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Launch Services Division Safety

Launch Services Safety Overview

Chuck Loftin
Senior System Safety Engineer
NASA/KSC Launch Services Division



Safety Roles & Responsibilities

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NASA/KSC Launch Services Division Safety (SA-D) services include...

- **Assessing the safety of the launch vehicle**
- **Assessing the safety of NASA ELV spacecraft (S/C) / launch vehicle (LV) interfaces**
- **Assessing the safety of spacecraft processing to ensure resource protection of:**
 - **KSC facilities**
 - **KSC VAFB facilities**
 - **KSC controlled property**
 - **Other NASA assets**
- **NASA personnel safety**
- **Interfacing with payload organizations to review spacecraft for adequate safety implementation and compliance for integrated activities**
- **Assisting in the integration of safety activities between the payload, launch vehicle, and processing facilities**

All organizations are responsible for the safety of their personnel in all facilities



KSC Safety Activities

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Safety Activities are defined by:

- *NASA-STD-8709.2 – NASA Safety and Mission Assurance Roles and Responsibilities for Expendable Launch Vehicles*
- *NPD 8610.23 – Launch Vehicle Technical Oversight Policy*
- *NPR 8715.7 – Expendable Launch Vehicle Payload Safety Program*
- *NPD 8700.3 – SMA Policy for NASA Spacecraft, Instruments, and Launch Services*
- *AFSPCMAN 91-710 – Eastern and Western Range Safety Requirements*



KSC Safety Activities

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Activities can include:

- Safety data package review/approval for flight hardware, GSE, & processing activities
- Approval of hazardous procedures and audit of non-hazardous procedures
- Validation of customer implementation of procedural and operational controls
- Verification of facility walk-downs and training
- Chairperson of Payload Safety Working Group (PSWG)
- Support of Design Reviews, Working Groups, Technical Interchange Meetings, etc.
- Support real-time resolution of safety issues during processing
- Review/Approval of safety variances



Payload Processing at Commercial Facility

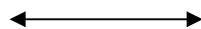
LS Division Safety roles:

- SOW Requirements
 - NASA FAR Safety Requirements
 - Safety and Health Plan
 - Mishap Reporting
- Facility/Operational Safety Requirement Tailoring
 - Incorporate applicable Range Requirements, NASA Standards, User Requirements
- Certification of Facility Readiness (CoFR)
 - Document review, Audits, Facility Walkdown
 - Facility GSE and Safety Systems
- Ground Operations Review (GOR)
- Performance Evaluation
 - User Feedback
 - Surveillance



Safety Responsibilities at the PPF and Launch Site

S/C Processing Facility



Launch Complex

USAF Range Safety
Public Safety/Base Safety/Launch Site Safety

NASA S/C Center & Contractor Safety & Mission Assurance

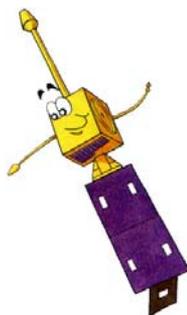


Payload Processing Facility
Facility Resource Protection/Safety Control Authority

NASA KSC Safety & Mission Assurance
KSC Resource Protection; LV – S/C Integration SMA; LV SMA



Launch Vehicle Contractor
LV SMA; LV – S/C Integration SMA





Compliance Documents

Mission, Range, and Processing Location determine applicable requirements

- NASA FAR supplement defines requirements for safety & health plan and mishap reporting
- OSHA defines personnel safety, Process Safety Management, etc.
- NPR 8715.7 defines the safety program for NASA ELV payloads
- NASA and KSC requirements and standards (i.e. NPR 8715.3) define system design and operational requirements for NASA facilities and NASA designed hardware
- KNPR 8715.3 defines operational safety requirements for processing/operations on KSC facilities (VAFB SLC-2W, KSC PHSF, etc..)
- AFSPCMAN 91-710 defines safety requirements for Eastern & Western range users
- MIL and industrial standards (e.g. ANSI, ASME, IEEE, ACGIH) may be contractually required



