever applies. Due to the temporary nature of S&ES activity at NASA centers, no permanently assigned personnel are anticipated; reports are not sent to declare no terminations. Also, personnel social security numbers are not reported for reasons of personnel privacy. The following information is required:
 - Date of report from LM, Sensing & Exploration Systems, and contract number
 - Employee name, assigned center badge number, and date of termination

- Name, address, and telephone number of LM S&ES program administrator to be contacted for questions or other information; currently Ms Barbara Espinoza, telephone (303) 971-2465, LM, mail stop S8900, P.O. Box 179, Denver, CO 80127.
- Material safety data, general—LM ESH maintains material safety data sheets (MSDS) for all hazardous materials at LM locations. Hazardous materials are defined by 29CFR1910.1200(g) and FED-STD-313D. ESH acquires MSDSs from arriving shipments of hazardous materials and reviews the MSDSs for appropriate content. Electronic copies of the MSDSs are posted on an LM intranet site with search capability for access by all LM personnel. This intranet is an alternative to paper copies for employee access to MSDSs. Hazardous material inventories are maintained by work areas at LM locations with a copy of the applicable MSDSs per 29CFR1910.1200(g). Hazardous materials shipped from an LM location are shipped with applicable MSDSs in or on the shipping container.
- Material safety data, products delivered to NASA—For hazardous materials identified under FED-STD-313 and included in products delivered to NASA, MSDSs meeting the requirements of 29 CFR 1910.1200(g) are provided, along with FED-STD-313 information, as applicable. The MSDS may be retrieved by the center’s shipping and receiving and managed in accordance with the center’s process.
- Hazardous materials inventory—LM standard process includes maintenance of a hazardous materials inventory as detailed in the LM Hazard Communication Standard, 1.3.3-T1-ESH-30.0-S. LM locations on NASA property compile an inventory of hazardous materials used at that location, and this inventory is available to NASA on request. The inventory includes the following:
 - Identity of the material
 - Location of the material by building and room
 - Quantity of each material normally kept at each location
- Radioactive materials management—Radioactive materials management requirements are contained or linked in LM command media 1.3.3-T1-ESH-59.0-S, Radioactive Material Safety. LM possesses radioactive materials in accordance with requirements of applicable licenses or reciprocity agreements. Radioactive material is transferred only to appropriately licensed entities.

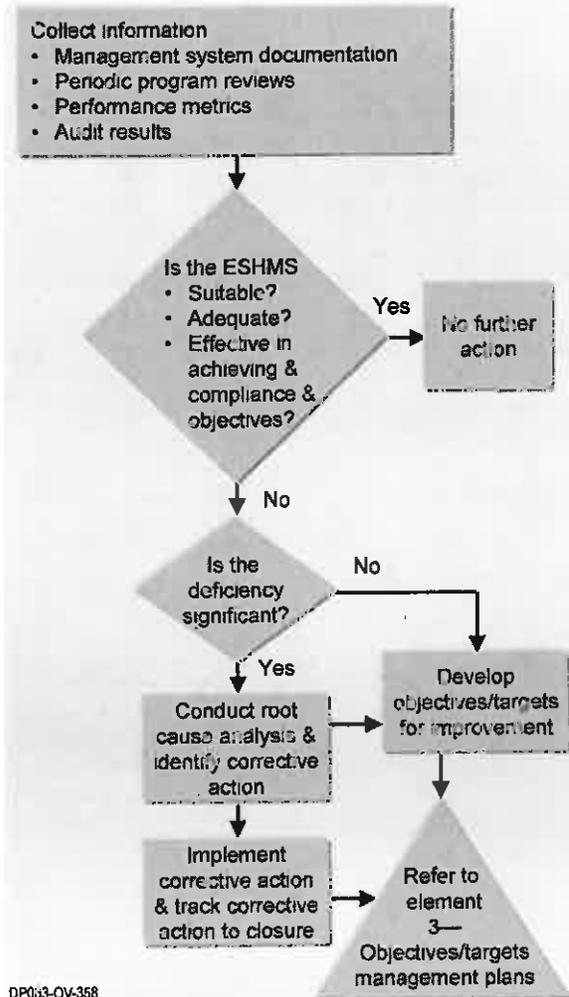


Figure 3.8-8 Management Review Process

3.10 GOVERNMENT ACCESS TO SAFETY AND HEALTH PROGRAM DOCUMENTATION

LM safety and health documentation including relevant personnel records that are not restricted from release outside the company are available for inspection or audit at the government's request.

3.11 REVIEW AND MODIFICATION OF SAFETY REQUIREMENTS

Upon NASA contracting officer's technical representative request, LM participates in the review and modification of safety requirements that are to be implemented by the government including any referenced documents therein.

3.12 PROCUREMENT

The Program System Safety engineer responsibility includes, but is not limited to, providing safety engineering support for reviewing and updating product safety requirements and criteria, and reviewing and updating safety requirements allocations to hardware and subsystems, specifically as it relates to procurement statements of work/data item descriptions and specifications, Interface Control Documents, and other program documentation. The source of requirements can be either requirements established by contract or requirements derived from hazard analysis. This process flows down the appropriate responsibility to ensure all required product safety data are collected and provided for a thorough and complete integrated safety package.

Requisitions for procurement of chemical substances are reviewed by ESH before purchase in accordance with LM requirements, the Toxic Substances Control Act (TSCA), other relevant EPA regulations (CFR 40), and other applicable requirements, including contractual requirements. Chemical substances delivered to NASA centers are accompanied by MSDSs as addressed in section 3.9.

4.0 WORKPLACE ANALYSIS

The ESHMS (sect. 3.8) provides a methodical, uniform, and consistent approach to risk identification, assessment, and management. Continually identifying and evaluating hazards in the workplace, coupled with timely corrective action plans, ensures a safe workplace in a dynamic program environment. LM typically addresses this through risk assessments; hazard assessments; compliance reviews (audits); environmental incident documentation; area safety inspections; the LMSII, investigation process; and the Error Prevention Council which includes investigations of mishaps and near misses (NASA close calls). Hazards on NASA property that are immediately dangerous to life or health are reported immediately to the NASA Occupational Safety Office and, as applicable, to the designated emergency response organization.

S&ES System Safety also identifies and controls hazards introduced to the workplace by the assembly and test activities specific to projects. System Safety provides hazard analysis, verification of contractual safety requirements, and test planning support to minimize risks associated with project processing.

Employees are empowered to identify and report hazards. Employees are informed through annual hazardous waste generator awareness training on the recognition of environmental spills and the emergency reporting methods to summon remediation support. Also, all LM employees are empowered to issue a Stop Work Command per LM 3.6-T1-ProdAssr-2.4-D, Stop Work Command. Situations calling for the Stop Work Command include the perception of immediate danger to personnel safety or product integrity; or the continued use of unacceptable, deficient, nonconforming, or dangerous tools, equipment, or processes. The operation may be resumed only after the condition has been corrected or the test team determines that no unsafe condition exists.

Risk Assessments—The risk assessment process identifies, characterizes, and prioritizes ESH risks, for purposes of developing risk mitigation strategies. The process assesses risks to personnel, equipment, and the environment, and is conducted at least annually. The risk assessment review process is standardized and documented.

Hazard Assessments—Hazard assessments are performed initially for new operations with area supervision and are updated on an as-required basis. Hazard assessments identify hazards associated with area operations to ensure that, if engineering or administrative controls cannot mitigate the hazard, correct personal protective equipment (PPE) is specified for the operational area. Steps in performing a hazard assessment include:

- Survey area to identify hazard presence (e.g., impact, penetration, chemical exposure, shock, heat)
- Identify hazard sources (e.g., machinery; high temperature sources, chemical tanks, falling objects)
- Organize and analyze data to determine the magnitude of effect from exposure to each hazard and the probability of exposure to each hazard
- Select protective equipment that ensures a level of protection beyond the minimum required to isolate the employee from the hazard
- Fit the user with the protective device and give instructions on care and use of the PPE emphasizing any limitations
- Provide PPE to the employee

The hazard assessment is described in the LM command media 1.3.3-T1-ESH-56.0-S, Personal Protective Equipment.

