BY ORDER OF THE COMMANDER
SPACE SYSTEMS COMMAND

SPACE SYSTEMS COMMAND
INSTRUCTION 91-701

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Safety

THE SPACE SYSTEMS COMMAND LAUNCH AND RANGE SAFETY PROGRAM

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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This instruction implements AFI 91-202, *The U.S. Air Force Mishap Prevention Program*, and is consistent with DoDD 3100.10, *Space Policy*, DoDD 3200.11, *Major Range and Test Facility Base (MRTFB)*, DoDD 3230.3, *DoD Support for Commercial Space Launch Activities*, DoDI 3100.12, *Space Support*, DoDI 3200.18, *Management and Operation of the Major Range and Test Facility Base (MRTFB)*, AFPD 91-1, *Nuclear Weapons and Systems Surety*, AFPD 91-2, *Safety Programs*, AFI 63-101/20-101, *Integrated Life Cycle Management*, and the *Memorandum of Agreement between the Department of the Air Force and the Federal Aviation Administration for Launch and Reentry Activity on Department of the Air Force Ranges and Installations*. It defines and implements launch and range safety requirements and responsibilities for Space Systems Command (SSC). It identifies interfaces with other DoD, Federal Aviation Administration (FAA), civil and commercial Range Users.

This instruction applies to Headquarters (HQ) SSC, subordinate units, and supporting units for the conduct of operations on SSC ranges. This instruction also applies to supporting Air Force Reserve Command and Air National Guard units when published in their respective 0-2 indexes. SSC organizations are responsible for complying with all applicable laws, statutes, and regulations. No policy or requirement in SSC 91-7XX series publications shall be considered as relief or authority to deviate from federal, state, or local laws, statutes, and regulations. If a conflict between requirements in any SSC 91-7XX series publication is discovered, contact the requirement owner for resolution.

The authorities to waive SLD/unit level requirements in this publication are identified with a Tier ("T-0, T-1, T-2, T-3") number following the compliance statement. See DAFMAN 90-161, *Publishing Processes and Procedures*, for a description of the authorities associated with the Tier numbers. Submit requests for waivers through the chain of command to the appropriate Tier waiver approval authority, or alternately, to the Publication OPR for non-tiered compliance items. Ensure all records generated as a result of processes prescribed in this publication adhere to AFI 33-322, *Records Management and Information Governance Program*, and are disposed IAW the Air Force Records Disposition Schedule, which is located in the Air Force Records Information Management System. Refer recommended changes and questions about this publication to the OPR using the DAF Form 847, *Recommendation for Change of Publication*. Route change request form or DAF Forms 847 from the field through the appropriate functional chain of command.

This publication may be supplemented, but all supplements must be approved by HQ SSC Directorate of Safety (HQ SSC/SE) prior to certification and approval for publishing. Each range may incorporate SLD-unique or program-unique requirements into documents other than a supplement, such as an operating instruction, which is only required to be coordinated internally within the local SLD organization structure and approved at the local Chief of Safety level.

SUMMARY OF CHANGES

This document has been updated primarily to reflect organizational changes associated with the establishment of SSC as a USSF Field Command (FLDCOM), and the re-alignment of launch and range safety program management from the former Air Force Space Command publication to an SSC publication.

Chapter 1

SSC LAUNCH AND RANGE SAFETY PROGRAM

1.1. Purpose. This publication establishes the SSC Launch and Range Safety Program. SSC operates two Space Force-owned national ranges for users having a valid need for launch and test range capabilities. SSC also conducts sustainment and modernization activities for the Launch and Test Range System (LTRS). SSCI 91-701 and its respective Space Launch Delta (SLD) supplements provide the requirements needed for all SSC organizations to meet the launch and range safety mission to protect the public, launch base personnel (government and contractor), range infrastructure and resources, and third party personnel from the hazards associated with SSC range operations, ensuring that risk is maintained at an acceptable level of safety consistent with mission needs. For all non FAA-licensed launches and landings at the Eastern Range (ER) and Western Range (WR), including test and evaluation (T&E) and DoD/civil space missions, the Space Force has sole responsibility for ensuring public health and safety and the protection of resources. All DoD, Space Force, SSC and SLD guidance, as tailored and applicable, will be enforced for non FAA-licensed launches and/or landings.

1.2. Vision and Approach.

1.2.1. Space launch and T&E operations are inherently risky. Space Launch Delta Safety Office (SLD/SE) personnel endeavor to assure safety is achieved from the inception of a program, through launch operations, until the last mission task is completed, working closely with Range Users, acquisition, operations, and maintenance organizations. In this role of assessing and making recommendations to achieve a minimum-acceptable level of range safety during pre-launch and launch operations, Space Launch Delta Safety is also more commonly known as Range Safety, a term used at other federal ranges.

1.2.2. The launch and range safety requirements contained in the SSC 91-7XX series publications, including this instruction, are based on the following:

1.2.2.1. Standardized design and safety requirements for launch/range systems benefit from commonality at multi-operational sites, e.g., the WR and ER.

1.2.2.2. Safety requirements address lessons learned and ensure a prudent level of protection is provided to the public during pre-launch, launch, and reentry operations (i.e., hazardous operations).

1.2.2.3. A minimum set of criteria and requirements are necessary to ensure the protection of people, resources, and launch area safety at SSC ranges and to ensure each organization is protected from the activities of each other.

1.2.2.4. Wherever possible, accept industry consensus standards, commercial space transportation standards, or government-unique standards, either in part or in whole.

1.2.2.5. An approach that strives to maintain maximum flexibility in the methods used to achieve safety objectives and not impose undue or overly restrictive safety requirements, to include consideration of alternate proposals for meeting safety objectives. Early and continuous coordination is the key to this successful partnership between Range Users and SLD/SE personnel.

1.2.3. The requirements in Chapters **3** – **7** of this instruction can be tailored to allow flexibility for new concepts and technology. Tailoring instructions can be found in SSCMAN 91-710, *Range Safety User Requirements Manual*.

1.2.4. Programs coming to SSC ranges that already have approval to launch from other ranges shall be evaluated by SLD/SE offices for compliance verification with the requirements specified in SSCMAN 91-710. **(T-3)** Range Users may submit their previously approved safety documentation for this evaluation. For example, if a program already has a flight termination system approval under Range Commanders Council (RCC) 319, *Flight Termination System Commonality Standard*, that approval may be transferrable to the ER and/or WR with only a compliance verification review.

1.2.5. For FAA-licensed launch activity, the ER/WR will accept FAA determinations for safety requirements and standards.

Chapter 2

RESPONSIBILITIES AND AUTHORITIES

2.1. Responsibilities and Authorities. SSC/CC has an inherent authority and legal responsibility to ensure activities on Space Force ranges/installations are conducted safely, and an explicit responsibility for Space Force resource protection. Resource protection may be provided through a combination of insurance, indemnification and risk mitigation activities. The FAA, as the regulatory agency of commercial launch operations, has a statutory responsibility for ensuring public health and safety and the safety of property for FAA-licensed launches from these ranges. The USSF and FAA hold all Range Users responsible for safe operations with respect to public safety and USSF or third party personnel and resources.

2.2. HQ SSC Directorate of Safety (HQ SSC/SE). HQ SSC/SE has authority and responsibility for the oversight of the SSC Launch and Range Safety Program.

2.2.1. HQ SSC/SE shall establish, evaluate, approve, and publish launch and range safety publications (SSC 91-7XX series) for carrying out these responsibilities.

2.2.2. HQ SSC Space Safety Division (HQ SSC/SEK).

2.2.2.1. HQ SSC/SEK, or designee, shall serve as the USSF Tri-Chair on the DAF/Federal Aviation Agency (FAA)/National Aeronautics and Space Administration (NASA) Common Standards Working Group (CSWG). This enables launch and range safety requirement commonality within the national space launch and range safety community.

2.2.2.2. HQ SSC/SEK, or designee, shall provide the direct interface between SSC, the FAA Office of the Associate Administrator for Commercial Space Transportation (FAA/AST), and NASA for establishing common launch and range safety requirements as identified in the CSWG Charter.

2.2.2.3. HQ SSC/SEK may coordinate proposed changes to SSC 91-7XX publications with the CSWG, as applicable, prior to final disposition.

2.2.2.4. HQ SSC/SEK shall support and co-chair with FAA/AST the CSWG Relief Review Panel, IAW the *Memorandum of Understanding between Air Force Space Command and Federal Aviation Administration Office of the Associate Administrator for Commercial Space Transportation for Resolving Requests for Relief from Common Launch Safety Requirements* (AFSPC/FAA MOU for Resolving Requests for Relief). The CSWG Relief Review Panel shall review SLD/SE and FAA disposition of relief requests and approved tailored common launch safety requirements documents at least annually. The CSWG Relief Review Panel shall recommend changes to common launch safety requirements to the CSWG.

2.2.2.5. HQ SSC/SEK shall participate with and support the RCC Range Safety Group (RSG) and other appropriate groups.

2.3. Space Systems Command Program Offices.

2.3.1. SSC, through its System Program Offices (SPO) and Detachments (DET), acquires and sustains space and missile systems and services for the United States Space Force or other DoD/interagency partners. SSC Program Managers have system lifecycle management

responsibility IAW AFI 63-101/20-101 for all launch services, systems, and end-items in the SSC-procured space and missile product line, including systems, and end-items located at the ranges.

2.3.2. SSC program managers shall ensure that all systems and products in the SSC-procured space and missile product line, including systems and services located at SSC ranges (launch and range), have launch and range safety requirements (SSCI 91-701 and SSCMAN 91-710) on contract. SSC program managers should coordinate acquisition actions, system safety considerations, and contract modifications with the SSC Directorate of Safety (HQ SSC/SE) and SLD/SE, as appropriate. **(T-2)**

2.3.3. **SSC Assured Access to Space (SSC/AATS)**

2.3.3.1. SSC/AATS ensures compliance with applicable tailored requirements of SSCMAN 91-710 during the acquisition, modernization, and sustainment of range ground systems and products.

2.3.3.2. SSC/AATS shall solicit coordination from the applicable SLD/SE and HQ SSC/SE organizations on requirements for range system upgrades and modifications, and invite them to participate in major technical reviews and technical interchange meetings. **(T-3)**

2.4. Space Launch Delta 30 and 45 (SLD 30 and SLD 45).

2.4.1. Space Launch Delta Commanders (SLD/CC). The SLD/CC is accountable to SSC/CC for launch and range operations. The SLD/CC has an inherent authority for the conduct of operations on the range, to include an obligation to protect the people, property and common interests of the installation. The SLD/CC is responsible for managing his/her respective range, and the management of a launch and range safety program consistent with operational requirements, which includes the prevention of launched objects from violating established safety, security, or range boundaries. Coordination of safety plans and procedures with other internal and external agencies within potentially affected areas is required to address anticipated hazards associated with launch and other activities occurring on the range (for example, managing roads, emergency response resources) to ensure adequate protection of personnel and resources.

2.4.2. The SLD/CC or his/her designated representative shall coordinate actions between the Space Launch Deltas to ensure consistent and standard launch and range safety requirements, criteria, processes, and approvals (to the maximum extent possible, given that valid differences may exist due to geography, climate, local government requirements, etc.) are levied on all Range Users, SLD agencies, and organizations providing services, systems, and products to the SWs. **(T-3)**

2.4.3. The SLD/CC or designee shall coordinate agreements (e.g., MOAs, MOUs, and/or other joint agreements) with non-SSC organizations that affect launch and range safety with HQ SSC/SE. **(T-2)**

2.4.4. The SLD/CC or designee shall approve tailoring performed on this instruction. **(T-2)**

2.4.5. For SSC procured non FAA-licensed launch activity, SLD 30 and/or SLD 45 shall provide the mission rules and data letter parameters (including any changes/updates) to the

affected SSC program office and Mission Director prior to the mission Flight Readiness Review. **(T-2)**

2.4.6. For United States Government (USG) and T&E launches, and FAA-licensed missions using SLD/SE services assessed by the FAA, the following items shall be approved by the SLD/CC, or his/her delegate: **(T-2)**

2.4.6.1. Mission rules (mission flight rules) for all launch vehicles.

2.4.6.2. Tailored versions of SSCMAN 91-710 affecting public safety.

2.4.6.3. Launch safety launch commit criteria.

2.4.6.4. Waivers to SSCMAN 91-710 (or legacy versions such as AFSPCMAN 91-710 and Eastern and Western Range (EWR) 127-1) requirements that affect public safety, delegatable only to the SLD Vice Commander (SLD/CV) for Operations.

2.4.6.5. The launch of radioactive materials below thresholds outlined in DAFMAN 91-110, *Nuclear Safety Review and Launch Approval for Space or Missile Use of Radioactive Material*. **Note:** There may be higher level approvals also required depending on the quantity and associated risk levels of radioactive material.