Safety Requirements and Standards

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NASA Safety Documents

- NPR 8715.3, *NASA General Safety Program Requirements*
- NPR 8715.7, *Expendable Launch Vehicle Payload Safety Program*
- NASA-STD-8719.9, *Standard for Lifting Devices and Equipment*
- NASA-STD-8719.13, *Software Safety Standard*
- NPR 8621.1, *NASA Procedures and Guidelines for Mishap Reporting, Investigating, and Recordkeeping*
- NSS 1740.12, *Safety Standard For Explosives, Propellants, And Pyrotechnics (Will soon be known as NASA-STD-8719.12)*
- NASA-STD-8719.14, *Process for Limiting Orbital Debris*



Safety Requirements and Standards

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KSC Safety Documents

- KNPR 8715.3, *KSC Safety Practices – Procedural Requirements*
- KTI 5212, *Material Selection List for Plastic Films, Foams, and Adhesive Tapes*
- KNPR 1860.1, *KSC Ionizing Radiation Protection Program*
- KNPR 1860.2, *KSC Non-ionizing Radiation Protection Program*

Government

- Title 29 CFR 1910, *Occupational Safety and Health Administration*
- Title 49 CFR, Parts 171 to 178, *Transportation, Department of Transportation*
- National Fire Codes (NFPA)



NPR 8715.7 Safety Program Reviews

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NASA Life Cycle Phases	FORMULATION				IMPLEMENTATION		
	<i>Pre-Systems Acquisitions</i>		Approval for Implementation		<i>Systems Acquisition</i>	<i>Operations</i>	<i>Decommissioning</i>
Project Life Cycle Phases	Pre-Phase A: Concept Studies	Phase A: Concept & Technology Development	Phase B: Preliminary Design & Technology Compensation	Phase C: Final Design & Fabrication	Phase D: System Assembly, Int & Test, Launch	Phase E: Operations & Sustainment	Phase F: Closeout/Recovery
Project Life Cycle Gates & Major Events	KDP A FAD Draft Project Requirements	KDP B Preliminary Project Plan	KDP C Baseline Project Plan	KDP D	KDP E Launch	KDP F End of Mission	Final Archival of Data
Mission Project Reviews	MCR	SRR MDR	PDR	CDR SIR	ORR PRE-SHIP	FRR LRR PLAR CERR	DR
ELV Payload Safety Process Major Events			PSI	SR I	SR II	SR III	
Acronyms							
KDP – Key Decision Point FAD – Formulation Authorization Document MCR – Mission Concept Review SRR – System Requirements Review MDR – Mission Definition Review PDR – Preliminary Design Review CDR – Critical Design Review SIR – System Interface Review (For Description See NPR 7120.5)				ORR – Operational Readiness Review PRE-SHIP – Review prior to shipment to launch site FRR – Flight Readiness Review LRR – Launch Readiness Review PLAR – Post-Launch Assessment Review CERR – Critical Events Readiness Review DR – Decommissioning Review		ELV Payload Safety Process Major Events PSI – Payload Safety Introduction Briefing SR I – Safety Review One SR II – Safety Review Two SR III – Safety Review Three	
Summary of Safety Process Deliverables by payload project (see sect. 2.4.2)							
Submitted at PSI: 1. Applicable safety requirements docs, past approved waivers, & known tailoring issues 2. Draft Systems Safety Plan 3. Preliminary hazard list 4. Ground Operations Flow Overview		Due ≥ 30 days prior to SR I: 1. Final System Safety Plan 2. Tailored Payload Safety Requirements 3. Safety Data Package I		Due ≥ 30 days prior to SR II: 1. Safety Data Package II 2. Final Tailored Safety Requirements Due at SR II: 1. Safety Actions Tracking		Due ≥ 60 days prior to SR III: 1. Safety Data Package III Due at SR III: 1. Safety Verifications Tracking Log 2. Safety Actions Tracking Log 3. Certificate of Safety Compliance	



NPR 8715.7 Safety Review I

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- **Begins prior to PDR & completed ≤ 60 days after PDR or as necessary ensuring PSWG's timely input to Key Decision Point C**
- **PSWG meeting in conjunction with PDR**
- **Payload project submittals due ≤ 30 days prior to the PDR meeting:**
 - **Final System Safety Plan**
 - **Tailored Payload Safety Requirements**
 - **Safety Data Package I**
- **PSWG shall:**
 - **Approve the final System Safety Plan**
 - **Discuss comments of Safety Data package I**
 - **Discuss the Tailored Payload Safety Requirements**
 - **Assess Preliminary Hazard Analysis and any Hazard Reports**
 - **Address any safety issues from PDR**
- **The PSWG Chairperson shall provide the Payload Project Manager with:**
 - **Status of Safety Review I including any safety concerns following the PDR meeting**
 - **Assessment of the project's safety efforts and identification of any safety concerns to support the project's Key Decision Point C**