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Compliance Reviews—Compliance reviews (audits) assess LM operations that present ESH risk (e.g., activities involving machines, electricity, elevated working positions, confined spaces, hazardous materials/waste). The reviews are designed to discover potential compliance risks, conditions, or practices that could threaten the safety or health of personnel and public, harm products, threaten the environment, or incur LM site liability. Reviewers document findings and corrective actions using LM's Web-based self-assessment manager system or equivalent. Area management is responsible for developing and implementing corrective actions related to the compliance review.

The compliance review process is required by the management system, element 7, self-assessment.

Environmental Incident Documentation—In case of an environmental incident, the ESH responder prepares an environmental incident report to document the response. Such incidents may pose employee safety and health concerns, and depending on magnitude and substance, may also pose public health concerns. The report includes:

- Date and time of incident
- Location of incident
- Preparer's name
- Description of incident
- Material released and quantity
- Action(s) taken
- External notifications
- Other supporting information

The detailed process for responding to environmental incidents is described in our integrated emergency response plans for LM facilities.

Area Safety Inspections—Managers and supervisors are required to perform periodic safety inspections to maintain a safe workplace. Managers and supervisors have the responsibility to correct, or to identify additional resources to correct, any deficiencies identified during the inspection.

The method for performing area safety inspections is described in the ESHMS, element 7, Self-Assessment, and in 1.3.3-T1-ESH-18.0-S, Monthly/Quarterly Self-Inspections.

LM Standard Injury and Illness Investigations—The LMSII investigation process is a Web-based tool that is collectively used by the medical authority and an employee's supervisor for investigating an occupational injury or illness. Following the LMSII process, the investigator identifies:

- Employee name
- Manager
- Date, time, and location of incident
- Line of business or program
- Employee's description of incident
- Type of accident
- Nature of injury
- Injured body part
- Manager's incident investigation
- Witness names
- Contributing factors
- Root cause

- Interim control measures
- Corrective action
- Status
- Disciplinary action
- Property damage

The LMSII database provides quick, accurate trend analysis of safety and health data. Requirements for use of LMSII are described in corporate Energy, ESH functional procedure ESH-04, Incident Reporting.

Error Prevention Council—The Error Prevention Council fosters communication of important safety considerations by managing an error prevention program. The council is chaired by the vice president of Product Assurance and System Safety, and includes representatives from across LM. The council processes near-miss and mishap cases to identify systemic conditions amenable to process improvement measures. The council forwards actions to other organizations for consideration and implementation. For example, the council makes recommendations to the Mission Success organization to develop specific lessons learned bulletins. Additionally, identified command media deficiencies are forwarded to the appropriate recipient. As an example, the council forwarded the need for Drop Mitigation command media to the Six Sigma Process that led to development of standard mitigation requirements in LM 2.4-T1-OPS-1.1-S, Drop Mitigation.

S&ES System Safety Role in Workplace Safety—The System Safety focus on product safety during assembly and test results in the identification of hazard controls applicable to the hardware and operations. These hazard controls enhance workplace safety during prelaunch activity. Hazard controls are manifested in the hardware design or in applicable test procedures.

4.1 HAZARD IDENTIFICATION

Hazards are identified during the project operations planning process. In addition, LM command media processes continue with safety assessment the workplace. LM command media 1.3.3-T1-ESH-18.0-S, Monthly/Quarterly Self-Inspections, and 1.3.3-T1-ESH-69.0-S, ESH Self Assessment, provide processes for wall-to-wall inspection, change analysis, and hazard analysis regarding safety hazards in the workplace. ESH methods for identifying and evaluating hazards are summarized as follows:

- Safety/housekeeping inspection for office areas—A checklist used by supervision to inspect their areas quarterly for hazardous conditions and to record corrective actions taken.
- Safety/housekeeping inspections for manufacturing, test, and laboratory areas—A checklist used by supervision to record monthly the inspection results and document corrective actions taken.
- ESH compliance reviews—Reviews designed to discover potential compliance risks, conditions, or practices that could threaten the safety or health of personnel and public, harm products, threaten the environment, or incur LM site liability. These reviews include an evaluation of the effectiveness of the organization's injury and illness program.
- Review of plans and procedures—Proposed modifications to facilities and major equipment are reviewed for ESH implications before approval. Whenever possible, the operational design is modified to mitigate potential risks. If design modifications cannot or do not eliminate the risk, administrative controls are implemented to protect the employees. If neither engineering controls nor administrative controls adequately address the risk, employees are provided with proper protective equipment to minimize injury or illness from the hazards associated with their tasks.

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- Review of new or modified equipment, processes, procedures, and substances—New and/or modified equipment, procedures, and substances are evaluated to ensure personnel safety and health before implementation and to ensure minimal impact to the environment, including waste/wastewater generation and discharge and air emissions.
- Preoccupancy reviews of facilities and infrastructure—ESH reviews are completed for government-furnished facilities and equipment before LM occupation or use. This ensures physical hazards are mitigated; ESH operating procedures are in place; and emergency procedures are posted.
- Test procedures—Review and approval of test procedures before operations in collaboration with System Safety and Quality Assurance, as appropriate, to ensure requirements are met.
- Test operations—Monitor test operations to control risk to personnel.
- Subcontractor activities—Monitor subcontractors at LM work locations.
- LM standard injury and illness investigation—Identify root causes of injuries and illnesses (i.e., hazards that caused injuries or illnesses).
- Employee awareness—Employees are required to identify and report hazards and take action to mitigate the hazard.
- Other—Perform incident and mishap investigations related to personnel safety and environmental protection.

The System Safety engineer performs hazard identifications to ensure risk to contract assets is minimized throughout the life of the contract. The following describes System Safety's role with respect to hazard identification.

A System Safety engineer is assigned the responsibility and accountability for system design, development, documentation, verification, test, operation, and program product safety. The System Safety engineer ensures compliance with safety requirements—both imposed and derived—necessary for a successful mission. The safety assessment is the System Safety engineer's top priority to support 100% mission success. The System Safety engineer is held responsible for hardware safety; the quality of the safety assessment; and reviews the readiness, performance, and pedigree of the product.

The role of the System Safety engineer includes the following functions and responsibilities:

- The System Safety engineer is the focal point for resolution of any project safety issue pertaining to product hardware.
- The System Safety engineer appeals any decision that in his or her judgment may adversely affect product safety. In no case is the appeal of an issue, judged to be safety critical by a System Safety engineer, dismissed or categorized as inappropriate behavior.
- Support development of all imposed or derived product safety requirements, including interfaces and verification requirements. Ensure safe product compatibility across interfacing components.
- Ensure design, analyses, and procedures for test, demonstrations, inspections, and manufacturing meet requirements, and incorporate the appropriate product safety verification.
- Ensure maintenance of product safety requirement waivers and deviations. Only accept deviations that conclusively show no adverse effect on product safety.
- Maintain in-depth knowledge of the safety assessment over its life cycle, and investigate/resolve any concerns.
- For commercial off-the-shelf products lacking the traditional historical pedigree, bring to management's attention any use of commercial off-the-shelf products that the System Safety engineer deems to be unacceptable risk.

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- Ensure verification methods (test, analysis, demonstration, inspection) are decisive, and adequate to characterize safety performance and support mission success.
- Elevate hardware safety concerns that cannot be resolved through normal channels to the PM.
- Monitor test operations to control residual risk.
- Perform incident and mishap investigations related to product hardware and related systems.
- Coordinate range safety activities to ensure requirements pertaining to product hardware are met.