2.4.6.6. Personnel permitted to remain within hazardous areas during launch.

2.5. Space Launch Delta Safety Office (SLD/SE).

2.5.1. The Chief of Safety serves as the senior safety advisor to the Space Launch Delta Commander. SLD/SE assesses the safety risks on Day-of-Launch (DoL) and verifies safety readiness to launch, as required. **(T-3)**

2.5.2. The Chief of Safety is delegated the authority to approve waivers to launch and range safety requirements contained in SSCMAN 91-710 that do not impact public safety and all equivalent levels of safety.

2.5.3. The Chief Safety Engineer is the Launch and Range Safety Technical Authority for SLD/SE. The Chief Safety Engineer assumes the duties of the Chief of Safety in his/her absence.

2.5.4. The SLD/SE sections that primarily support the launch and range safety mission include: Safety Assessment (SEA) and Launch Safety (SEL).

2.5.4.1. Safety Assessment (SEA). This section consists of Systems Safety Engineering, Pad Safety, and Launch Vehicle Safety. Functions conducted include, but are not limited to:

2.5.4.1.1. Development and enforcement of system safety criteria pertinent to the design, inspection, test and operations of launch vehicles, payloads, ground support equipment, and facilities/structures.

2.5.4.1.2. Providing guidance on system safety order of precedence as a means of reducing hazard potential of specific designs or operations.

2.5.4.1.3. Review and approve Range User Missile System Prelaunch Safety Packages (MSPSP), range flight safety system pre-launch test procedures, hazardous operation

and safety critical operation procedures, pad safety plans, ground operations plans, and danger area information plans.

2.5.4.1.4. Further details on pad safety functions are described elsewhere in this document.

2.5.4.2. Launch Safety (SEL). This section consists of Flight Analysis and Risk Analysis. Functions conducted include, but are not limited to:

2.5.4.2.1. Review and approval of flight plans.

2.5.4.2.2. Development of launch vehicle positive control criteria.

2.5.4.2.3. Development of launch day safety clearance zones/contours to support surveillance and clearance.

2.5.4.2.4. Flight safety system (FSS) need determination.

2.5.4.2.5. Development and interpretation of mission rules.

2.5.4.2.6. Collision avoidance for non FAA-licensed missions.

2.5.4.2.7. Launch window determination.

2.5.4.2.8. Providing DoL technical advice, analysis and safety recommendations.

2.5.4.2.9. Assessment of range ground instrumentation modifications.

2.5.4.2.10. Risk analysis for debris, toxics, distant focusing overpressure and radiation hazards.

2.5.4.2.11. Development and management of risk models to assist with above functions.

2.5.5. SLD/SE shall approve all hazardous and safety critical procedures. **(T-3) Exception**: For FAA-licensed launches, SLD/SE approval of hazardous and safety critical procedures shall be done in accordance with Range User agreements.

2.5.6. SLD/SE shall suspend USG and T&E Range User operations that are not in compliance with the requirements of SSCMAN 91-710 (or legacy versions of AFSPCMAN 91-710 or EWR 127-1), and IAW launch provider's agreement with the range for FAA-licensed launches. **(T-3)**

2.5.7. SLD/SE shall inform HQ SSC/SE of any Range User that requests to launch nuclear reactors or radioactive materials in quantities in excess of the threshold limits established by DAFMAN 91-110. **(T-2)**

2.5.8. SLD/SE shall support SSC SPO/DETs in performing launch and range safety related integrated lifecycle management functions. **(T-2)** For example, for each SSC-procured launch service, system, and/or end-item, SLD/SE should participate in major technical reviews and technical interchange meetings.

2.5.9. SLD/SE shall evaluate and approve flight safety systems (also known as the range safety system – tracking, telemetry, and flight termination system) for USG and T&E operations, and IAW launch provider's agreements for FAA-licensed launches. **(T-2)**

2.5.10. SLD/SE shall support SSC SPO/DETs in launch and range safety-related space flight worthiness certification tasks. **(T-2)**

2.5.11. SLD/SE shall develop mission rules, flight termination criteria, and launch support requirements. **(T-2)**

2.5.12. SLD/SE shall issue a Launch Safety Approval to the Range User once the Range User obtains the following approvals: **(T-2)**

2.5.12.1. Final flight plan approval.

2.5.12.2. MSPSP approval.

2.5.12.3. Flight safety system (FSS) approval.

2.5.13. SLD/SE shall evaluate and provide a safety recommendation to the SLD/CC for personnel authorized to remain in hazardous launch areas during launch. **(T-2)**

2.5.14. SLD/SE shall forward copies of all approved SSCMAN 91-710 waivers and equivalent level of safety determinations to HQ SSC/SEK prior to each applicable launch. **(T-2)**

2.5.15. SLD/SE shall review all waivers on an annual basis and close where appropriate. **(T-2)**

2.5.16. SLD/SE shall perform initial evaluations of all public and Range User submitted comments and change requests to SSC 91-7XX launch and range safety publications, and coordinate proposed responses with the other range and HQ SSC/SE. **(T-2)**

2.5.17. SLD/SE shall provide FAA/AST a copy of proposed range safety changes that could affect the FAA assessment of range safety services, and resolve any conflicts with the change requests. This includes any planned or impending changes, including additions or deletions, to range safety organizations, programs, processes, ground systems, and/or end-items. **(T-0)**

2.5.18. SLD/SE shall participate in the CSWG. **(T-2)**

2.5.19. SLD/SE shall participate with and support the RCC RSG and other appropriate groups. **(T-2)**

2.5.20. Pad Safety (Operations Safety Manager, WR) Responsibilities and Authorities.

2.5.20.1. Engage with specific launch vehicle/payload system safety personnel on their safety critical and hazardous operations, to include GO/NO-GO recommendation on DoL (for FAA-licensed launch, IAW Range User agreements). **(T-3)**

2.5.20.2. Provide safety surveillance during hazardous and safety critical and selected routine launch operations in coordination with Range Users and applicable agreements, notifying the designated Operations Squadron as necessary. **(T-3)**

2.5.20.2.1. Define safety clearance zones and control access (to include safety roadblocks and roving patrols) during hazardous operations, in conjunction with the Range User. **(T-3)**

2.5.20.2.2. Verify the Flight Caution Area (FCA) and Flight Hazard Area (FHA) are clear at a designated time in the launch countdown. **(T-3)**

2.5.20.2.3. Ensure appropriate support personnel, such as Fire, Medical, Environmental Health, and other agencies, are standing by at the complex, facility, or

designated area during hazardous operations as specified in the applicable Pad Safety Plans and procedures. **(T-3)**

2.5.20.3. Perform inspections and surveys to analyze risks, identify cause factors, and assign risk assessment codes. **(T-3)**

2.5.20.4. Observe and provide guidance to Range Users to ensure compliance and implementation of launch and range safety requirements, in accordance with applicable agreements. **(T-3)**

2.5.20.5. Interface with local, county, state, and federal safety agencies regarding Occupational Safety and Health Administration (OSHA) and environmental issues. **(T-3)**

2.5.20.6. Perform mishap investigations and monitor corrective actions, as required, in accordance with DAFI 91-204, *Safety Investigation and Reports.* **(T-3)**

2.5.20.7. Organize and supervise launch support teams. **(T-3)**

2.5.20.8. Represent SLD/SE at daily launch vehicle and/or payload processing meetings. **(T-3)**

2.5.20.9. Provide in-house training, evaluation, and certification. **(T-3)**

2.5.20.10. Maintain familiarity with launch site Explosives Site Plan requirements. **(T-3)**

2.5.21. Technical support in the following subject matter areas shall be provided for USG and T&E Day-of-Launch operations to ensure launch safety at the ranges. **(T-3)**

2.5.21.1. Flight safety analysis and risk assessment.

2.5.21.2. Pad safety/system safety engineering.

2.5.21.3. Area clearance management.

2.5.21.4. Flight termination systems.

2.6. Other Space Launch Delta Mission Partners.

2.6.1. SLD/SE shall partner with other SLD offices, particularly those identified below, to achieve the objective of protecting the general public, the launch site, and government resources. **(T-2)** Resource safety and protection of non-government resources is the responsibility of the Range User as specified in SSCMAN 91-710. Functional-specific requirements for these offices, summarized below, can be found in their associated Air Force, Space Force, SSC, and SpaceLaunch Delta-level departmental series regulations (e.g. AF 32-series for civil engineering).

2.6.2. Radiation Safety Officer. The Radiation Safety Officer at each SLD assists SLD/SE with:

2.6.2.1. Reviewing and approving the design, test, and inspection of non-ionizing and ionizing radiation sources.

2.6.2.2. Surveying radio frequency (RF) transmitting devices as required.

2.6.2.3. Coordinating with other organizations to ensure activities and operations are in compliance with radiation protection program regulations.

2.6.3. Bioenvironmental Engineering Office. The Bioenvironmental Engineering Office at each SLD assists SLD/SE with reviewing and approving the design, test, and inspection of systems with acoustic, laser, and radiation hazards. This includes review of scrubbers and incinerators, hypergolic vapor control systems and processes, air monitoring systems, laser systems, acoustic-related hazards, and occupational health/personal protective equipment.

2.6.4. Base Civil Engineering. The Base Civil Engineering Office and its components at each SLD assists SLD/SE with:

2.6.4.1. Coordinating on and submitting explosive site plans.

2.6.4.2. Obtaining necessary environmental permits.

2.6.4.3. Reviewing and approving facility and structure modifications.

2.6.4.4. Ensuring sufficient base infrastructure (power, command and control) for mandatory range safety systems.

2.6.4.5. Establishing hazardous atmosphere classifications.

2.6.4.6. Reviewing and approving hypergolic propellant vapor control systems and processes.

2.6.4.7. Coordinating with other organizations to ensure activities and operations are in compliance with fire protection/prevention and environmental regulations, plans and procedures.

2.6.5. Cape Support [SLD 45 only] and Range Scheduling [SLD 30 only]. Prior to pre-launch and launch operations, Cape Support (for ER) or Range Scheduling (for WR) shall notify and request support as required from Pad Safety, Fire, Medical, Security, Environmental Health, and other agencies. **(T-3)**

2.6.6. Facility Operators. Facility Operators, which could be Space Launch Delta organizations or Range Users, shall coordinate with SLD/SE on facility emergency procedures, monthly inspections, posting of warning signage, test plan approvals, facility emergency operation plan approval, emergency evacuation plans, and other applicable activities. **(T-3)**

2.6.7. Operations Squadrons. The Operations Squadrons shall coordinate with SLD/SE on any safety related issues, especially those identified with hazardous procedures. **(T-3)** The Operations Squadrons also shall:

2.6.7.1. Provide instrumentation and range safety display (RSD) systems necessary to carry out pre-launch and flight safety functions. **(T-3)**

2.6.7.2. Implement SLD/SE-provided real-time mission rules and flight termination criteria for ground-based command destruct. **(T-3)**

2.6.7.3. Issue hazard notifications. **(T-3)**

2.6.7.4. Coordinate evacuation of land, air and sea areas based on launch safety requirements. **(T-3)**

2.6.8. Mission Flight Control Officer (MFCO).

2.6.8.1. For launches utilizing ground-initiated command destruct systems (CDS), the MFCO is directly responsible to the SLD/CC or designated representative for the

implementation and execution of safety actions (e.g., flight termination decision, hold-count when range safety constraints are violated) during a launch.

2.6.8.2. As stated in AFSPCI 13-610, *Launch & Range Operations*, the MFCO is considered a mandatory launch position when a ground-initiated command destruct system is used, and key personnel supporting day-of-launch operations must be provided a structured training and qualification program. MFCO training and evaluation will use simulated systems and scenarios to provide realistic environments that minimize the impact of training upon real-world operational environment, to include performing flight termination actions and other non-nominal actions.

2.6.9. Aeronautical/Aerospace Surveillance Officer (ASO) (WR) or Surveillance Control Officer (SCO) (ER). As directed by the SLD/CC, the ASO/SCO, who reports to the designated SLD representative, shall support launch and range safety activities by advising of hazard area violations so that safety risk assessments can be provided regarding acceptable/unacceptable continuance of launch activities. **(T-3)**

2.6.10. Auxiliary Surveillance Support. Other federal government agencies may assist in clearing hazardous areas in support of launch operations IAW applicable MOAs.

2.6.11. Space Launch Delta Plans Office. The SLD Plans Office shall advise SLD/SE of proposed new programs at the earliest practical time and identify operations requiring SLD/SE support. **(T-3)** This allows for SLD/SE requirements to be considered early in the planning phase of new programs.

2.7. Commercial Space Launch.

2.7.1. For FAA-licensed launches, the FAA has a statutory responsibility for ensuring public health and safety and the safety of property. Space Launch Delta agreements (MOU/As, lease/licenses, Commercial Space Operations Support Agreements (CSOSA)/Space Operations Support Agreements (SOSA), etc.) and contracts with Kennedy Space Center (KSC), FAA and launch agencies allow the SLD/CC to exercise trusted partnerships and ensure mutual responsibilities for protection of people, property and common interests are met in the most efficient manner possible while eliminating duplicative efforts.