NPR 8715.7 Safety Data Package I

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- **Descriptions of hazardous and safety critical flight hardware and software, systems, components, materials, and GSE that reflects the PDR-level design and operations scenario**
- **A description of the payload and mission**
- **Initial descriptions of all payload systems including hazardous and safety critical subsystems, their operation, and interfaces**
- **Preliminary hazard reports and summaries of the hazard analyses**
- **Information identifying compliance to the Tailored Payload Safety Requirements**
- **For previously launched buses, identification and description of safety-related problems, mishaps, or failures that occurred during fabrication, testing, processing, or integration that could affect the safety of the flight hardware or software, GSE, personnel, or other NASA resources**



NPR 8715.7 Safety Review II

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- **Begins prior to CDR & completed \leq 60 days after CDR or as necessary ensuring PSWG's timely input to Key Decision Point D**
- **PSWG meeting in conjunction with CDR**
- **Payload project submittal items due \leq 30 days prior to the CDR meeting:**
 - **Safety Data Package II**
 - **Final Tailored Payload Safety Requirements**
- **Payload project submittal items due at CDR:**
 - **Safety Action Tracking Log for review and concurrence to close completed actions**
- **PSWG shall:**
 - **Discuss comments of Safety Data Package II**
 - **Address any safety issues from CDR**
 - **Review the project for any changes to the design, processing, or interfaces for new or increased hazards or safety issues**
- **The PSWG Chairperson provides the Payload Project Manager with:**
 - **Status of Safety Review II including any safety concerns following the CDR meeting**
 - **Assessment of the project's safety efforts and identification of any safety concerns to support the project's Key Decision Point D**



NPR 8715.7 Safety Data Package II

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- **Updated Safety Data Package I information that reflects the CDR-level design & operations**
- **Updated description of payload & mission**
- **Updated Hazard Reports**
- **Descriptions of hazardous and safety critical subsystems, their operation, and updated methods of compliance to the Tailored Payload Safety Requirements**
- **Detailed information of safety features, inhibits, monitoring systems, and their control and status during all processing phases**
- **Supporting plans, studies, and reports (provided or referenced), upon request**
- **Description of GSE, summary of hazardous, non-hazardous, and safety critical operations, list of hazard reports, and supporting hazard analyses for operations performed in NASA facilities, NASA contracted facilities, and launch site facilities (i.e., Ground Ops Plan)**
- **A cross-reference identifying the disposition of review comments and indicating any changes**



NPR 8715.7 Safety Review III

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- **Begins with data submittal & completed at a PSWG meeting held ≥ 5 business days prior to LSP's Ground Operations Review**
- **Payload project submittals:**
 - **Safety Data Package III**
 - **Due ≥ 60 days prior to Safety Review III**
 - **Finalized ≤ 30 days before hardware shipment to processing site**
 - **Safety Action Tracking Log**
 - **Safety Verification Tracking Log**
 - **Certificate of ELV Payload Safety Compliance**
- **PSWG verifies that all safety requirements have been satisfied or will be satisfied and waivers have been approved**
- **The PSWG Chairperson and the ELV Payload Safety Manager shall sign the Certificate of ELV Payload Safety Compliance indicating that the project has completed the safety approval process**
- **The ELV Payload Safety Manager shall provide the Payload Project Manager with a letter ≤ 5 days after successful completion of Safety Review III. The letter shall:**
 - **Indicate that the project has successfully completed the payload safety review process per this NPR**
 - **Include a copy of the signed Certificate of ELV Payload Safety Compliance**
 - **Identify any conditions or constraints applicable to the safety approvals**



NPR 8715.7 Safety Data Package III

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- **Includes all the Safety Data Package updates with all comments addressed, incorporate all changes that reflect the as-built configuration and planned processing activities**
- **As-built description of payload and mission**
- **Final Hazard Reports**
- **Updated descriptions of hazardous and safety critical subsystems**
- **Updates to supporting plans, studies, and reports; required summaries of test results provided upon request**
- **Record of test failures, anomalies, mishaps involving qualification hardware, flight hardware, GSE, software (if used for hazard control), and an assessment of the resolution and safety implications of these events**
- **A signed copy of approved safety waivers**
- **A cross-reference identifying the disposition of review comments since previous submittal and indication of any changes**