System Safety engineer tasks include, but are not limited to:

- Identifying hazards in design concepts and throughout development and production by adequate analysis, testing, quality assurance, and product support.
- Evaluating product and process designs, using design standards, design reviews, historical data, and experience on comparable products to ensure the control or elimination of potential hazards.
- Verifying product safety requirements by testing, analysis, or other methods that components, subsystems, and end-products meet safety objectives established for the program and product.

4.2 INSPECTIONS

Supervisors conduct quarterly office area inspections and monthly work area inspections, and document results and corrections on checksheet forms. Hazards are identified during these inspections. Supervisors are responsible for mitigating identified hazards. ESH engineers periodically review completed checksheet forms to gauge the hazard severity, probability of occurrence, and adequacy of the corrective actions. ESH engineers are responsible for conducting assessments that identify hazards and ensure compliance with ESH requirements. Discrepancies are recorded, and status of corrective action implementation is tracked until closed, using the LM self-assessment manager, or equivalent tool.

While at NASA facilities, LM safety inspections and walkdowns are performed and discrepancies corrected for our assigned work areas. For reporting consistency, and unless directed otherwise by NASA, the LM quarterly office area and monthly work area checksheets or equivalent are used. Discrepancies are documented and addressed before the start of affected operations. The inspections identify:

- Discrepancies between observed conditions and current requirements
- New or modified hazards

4.3 EMPLOYEE REPORTS OF HAZARDS

LM employees have the freedom and authority to:

- Identify and record any problems relating to the personnel safety, product, process, or quality system
- Stop operations, recommend, or provide solutions
- Verify implementation of solutions
- Control further operations or processing, delivery, or installation of nonconforming products until the deficiency or unsatisfactory condition has been fixed

During critical operations, employees are instructed to state loudly the familiar one-word command if a hazard is suspected or observed: STOP! LM extends use of this command to any NASA employee, subcontractor, partner, or other individual involved in or otherwise witnessing an LM operation. This STOP command can be used by any employee at any time a risk to personal safety, the environment or product hardware is suspected—it is not a command reserved for management.

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Employees are encouraged to identify areas in which safety can be improved, particularly by working with their supervision. Conversely, supervision is instructed by many ESH programs and initiatives to work with their employees in identifying and resolving ESH issues. This ensures employees are supported in their efforts. Employees can submit service requests to Facility Operations and Services to provide repairs to faulty equipment or to make facility modifications to eliminate an identified workplace hazard.

In addition, the LM ESH website on the LM intranet contains ESH points of contact identified by LM location to facilitate reporting of any unsafe or hazardous condition. The caller may, at his or her own discretion, remain anonymous; however, in no case is there reprisal to an employee for reporting a suspected or known unsafe condition. The no-reprisal mandate flows down from the LM corporate-wide ethics training program and direction from Chief Executive Officer Mr Robert Stevens; it is a core value.

5.0 MISHAP INVESTIGATION AND RECORD ANALYSIS

5.1 MISHAP INVESTIGATION AND REPORTING

Events at LM requiring emergency assistance are reported by telephone using the 911 number with the exception of the LM Newtown location which uses telephone number 123 for emergency assistance. These events can include fire (although in most locations, automatic notification to fire and rescue is completed through building fire alarm systems), medical emergencies, hazardous material spills, or security breach. For all LM activity regardless of location, these emergencies and other events that result in personnel injury/occupational disease/fatality or potential damage/contamination or damage/contamination to hardware are also reported through LM processes. Personnel injury is reported through the LMSII system, and events involving hardware are reported through the LM flash notice system.

Personnel Injury Reporting—When an occupational injury occurs, the employee reports to the site's medical facility and ultimately participates in the LMSII investigation. The Standard Injury and Illness Investigation system is resident on the LM intranet and provides a systematic process of identifying root causes of occupational-related injury or illness, recommending corrective actions, communicating the results, and implementing corrective actions to prevent similar events from occurring.

Flash Notice—When hardware is damaged or threatened by an event, the supervisor is responsible for issuing a flash notice to the LM point of contact. The flash notice is distributed to key personnel across LM. Rapid notification in support of contracts requiring GSFC Clause 52.223-91 is provided to the GSFC Safety and Environmental Division by telephone at (301) 286-6296 and the GSFC program contracting officer.

On contracts requiring GSFC Clause 52.223-91, occurrences directly associated with Goddard Space Flight Center contract activity at LM or LM activity at a non-LM facility are reported within one business day of the occurrence (or, in the case that an injury does not result in an immediate lost-time case, one business day from the time ESH is aware that the injury became a lost time case). The report is provided to the Goddard Space Flight Center Safety and Environmental Division by telephone at (301) 286-6296 and the GSFC program contracting officer.

5.1.1 LMSII, Mishap, and Near-Miss (Close Call) Reporting to NASA

Occurrences directly associated with S&ES activity at LM or LM activity at a non-LM facility in the course of a NASA contract are reported within one business day of the occurrence (or, in the case that an injury does not result in an immediate lost-time case, one business day from the time ESH is aware that the injury became a lost time case). The report is provided to the applicable NASA contracting officer. For personnel injury cases, the information includes the name of the employer of the injured employee, job function of the employee, the nature of the injury, and a brief description of the task performed when the injury occurred. For events related to hardware safety, initial report details are provided from the LM flash notice form (fig. 5.1.1-1). LM threshold definitions of mishap and near miss differ slightly from the NASA thresholds of mishap and close call; however, the LM reporting system captures all events applicable to the NASA reporting system described in NPR 8621.1. The NASA contracting officer is responsible for event reporting to other NASA agencies as required by NPR 8621.1.

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FLASH NOTICE FORM		
E-Mail this form to the Central System Safety at Fc-Ast, FlashNotice		
Incident Type: (Check One) MISHAP (Estimated property damage greater than \$10 K): <input type="checkbox"/> NEAR MISS (No property damage, or estimated property damage less then \$10K): <input type="checkbox"/> Note: Injury incidents are NOT automatically classified as mishaps. Use property damage guidelines to classify Flash Notice Types.		
1. Submitted by:	2. Phone (with area code):	3. E-Mail:
4. Date of Incident:	5. Time:	6. Location, including city:
7. Sequence number (to be completed by Central System Safety):		8. Nonconformance Documentation Number: Check One: NC <input type="checkbox"/> AR <input type="checkbox"/>
9. Program:		10. Product name:
11. Mishap or Near Miss Type(s): Injury to personnel: <input type="checkbox"/> Potential <input type="checkbox"/> Actual Damage to flight hardware: <input type="checkbox"/> Potential <input type="checkbox"/> Actual Damage to flight hardware: <input type="checkbox"/> Potential <input type="checkbox"/> Actual Damage to ground hardware: <input type="checkbox"/> Potential <input type="checkbox"/> Actual Damage to facilities: <input type="checkbox"/> Potential <input type="checkbox"/> Actual Damage to environment: <input type="checkbox"/> Potential <input type="checkbox"/> Actual <input type="checkbox"/> Other (Specify)		12. Injury/Damage: Deaths: _____ Injured: _____ Monetary Loss: _____ Program Impact: _____ Supervisor's Injury Investigation: _____ Form Required: _____
13. Description of incident:		
14. Was a huddle conducted? <input type="checkbox"/> Yes <input type="checkbox"/> No 15. Was a pre-ops briefing conducted? <input type="checkbox"/> Yes <input type="checkbox"/> No 16. Were photos taken of the Incident ? <input type="checkbox"/> Yes <input type="checkbox"/> No (If Yes attach to NC document)		
17. Immediate actions taken (safing/containment):		
18. Preliminary cause assessment (Central System Safety understands that additional or different cause(s) may be revealed as more data is collected):		

Figure 5.1.1-1 Lockheed Martin Flash Notice Form

5.1.2 LMSII, Mishap, and Near-Miss (Close Call) Investigation

LMSII reports are reviewed and approved by ESH. Investigations that are incomplete, including identification of root cause and implementation of corrective action, are not approved until completed.