2.7.2. IAW with Title 14 Code of Federal Regulations (CFR) launch safety regulations, FAA-licensed launch operators (Range Users) are required to enter into an agreement with a Federal Range to provide access to and use of USG property and services required to support an FAA-licensed launch from the facility and for public safety related operations and support. **(T-0)** This includes compliance with flight safety procedures and requirements identified in the agreement. The mechanism that documents this agreement with the ER/WR are CSOSA/SOSAs and their annexes, and real property agreements, addressed further in AFSPCI 10-1215, *Support to FAA-Licensed Space Launch Activities*.

2.7.3. Services provided by the ER/WR in support of FAA-licensed activity are performed IAW Space Force processes and standards. Space Force safety processes (including SSCMAN 91-710 and any associated tailoring), may be used to meet the common safety requirements of the FAA and Space Force for commercial launches off the ER/WR.

2.7.4. CFR Title 14 explains that the FAA accepts analyses performed by a Federal launch range without need for further demonstration of compliance to the FAA if the FAA has

assessed the range and determined CFR requirements are satisfied. The FAA and the ranges cooperate to assure these assessments are comprehensive and accurate, as this fully supports the goal of elimination of duplicative efforts. When FAA-licensed missions use SLD/SE services assessed by the FAA, the SLD/CC will certify to the FAA that Space Force processes and standards have been met.

2.7.5. FAA-licensed launch operators/Range Users must obtain FAA approval of CFR Title 14 Launch Safety regulation noncompliances. The FAA provides copies of FAA-approved noncompliances to both SLD/SE offices for information purposes. The Space Launch Deltas do not approve waivers to common safety requirements for FAA-licensed launches from federal ranges without also obtaining FAA approval.

2.7.6. As stated in CFR Title 14, the FAA may immediately terminate, prohibit, or suspend an FAA-licensed launch, reentry, or operation of a launch or reentry site if the FAA determines it is detrimental to public health and safety, the safety of property, or any national security or foreign policy interest of the U.S. Additionally, the SLD/CC or designated representative can stop an FAA-licensed launch, IAW launch provider agreements with the range, if the range is not "ready to support" the launch/landing operation.

2.7.7. Technical support in the following subject matter areas must be provided for DoL operations to ensure launch safety at the ranges during prelaunch and countdown activities. SSC subject matter expertise, when provided in accordance with the launch provider's agreements with the range, shall conduct themselves in accordance with SSC standards and support processes.

2.7.7.1. Flight safety analysis and risk assessment.

2.7.7.2. Pad safety/system safety engineering.

2.7.7.3. Area clearance management.

2.7.7.4. Flight termination systems.

2.8. Documentation Requirements.

2.8.1. Range Safety Operations Requirements (RSOR).

2.8.1.1. The RSOR levies additional safety requirements peculiar to a launch vehicle series. SLD/SE shall develop and publish an RSOR defining general range support requirements for each launch program with an Annex for each applicable Program Requirements Document or Operations Requirement prepared by a Range User. **(T-2)**

2.8.1.2. The RSOR shall be approved by the Chief of Safety or designated representative in time to adequately support SLD requirements and timelines. **(T-2)**

2.8.2. Operations Supplements to the RSOR.

2.8.2.1. SLD/SE shall develop and publish an Operations Supplement (Ops Sup) to the RSOR containing additional information or requirements particular to a given launch and which are not contained in the RSOR, this document, or the SLD supplement to this document. **(T-2)**

2.8.2.2. The RSOR Ops Sup shall be approved by the Chief of Safety or designated representative and distributed no later than F-5 working days (F minus time). **(T-2)**

2.8.3. SLD/SE Launch Safety Approval.

2.8.3.1. For USG and T&E launches, SLD/SE shall issue Launch Safety Approval to the Range User no later than the Launch Readiness Review, provided the Range User has obtained all other required approvals. **(T-2)**

2.8.3.2. SLD/SE shall include Final Flight Plan Approval, Missile System Ground Safety Approval, and Flight Termination System (FTS) Approval as part of the overall Launch Safety Approval. **(T-2)**

2.8.3.3. Failure of a Range User to obtain a Launch Safety Approval may result in the launch being removed from the range schedule.

Chapter 3

FLIGHT SAFETY ANALYSIS AND PROCESSES

3.1. Purpose. The purpose of flight safety analysis (FSA) is to protect people and resources, where practical, by identifying the hazards associated with normal and malfunctioning launch, reentry, or test operations, containing and/or minimizing launch or test hazards, and mitigating the remaining risks. FSA activities are conducted as part of the launch or test operations approval process, prior to launch.

3.2. Hazards. The hazards typically associated with launch, reentry, or test operations result from inert and explosive debris due to vehicle malfunction and subsequent breakup, chemical toxicity to propellants released inadvertently to the atmosphere or normal combustion of the propellant, and the distant focusing of an overpressure blast wave.

3.3. Risk Mitigation. To contain and isolate these hazards from populated areas, FSA typically involves developing destruct lines in order to contain inert and explosive debris within pre-determined areas, restricting launch azimuths and stage drop areas, clearing or evacuating hazardous areas, wind restrictions, and/or the development of mission rules for the activation of FSSs if needed to destroy errant launch vehicles or test articles. The minimization of launch hazards may include avoiding land impact of jettisoned components (jettisoned bodies) and associated inert debris, not allowing large explosive debris to impact intact, controlling hazards to sparsely populated or broad ocean areas, and only allowing flight over land when absolutely necessary. Flight abort activation rules are designed to avoid increased collective risk to people in protected areas as compared to continued flight.

3.4. Residual Risk Assessment.

3.4.1. When hazards cannot be contained or minimized to an insignificant level, then risk assessments are performed in accordance with SSCMAN 91-710, Volume 1, *Range Safety User Requirements Manual - Space Systems Command Range Safety Requirements and Procedures,* to determine if the remaining risk is acceptable (acceptable launch risk).

3.4.2. SLD/SE shall use up-to-date software models and tools to assess the risks associated with any hazards that cannot be contained resulting from operations performed at the ranges. **(T-3)**

3.5. Conducting a Flight Safety Analysis (FSA).

3.5.1. For USG and T&E launches, SLD/SE shall conduct an FSA using processes and range-user provided data as prescribed in detail in SSCMAN 91-710, Volume 2, *Range Safety User Requirements Manual - Flight Safety Requirements*. **(T-2)**

3.5.2. For FAA-licensed launches, SLD/SE shall conduct an FSA in accordance with the DAF/FAA MOA and as specified in formal agreements between commercial launch providers and the range. **(T-3)** An FSA should consist of components as listed in **Table 3.1**.

Table 3.1. Flight Safety Analysis (FSA) Components.

Analysis Component	SSCMAN 91-710 Volume 2 Reference
Trajectory Analysis	Section 3.1
Malfunction Turn Analysis	Section 3.2
Inert and Explosive Debris Analysis	Section 3.3
Debris, Toxics and Distant Focusing Overpressure Analysis	Section 3.4
Acoustic Analysis	Section 3.5
Sonic Boom Analysis	Section 3.6
FTS Determination Analysis	Section 3.7
Post-Flight Vehicle Performance Analysis	Section 3.8

3.5.3. Other related safety analyses include:

3.5.3.1. Flight safety limits analysis.

3.5.3.2. Straight-up time analysis.

3.5.3.3. Gate analysis.

3.5.3.4. Terminal area safety limit analysis.

3.5.3.5. Data loss flight time analysis.

3.5.3.6. Time delay analysis.

3.5.3.7. Collision avoidance analysis.

3.5.3.8. Probability of failure analysis.

3.5.3.9. Flight hazard area analysis.

3.5.3.10. Flight safety system safing analysis.

Chapter 4

PRE-LAUNCH PROCESSING AND MATERIAL SAFETY

4.1. Purpose. SLD/SE shall proactively and responsively support implementation of actions necessary to support mission preparation, pre-launch processing, and material safety of hazards that could endanger the public, launch base personnel, and government resources. **(T-2)** The goal is to make sure safety is designed into systems, subsystems, equipment, facilities, interfaces, and pad safety operations in order to eliminate or reduce the risks of hazards to acceptable levels. Among these hazards are:

4.1.1. Explosive or flammable liquids and vapors;

4.1.2. Radio frequency radiated energy or electrostatic discharge in close proximity to explosives;

4.1.3. The sudden release of energy from failed pressure system integrity;

4.1.4. Diverse operations for moving and handling hazardous loads;

4.1.5. Unique considerations to facility and structure design and construction; and

4.1.6. Personnel exposure to hazardous operations which may require unique base infrastructure, training and/or personnel protective equipment.

4.2. System Safety Requirements. SSCMAN 91-710 Volumes 1, 3, 5, and 6 provide detailed requirements, processes, and data requirements for pre-launch processing and material safety. System safety sections of those volumes are identified in **Table 4.1** for reference.

Table 4.1. Matrix of SSCMAN 91-710 System Safety Requirements.

	Design, Test and Inspection Requirements	Procedural and Operational Requirements
Pad Safety - General Roles and Responsibilities	N/A	Volume 6, Chapter 2.1.3
Ground Operations (General Requirements and Design Requirements)	Volume 3, Chapter 3	Volume 6, Chapter 3 and 5
Safety and Emergency Plans	Volume 3, Attachment 1	Volume 6, Chapter 4
Ground Operations (Personnel Requirements, Hazardous Operations, Personal Protective Equipment, Fall Protection, Restrictions Due to Lightning/Wind, Facility Use)	N/A	Volume 6, Chapter 5

Cranes and Material Handling Equipment (MHE)	Volume 3, Chapter 6	Volume 6, Chapter 6
Acoustic Hazards	Volume 3, Chapter 7	Volume 6, Chapter 7
Non-Ionizing Radiation Sources, Radio Frequency (RF) and Lasers	Volume 3, Chapter 8	Volume 6, Chapter 8
Ionizing Radiation (Radioactive) Sources	Volume 3, Chapter 9	Volume 6, Chapter 9
Hazardous Materials	Volume 3, Chapter 10	Volume 6, Chapter 10
Ground Support and Flight Hardware Pressure System Operations	Volume 3, Chapter 11	Volume 6, Chapter 11
Ordnance Operations	Volume 3, Chapter 13	Volume 6, Chapter 13
Electrical Systems Operations	Volume 3, Chapter 14	Volume 6, Chapter 14
Motor Vehicle and Convoy Operations	Volume 3, Chapter 15	Volume 6, Chapter 15 and 16
Launch Operations	N/A	Volume 6, Chapter 17
Hazardous and Safety Critical Procedures – Instructions and Approval Process	N/A	Volume 6, Attachment 2
Facilities and Structures	Volume 5, Chapters 1-2, 4-6	Volume 5, Chapter 3

Chapter 5

HAZARDOUS AREAS AND LAUNCH COMMIT CRITERIA

5.1. Purpose.

5.1.1. In order to ensure launch and test operations from the range do not pose unnecessary risk, SLD/SE defines hazardous areas to protect personnel and resources by confining the adverse effects of hazards associated with launch vehicles and payloads launched on SSC ranges.

5.1.2. Additionally, launch day parameters associated with launch vehicle, range, and environmental criteria are established that must be met prior to final approval for launch. This information is provided to assist SSC ranges in understanding and planning for potential holds or scrubs as a result of safety violations during the launch countdown that could impact public, launch site, and launch complex safety. Additional guidance for specific missions/launches may be documented in SLD supplements and RSOR documents.

5.2. Hazardous Area and Safety Critical Pad Support. SLD/SE shall develop, review, monitor, and enforce hazardous control areas, in coordination with appropriate launch complex control authorities, other SLD support agencies, and Range Users. **(T-2)** **Table 5.1** provides a reference to detailed Pad Safety responsibilities, processes, Range User relationships, and other requirements for defining and controlling safety clearance zones, as well as coordinating with support personnel during hazardous operations, performing FTS checks, and other safety critical pad support operations.

Table 5.1. Pad Safety Hazardous Area Support Cross Reference.

Pad Safety Activities	SSCMAN 91-710 Volume 6 Reference
Pre-Launch Countdown General Requirements	Section 17.1.1
Launch Countdown General Requirements	Section 17.1.2
Launch Countdown Operations	Section 17.1.3
Post-Launch Operations	Section 17.3

5.2.1. SLD/SE shall develop and publish a generic Hazardous Launch Area and a generic DoL Blast Danger Area (BDA) for each launch complex in the Danger Area Information Plan (DAIP). **(T-2)**

5.2.2. Based on the generic information in the DAIP and the specific information from a particular launch, SLD/SE shall issue a mission-specific Roadblock Access/DAIP letter that defines the DoL Hazardous Launch Areas and BDAs for each individual launch operation. **(T-2)**

5.2.3. The Roadblock Access/DAIP letter shall also identify the names, number and population type (launch essential personnel, neighboring operations personnel, etc.) of authorized personnel within the Hazardous Launch Areas. **(T-3)**

5.2.4. Concurrence from the Chief of Safety shall be obtained for all personnel required or requesting to be within a hazardous launch area during a launch operation. **(T-3)** This includes the following:

5.2.4.1. Launch essential personnel/neighboring operations personnel may be permitted within the impact limit lines (ILL), FCA, and FHA, so long as the relevant collective and individual risk criteria are met.