Safety Verification Tracking Log (SVTL)

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- **Documentation (in a tabular format) of the status of safety verifications identified in the Hazard Reports**
- **Information for each safety verification:**
 - tracking number
 - brief description of the verification,
 - Hazard Report number(s)
 - Any constrained operation(s)
 - If independent verification is needed
 - Scheduled and actual completion dates
 - Method of closure, status, and any comments
- **“Closed” - mitigations are in place and that the safety risk is controlled as specified in the Hazard Report. Safety verifications often are best performed at a certain time in the payload processing flow.**
- **Submitted at Safety Review III and used to ensure the completion of safety verifications even after transportation to the launch area processing site**



Safety Data Requirements/Milestones

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Description	Action By	Review	Requirement	Submittal Requirements
System Safety Program Plan (SSPP)	S/C	PSWG	NPR 8715.7; AFSPCMAN 91-710	- Draft due for Mission/Concept Briefing - Final due 30 days prior to PDR (part of Safety Review I)
Safety Intro/Concept Briefing	S/C	PSWG, et.al.	NPR 8715.7; AFSPCMAN 91-710	- Mission Kickoff
Requirements Tailoring	S/C	PSWG	NPR 8715.7; AFSPCMAN 91-710	- Due 30 days prior to PDR (part of Safety Review I)
S/C Safety Data Package I	S/C	PSWG	NPR 8715.7; AFSPCMAN 91-710	- Due 30 days prior to PDR (part of Safety Review I)
Preliminary Design Review (PDR)	S/C	PSWG	NPR 8715.7; AFSPCMAN 91-710	
Safety Review I	S/C	PSWG	NPR 8715.7	- Safety Data Package I due 30 days prior to PDR
Payload Safety Working Group (PSWG) meetings	S/C	PSWG	NPR 8715.7	- PDR, CDR, GOWGs, and as requested
S/C Safety Data Package II	S/C	PSWG	NPR 8715.7	- Due 30 days prior to CDR (part of Safety Review II)
Preliminary S/C Plastic Films, Foams & Adhesives (PFA) List	S/C	PSWG	KTI-5212; NPR 8715.7; AFSPCMAN 91-710	- Due 30 days prior to CDR (part of Safety Review II)



Safety Data Requirements/Milestones

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Description	Action By	Review	Requirement	Submittal Requirements
Critical Design Review (CDR)	S/C	PSWG	NPR 8715.7; AFSPCMAN 91-710	
Safety Review II	S/C	PSWG	NPR 8715.7	- Safety Data Package II due 30 days prior to CDR
S/C Safety Data Package III	S/C	PSWG	NPR 8715.7 AFSPCMAN 91-710	- 90 days prior to S/C shipment (part of Safety Review III)
Final S/C Plastic Films, Foams & Adhesives (PFA) List	S/C	PSWG	KTI-5212 NPR 8715.7; AFSPCMAN 91-710	- Due 90 days prior to S/C shipment (part of Safety Review III)
Safety Verification Tracking Log (SVTL)	S/C	PSWG	NPR 8715.7	- 90 days prior to S/C shipment (part of Safety Review III)
Safety Review III	S/C	PSWG	NPR 8715.7	- Safety Data Package III due 90 days prior to S/C ship
S/C Safety Data Package III Approval	PSWG	PSWG	NPR 8715.7; AFSPCMAN 91-710	- 30 days prior to S/C shipment (end of Safety Review III)
Certificate of ELV Payload Safety Compliance	PSWG Chair, ELV Payload Safety Manager	PSWG	NPR 8715.7	- 30 days prior to S/C shipment (end of Safety Review III)