An investigation of the mishap is conducted under LM supervision to determine the root cause of the mishap. LM Mishap and Near Miss Investigation Guidebook, 3.6-T1-SysSaft-3.2-G, provides information and guidance for conducting a mishap or near miss investigation by LM. If NASA management deems it necessary to appoint a mishap investigation board, LM provides support as requested. Mishaps and near miss investigation results are reviewed by the Error Prevention Council for adequacy.

5.1.3 Prevention of Recurrence of Mishaps

The ESH department is the central location/depository for reports and records pertaining to occupational injuries and environmental incidents. The Error Prevention Council, operated by the System Safety organization, is the central location/depository for flash notices.

ESH engineers are present in work areas and are integrated into local operations to allow for early identification of potential risks and enables mitigation for injury prevention. ESH engineers routinely communicate with LM lines of businesses including System Safety and participate in project team activities to review and evaluate ongoing operations.

Error Prevention Council reviews the results of mishap/near miss investigations and determines the adequacy of the root cause(s) and corrective action. If the Council determines corrective action should be applied across the LM enterprise to avoid recurrence, an action is transferred to the appropriate functional organization for disposition. Depending on the nature of the incident, company-wide stand-downs are implemented to solicit and address input from employees regarding process improvements. A stand-down can also occur in response to an unfavorable trend in flash notices such as the perception that expected focus on error prevention was not maintained.

In addition, ESH publishes bulletins that focus on key ESH issues and summarizes selected accident, illness, and injury cases from the previous month as a lessons learned tool. These bulletins are published electronically and are available to employees via the LM intranet.

5.2 TREND ANALYSIS

Two parallel trend analysis processes exist at LM. Occupational injury/illness trends are analyzed by ESH, and hardware mishaps and near miss trends are analyzed by the Error Prevention Council.

The LMSII process allows automatic compilation and trending of injury data in real time. The LM ESH department routinely reviews the data, performs trend analyses, and prepares reports for senior management. LMSII reporting tools provide status of safety and health performance and focus for management. The fishbone analysis tool (fig. 5.2-1) provides an example of standard injury and illness causes. The causes applicable to the event are highlighted and amplified as appropriate to determine root causes to be addressed with corrective action.

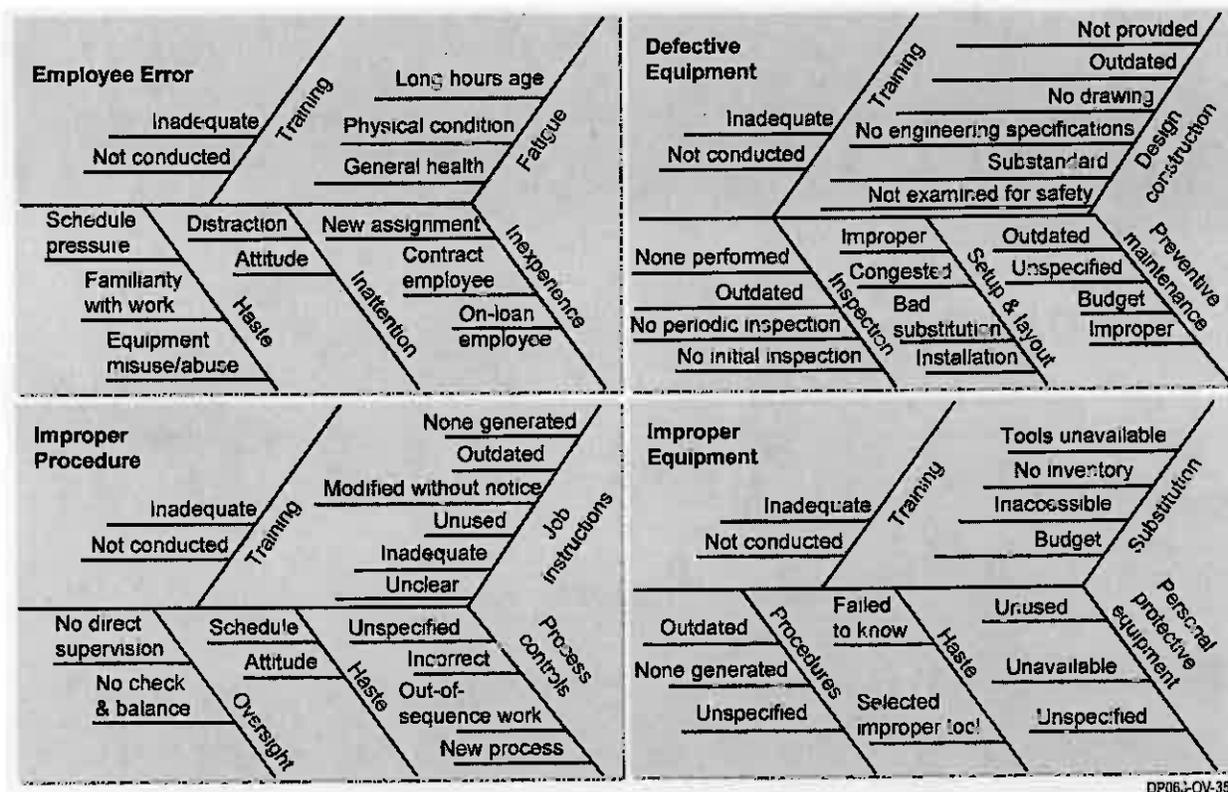


Figure 5.2-1 Fishbone analysis defines root causes and provides appropriate corrective actions.

Upon request, LM provides the following metrics to the NASA customer at the monthly program management review:

- OSHA recordable rates
- OSHA day-away cases rate
- OSHA severity rate

The Error Prevention Council meets monthly, and mishap/near miss trends are presented by the council chairperson for council consideration. Actions are assigned to functional areas as applicable for disposition of potential process changes to reverse unfavorable trends.

Per NPR 8715.3, LM provides the following:

- Accident/incident summary report—New and open mishaps/near misses/occupational injuries and illnesses related to the S&ES NASA programs are described in summary form along with current investigation status. This monthly report is generated by LM ESH and System Safety and delivered by the LM contracting officer to the NASA contracting officer on or before the tenth day of the following month. The NASA contracting officer is responsible for any further distribution at NASA. Summary reports in support of contracts requiring GSFC Clause 52.223-91 are submitted monthly using NASA Incident Reporting Information System (IRIS) or e-mail to Lisa.L.Cuiler@nasa.gov; these reports shall specify incidents, disabling injuries, lost work days incident rate, days lost, property damage cost, manhours worked/month, and total employees.
- Log of occupational injuries and illnesses—Upon request, the LM ESH department provides a copy of its annual summary of occupational injuries and illnesses to the NASA contracting officer after the end of the year to be reported.

6.0 HAZARD PREVENTION AND CONTROL

LM managers work with subcontractors and NASA to promote a safe and healthful work environment in onsite and offsite facilities. This includes communicating applicable information related to ESH policies/procedures, best practices, lessons learned, hazards and their discrepancies, and corrective actions. The Standard Injury and Illness investigation system, lessons learned databases, flash notices, LM Mission Success bulletins, and Government Industry Data Exchange Program (GIDEP) documents are some of the tools used to identify unique hazards for projects and recommend corrective action. LM ESH and System Safety assigned to support NASA projects provide ongoing support to prelaunch processing for hazard identification, evaluation, and control. Various LM command media tasks are assigned to safety throughout the design, assembly, and test phases. Contractual deliverables created by System Safety also support the clarification and dissemination of hazard control information.

If work is performed by LM at a NASA center, hazards and planned hazard controls are communicated to the NASA center safety representatives in the project safety analysis report, test procedures, and coordination meetings of planned activities.

6.1 APPROPRIATE CONTROLS

The hazard reduction precedence sequence used by LM is based on the severity of the hazard. An imminent hazard requires immediate abatement and, if necessary, evacuation of employees until the hazard is mitigated. A non-imminent hazard may be addressed through design change, procedure change, the service request process, safety specific communications, awareness briefings, or other applicable means.