5.2.4.2. Neighboring operations personnel located at work areas may be permitted inside the ILLs if they are performing safety, security, or operationally critical functions. This must be approved by the SLD/CC or designated representative.

5.2.4.3. Non-essential personnel may be permitted inside the ILL. This must be approved by the SLD/CC or designated representative.

5.2.5. If an anomaly occurs during a launch, vehicles (cars, trucks, trailers, specialized mobile equipment, etc.) located within the appropriately specified hazardous areas are subject to damage. For this reason, non-approved vehicles (private, government, or contractor-owned) are prohibited from parking within these hazardous launch areas. Risk assessments may be performed for persons required to be in the vicinity of or occupying approved vehicles to determine if they meet the personnel risk criteria in SSCMAN 91-710, Volume 1, Attachment 5.

5.2.6. SLD/SE, with information provided by SSC/AATS program office or the launch contractor, shall provide a description of the ship/boat and aircraft areas that are hazarded by normally jettisoned and impacting stages to the Range Operations Squadron/Range Scheduling for issuance of Notices to Air Missions (NOTAM) for aircraft and Notices to Mariners (NTM) for shipping interests, as required. **(T-2)** Range Users should include a buoyancy analysis as part of this information submitted to SLD/SE in the Final Flight Data Package.

5.2.7. Launch areas hazardous to aircraft and ships as defined by NOTAMs and NTMs shall be surveyed on launch day for intruder aircraft and ships. **(T-2)**

5.2.8. FAA control of air traffic in designated areas around the launch area shall be maintained and coordinated between the appropriate range officers and the FAA to ensure that aircraft are not endangered by launches and that launches are not delayed by the presence of aircraft. **(T-0)**

5.2.9. Designated clearance areas, warning areas, and restricted airspace areas shall be active and controlled according to Safety Operating Instructions, SLD 45 and SLD 30 instructions, and FAA directives and regulations. **(T-2)**

5.2.10. Marine radio broadcast warnings shall be made to inform vessels of the effective closure times for designated hazardous sea areas. **(T-2)**

5.2.11. Specific surveillance positive control requirements, accounting for adequate time to respond and time to initiate clearance actions, shall be specified in the appropriate RSOR and/or SW supplements to this document. **(T-2)**

5.3. Launch Commit Criteria (LCC). SLD/SE shall develop, review, monitor, and enforce LCC, in coordination with appropriate launch complex control authorities, other SLD support agencies, and Range Users. **(T-2)** **Table 5.2** provides a reference to detailed SLD/SE

responsibilities, processes, Range User relationships, and other requirements for defining and enforcing LCC.

Table 5.2. Launch Commit Criteria (LCC) Cross Reference.

LCC Type	SSCMAN 91-710 Reference
Ground Flight Safety System	Volume 6, Section A4.2.1
Blast Overpressure	Volume 6, Section A4.2.2
Collision Avoidance	Volume 6, Section A4.2.3
Launch Winds and Debris	Volume 6, Section A4.2.4
Natural and Triggered Lightning	Volume 6, Section A4.2.5
Toxics	Volume 6, Section A4.2.6
Safety Clearance Zones	Volume 6, Section A4.2.7
Air, Land, and Sea Surveillance	Volume 6, Section A4.2.8
Jettisoned Bodies	Volume 6, Section A4.2.9

Chapter 6

FLIGHT SAFETY SYSTEM (GROUND ELEMENTS)

6.1. Flight Safety System (FSS) Composition.

6.1.1. The entire FSS consists of the airborne and ground FTS, airborne and ground tracking systems, and airborne and ground telemetry data transmission systems. This publication only addresses the launch and range safety requirements for the ground components of the FSS. Requirements for the airborne components of the FSS are located in SSCMAN 91-710, Volume 4 and RCC 319.

6.1.2. For ground-initiated command destruct FSS systems, the ground element of the FSS consists of the range tracking system (RTS) and the command destruct system (CDS). The RTS is composed of the hardware, software, and processes required to transmit, receive, process, and display selected launch vehicle data. The RTS includes a range safety display (RSD) system, which displays vehicle flight performance data that the MFCO uses as the basis for a flight termination decision for launches utilizing ground-initiated command destruct systems. The CDS provides the MFCO the capability to terminate the vehicle's flight for launches utilizing ground-initiated command destruct systems.

6.1.3. For autonomous flight safety systems (AFSS), the ground element consists of a situational awareness system (SAS) and emergency response systems, which can be implemented in different ways. AFSS launches require near real-time launch vehicle time, space and position information be provided for situational awareness, operational reporting and emergency response throughout the flight period of range safety responsibility. **Note**: Not all RTS specific requirements apply to AFSS SAS; applicability is determined during the tailoring process.

6.2. General Requirements.

6.2.1. The SLD/CC has final approval authority for FSS requirements for all USG and T&E launches. For FAA-licensed missions using SLD/SE services assessed by the FAA, the SLD/CC certifies to the FAA that AF processes and standards have been met.

6.2.2. Concurrence by SLD/SE is required for all design, development, test (including modifications to test), operations, modifications, maintenance, sustainment, commissioning, and operational acceptance activities of FSS ground systems on SSC ranges.

6.2.2.1. SLD/SE shall review any change or modification made to a SLD/SE-approved FSS, to include modifications to or substitutions of associated equipment, components, component identification, test procedures, basic characteristics, and rating, or any changes affecting the configuration or integrity of the FSS to determine if the previously awarded SLD/SE approval should be revoked and if component/system re-qualification is required. **(T-2)**

6.2.2.2. SLD/SE shall be involved with FSS requirements development, design reviews, test plan and procedure development, and monitoring FSS development and operational testing conducted IAW acquisition and commissioning/acceptance processes. **(T-2)**

6.2.2.3. SLD/SE shall review and approve all FSS test plans and revisions. **(T-2)**

6.2.2.4. SSC organizations involved with the development, acquisition, modification, upgrade, test, commissioning/operational acceptance, or operation of any ground segment of the FSS or systems that interface with any ground segment of the FSS shall ensure that SLD/SE is notified of all activities needed to meet the above stated requirements. **(T-2)**

6.2.2.5. The FSS commissioning/operational acceptance process shall include real-world operations of new systems in parallel with legacy systems, unless otherwise approved by SLD/SE. **(T-3)** This verifies new or upgraded FSS performance prior to operational use, before the deactivation of legacy systems or use of Range User provided ground elements.

6.2.2.6. SLD/SE shall determine the number of required parallel operations (both shadow backup and shadow prime) during FSS commissioning/operational acceptance activities. **(T-3)**

6.3. Range Pre-Launch Ground Safety Activities.

6.3.1. The SSC ranges and SLD/SE shall support pre-launch ground safety activities, to include the pre-launch checkout of airborne and ground FSSs, to ensure all systems meet safety requirements in accordance with Range User agreements. **(T-2)**

6.3.2. SLD/SE offices shall support FSS (airborne elements) pre-launch activities/tests as contained in SSCMAN 91-710, Volume 4 and RCC 319 to ensure safety systems are functioning properly. **(T-2)**

6.3.3. SLD operations designated representatives shall support FSS (ground elements) pre-launch activities/tests as contained in SSCMAN 91-710, Volume 4 and RCC 319 to ensure safety systems are functioning properly. **(T-2)**

6.3.4. Failure Analysis.

6.3.4.1. In the event of an FSS ground system or ground system test failure (before, during, or after flight), SLD/SE must be notified.

6.3.4.2. The system, procedures, and equipment shall undergo a written failure analysis. **(T-2)**

6.3.4.3. The failure analysis shall identify the root cause and mechanism of the failure to the smallest replaceable item. **(T-2)**

6.3.4.4. SLD/SE shall review and approve all failure analyses and corrective actions, and provide a revalidation of reliability before approval for future use is granted. **(T-2)**

6.4. Range Tracking System (RTS) Requirements.

6.4.1. RTS requirements in support of ground-initiated command destruct FSS systems are:

6.4.1.1. Metric tracking and vehicle telemetry data is required to provide the MFCO with display and knowledge of vehicle's present position and predicted debris impact locations until final impact point for launch vehicles with suborbital trajectories and to the end of range safety responsibility for orbital vehicles.

6.4.1.2. Launches shall be supported by a minimum of two adequate and independent strings. A string consists of the ground-based elements that receive/create the state vector, transport the data and display the data on the RSD.

6.4.1.3. Range tracking instrumentation data sources and associated range safety display system information shall be designed to minimize the likelihood of an undiscovered software single point of failure which could deny the MFCO the capability to monitor in-flight launch vehicle performance.

6.4.1.4. Compliance with system requirements may be demonstrated through independent verification and validation, heritage pedigree review, thorough integrated subsystem and system level testing and/or other method(s) to verify that the software functions as intended and responds to credible non-nominal conditions (such as hardware failures, unexpected data values, etc.) properly.

6.4.1.5. The overall RTS shall be robust, flexible, highly fault tolerant, allow for catastrophic failure in a single system without loss of all tracking data and remain partial mission-capable as multiple component failures occur (graceful degradation).

6.4.2. Metric tracking sources such as radars, optic tracking instruments, telemetry inertial guidance (TMIG) data, and Global Positioning System (GPS) data shall provide real-time state vectors (position and velocity). These resultant state vectors are inputs for the range processing and display systems known as the RSD system.

6.4.2.1. A metric tracking source is considered adequate if it meets the following reliability, accuracy, and timeliness requirements:

6.4.2.1.1. Reliability. For launches utilizing ground-initiated command destruct systems, the ground system reliability shall be 0.999 (the probability that all the strings will not fail) at the 95 percent confidence level for the duration of range safety responsibility. SLD/SE shall address systems that cannot meet this requirement on a case-by-case basis. **Note:** A reliability analysis should be performed IAW guidelines set forth in MIL-HDBK-781, *Reliability Test Methods, Plans, and Environments for Engineering Development, Qualification, and Production,* to demonstrate the reliability design was used in the concept and detailed design of the components and/or system.

6.4.2.1.2. Accuracy. Instantaneous impact point (IIP) uncertainty resulting from all error sources shall meet the following accuracy requirements:

6.4.2.1.2.1. The launch area (when the range instantaneous impact point (RIIP) ≤ 66,000 feet) IIP uncertainties shall not exceed 1,000 feet.

6.4.2.1.2.2. The midcourse (downrange) IIP uncertainties shall not exceed 1.0 percent of the IIP range when the RIIP > 66,000 feet.

6.4.2.1.2.3. [WR Only] The terminal area IIP uncertainties for ballistic missiles with a maneuverable upper stage shall not exceed 7,000 feet.

6.4.2.1.3. Timeliness. Timeliness and 3-sigma present position (PP) shall meet the requirements specified in SSCMAN 91-710.

6.4.2.2. An RTS metric tracking source is considered independent if it is electrically, mechanically, and structurally separate from any other tracking source, so that one tracking source does not influence another tracking source.

6.4.2.3. TMIG data is a mandatory tracking source for programs using a launch vehicle inertial guidance system when validated by the SSC range or certified to RCC-324. TMIG data is required at a 10 samples per second update rate from T-0 through the end of safety responsibility.

6.4.2.4. See RCC-324 for GPS metric tracking consensus standards.

6.5. Range Safety Display (RSD) Requirements in Support of Command Destruct Capability. For launches utilizing ground-initiated command destruct systems:

6.5.1. An RSD system is mandatory as the primary information display system used by the MFCO to evaluate launch vehicle flight.

6.5.2. A RSD shall be capable of displaying all tracking source data and shall be able to process and display data from at least two adequate and independent metric tracking sources.

6.5.3. SLD/SE (Flight Analysis) shall provide RSD requirements, instructions, and data necessary for display generation to range personnel responsible for RSD systems operations. **(T-2)**

6.5.4. Real-Time Prediction Requirements.

6.5.4.1. PP and IIP solutions shall be provided for display on the RSD at a rate of 10 samples per second or faster.

6.5.4.2. The PP and IIP solutions shall be computed from data supplied by the tracking sources.

6.5.4.3. PP and IIP computations and displays shall be single failure tolerant.

6.5.4.4. The RSD shall process the PP data derived from the tracking system into a current time IIP that as a minimum meets the IIP accuracy requirement listed in **paragraph 6.4.2.1.2** The design shall minimize IIP excursions. Non-credible launch vehicle IIP excursions shall be flagged to the MFCO (example: color change) or not displayed.