Safety Data Requirements/Milestones

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Description	Action By	Review	Requirement	Submittal Requirements
S/C Hazardous Procedures	S/C	KSC, RS	KNPR 8715.3; AFSPCMAN 91-710	- 55 Days prior to use
S/C Waivers, Variances	S/C	PSWG	NPR & KNPR 8715.3; AFSPCMAN 91-710	- As needed (should be identified during the tailoring process)
LV Material Use Authorization	LV	PSWG	KNPR 8072.1; KNPR 8715.3; AFSPCMAN 91-710	
LV Mission-Unique MSPSP	LV	PSWG	AFSPCMAN 91-710	- NLT 45 days prior to H/W Shipment to Range
Radiation Use Authorization Request	S/C; LV	RPO	KNPR 1860.1; AFSPCMAN 91-710	- 4 Months prior to S/C arrival at processing site
LV Hazardous Procedures	LV	KSC, RS	EWR 127-1 or AFSPCMAN 91-710	- 55 Days prior to use
LV Waivers, Variances	LV	KSC, RS	EWR 127-1 or AFSPCMAN 91-710	
Ground Operations Review (GOR)	KSC	S/C, KSC		- 30 days prior to S/C ship
Mishap Reports	S/C; LV; PPF		KNPR 8715.3; NPR 8621.1B	- ASAP/within requirements
Safety & Mission Success Review (SMSR)	KSC & S/C	HQ Code Q	OSMA-SMARR-05-01	- L-30 days



LSP Portal: ELV Payload Safety Mission Documentation

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Payload Safety Working Group

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The Payload Safety Working Group (as chartered by NPR 8715.7), is the “Round Table” of ELV Payload Safety

- **Designed to ensure appropriate involvement and coordination of all organizations that support the associated mission and share safety responsibility for the mission**
- **Ensures compliance with safety requirements that apply to the payload**
- **Provides clear and useful guidance to the Payload Project Office**
- **Proactively works with the project to identify potential hazards and safety issues and advises on strategies for early abatement, mitigation, or resolution**
- **Provides a common and uniform ELV payload safety process**
- **All members have an equal say**
- **KSC Safety will act as PSWG Chairperson; the chair does not have an overriding veto**
- **Not as regimented as many safety panels**
 - **Informal atmosphere**
 - **All welcome to speak at any time about any relevant safety topic**



Payload Safety Working Group

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- **PSWG involvement includes:**
 - Requirements tailoring
 - Approvals
 - Safety Plan Development
 - Safety Data Package Development
 - Safety Data Package reviews
 - Specialized safety working groups
 - General safety topics discussion
 - Safety action items
- Functions as both a panel and as a working group
- Working groups can be held at anytime at the request of any PSWG member by face-to-face meetings or telecons



- **Things KSC Safety likes to see:**
 - **Plastic films, foams, and adhesive tapes (PFAs) to be used identified and submitted as soon as they are known**
 - **Hazard reports in Data Packages**
 - **Timely submittal of safety verification tracking log (SVTL) statuses**
 - **Safety analyses addressing KSC lessons learned**
 - **A Payload Organization safety representative at the launch site during S/C hazardous operations**
 - **Access to spacecraft propellant fill and drain valves through the payload fairing for contingency offloading**



KSC Safety

- **Things KSC Safety Does Not like to see:**
 - **Safety variances stating schedule and/or cost as the only driving factor(s)**
 - **GSE, PFAs, test plans, etc. that show up at the launch site that were not approved through the PSWG process**
 - **Launch site processing being performed before approvals**
 - **Non-safety personnel performing safety assessments**
 - ***“...but XYZ payload didn’t have to...”***
 - **The use of older safety requirements because of convenience**



Contingency Planning

- **NASA Launch Services Program (LSP) Mishap Preparedness and Contingency Plan (MPCP)**
 - Developed by Launch Services Division SMA for each mission.
 - Effective from Countdown Call-To-Stations through end of Launch vehicle mission.
 - Identifies specific immediate actions that NASA Launch Team personnel take in response to a launch mishap including:
 - Establishment of an Interim Response Team (IRT)
 - Mishap notification
 - Mishap Coordination with Launch Range
 - Coordination and release of public information
 - Mishap response teleconferences
 - Data impoundment at all locations where NASA and spacecraft personnel support launch operations
 - Witness statement collection





NASA/KSC Launch Services Division Safety Contacts

System Safety: Chuck Loftin

Phone: (321) 867-8797

Email: charles.e.loftin@nasa.gov

System Safety Back-up: Don Brandl

Phone: (321) 867-0830

Email: donald.e.brandl@nasa.gov

Contingency Planning: Harold Donald

Phone: (321) 867-3393

Email: harold.h.donald@nasa.gov