If a residual risk to personnel, hardware, or the environment is identified during a hazard analysis, a process to identify risk mitigation the risk is initiated. Four common types of control that can be implemented to mitigate a hazard to personnel safety are listed below. They are listed in the sequence of preferred implementation.

- 1) Design for minimum risk—Design to eliminate the hazards is considered first.
- 2) Incorporate safety devices—If identified hazards cannot be eliminated or their associated risk adequately reduced through design, that risk is reduced through the use of fixed, automatic, or other protective safety design features or devices. Provisions are made for periodic functional checks of safety devices when applicable.
- 3) Provide warning devices—When neither design nor safety devices can effectively eliminate identified hazards or adequately reduce associated risk, devices are used to detect the condition and to produce an adequate warning signal to alert personnel of the hazard. Warning signals and their application are designed to minimize the probability of incorrect personnel reaction to the signals and are standardized within similar types of systems.
- 4) Develop procedures and training—Where it is impractical to eliminate hazards through design selection or adequately reduce the associated risk with safety and warning devices, procedures and training are used. Procedures identify the need for PPE if appropriate and provide precautionary notations.

Tables 6.1-1 and 6.1-2 show the criteria applied by System Safety to identify and accept any residual risk.

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Table 6.1-1 Accident/Incident Severity Categories

Severity	Category	Definition
Catastrophic	I	May cause death, monetary loss >\$1,000,000, or downtime >4 months
Critical	II	May cause severe injury or severe occupational illness, equipment loss \$200,000 to \$1,000,000, or downtime 2 weeks to 4 months
Marginal	III	May cause minor injury or occupational illness, equipment loss \$10,000 to \$200,000, or downtime 1 day to 2 weeks
Negligible	IV	Does not result in injury or occupational illness, equipment loss <\$10,000, or downtime <1 day

Table 6.1-2 Accident/Incident Probability Levels

Level	Definition
A	Frequent, likely to occur repeatedly in the life of an item
B	Reasonably probable, likely to occur several times in the life of an item
C	Occasional, likely to occur sometime in the life of an item
D	Remote, unlikely to occur but possible in the life of an item
E	Extremely improbable, very unlikely to occur but still possible

Using the criteria in tables 6.1-1 and 6.1-2, System Safety and project management may evaluate potential hazards by severity and probability of occurrence to develop a criticality value, called a hazard risk index. The hazard risk index can be used to determine what actions need to be taken, if any, to reduce and/or eliminate risk. Table 6.1-3 shows the general criteria that may be applied to known accident risks and recommended actions for remediation.

Table 6.1-3 Hazard Risk Indices

IA, IB, IC, IIA, IIB	Unacceptable, implement remedial actions
ID, IIC, IIIA, IIIB	Undesirable, implement remedial actions as appropriate or obtain waiver
IE, IID, IIE, IIIC, IIID, IIIE, IVA, IVB, IVC, IVD, IVE	Acceptable without review

In addition to the hazard risk index, hazards must be controlled as described below commensurate with the hazard severity:

- 1) If a system failure may lead to a catastrophic hazard, the system has three inhibits (dual fault tolerant). A catastrophic hazard is defined as a condition that may cause death or permanent disability, major system or facility destruction on the ground, or loss of vehicle during the mission.
- 2) If a system failure may lead to a critical hazard, the system has two inhibits (single fault tolerant). A critical hazard is defined as a condition that may cause severe injury or occupational illness, or major property damage to facilities, systems, or flight hardware.
- 3) Hazards that cannot be controlled by failure tolerance (e.g., structures, pressure vessels) fall into the Design for Minimum Risk category and have separate detailed safety requirements that must be met. Hazard controls related to these hazards are extremely critical and warrant careful attention to the details of compliance verification.

Hazard controls are typically expressed in designs or procedures. In addition to hazard control verification as required in deliverable safety documents per contract, System Safety has review and approval authority for the following program elements to verify application of hazard controls as required by LM command media 3.1-T1-CDM-2.1-S, Configuration Identification Functional Reviews:

- 1) Ground support equipment that interfaces with deliverable hardware.
- 2) Assembly and installation drawings for deliverable hardware
- 3) Tooling/fixture drawings that have a direct interface with a deliverable product
- 4) Software design and test documents, version description documents, and software code for software that contains hazardous commands or commands that activate/control hazardous action

6.1.1 Hazardous Operations

Hazardous operations are evaluated, at a minimum, for the following basic requirements: characterizing hazardous operation, verifying training and certification, developing procedures, and using permits. System Safety characterizes and prioritizes hazardous operations. ESH evaluates new or nonroutine hazardous operations to determine potential risk to personnel health and safety and to ensure appropriate controls are in place to mitigate the risk. Likewise, System Safety reviews new or nonroutine hazardous operations when a potential loss of critical product has been determined. The area supervisor is responsible for notifying area personnel when hazardous operations are to be performed and when hazardous conditions may exist. Generic hazardous operations during assembly, integration, and test are as follows:

- 1) Crane operations
- 2) Open loop RF transmission
- 3) Flight hardware deployments
- 4) Acoustics test
- 5) Dynamic interaction test
- 6) Thermal vacuum test
- 7) Helium pressurization
- 8) Propellant load
- 9) Flight system transport

During the project test planning process, System Safety continues to screen and identify operations that are hazardous. A current list of hazardous operations planned for conduct at NASA centers is included in the project Missile System Prelaunch Safety Package when required by contract. Test procedures identify the specific hazardous operations along with the appropriate controls/steps to mitigate the hazards. Methods to inform personnel of the commencement of hazardous operations are included in test procedures and such as required test participants, area warning lights and instructions to personnel present for the operation as applicable. ESH and System Safety review and approve applicable procedures before they are performed. Procedures performed at NASA centers may also be subject to review and approval by the Center Safety Office before they are performed in accordance with center requirements.

Program personnel perform test and critical hardware moves in accordance with written procedures. Test team required attendees and allowed optional participants are listed in each procedure, and the team test reviewers ensure the proper personnel are listed to perform the tasks. On request, LM provides NASA access to procedures to verify safe implementation of hazardous operations.

6.1.2 Written Procedures

The test planning process detailed in 2.3.8.1-T1-Test-1.0-P, Test Engineering Process, dictates a structured process for planning and development of test procedures that implement hazardous operations. Program personnel including NASA may participate in the test engineering process. The test engineering process also requires the generation and retention of various documents that are available for audit. Test procedures provide specific task direction and contain clear statements of task specific hazardous situations for products. In addition to written procedures, supervisors ensure appropriate permits for operations are approved before any work is attempted. Permits required by regulation (e.g., wastewater discharge, hazardous waste), and permits required by command media for hazardous operations (e.g., hot work, permit required confined space entry), are also obtained before the start of operations. Restrictions on the application of permits are detailed in the appropriate command media.

ESH and System Safety review and approve test procedures including hazardous test procedures. The test engineering process requires a written and approved procedure before the commencement of all test operations.

Maintenance and repair hazards are controlled by written command media procedures. For example, Accessory Hoisting Equipment, 1.3.3-T1-ESH-1.0-S, and Overhead Cranes, 1.3.3-T1-ESH-12.0-S, command media addresses maintenance of systems interfacing with products. Command media also addresses control of generic hazards such as electrical, confined space, and unprotected heights that could be encountered during maintenance or repair.

Hazardous material and waste handling are managed through various command media instructions that are included in appendix A.

6.1.3 Protective Equipment

Personal Protective Equipment, 1.3.3-T1-ESH-56.0-S, is the LM standard for personnel protective equipment that includes the selection, issue, training, and maintenance. PPE is used only when engineering and administrative controls cannot be accomplished and are insufficient in protecting the employee from physical or toxic hazards. Hazard assessments are performed by ESH to determine the specific protective equipment necessary for the work environment in accordance with local ESH operating procedures and test procedures. Precautionary steps to safeguard employees are included in operating procedures/instructions. Employees are trained on the proper use, inspection, and maintenance of protective equipment selected for their work environment. PPE is generally issued to individuals, and it is the individual user that is trained with requirements to inspect equipment before use and the methods to properly maintain the equipment. There is no requirement for documentation of maintenance or inspection of PPE issued to personnel. Other equipment used for personnel safety such as an oxygen meter is labeled with calibration due date.