6.5.4.5. Velocity vs. time, altitude, fast/slow time relative to nominal, plus count time, dynamic nominal, and other data identified in the RSOR shall also be displayed.

6.5.4.6. An IIP View shall be provided and meet the following requirements:

6.5.4.6.1. Display a geographic map with the nominal trajectory line, trajectory wind adjust line, nominal box, sub-missile point, 3-sigma lines, and other destruct criteria.

6.5.4.6.2. Display dynamic data to include the IIP plots and moving Chevron lines calculated during the mission.

6.5.4.6.3. Display shall also be capable of providing variable flight azimuths.

6.5.4.7. A PP View shall be provided. The PP View is comprised of the Profile and Over-head Views. The PP View consists of a near and far map. A launch initially begins in the near map and switches to the far map as the vehicle progresses down range.

6.5.4.8. A Velocity vs. Time View shall be provided. This display is a plot of the launch vehicle’s expected velocity throughout the flight.

6.5.4.9. Dynamic data shall indicate the individual sources used to calculate the variable in these views, as well as best and second best sources.

6.5.4.10. A Vehicle Data Page shall be provided. The Vehicle Data Page provides alphanumeric data regarding vehicle performance for the Best and Second-Best sources. The vehicle data page lists the vehicle latitude, longitude, height, and missile heading, as well as IIP and PP performance characteristics.

6.5.5. Video Display Requirements.

6.5.5.1. Video monitors with channel switching capability shall be provided at the SLD operations console positions.

6.5.5.2. Specific video coverage requirements peculiar to a mission shall be identified in the RSOR for the vehicle or the Operations Supplement (Ops Sup) for the mission.

6.5.6. Specific telemetry display requirements shall be documented in the RSOR or Ops Sup for a mission.

6.6. Command Destruct System (CDS).

6.6.1. For launches utilizing ground-initiated command destruct systems, the CDS provides the MFCO with the capability to terminate launch vehicle flight if an FTS is used and flight termination criteria are violated or mission rules call for the MFCO to initiate flight termination action.

6.6.2. Detailed CDS performance requirements are contained in the Combined Command Destruct System Range Safety Requirements (CCDSRSR) document. Space Launch Delta unique CDS requirements shall be contained in the SLD supplement to this document. **(T-3)** CDS safety requirements must include the following:

6.6.2.1. The capability to issue flight termination commands shall exist throughout powered flight until flight control end of mission or until orbital insertion, as dictated by the mission.

6.6.2.2. The flight control command functions, including the capability to override, shall take precedence over all other commands.

6.6.2.3. When the launch vehicle airborne FTS receiver is active and ordnance is electrically connected, a CDS shall be radiating at the proper frequency and have the receivers captured.

6.6.2.4. When the FTS receiver is “on,” no CDS commands shall radiate in support of another operation, unless there is a minimum of a 4 MHz frequency separation between the carrier center frequencies.

6.6.2.5. The operation of the CDS shall be verified prior to launch.

6.7. Telemetry Systems in Support of Command Destruct Capability. The range shall have the ability to receive/process telemetry data from the launch vehicle and enter the data into the range data transport system.

6.7.1. The telemetry system shall have, at a minimum, sufficient sensitivity to receive tracking data until the launch vehicle IIP passes the gate specified by Flight Analysis.

6.7.2. To support launch vehicles where both sources of track are in telemetry the range telemetry system shall be fully dual redundant (two independent strings).

6.7.3. To support simultaneous tracking of multiple objects where all sources of track are in telemetry, additional telemetry antennas shall be available to prevent a single point of failure from resulting in loss of all tracking. **Note**: Other real-time information on in-flight vehicle performance and behavior typically includes engine chamber pressures, roll rate, attitude, launch vehicle velocity vs. time, automatic gain control values of the command destruct receivers, and occurrence of discrete events. Program specific requirements are captured in RSORs.

6.8. Command Destruct Software Requirements. Software requirements for the FSS ground components used to support launches utilizing ground-initiated command destruct systems, shall comply with the requirements specified in SSCMAN 91-710, Volume 3, Chapter 16. SLD/SE shall approve all software and firmware used in FSS components or systems prior to production **(T-2)**.

6.9. Range User Provided Ground Elements. Any Range User provided telemetry (TM) ground elements of the RTS, in whole or in part, used to satisfy SLD/SE needs, must meet the following requirements. A distinction is made between ground-initiated command destruct systems and SAS/emergency response systems for AFSS missions.

6.9.1. SLD/SE concurrence is required for all Range User provided ground system segments prior to operational use. **(T-2)**

6.9.2. For hybrid solutions, using a combination of Range and User assets, concurrence shall also be obtained from the corresponding Range Operations Squadron. **(T-2)**

6.9.3. If the Range User provides a hybrid solution, the only requirements that apply are those that pertain to the provided subsystem. The other LTRS subsystems that complete the overall TM RTS are considered certified in meeting range safety requirements.

6.9.4. The Range User shall coordinate and obtain SLD/SE approval for development, test, and modification activities of Range User provided ground system segments of the FSS. **(T-2)**

6.9.5. Failure(s) of any Range User provided ground system segment component (before, during, or after flight) that affects any requirement contained within this chapter must be reported to SLD/SE. A post flight root-cause analysis must be performed with corrective actions identified. SLD/SE shall assess and re-validate reliability before approval for future use is granted. **(T-2)**

6.9.6. **Range User Provided Ground Elements for Ground-Initiated Command Destruct Missions.**

6.9.6.1. FSS ground-initiated command destruct requirements contained within **paragraph 6.2.1** also apply to Range User provided ground elements, as deemed appropriate by SLD/SE.

6.9.6.2. If Range User provides entire TM RTS, it shall interface with the LTRS CDS.

6.9.6.3. System Performance Requirements. RTS requirements contained within **paragraph 6.4** apply to Range User provided systems, as deemed appropriate by SLD/SE.

6.9.6.3.1. Reliability.

6.9.6.3.1.1. Each individual tracking source shall have a minimum availability of at least 97% during the time-period of range safety responsibility. There shall be no single point of failure that results in loss of all tracking data.

6.9.6.3.1.2. Each RTS source shall have no single point failure mode that shows a non-nominal vehicle is nominal. Examples of failure modes include but are not limited to forward prediction, Kalman filters, indication of data loss, etc.

6.9.6.3.1.3. Loss of a single onboard source shall not cause complete loss of the RTS.

6.9.6.3.2. Latency. The latency of data from reception to MFCO display shall be specified, validated and factored into destruct line generation. In general, latency values less than 250 ms will meet current safety requirements.

6.9.6.3.3. Accuracy. The specified accuracy shall not be degraded by ground system processing due to rounding, truncating, duplicating samples, etc.

6.9.6.4. Subsystem Requirements.

6.9.6.4.1. Antenna System Requirements.

6.9.6.4.1.1. Acquisition. Each antenna shall have the capability to acquire and maintain track of the flight system.

6.9.6.4.1.2. If a directional steerable dish is used, it shall have an independent means of tracking. The capability to reacquire tracking using real-time updated pointing data shall be taken under consideration during design, based on meeting reliability and availability requirements.

6.9.6.4.2. Processing System Requirements. TM processing systems shall be capable of processing at the data rate provided by airborne system for safety critical functions. Unless otherwise specified, the minimum processing speed shall handle 10 samples per second.

6.9.6.4.3. Display System Requirements. RSD requirements contained within **paragraph 6.5** apply to Range User provided systems, as deemed appropriate by SLD/SE.

6.9.6.4.3.1. Vehicle performance parameters shall be provided as tailored for each program and approved by SLD/SE. The display content shall not be changed without prior SLD/SE notification. The displays shall be maintained throughout the flight period of range safety responsibility. The following are examples of data to be included:

6.9.6.4.3.1.1. Vehicle position in IIP space overlaid on a moving map with the planned trajectory trace for orientation and abort lines.

6.9.6.4.3.1.2. Continuous readout of Geodetic coordinates of IIP and Present Position as well as Range (km).

6.9.6.4.3.1.3. Chamber Pressure(s) for all potentially thrusting stages.

6.9.6.4.3.1.4. Continuously updating telemetry frame sync status.

6.9.6.4.3.1.5. Planned vehicle events (i.e. staging, fairing separation, payload separation).

6.9.6.5. Data Products.

6.9.6.5.1. Performance and subsystem requirements compliance document including verification method shall be submitted to SLD/SE earlier than 60 days prior to use. **(T-3)**

6.9.6.5.2. Overall schematic of Range User provided ground segments and descriptions of operation shall be submitted to SLD/SE earlier than 60 days prior to use. **(T-3)**

6.9.6.5.3. Range User configuration control plans/process for supplied ground system segments shall be submitted to SLD/SE earlier than 60 days prior to use. **(T-3)**

6.9.6.5.4. Prelaunch test procedures/plans shall be provided to SLD/SE for approval earlier than 30 days prior to use. **(T-3)** Any changes to these test procedures/plans shall be provided to SLD/SE for re-approval. **(T-3)**

6.9.6.5.5. For each mission, all User-provided TM RTS ground segments shall have specific operational support plans describing how each asset collects and records required safety data. **(T-3)** Mission-specific planning information includes: link margin analysis for all TM links showing positive margin throughout range safety responsibility, acquisition plans, switching plans, coverage plans and antenna link auto-track assignments. User-provided TM RTS ground segment operational support data shall be provided to SLD/SE at least 7 days before launch. **(T-3)**

6.9.6.5.6. Within 30 days post flight, a TM ground system analysis shall be provided to SLD/SE to demonstrate that the data provided by each required TM system was available for at least 97% of range safety responsibility with no more than a 5 second total loss of signal. **(T-3)**

6.10. Autonomous Flight Safety System (AFSS) Ground Element Requirements.

6.10.1. General Requirements.

6.10.1.1. The SAS shall include near real-time display, record and playback capability. All telemetry transmitted with AFSS-related parameters shall be recorded during periods when the AFSS is active.

6.10.1.2. Pre-launch.

6.10.1.2.1. The health and status of the launch vehicle tracking system and the AFSS shall be provided in real time to SLD/SE for safety mandatory tests.

6.10.1.2.2. A government representative shall be in a position to monitor AFSS status to T-0 to verify AFSS readiness.

6.10.1.2.3. Voice communications shall be maintained between the government representative and the Range User to facilitate a hold call, as required.

6.10.1.2.4. Pre-flight evaluation data shall be recorded/saved and made available for playback as requested by SLD/SE.

6.10.1.2.5. Data shall be archived for at least 6 months.

6.10.1.3. In-Flight.

6.10.1.3.1. During vehicle flight, from liftoff to end of programmed positive control (AFSS is disabled), near real-time information must be available for situational awareness, operational reporting and emergency management response (delays acceptable as necessary for information transmission/processing).

6.10.1.3.2. For USG and T&E activity the range will maintain the capability to provide higher headquarters notification. The user, under 14 CFR for commercial/FAA-licensed activity, will meet their obligation to notify the FAA and provide information to the Space Force.

6.10.1.3.3. Telemetry shall be recorded for AFSS and other safety critical systems while those systems are active.

6.10.1.3.4. AFSS evaluation data isn't required to be displayed in real-time or after the systems are disabled.

6.10.1.4. Post-launch. Telemetry shall be recorded, converted to engineering data, analyzed and provided to SLD/SE for post flight evaluation. This analysis is used to verify proper system performance and is an essential activity to understand the risk range activity presents to national security interests, Space Force resources, and common interests of all Range Users. Analysis shall be for a period to include all launch day countdown tests to end of programmed positive control (AFSS is disabled).

6.10.1.5. SLD/SE concurrence is required for all SAS prior to operational use. **(T-2)**

6.10.1.6. For hybrid solutions, concurrence shall also be obtained from the corresponding Range Operations Squadron. **(T-2)**

6.10.1.7. If the Range User provides a hybrid solution, the only requirements that apply are those that pertain to the provided subsystem. The other LTRS subsystems that complete the overall TM RTS are considered certified in meeting range safety requirements.

6.10.2. System Performance Requirements.

6.10.2.1. Reliability. AFSS in-flight performance recording and SAS real-time monitoring requires a 97% minimum reliability. Verification is proven based on quantitative analysis of data from system(s) developer, modeling or field testing under operationally realistic conditions.

6.10.2.2. Latency.

6.10.2.2.1. An SAS delay rate shall be approved by SLD/SE for each mission type to ensure that a non-nominal flight can be detected and location of debris determined. An SAS total system delay time of less than 5 seconds should be adequate for most launch applications.

6.10.2.2.2. The delay (data latency) introduced by each component or subsystem of the SAS shall support the total system delay requirement.

6.10.2.2.3. This system delay time calculation shall be measured from airborne sensor or RF reception through the SAS display including any data buffering, transfer, processing, or smoothing and shall be maintained throughout the flight period of range safety responsibility.

6.10.2.3. Accuracy.

6.10.2.3.1. The accuracy of the state vector delivered to the SAS display systems shall be sufficient to support the sample rate and system delay time requirements.

6.10.2.3.2. The accuracy of the Range Users' entire airborne and applicable SAS shall be specified.

6.10.2.3.3. The required accuracy shall be maintained throughout the flight period of range safety responsibility.

6.10.2.4. Sample Rate.

6.10.2.4.1. An SAS sample rate shall be approved by SLD/SE for each mission type to ensure that a non-nominal flight can be detected and location of debris determined. An SAS sample rate of at least 1 sample every 2.5 seconds should be adequate for most launch system applications for emergency notification purposes.

6.10.2.4.2. The sample rate shall be specified by the Range User and not changed without SLD/SE approval.

6.10.2.4.3. The specified sample rate shall be maintained throughout the flight period of range safety responsibility. Each sample shall be a unique measurement and not a repeat or extrapolation of the previous value.

6.10.3. Subsystem Requirements.

6.10.3.1. Antenna System Requirements.

6.10.3.1.1. Acquisition. Each antenna shall have the capability to acquire and maintain track of the flight system.

6.10.3.1.2. Reacquisition. The capability to reacquire tracking using real-time updated pointing data shall be taken under consideration during design, based on meeting reliability requirements.

6.10.3.2. Situational Awareness Display.

6.10.3.2.1. Vehicle performance parameters shall be provided as tailored for each program and approved by SLD/SE. The SAS display content shall not be changed without prior SLD/SE notification. SAS displays shall be maintained throughout the flight period of range safety responsibility. The following are examples of data to be included as part of the SAS:

6.10.3.2.1.1. Vehicle position in IIP space overlaid on a moving map with the planned trajectory trace for orientation and abort lines.

6.10.3.2.1.2. Continuous readout of geodetic coordinates of IIP and Present Position as well as range.

6.10.3.2.1.3. An indication that shows the command state of the AFSS (i.e. destruct, safe, off).

6.10.3.2.1.4. An indication that shows information received is continuously updated (for example, telemetry frame sync status).

6.10.3.2.2. The SAS display may optionally provide additional information on:

6.10.3.2.2.1. Chamber pressure(s) for all potentially thrusting stages.

6.10.3.2.2.2. Planned vehicle events (i.e., staging, fairing separation, payload separation).

6.10.4. Data Products.

6.10.4.1. Performance and subsystem requirements compliance document including verification method shall be submitted to SLD/SE earlier than 45 days prior to use. **(T-3)**

6.10.4.2. Overall schematic of Range User provided ground segments and descriptions of operation shall be submitted to SLD/SE earlier than 45 days prior to use. **(T-3)**

6.10.4.3. All User-provided SAS collection assets shall have specific operational support plans describing how each asset collects and records required safety data. **(T-3)**

6.10.4.4. Link margin analysis showing positive margin throughout Safety responsibility, accounting for acquisition plans, switching plans, coverage plans and antenna link auto-track assignments, shall be provided to SLD/SE at least 7 days before launch. **(T-3)**

6.10.4.5. Post flight performance of the subsystems that comprise the SAS shall be provided to SLD/SE within 30 days after each launch. **(T-3)**

6.10.5. Certification.

6.10.5.1. For USG and T&E launches, and FAA-licensed missions using SLD/SE services assessed by the FAA, data products must be approved by SLD/SE prior to operational use of Range User provided ground elements. **(T-2)**

6.10.5.2. Once the system is approved for launch and range safety use, hardware and software changes shall not occur without SLD/SE approval. **(T-2)**

6.10.6. Preflight Validation.

6.10.6.1. Preflight testing shall be performed on the entire end-to-end system to validate configuration and ensure that every element is functional and ready for flight. **(T-2)**

6.10.6.2. For hybrid solutions, Range User supplied ground segments shall participate in all LTRS prelaunch testing. **(T-2)**

6.10.6.3. Range Users providing the entire TM RTS or SAS solution must provide prelaunch test procedures and test results of all systems to SLD/SE. **(T-2)** These procedures validate configuration, demonstrate functionality, and provide ready for flight confirmation.

6.10.6.4. Following final validation, no further changes are allowed until after the period of safety responsibility, unless approved by SLD/SE.

Chapter 7

FLIGHT CONTROL AND COUNTDOWN HOLD AUTHORITY

7.1. Flight Control.

7.1.1. For USG and T&E launches, SLD/SE shall verify that all launch vehicles launched from or onto SSC ranges have a positive, range-approved method of controlling errant launch vehicle flight to meet the objectives of managing risk to the public and launch-essential personnel. **(T-2)**

7.1.2. For FAA-licensed missions using SLD/SE services assessed by the FAA, the SLD/CC certifies to the FAA that Space Force processes and standards have been met.

7.1.3. When required, flight control systems on launch vehicles using SSC ranges shall include an airborne FSS that shall meet the requirements of SSCMAN 91-710, RCC 319 and RCC 324, *Global Positioning and Inertial Measurements Range Safety Tracking Systems Commonality Standard,* as tailored. **(T-3)**

7.1.4. Launch safety flight control requirements (i.e., launch constraint criteria and committed coverage plans) shall be contained in SLD level documentation (e.g. RSOR, RSOR supplements, Mission Data Load (MDL) files for AFSS missions, etc.). **(T-2)** These launch safety flight control requirements are the basis for the launch safety GO/NO-GO (launch commit) for launch.

7.1.5. For launches utilizing ground-initiated command destruct systems, the MFCO shall make a decision concerning continued flight or flight termination based on interpretation of real-time events, mission rules, all available data sources, and sound judgment. **(T-2)**

7.1.6. For USG and T&E launches, SLD/SE shall provide the mission rules and flight termination criteria to the Range User for launches utilizing ground-initiated command destruct systems, or alternatively for AFSS missions, the MDL files implementing mission rules and flight termination criteria. **(T-2)** For FAA-licensed missions using SLD/SE services assessed by the FAA, the SLD/CC certifies to the FAA that Space Force processes and standards have been met.

7.1.7. Mission rules should address situations where:

7.1.7.1. Validated data confirms the launch vehicle has violated established flight safety criteria, in particular that the launch vehicle IIP has violated the destruct line limits.

7.1.7.2. The launch vehicle exhibits gross deviation or obvious erratic flight where, in the judgment of the MFCO, continued flight may pose an unacceptable launch safety risk (to include loss of positive control) though the above destruct criteria are not violated.

7.1.7.3. The performance of the launch vehicle is unknown and the capability exists to violate flight safety criteria.

7.1.7.4. Special mission rules as requested by the Range User or as determined from pre-launch flight analysis. SLD/SE shall approve any special mission rules. **(T-2)**

7.1.8. Command Capability. SSC ranges shall ensure that range managed instrumentation provides uninterrupted command capability for all systems that use a ground-commanded FTS

or thrust termination system. **(T-2)** For systems that use command receiver decoders, capture from FTS turn-on through flight control end of mission is mandatory.

7.2. Launch Commit Decision and Hold Authority.

7.2.1. For launches utilizing ground-initiated command destruct systems, the MFCO is responsible for the launch commit decision from a flight control perspective. The launch commit decision is based on the ability of range instrumentation to meet minimum launch safety requirements. The MFCO shall perform final checkout of the RTS and CDS prior to accepting the system for operational launch commit. **(T-2)**

7.2.2. The MFCO or designated Space Launch Delta representative is authorized to initiate launch holds during the countdown for violations of range instrumentation LCC. Real-time operational activities and decisions may require the MFCO to upgrade non-mandatory assets to mandatory to ensure minimum launch safety requirements continue to be met.

7.2.3. The SLD/CC or his/her delegate has waiver authority for mandatory launch safety requirements for non FAA-licensed missions. For FAA-licensed missions, the Range representative shall provide a Range RED/GREEN to the Range User. **(T-2)** In either case, written documentation shall be maintained after the countdown/launch to record waivers. **(T-2)**

7.3. Launch Abort and Misfire/Hangfire Operations.

7.3.1. In the event of a launch abort, when the status of the launch vehicle is unknown, the range assumes that the vehicle could liftoff without warning. Under this circumstance, the range does not release instrumentation until all launch safety requirements have been met or are no longer necessary.

7.3.2. Any failure to launch or ignite properly is treated as a hangfire until it can be definitely established that a misfire has occurred or until the 30-minute waiting period has elapsed. The 30-minute waiting period does not apply to ballistic missile launch vehicles in cases where it is directed otherwise by approved technical orders [WR only].

7.3.3. The FSS shall remain configured in a manner that enables the MFCO or AFSS to initiate destruct action if necessary until Pad Safety (ER)/Flight Safety Project Officer (WR) has verified to the MFCO or designated SLD/SE representative that the launch vehicle is no longer in a launch configuration.

7.3.4. In the event of a launch abort or misfire or following expiration of the 30-minute wait period in the case of a hangfire with solid propellant stages or solid propellant starter devices, Pad Safety shall perform the following activities:

7.3.4.1. Ensure the ignition firing circuit has been disabled. **(T-3)**

7.3.4.2. After approval from the MFCO or designated SLD/SE representative, allow rotation of the FTS safe and arm (S&A) to safe. **(T-3)**

7.3.4.3. Inform the MFCO or designated SLD/SE representative that the FTS S&A devices are in the safe position. **(T-3)**

7.3.4.4. For launches utilizing ground-initiated command destruct systems, request the command receivers to be turned off after coordination with the MFCO. **(T-3)**

7.3.4.5. Inform the MFCO or designated SLD/SE representative that the safing devices are reinstalled. **(T-3)**

7.3.4.6. SLD/SE shall make a launch complex inspection in conjunction with the Range User and allow access to the launch complex for work when it is safe to do so. **(T-3)**

7.3.4.7. Adjust or lift roadblocks as required. **(T-3)**

7.3.4.8. When no further launch attempt is contemplated, verify that hazardous ordnance items are disconnected electrically and shielded, and if required, removed for return to the storage area. **(T-3)**

7.3.4.9. Request support from the Explosive Ordnance Disposal (EOD) team when disarming of ordnance systems or components cannot be accomplished using normal methods. **(T-3)**

7.3.4.10. If necessary, the EOD team shall initiate render-safe procedures. **(T-3)**

7.3.5. For launch vehicles using liquid propellant stages, Pad Safety shall monitor the detanking of propellants, where applicable. **(T-3)**

7.4. Mission Scrubs. In cases where the mission and/or launch countdown is terminated under normal circumstances, the range shall not release instrumentation, to include command destruct receivers when used, until all launch safety requirements and SLD/SE approved procedures have been met or completed. **(T-3)**

7.5. Communications.

7.5.1. The flight control communication circuit requirements shall be specified in the applicable RSOR, Operations Supplement, or Operations Directive (OD). **(T-3)**

7.5.2. Checkout and Operation of Communication Networks. The Range shall ensure all communication networks required for safety operations identified in an RSOR or Ops Sup are checked out and operational prior to the scheduled time for FTS destruct checks. **(T-3)**

7.5.2.1. For launches utilizing ground-initiated command destruct systems, MFCO communications shall be recorded for all launches. **(T-2)** The recording shall be continuous from L-10 minutes through the flight control end of mission (EOM). **(T-2)**

7.5.2.2. If under the control of a Safety/Accident Investigation Board, the tapes shall be retained/disposed of at the direction of the Board President. **(T-2)**

7.5.3. Restrictions applicable to flight control communications and recordings:

7.5.3.1. To avoid unauthorized dissemination of launch safety communications, recordings, and circuits, no individual, agency, or organization shall be permitted to monitor the MFCO composite circuits without the approval of the Chief of Safety. **(T-3)**

7.5.3.2. Access to these circuits shall not be allowed at positions other than those specified in the applicable RSOR, Ops Sup, or OD. **(T-3)**

7.6. Forward Observers and Skyscreens. (Only used for launches utilizing ground-initiated command destruct systems)

7.6.1. Forward Observers. Forward Observers can be airborne or shipborne, while Forward Observers (Ground) are placed at strategic locations on base around the launch pad.

7.6.1.1. Forward Observers (Ground) are required for all pad launches. **(T-3)**

7.6.1.2. The location and manning of forward observer sites shall be contained in the appropriate RSOR. **(T-3)**

7.6.2. Television Skyscreens (TVSS) - Launch Vehicle Flight Line and Program Cameras.

7.6.2.1. Video recordings of flight line (back azimuth) and program TVSS camera systems are required for all pad launches and shall be placed in operation no later than L-60 minutes. **(T-3)** Outputs from these sources, as well as selected long-range optical systems, are displayed in real time in the mission flight control center. All Skyscreen systems shall remain operational until released by the MFCO. **(T-3)**

7.6.2.2. The flight line (back azimuth) camera shall be free to move the azimuth and elevation to permit centering the launch vehicle in the field of view while tracking and shall be located within ± 15 degrees of the uprange extension of the flight line. TVSS flight line (ER only) sites shall be located within + 15 degrees of a line extending from the launch point.