6.1.4 Hazardous Operations Permits

How internally driven (i.e., nonregulatory) LM permits apply at LM facilities is described in command media. For example, the hot work permits required by LM 1.3.3-T1-ESH-26.0-S, Portable Hand and Power Tools, defines applicability of the permit and how the permit is acquired. Training and certifications required for internal operating permit controlled work comply with section 7.0.

LM command media 1.3.3-T1-ESH-29.0-S, Waste Management, summarizes the waste management system used at LM and provides specific requirements for operating elements during waste accumulation, including issuing notifications, identifying waste types, ordering containers, handling containers, and training employees. The intent of this Standard is to protect the health and safety of LM employees and the public; to protect the environment; and to comply with local, state, and federal regulations developed pursuant to the Resource Conservation and Recovery Act.

LM recognizes that internal operating permit processes at NASA centers may differ from LM's processes, and NASA center processes take precedence for operations at NASA centers. Procedures for hazardous operations at a NASA center are available to NASA, and safety requirements for these operations are precoordinated. This includes operations involving potential exposures to asbestos, other toxic materials, hazardous waste, and emissions/discharges to the environment. The ESH and System Safety organizations participate directly in hazardous operations in an immediate control function role (e.g., participating in actual satellite fueling operations) and also in a higher-level control function by reviewing and approving hazardous operations procedures. This review and approval function is required by command media.

6.2 FACILITIES MAINTENANCE

S&ES contract activity maintains no NASA center facilities. ESH is responsible for implementing programs that ensure hazards in facilities operated by LM are appropriately controlled. ESH approves building modifications to ensure safety requirements are met.

6.3 PREVENTIVE MAINTENANCE

Preventative maintenance is scheduled through a computer-generated database that tracks equipment maintenance due dates. Maintenance is performed in accordance with manufacturer's recommendations, industry standards, command media, or task specific procedures. When facility equipment is due for maintenance it is scheduled for least impact to ongoing programs. In the event an anomaly is found during maintenance, evaluations begin to determine options for use, repair, or replacement. If the anomaly renders the equipment unsafe, it is tagged out. If a flash notice is generated as a result of preventive maintenance operations associated with program related equipment, the notice is shared with the NASA. LM command media 3.6-T1-MSuccess-1.3-P, GIDEP and Mission Success Bulletin Processing, provide the process by which GIDEPs received are evaluated for applicability to LM operations. The process also drives the generation of a GIDEP notice based on discovery within LM for distribution to government agencies including NASA.

6.4 MEDICAL PROGRAM

LM provides a medical surveillance program to ensure employees working with toxic substances or harmful physical agents are not adversely affected by exposure. Periodic examinations are made available to employees with the frequency and type of examination defined by the nature of the exposure.

Specific elements included the surveillance program are:

- Medical exams and testing for employees, as required by federal (including OSHA and DOT), state, local, and ESH requirements
- Treatment of occupational injuries and illnesses
- Advising employees on medical issues
- In case of an exposure, this same program is used for post exposure evaluation

Emergency first aid, cardiopulmonary resuscitation, and emergency response are available at LM locations and subcontractors. Depending on location, these services may be provided directly by LM or subcontractors or by outside support entities such as local fire and rescue services and contract medical providers. In the event the medical emergency is at a NASA facility, the onsite medical team may provide initial treatment, as allowed by contract.

After an injury occurs, LM has a case management program to verify the employee receives the appropriate care. This helps to ensure the injured employee recovers as quickly as possible and can return to work without further injury. In some instances, the injured employee returns to work on a restricted basis before resuming pre-injury duties.

7.0 EMERGENCY RESPONSE

LM takes preparatory action to enable an organized response in case of a natural emergency or disaster, an accident, or an intentional event, such as violence in the workplace. Action focuses on minimizing exposure of the public and employees, the environment, and assets to unwarranted risk, injury, or damage, while maximizing recovery of operational capability. To a large degree, the response system is developed from government security program requirements, but LM has augmented the system with principles from municipal, state and federal public catastrophe response methods. In this regard, LM follows the structured incident management system, thus allowing outside public resources to be added to an onsite emergency response. LM also participates in forums provided by, and recommendations from, private insurance carriers and insurance brokers regarding disaster planning. Main facilities receive annual risk management reviews from the insurers.

Employees follow the LM site crisis management plan or the host site's crisis management plan, or equivalent, unless other structures are mandated. The crisis management plan identifies the chain of command and the response process for various emergencies. In the event of an emergency, an employee must:

- Move to a safe location
- Report incident to supervisor, if immediately available
- Call the local facility's emergency number
- Stay on the telephone line until instructed to hang up by the dispatcher

LM emergency response team employees receive specialized training in any one, or all of the following fields: first aid, automatic electronic defibrillator, blood-borne pathogens, and 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response Standard), fire extinguisher training. In addition to recertification training, the emergency response team members hold emergency response drills and are evaluated for emergency preparedness.

In the event of a mission anomaly, ESH maintains program-specific procedural command and control-related to personnel ESH and flight hardware. Provisions are made to ensure adequate personnel and PPE are available for the response team. Also, a hierarchy of personnel responsible for making decisions related to personnel safety and health is available in the event an action occurs that is not covered by a task specific procedure.

Methods for notifying NASA center emergency forces are specified to visiting LM employees by the NASA center host. NASA maintains full incident command for emergencies occurring on NASA property, unless contractually specified otherwise.

8.0 SAFETY AND HEALTH TRAINING

The goal of the training program is to ensure qualified personnel are available to perform their assigned tasks and to operate facilities safely and reliably. Training focuses on understanding and applying safe work procedures to the task; recognizing and dealing with any associated hazards; avoiding accidents; disciplinary actions, as appropriate; and being familiar with appropriate PPE and/or countermeasures to safely and effectively deal with hazards encountered on the job.

LM ESH Training Standard, 1.3.3-T1-ESH-10.0-S, establishes the requirements for the ESH training that is necessary to control the exposure of LM employees to hazards during LM activities. An ESH training matrix, derived from regulatory requirements and from training needs identified by ESH, is used to assist managers/supervisors in determining an employee's ESH training needs. Where training is required, employees are trained in accordance with regulatory, corporate, and applicable contractual requirements before performing the task. Training requirements depend on the employee's assigned job function, resulting in more detailed training for hands-on operators, as opposed to general training for new employee orientation. Similarly, training requirements for management differ from that required for production workers. In addition, tailored training may be developed and required in response to outcomes of job safety analyses, hazard analyses, mishap investigations, trend analyses, or other circumstances. Thus, the LM training program addresses numerous requirements and takes into consideration parallel regulatory requirements (e.g., 29 CFR 1910.38 for emergency action plans and fire prevention plans versus EPA Resource Conservation and Recovery Act for Emergency Planning and Community Right-to-Know). A comprehensive training and course listing identifying job function and associated training requirements is in appendix B. A current version of the training and course listing is available on the LM intranet.

Error Prevention training is also administered per LM command media 3.6-T1-SysSaft-3.0-D to provide personnel the tools to evaluate tasks at hand to minimize human error. A glossary of conditions known as traps is also highlighted to give personnel the opportunity to recognize precarious situations. AESOP (Assignment, Equipment, Situation, Obstacles, Personnel) huddle is the moniker for the standard set of considerations to be addressed before performing work. Those items for consideration are as follows:

- Assignment to clearly define responsibilities
- Equipment to verify the equipment meets all requirements for the task
- Situation assessment to identify issues with beginning, accomplishing, or completing the assigned task
- Obstacles to verify appropriate clearances
- Personnel to verify all personnel involved with the task are physically and mentally ready

Existing training resources available through LM, NASA, and the contractor community are fully used to the extent possible to ensure consistency of messages, understanding of the overall safety picture, and minimizing contract costs. Training requirements for LM operations planned at a NASA center are coordinated with NASA, and LM personnel complete training to meet NASA center requirements. In the case of a multiple employer work environment on NASA property, NASA training requirements take precedence. For operations at a NASA facility, LM training that meets requirements of a NASA center training certification is not repeated, upon agreement with the Occupational Safety Branch and Occupational Health and Test Support office. Visitors may be required to take targeted training before accessing specific work locations.

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LM provides employees with training in PPE and other courses, as needed, to safely accomplish assigned duties. Specific to PPE, a basic course is provided, and specific PPE training is provided where more severe hazards can be encountered, e.g., courses in respiratory protection, fall protection, and electrical safety. Class instruction includes hazard recognition and PPE inspection, use, maintenance, and limitations.

Supervisory duties include:

- Identifying training requirements for employees
- Ensuring employees are current with training requirements
- Monitoring certifications and training records

ESH duties include:

- Performing hazard assessments to define PPE requirements
- Defining safety training requirements for tasks
- Providing assistance in developing worker training
- Conducting training, as applicable
- Conducting periodic assessments of ESH programs, including PPE

LM provides general safety briefings to non-LM personnel; however, specific safety training such as respiratory protection, hearing conservation, confined space entry, and fall protection are not provided to non-LM personnel for legal reasons. Persons that are not LM employees must receive necessary training and equipment from their employer. Non-LM personnel that cannot demonstrate training and do not have their own applicable protective equipment for a given hazardous condition are prohibited from work that exposes them to a hazardous condition requiring training and equipment.

Each LM employee has a learning plan that is maintained by their supervisor. Required training and associated due dates for retraining are tracked in an on-line system called eCard. The training records of all employees are available for viewing by anyone with LM intranet access. The eCard system is used by the individual employee to monitor training status as well as test teams to monitor suitability of test participants for specific tasks. Training materials and training records are available for NASA review upon request.

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APPENDIX A—PRIMARY LOCKHEED MARTIN ESH AND SYSTEM SAFETY DOCUMENTS

The most current version of command media posted on the LM intranet applies. LM sites may implement alternates to command media that demonstrate compliance to all applicable requirements.

Table A-1 LM Command Media

LM Document Number	Title
Corporate Policies & Functional Procedures	
CPS-002	Mission Assurance
CPS-015	Environment, Safety & Health
CPS-420	Corporate Real Estate
CPS-527	Records Management
ESH-01	ESH Management System
ESH-02	Real Estate Transactions
ESH-03	Metrics
ESH-04	Incident Reporting
ESH-05	Contractor Management
ESH-06	Waste Disposal
ESH-07	Commercial Motor Vehicle Safety
ESH-08	Hazardous Materials Transportation
ESH-09	ESH Host-Tenant Responsibilities
ESH-10	Environmental Safety & Health Self-Assessment Process
MA-002	System Safety
LM Directives/Standards/Processes/Guidebooks/Checklists	
13 3-T1-ESH-1 0-D	Environment, Safety & Health Directive
13 3-T1-ESH-1 0-P	Environment, Safety & Health Management System
13 3-T1-ESH-1 0-P-W1	Risk Assessment Description Work Product
13 3-T1-ESH-1 0-P-W2	Objective & Program Development Description
13 3-T1-ESH-1 0-S	Accessory Hoisting Equipment
13 3-T1-ESH-2 0-D	Alternate Procedure for Suspended Load Operations
13 3-T1-ESH-2 0-S	Air Quality Program
13 3-T1-ESH-2 0-S-F1	Solvent Use Record
13 3-T1-ESH-2 0-S-F2	Coating/Thinner/Adhesive/Sealant Use Record
13 3-T1-ESH-3 0-S	Asbestos Control
13 3-T1-ESH-4 0-S	Storage Battery Safety
13 3-T1-ESH-5 0-S	Bloodborne Pathogens
13 3-T4-ESH-6 0-G	Hazardous Material Business Plan
13 3-T1-ESH-2 0-S-F2	Coating/Thinner/Adhesive/Sealant Use Record
13 3-T1-ESH-8 0-S	Compressed Gas Safety
13 3-T1-ESH-9 0-S	Confined Space Entry Standard
13 3-T1-ESH-10 0-S	ESH Training
13 3-T1-ESH-11 0-S	Contractor Safety
13 3-T1-ESH-12 0-S	Cranes, Overhead
13 3-T1-ESH-14 0-S (in revision)	Electrical Safety
13 3-T1-ESH-15 0-S	Elevator Safety
13 3-T1-ESH-16 0-S (in revision)	Chemical Spills & Releases
13 3-T1-ESH-17 0-S	Ergonomics Program
13 3-T1-ESH-18 0-G	Monthly/Quarterly Self-Inspections
13 3-T1-ESH-18 0-S-C2	Self-Inspection Checklist for Manufacturing, Test, Production & Laboratory Areas
13 3-T1-ESH-18 0-S-C1	Self-Inspection Checklist for Office
13 3-T1-ESH-19 0-S	Mobile Cranes
13 3-T1-ESH-19 0-S-C1	Mobile Crane Inspection Daily/Monthly Checklist
13 3-T1-ESH-19 0-S-C2	Mobile Crane Inspection Monthly/Annual Checklist
13 3-T1-ESH-20 0-S	Cryogenic Safety
13 3-T1-ESH-24 0-S	Emergency Eyewash & Safety Showers
13 3-T1-ESH-25 0-S	Fall Protection
13 3-T1-ESH-26 0-S	Portable Hand & Power Tools
13 3-T1-ESH-26 0-S-C1	Portable (Power Operated & Powder Actuated) Tools & Equipment Checklist
13 3-T1-ESH-28 0-S (in revision)	Hazardous Material Storage