7.6.2.3. Vertical Wire Program Skyscreen sites shall be perpendicular to the flight azimuth and located within + 15 degrees of a line extending from the launch point.

7.6.2.4. The program camera shall be fixed in azimuth and free to move in elevation, and shall be located on a line of sight within ± 15 degrees of the perpendicular to the flight azimuth at the launch pad.

7.6.2.5. A vertical reference line and arrow (indicating the planned direction of the launch vehicle's flight) shall be superimposed on the TVSS transmission and monitored at the MFCO console positions.

7.6.2.6. Additional SLD/SE requirements for flight line (back azimuth) and program cameras shall be provided in the RSOR. **(T-3)**

7.6.2.7. Video recordings shall be retained for 45 calendar days unless or until released by SLD/SE. **(T-3)** If under the control of a Safety/Accident Investigation Board, the tapes shall be retained/disposed of at the direction of the Board President. **(T-2)**

7.7. Timing and Sequencing.

7.7.1. The range requires a timing and sequencing system. The system must connect range sites and stations with each other and with external resources. The network must provide the flexibility and dependability necessary to transport the timing, synchronization, count, holdfire, and first motion signals needed to carry out supported range operations. Central timing controls the transmission of data to the sites.

7.7.2. Holdfire. The range shall have a capability to interrupt the firing sequence of a launch vehicle in the event of loss of safety critical systems or violations of mandatory launch safety launch commit criteria. The system may be a holdfire switch in the range control center or voice communications with the user/pad safety.

7.7.2.1. Each MFCO shall have access to the following timers. **(T-3)**

7.7.2.1.1. A universal, coordinated time display in hours, minutes, and seconds.

7.7.2.1.2. Countdown indicators in minutes and seconds for the applicable range countdown networks.

7.7.2.1.3. Two manual interval timers in seconds to be used as stopwatches.

7.7.2.2. All MFCO timers shall be operational for launch. **(T-3)**

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Director of Safety

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

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SSCMAN 91-710V5, *Range Safety User Requirements Manual - Facilities, Structures and Reusable Launch Vehicle/Reentry Vehicle Operating Location Requirements*, 27 December 2022

SSCMAN 91-710V6, *Range Safety User Requirements Manual - Ground and Launch Personnel, Equipment, Systems, and Material Operations Safety Requirements*, 27 December 2022

SSCMAN 91-710V7, *Range Safety User Requirements Manual - Glossary of References and Supporting Information*, 27 December 2022

Prescribed Forms

None

Adopted Forms

DAF Form 847, *Recommendation for Change of Publication*

Abbreviations and Acronyms

AFSS—autonomous flight safety system

BDA—Blast Danger Area

CC—Commander

CCDSRSR—Combined Command Destruct System Range Safety Requirements

CDS—command destruct system

CFR—Code of Federal Regulations

CSOSA—Commercial Space Operators Support Agreement

CSWG—Common Standards Working Group

DAF—Department of the Air Force

DAIP—Danger Area Information Plan

DET—detachment

DoL—Day-of-Launch

EOD—Explosive Ordnance Disposal

EOM—end of mission

ER—Eastern Range

EWR—Eastern and Western Range

FAA—Federal Aviation Administration

FAA/AST—FAA/Associate Administrator for Commercial Space Transportation

FCA—Flight Caution Area

FHA—Flight Hazard Area

FSA—flight safety analysis

FSS—flight safety system

FTS—flight termination system

GPS—Global Positioning System

HQ SSC—Headquarters Space Systems Command

HQ SSC/SE—Headquarters Space Systems Command, Directorate of Safety

HQ SSC/SEK—Headquarters Space Systems Command, Space Safety Division

IIP—instantaneous impact point

ILL—impact limit lines

KSC—Kennedy Space Center

LCC—launch commit criteria

LTRS—Launch and Test Range System

MDL—Mission Data Load

MFCO—Mission Flight Control Officer

MHE—material handling equipment

MHz—megahertz

MOA—memorandum of agreement

MOU—memorandum of understanding

MRTFB—Major Range and Test Facility Base

MSPSP—Missile System Prelaunch Safety Package

MTE—minimum time to endanger

NASA—National Aeronautics and Space Administration

NOTAM—Notice to Air Missions

NTM—Notice to Mariners

OD—Operations Directive

OPR—Office of Primary Responsibility

Ops Sup—Operations Supplement

OSHA—Occupational Safety and Health Administration

PP—present position

RCC—Range Commanders Council

RF—radio frequency

RIIP—range instantaneous impact point

RSD—range safety display

RSG—Range Safety Group

RSOR—Range Safety Operations Requirements

RTS—range tracking system

S&A—safe and arm

SAS—situational awareness system

SCO—Surveillance Control Officer

SE—Safety Office

SLD—Space Launch Delta

SLD 30—Space Launch Delta 30

SLD 45—Space Launch Delta 45

SLD/CC—Space Launch Delta Commander (Range Commander)

SLD/SE—Space Launch Delta Safety Office

SOSA—Space Operations Support Agreement

SPO—System Program Office

SSC—Space Systems Command

SSC/AATS—Space Systems Command, Assured Access to Space

T&E—test and evaluation

TM—telemetry

TMIG—telemetry inertial guidance

TVSS—Television Skyscreens

USG—United States Government

WR—Western Range

Terms

abort—see launch abort.

adequate—refers to the capability of tracking sources to provide real-time state vectors (position and velocity) to meet accuracy, timeliness, and reliability criteria specified in SSCMAN 91-710 Volume 2 and is defined by error statistics for each tracking source.

DAF/NASA/FAA Common Standards Working Group—a group of DAF, NASA and FAA launch and range safety experts formed to develop and maintain common safety standards and requirements for space launch operations at Federal and non-Federal ranges.

azimuth—an arc of the horizon measured between a fixed point and the vertical circle passing through the center of an object; quantities may be expressed in positive quantities increasing in a clockwise direction, or in X, Y coordinates where south and west are negative; may be referenced to true north or magnetic north depending on the particular system used; see launch azimuth.

collision avoidance/collision avoidance analysis—a process designed to prevent collisions between on-orbit tracked objects or to prevent collisions between on-orbit tracked objects and launched vehicles (including spent stages)/payloads by determining and implementing courses of action through careful analysis of validated conjunction assessments and satellite health and mission requirements. The process includes establishing launch wait periods in either the launch window or spacecraft thrust firings based on validated conjunction assessments and accounts for uncertainties in spatial dispersions, arrival time of orbiting objects and/or the launch vehicle/payload, and modeling accuracy. There are two different types of collision avoidance: (1) safety collision avoidance, addressing potential collisions between launched vehicles and catalogued manned on-orbit objects for the protection of life, and (2) mission assurance collision avoidance, addressing potential collisions between launched vehicles and catalogued unmanned on-orbit objects based on mission requirements to comply with space debris minimization requirements and assure mission success.

collision avoidance closure period—see *launch wait* and *launch hold*.

collision avoidance no launch period—see *launch wait* and *launch hold*.

common safety standard/common requirement—any Launch Safety requirement located in both the DAF and FAA Launch Safety requirements documents.

conjunction assessment—a process for determining the point and time of the closest approach of two tracked orbiting objects or between a tracked orbiting object and a launched vehicle (including spent stages)/payload; conjunction assessment is performed in association with a specified miss distance screening criteria or the corresponding probability of collision; associated with the closest approach assessment is the closest approach distance, the times of launch and/or orbital firing that would result in the closest approach and meeting the miss distance or collision probability criteria; a probability of collision with accuracy given for the ephemeris of both objects.

countdown—the timed sequence of events that must take place to initiate flight of a launch vehicle.

data loss flight time analysis—(1) establishes a data loss flight time and a planned safe flight state to establish each flight termination rule that applies when launch vehicle tracking data is not available for use. (2) Establishes the shortest elapsed thrusting time during which a launch vehicle can move from normal flight to a condition where the launch vehicle’s hazardous inert and explosive debris impact dispersion extends to any protected area as a data loss flight time. (3) Establishes a data loss flight time for all times along the nominal trajectory from liftoff through that point during nominal flight when the minimum elapsed thrusting time is no greater than the time it would take for a normal vehicle to reach the overflight gate, or the planned safe flight state, whichever occurs earlier. (4) Establishes the minimum time to endanger (MTE), or the first time that a launch vehicle has sufficient energy to hazard the area outside the impact limit lines (ILL)

(assumes flight in the worst case direction), after which time, if no sensor has acquired launch vehicle track by MTE, flight termination is authorized.

destruct lines—lines established to ensure that a launch vehicle's critical debris impact dispersion does not violate the impact limit line; destruct lines are displayed on the Range Safety Display. When the instantaneous impact point, based on valid tracking data, shows that the vehicle will cross the destruct lines, the Mission Flight Control Officer is authorized to terminate the flight.

distant focusing overpressure—constructive interference of a shockwave that can create localized damage beyond expected distances.

ephemeris—a tabular statement of the computed position of a celestial body for regular intervals.

explosive debris—solid propellant fragments or other pieces of a launch vehicle or payload that result from break up of the launch vehicle during flight and that is capable of exploding upon ground impact (see also *inert debris*).

FAA-licensed launch—any launch that is performed under a license from the FAA.

flight—for flight analysis purposes, flight begins at a time in which a launch vehicle normally or inadvertently lifts off from a launch platform.

flight control—the flight control mission supports and enforces the flight control rules and is executed by the MFCO for launches utilizing ground-initiated command destruct systems. The flight control mission begins when the system or procedures used to exercise positive control of launch vehicle flight is activated during the launch countdown and is completed at flight control end of mission. During the flight control mission, the MFCO's responsibilities for launches utilizing ground-initiated command destruct systems include: an assessment of the readiness of the operation to proceed; final flight control GO/NO-GO recommendation; monitoring launch vehicle performance in flight; and serving as the sole decision-making authority and initiator of the flight termination system (if required).

flight control end of mission—flight control end of mission (EOM) represents the end of flight control responsibility and is determined by launch safety analysis which is based on Range User data, mission objectives, and the risk to the public. Due to the unique mission objectives, flight control EOM is unique to the mission. Examples of flight control EOM include, but are not limited to: orbital insertion; end of powered flight (caused either by fuel depletion/shutoff or flight computer shutdown); nominal at-the-horizon loss of signal as viewed from the launch area; a planned vehicle event or vehicle aspect angle; separation of the last stage that contains a flight termination system; or completion of destruct actions or errant missile actions.

flight hazard area analysis—an analysis that identifies any regions of land, sea, or air that shall be surveyed, public notices provided, controlled or evacuated in order to control the risk to the public from inert and explosive debris impact hazards.

flight period of range safety responsibility—from activation of the onboard FTS, subsequent launch and ending at FTS deactivation. This typically starts at launch (T-0) and lasts through loss of signal as viewed from the launch head and off-axis based systems.

flight safety analysis—the analyses and processes that must be completed prior to obtaining approval for launch or test operations in order to protect people and resources, where practical, by identifying the hazards associated with launch or test operations, containing and/or minimizing launch or test hazards, and controlling the remaining risks. SSC ranges have definitive processes

and software tools that are used to conduct the analyses and document the technical flight safety approach.

flight safety limits—the limits within which a vehicle may continue to operate and beyond which flight termination must take place; see *destruct line*.

flight safety limits analysis—identifies the location of populated or other protected areas, and establishes flight safety limits (destruct lines) that define when an FSS shall terminate a launch vehicle's flight to prevent the hazardous effects of the resulting inert and explosive debris impacts from reaching any populated or other protected area and ensure that the launch satisfies the public risk criteria.

flight safety system—a system designed to limit or restrict the hazards to public health and safety and the safety of property presented by a launch vehicle or reentry vehicle while in flight by initiating and accomplishing a controlled ending to vehicle flight. A flight safety system may be destructive resulting in intentional break up of a vehicle or nondestructive, such as engine thrust termination enabling vehicle landing or safe abort capability.

flight safety system safing analysis—identifies the expected point in time for which safing of the flight safety system may occur or the point in flight where it is no longer required.

flight termination action—the transmission of thrust termination and/or destruct commands to an in-flight launch vehicle and/or payload.

flight termination system—all components onboard a launch vehicle that provide the ability to terminate a launch vehicle's flight in a controlled manner; the flight termination system consists of all command terminate systems, inadvertent separation destruct systems, and other systems or components that are onboard a launch vehicle used to terminate flight.

fragmentation—the act or process of breaking up.

fully mission-capable—a material condition of any piece of military equipment or system, indicating that it can perform all of its missions.

gate analysis—establishes the portion of a flight safety limit, a gate, through which a normally performing launch vehicle's instantaneous impact point will be allowed to proceed, enabling determination of whether the launch vehicle's flight is in compliance with general public risk criteria.

general public—all persons who are not in the launch-essential personnel or neighboring operations personnel categories; for a specific launch, the general public includes visitors, media, and other non-operations personnel at the launch site, as well as persons located outside the boundaries of the launch site that are not associated with the specified launch.