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Table A-1 LM Command Media

LM Document Number	Title
13 3-T1-ESH-29 0-S	Waste Management
13 3-T1-ESH-30 0-S	Hazard Communication
13 3-T1-ESH-32 0-S	Heat & Cold Stress
13 3-T1-ESH-36 0-S	Powered Industrial Truck Safety
13 3-T1-ESH-36 0-S-C1	Powered Industrial Truck Inspection Checklist
13 3-T1-ESH-37 0-S	Laboratory Safety
13 3-T1-ESH-38 0-S	Ladder Safety
13 3-T1-ESH-38 0-S-C1	Ladder Safety Checklist
13 3-T1-ESH-39 0-S	Laser Safety
13 3-T1-ESH-40 0-S	Control of Hazardous Energy (Lockout/Tagout)
13 3-T1-ESH-40 0-S-F1	Space Systems Lockout/Tagout Emergency Removal Form
13 3-T1-ESH-40 0-S-T-1	Space Systems LOTO Procedure Format
13 3-T1-ESH-41 0-S	Liquefied Petroleum Gas
13 3-T1-ESH-42 0-S	Machine Safety
13 3-T1-ESH-43 0-S (in revision)	Medical Surveillance
13 3-T1-ESH-45 0-S	National Environmental Policy Act
13 3-T1-ESH-47 0-S	Noise & Hearing Conservation
13 3-T1-ESH-48 0-S	Radio Frequency & Ultraviolet Radiation Safety
13 3-T1-ESH-49 0-S	Oxygen-Deficient & Oxygen-Enriched Atmospheres
11 3-T1-ESH-52 0-S	Personnel Aerial Lifting Devices
13 3-T1-ESH-53 0-S	Pesticides
13 3-T1-ESH-54 0-S	Pollution Prevention
13 3-T1-ESH-56 0-S	Personal Protective Equipment
13 3-T1-ESH-57 0-S	Fluid Systems Pressure Safety (Non-Flight)
13 3-T1-ESH-58 0-S (in revision)	Process Safety Management
13 3-T1-ESH-59 0-S	Radioactive Material Safety
13 3-T1-ESH-63 0-S	Respiratory Protection Program
13 3-T1-ESH-64 0-S (in revision)	Restricted Hazardous Material
13 3-T1-ESH-69 0-S	ESH Self Assessment
13 3-T1-ESH-70 0-S	Excavation Safety
13 3-T1-ESH-72 0-S	Spray Painting
13 3-T1-ESH-73 0-S	Standard Injury & Illness Reporting
13 3-T1-ESH-75 0-S	Toxic Substances Control Act Compliance
13 3-T1-ESH-76 0-S	Vehicle Safety
13 3-T1-ESH-77 0-S	Local Exhaust Ventilation
13 3-T1-ESH-79 0-S	Warehousing Safety
13 3-T1-ESH-80 0-S	Water Quality for Regulatory Compliance
13 3-T1-ESH-81 0-S	Working Alone
13 3-T1-ESH-82 0-S	X-Ray Machine Safety
13 3-T1-ESH-83 0-S	ESH Requirements for Foreign & Remote Operations
13 3-T3-ESH-35 0-S	Injury Illness Prevention Program—California
13 3-T3-ESH-68 0-S	Superfund Amendment & Reauthorization Act Compliance
13 3-T4-ESH-6 0-G	Hazardous Material Business Plan
13 3-T4-ESH-33 0-G	Indoor Air Quality Response
13 3-T4-ESH-66 0-G	ESH Safety Committee—California
13 3-T4-ESH-61 0-G	Regulatory Agency Inspection Protocol
L3-T1-SysSaft-3 0-D	System Safety
L3-T1-SysSaft-3 0-S	System Safety Standard
L3-T1-SysSaft-3 1-D	Eyes on Space Systems Company
L3-T3-SysSaft-1 0-D	System Safety Hazards Analysis of Suspended Load Operations
L3-T3-SysSaft-1 0-D-F1	System Safety Suspended Load Operations Hazard Analysis Report
36-T1-SysSaft-3 0-D	Error Prevention
36-T1-SysSaft-3 1-P	Mishap & Near Miss Reporting
36-T1-SysSaft-3 1-P-F1	Flash Notice
36-T1-SysSaft-3 1-S	Error Prevention Huddles
36-T1-SysSaft-3 1-S-C1	Error Prevention Checklist
36-T1-SysSaft-3 2-G	Mishap & Near Miss Investigation

The most current version of these documents, or their replacement documents, is in effect for work performed

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APPENDIX B—JOB FUNCTION CHART

Job Function	Training	Requirement	Initial*	Retraining*	Reference
All employees	ESH compliance training	Compliance training plan	Yes	Perm	1 3 3 -T1-ESH-10 0-S
All new hires	New employee orientation materials	ISO 14001	Yes	Perm	1 3 3 -T1-ESH-10 0-S
All employees	Supervisor checklist & hazcom briefing	1910 1200	Yes	Perm	1 3 3 -T1-ESH-10 0-S
Employees in jobs where hazardous waste is generated & managed, including those engaged in emergency response & cleanup activities	Generator awareness annual training (OJT)	40 CFR 265 16 6 CCR 1007-3—265 15	Yes	1 year	1 3 3 -T1-ESH-10 0-S
Using & handling hazardous material other than normal use office supplies	Hazard communication	HCP—Chemical Information System Handbook & ESH Standard 1 3 3 -T1-ESH-30 0-S	Yes	2 years	1 3 3 -T1-ESH-10 0-S
Employees engaged in hazardous material/waste response & cleanup activities	Emergency response	OSHA 1910 120 6 CCR 1007 3—265 16	Yes	1 year	1 3 3 -T1-ESH-10 0-S
Employees engaged in firefighting response	Fire brigade	OSHA 1910 156 6 CCR 1007 3—265 16	Yes	1 year	1 3 3 -T1-ESH-10 0-S
Individuals affected by lockout & tagout must understand program	Lockout/tagout	ESH Standard 1 3 3 -T1-ESH-40 0-S	Yes	Perm unless program changes	1 3 3 -T1-ESH-10 0-S
Individuals authorized to lock out & tag out equipment for servicing & maintenance	Lockout/tagout for authorized employees	ESH Standard 1 3 3 -T1-ESH-40 0-S	Yes	1 year inspection	1 3 3 -T1-ESH-10 0-S
When required to wear a respirator	Respirator training	ESH Standard 1 3 3 -T1-ESH-63 0-S	Yes	1 year	1 3 3 -T1-ESH-10 0-S
When required to use class I & II lasers	Laser class I & II	ESH Standard 1 3 3 -T1-ESH-39 0-S	Yes	Perm	1 3 3 -T1-ESH-10 0-S
When required to use class III & IV lasers	Laser class III & IV	ESH Standard 1 3 3 -T1-ESH-39 0-S	Yes	2 years	1 3 3 -T1-ESH-10 0-S
When designated hearing conservation area or function (above 85 db-TWA)	Hearing conservation	ESH Standard 1 3 3 -T1-ESH-47 0-S	Yes	1 year	1 3 3 -T1-ESH-10 0-S
Operations identified by radiation protection officer	Radiation training	ESH Standard 1 3 3 -T1-ESH-59 0-S	Yes	Perm	1 3 3 -T1-ESH-10 0-S
Entry into designated confined space	Confined space	ESH Standard 1 3 3 -T1-ESH-9 0-S	Yes	Perm	1 3 3 -T1-ESH-10 0-S
Any function requiring the use of protective equipment—gloves, goggles, face shield, apron, etc	PPE	ESH Standard 1 3 3 -T1-ESH-56 0-S	Yes	Perm	1 3 3 -T1-ESH-10 0-S
Designated groups & functions with risk of exposure to pathogens associated with contact with untreated blood & body fluids, defined in OP-42 0	Blood-borne pathogens	ESH Standard 1 3 3 -T1-ESH-5 0-S	Yes	1 year	1 3 3 -T1-ESH-10 0-S
Functions using cab-operated cranes	Crane operator	ESH Standard 1 3 3 -T1-ESH-12 0-S	Yes	1 year	1 3 3 -T1-ESH-10 0-S
Employees operating powered industrial trucks (PIT)	Powered industrial trucks	ESH Standard 1 3 3 -T1-ESH-36 0-S	Yes	1 year	1 3 3 -T1-ESH-10 0-S
Employees potentially exposed to open electricity of 50V or more	Electrical safety	ESH Standard 1 3 3 -T1-ESH-14 0-S (Developing)	Yes	1 year	1 3 3 -T1-ESH-10 0-S
Employees using elevated platforms, such as scissor lifts, man lifts, etc	Elevated platforms	ESH Standard 1 3 3 -T1-ESH-52 0-S	Yes	5 years	1 3 3 -T1-ESH-10 0-S
Employees with potential for regularly encountering asbestos-containing material	Asbestos awareness	ESH Standard 1 3 3 -T1-ESH-3 0-S	Yes	1 year	1 3 3 -T1-ESH-10 0-S
Employees engaged in activities where protection is required to prevent falls from elevated areas	Fall protection	1 3 3 -T1-ESH-25 0-S	Yes	3 years	1 3 3 -T1-ESH-10 0-S

*Training course status by individual is tracked in the LMS/eCard database

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APPENDIX C—ACRONYMS

AESOP	Assignment, Equipment, Situation, Obstacles, Personnel
EPA	Environmental Protection Agency
ESH	Environment, Safety, and Health
ESHMS	Environment, Safety, and Health Management System
FFMEA	Functional Failure Modes and Effects Analysis
GIDEP	Government Industry Data Exchange Program
LM	Lockheed Martin
LMSII	Lockheed Martin Standard Injury and Illness
MSDS	Material Safety Data Sheet
NASA	National Aeronautics and Space Administration
OSHA	Occupational Safety and Health Administration
PEP	Performance Evaluation Profile
PPE	Personal Protective Equipment
TSCA	Toxic Substances Control Act