green number/critical time—the minimum thrusting time during which a launch vehicle can move from a state or condition of nominal flight to a state or condition where the launch vehicle's inert and explosive debris endangers a protected area. See also *data loss flight time analysis* and *minimum time to endanger*.

ground-initiated command destruct—the process in which a sequence of commands are issued from a ground station or center that, when executed by the flight system, causes the launch vehicle to be destroyed.

hybrid solution—a Range User provided subset of the TM RTS or SAS with the intention of connecting/utilizing a portion of the Launch and Test Range System (LTRS).

impact point—a point on the surface of the Earth where vehicle debris contacts the ground/surface; this point may be an actual/real point or estimated/projected point based on predictive analysis; see also *instantaneous impact point*.

inert debris—material vehicle fragments that are deficient in active properties.

instantaneous impact point—an impact point, following thrust termination of a launch vehicle, calculated in the absence of atmospheric drag effects.

laser—any device that can produce or amplify optical radiation primarily by the process of controlled stimulated emission; a laser may emit electromagnetic radiation from the ultraviolet portion of the spectrum through the infrared portion; an acronym for "light amplification by stimulated emission of radiation."

launch abort—the termination of a launch sequence in an unplanned manner or the failure of the launch vehicle to liftoff for reasons not immediately known.

launch base—refers to Cape Canaveral Space Force Station (Florida) and Vandenberg Space Force Base (California).

launch commit criteria—see *launch safety launch commit criteria*.

launch countdown—see *countdown*.

launch-essential personnel—the minimum number of persons necessary to successfully and safely complete a hazardous or launch operation and whose absence would jeopardize the completion of the operation; this designation also includes people required to perform emergency actions according to authorized directives, people whose prescence is necessary to perform their assigned duties (e.g., mission assurance personnel performing an observation in compliance with contractual obligations), persons specifically authorized by the Space Launch Delta Commanders to perform scheduled activities, and those personnel in training; the Range Users and Space Launch Delta Commanders jointly determine, with SLD/SE concurrence, the number of launch-essential personnel allowed within safety clearance zones or hazardous launch areas.

launch hold—a temporary delay in the countdown, test, or practice sequence for any reason. Typically a short period of time when launch is not permitted for reasons such as to avoid a conjunction on launch, safely accommodate temporary intrusion into a flight hazard area, pause for weather constraints, or troubleshoot systems. A launch hold can occur within a launch window, can delay the start of a launch window, or terminate a launch window early. See also *launch wait*.

launch mishap—a mishap occurring during launch vehicle operations, including upper stages. This includes payloads that do not obtain the intended orbit, re-contact of the payload with the upper stage/ launch vehicle, or collisions before completion of the initial drift orbit, and flight safety system failures.

launch mission risk—the risk associated with a launch mission.

launch operator—FAA term for any individual or organization that conducts any launch activity under an FAA launch license; see also *Range User*.

launch pad—a concrete or other hard surface area on which a missile launcher is positioned.

launch point—see *launch site*.

launch safety—requirements, processes and procedures designed to protect the public, launch base personnel (government and contractor), and range infrastructure from the hazards associated with launch operations. Launch Safety is a function performed by the SLD/SE organization at SSC ranges and includes: Systems Safety, Pad Safety, Flight Analysis, and support to Flight Operations.

launch safety launch commit criteria—hazardous or safety critical parameters, including, but not limited to, those associated with the launch vehicle, payload, ground support equipment, flight safety system, hazardous area clearance requirements, and meteorological conditions that must be within defined limits to ensure that public, launch area, and launch complex safety can be maintained during a launch operation.

launch safety program—a comprehensive safety program for launch vehicles and related operations and facilities starting with program introduction at a range. It addresses design, manufacturing, transportation, ground handling/processing, pre-launch testing, launch of space systems through orbital insertion, reentry, and/or impact of suborbital systems. This includes collision avoidance through orbital insertion, attainment of Earth escape velocity or reentry, and/or end of programmed range safety control. Also includes safety of activities connected with the deployment (debris minimization), and recovery (if required) of test vehicles or payloads that don't obtain initial orbit (either planned or unplanned). The launch safety program is a subset of the space safety program.

launch scrub—see *mission/launch scrub*.

launch site—the specific geographical location from which a launch takes place.

launch support team—the launch support team (LST) is a multi-disciplinary team of trained technical personnel pre-positioned to control the ILL and provide rapid response to emergencies and site recovery during missile or space launch operations. The initial reaction of the LST following a catastrophic anomaly is to verify the survivability of all personnel within the ILL and to direct evacuation of manned locations and the fallback area (if required). The LST Chief will then assist with emergency operations as necessary, and assume the role as the Emergency Operations Center on-scene safety representative.

launch wait—a specified time in a launch window during which a Range or Range User shall not initiate flight in order to prevent collisions with on-orbit mannable objects or other protected orbital objects; also see launch hold.

liftoff—any motion (physical separation (intentional or unintentional)) with respect to the launch platform. The term liftoff is most often used in the context of motion with respect to a fixed asset, such as a launch pad or sea platform. But for the purposes of Launch Safety, liftoff also includes separation from a carrier aircraft.

mandatory (in reference to instrumentation or capability)—a system that must be made operationally ready to support SLD/SE and be fully mission-capable before entering the plus count.

mandatory requirement—the minimum requirement that is essential to achieve program, mission, or test objectives.

manned on-orbit object—a spacecraft that is currently occupied or is expected to be occupied in the future.

minimum time to endanger—the minimum thrusting time during which a launch vehicle can move from a state or condition of nominal flight to a condition where the launch vehicle's inert and explosive debris endangers a protected area: see *data loss flight time analysis*.

minus count—the portion of a launch countdown beginning with the start of the countdown and ending at vehicle ignition. See also *plus count*.

mission—a task, together with the purpose, that clearly indicates the action to be taken and the reason therefore; in common usage, especially when applied to lower military units, a duty assigned to an individual or unit; a task; see *space launch mission*.

mission-capable—a material condition of a piece of equipment or system indicating that it can perform at least one and potentially all of its designated missions; mission-capable is further defined as the sum of fully mission-capable and partial mission-capable.

mission/launch scrub—the termination of a launch operation.

mission rules—a documented set of mission-specific rules developed by the Range User and the Space Launch Delta Commander or his/her designated representative which specify, in detail, those flight control requirements and procedures to be applied during the launch mission, in particular the application of flight control and flight termination criteria or special conditions for continuing the mission. In addition, the mission rules may define other more specific rules such as launch hold criteria and procedures, emergency procedures, and evacuation procedures of the flight control center during the countdown and in-flight.

neighboring operations personnel—those individuals, not associated with the specific/current operation or launch under consideration, who are required to perform safety, security, or operationally critical tasks at the launch base and who are aware of the launch mission risks and trained in mitigation tasks or accompanied by properly trained escorts.

nominal—being according to plan; satisfactory.

nominal trajectory—the expected or planned trajectory associated with the flight of a launch vehicle.

normal flight—a launch vehicle that remains within the nominal trajectory and potential three-sigma trajectory dispersions about the nominal trajectory.

on-orbit—an object is on-orbit after orbital insertion and when the object becomes orbital.

Pad Safety Plan—the detailed safety procedures used for missile operations; these plans are written by the range contractor and Pad Safety.

payload—the object(s) within a payload fairing carried and/or delivered by a launch vehicle to a desired location or orbit; a generic term that applies to all payloads that may be delivered to or from SSC ranges; includes but is not limited to satellites, other spacecraft, experimental packages, warheads, reentry vehicles, dummy loads, cargo, and any motors attached to them in the payload fairing.

payload fairing—provides protection to the payload during launch from the external environment and contamination.

plus count—the portion of a launch countdown starting at vehicle ignition. See also *minus count*.

powered flight—that portion of the flight of a vehicle when thrust occurs; it does not include the non-powered coast phases of flight.

probability of failure analysis—estimates launch vehicle failure probability, using accurate data, scientific principles, and a method that is statistically or probabilistically valid.

program manager—the single individual specifically designated, under the integrated weapon system management architecture, to be responsible for the life cycle management of a system or end-item. The program manager is vested with full authority, responsibility, and resources to execute and support an approved Space Force program.

range infrastructure—assets owned and/or operated by SSC ranges.

range safety program—a program implemented to ensure that launch and flight of launch vehicles and payloads presents no greater risk to the general public than that imposed by the over-flight of conventional aircraft; such a program also includes launch complex and launch area safety and protection of national resources.

range tracking system—a range tracking system (RTS) is composed of the hardware, software, and manpower required to transmit, receive, process, and display selected launch vehicle data. For launches utilizing ground-initiated command destruct systems, this data allows a MFCO to compare actual and nominal flight trajectories, verify performance in conjunction with vehicle telemetry, and identify violations of destruct criteria. With this information, the MFCO knows when a flight rule has been violated and flight termination actions are authorized.

Range User—any individual or organization that conducts or supports any activity on resources (land, sea or air) owned or controlled by SSC ranges; includes such organizations as the Department of Defense, United States government agencies, civilian launch operators, and foreign government agencies and other foreign entities that may use SSC range facilities and test equipment; conduct prelaunch and launch operations, including payloads to orbital insertion or impact; and/or require on-orbit or other related support.

risk assessment—an evaluation of possible loss in terms of hazard or deficiency severity and mishap probability of occurrence; an evaluation of the probability of an event and assessment of its expected consequence combined into a believable set of risk, regret, and reward probabilities resulting in an expected value for that outcome.

safe—to bring to a safe condition; a condition that avoids damage to equipment, personal injury, or death.

safety critical—an operation, process, system, or component that controls or monitors equipment, operations, systems, or components to ensure personnel, launch area, and public safety; may be hazardous or non-hazardous.

shall—mandatory action.

ship—a large, sea-going watercraft, usually with multiple decks. A ship usually has sufficient size to carry its own boats, such as lifeboats, dinghies, or runabouts.

should—recommended action.

Situational Awareness System (SAS)—consists of real-time telemetry receiving stations, communication path, ground processing and display systems for AFSS missions.

software—programs and data stored in either volatile or nonvolatile memory used by a computer. The term software includes both software and firmware.

Space Launch Delta Safety Office—the Space Launch Delta organization responsible for launch and range safety functions. Led by the Space Launch Delta Chief of Safety, this office ensures that the Launch and Range Safety Program meets range and Range User needs.

space launch mission—all launch base activities associated with a program from Program Introduction through orbital insertion plus one complete revolution.

space safety—a dynamic process designed to improve operational effectiveness by managing/preventing close calls, reducing mishaps, and supporting mission assurance throughout the life cycle of a space system.

SSC-procured space system and/or service—a space system consisting of an SSC-procured launch vehicle, launch service, SSC-owned spacecraft, and/or associated ground support equipment.

SSC ranges—all ranges owned and operated by Space Systems Command; currently this refers to the ranges owned and operated by SLD 30 (the Western Range at Vandenberg Space Force Base, California) and SLD 45 (the Eastern Range at Cape Canaveral Space Force Station, Florida).

straight-up time analysis—establishes the straight-up time as the latest time after liftoff, assuming a launch vehicle malfunctioned and flew in a vertical or near vertical direction above the launch point, at which activation of the launch vehicle's FSS or breakup of the launch vehicle would not cause hazardous inert or explosive debris, and it's associated overpressure and secondary fragmentation, to affect any populated or other protected area.

suborbital—being or involving less than one orbit of the Earth.

system safety—the application of engineering and management principles, criteria, and techniques to achieve acceptable risk within the constraints of operational effectiveness and suitability, time, and cost throughout all phases of the system life cycle.

terminal area safety limit analysis—for a suborbital launch that involves overflight or near overflight of a populated or otherwise protected area prior to the planned safe flight state, the FSA includes a hold-and-resume gate analysis for each populated or otherwise protected area, and accounts for the terminal area gate, "no destruct" markers/icons, and terminal area destruct lines.

threshold—1) a level, point, or value above which something is true or will take place and below which it is not or will not take place; 2) minimum acceptable value that, in user's judgement, is necessary to satisfy the need (*Capability Production Document for Launch and Test Range System*, 5 Oct 2016); 3) a minimum acceptable operational value below which the utility of the system becomes questionable.

thrust—to push or drive with force.

time delay analysis—establishes the mean elapsed time between the violation of a flight termination rule and the time when the FSS is capable of terminating flight for use in establishing flight safety limits, accounting for known relevant sources of delay that can affect flight termination implementation.

trajectory—the path a vehicle takes from liftoff through space.

validation—the process of evaluating a system or software component during, or at the end of, the development process to determine whether it satisfies specified requirements.

verification—confirms that a system element meets design-to or build-to specifications. Throughout the system's life cycle, design solutions at all levels of the physical architecture are verified through a cost-effective combination of analysis, examination, demonstration, and testing, all of which can be aided by modeling and simulation.

waterborne vessel—a watercraft bigger than a rowboat.