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AIR FORCE SPACE COMMAND

AIR FORCE SPACE COMMAND
MANUAL 91-710 VOLUME 7

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Safety

RANGE SAFETY USER REQUIREMENTS MANUAL VOLUME 7 – GLOSSARY OF REFERENCES, ABBREVIATIONS AND ACRONYMS, AND TERMS

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This manual implements Department of Defense Directive (DoDD) 3100.10, ***Space Policy***; DoDD 3200.11, ***Major Range and Test Facility Base***; DoDD 3230.3, ***DoD Support for Commercial Space Activities***; Air Force Policy Directive (AFPD) 91-1, ***Nuclear Weapons and Systems Surety***; AFPD 91-2, ***Safety Programs***; AFPD 63-12, ***Assurance of Occupational Safety, Suitability, and Effectiveness***; Air Force Instruction (AFI) 91-202, ***The US Air Force Mishap Prevention Program***, (AFSPC Sup 1); and the ***Memorandum of Agreement between the Department of the Air Force and the Federal Aviation Administration on Safety for Space Transportation and Range Activities***.

This volume incorporates information previously found throughout Chapters 1 through 7 of Eastern and Western Range 127-1. It includes the references used throughout volumes 1 through 6 of this publication as well as abbreviations and acronyms, and terms.

This volume applies to all Range Users conducting or supporting operations on the AFSPC ranges. Range Users include any individual or organization that conducts or supports any activity on resources (land, sea, or air) owned or controlled by AFSPC ranges. This includes such organizations as the Department of Defense (DoD), United States (US) government agencies, civilian launch operators, and foreign government agencies and other foreign entities that use AFSPC range facilities and test equipment; conduct pre-launch and launch operations, including payloads to orbital insertion or impact; and/or require on-orbit or other related support. Commercial users intending to provide launch services from one of the ranges shall have a license or license application in process from the Department of Transportation's Federal Aviation Administration (FAA) or have a DoD sponsorship and be accepted by the DoD to use the ER or WR. Foreign government organizations or other foreign entities shall be sponsored by an appropriate US government organization or be a customer of a Range User. This volume applies to the Air National Guard. It does not apply to the Air Force Reserve Command.

NOTE: Volume 1 includes a complete table of contents for all the volumes of AFSPCMAN 91-710. In addition, each volume contains its own table of contents.

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Abbreviations and Acronyms

θ—roll angle

ΔP/P—pressure perturbation divided by ambient pressure

°C—degrees Centigrade

1 ROPS—1st Range Operations Squadron

1 ROPS/DO—1st Range Operations Squadron, Operations, Mission Flight Control

2 ROPS—2nd Range Operations Squadron

2 ROPS/DO—2nd Range Operations Squadron, Operations

2 ROPS/DOUS—2nd Range Operations Squadron, 30th Range Scheduling

14 AF/CC—14th Air Force/Commander

30 AMS—30th Aeromedical-Dental Squadron

30 CEG/CEBD—30th Civil Engineering Group

30 CES—30th Civil Engineering Squadron

30 CES/CEF—30th Civil Engineer Group, Fire Protection

30 MDG/SGPB—30th Medical Group, Bioenvironmental Engineering

30 OG—30th Operations Group

30 SPTG—30th Support Group

30 SW/CC—30th Space Wing/Commander

30 SW/CEV—30th Space Wing/Environmental Management Flight

30 SW/SE—30th Space Wing/Chief of Safety

30 SW/SEG—30th Space Wing/Ground Safety

30 SW/SEGB—30th Space Wing/Pad Safety

30 SW/SEGW—30th Space Wing/Explosives Safety, Nuclear Surety

30 SW/SEO—30th Space Wing/Mission Flight Control

30 SW/SES—30th Space Wing/Systems Safety

30 SW/SEW—30th Space Wing/Weapons Safety

30 SW/SEY—30th Space Wing/Operations Support and Analysis

30 SW/SPTG—30th Space Wing/Support Group

30 SW/XP—30th Space Wing/ Programs and Plans

30 SW/VC—30th Space Wing/Vice Commander

30 WS—30th Weather Squadron

45 CEG/CEF—45th Civil Engineer Group, Fire Protection

45 MDG—45th Medical Group

45 MDG/SGPB—45th Medical Group, Bioenvironmental Engineering

45 OG—45th Operations Group

45 SPTG—45th Support Group

45 SW/CC—45th Space Wing/Commander

45 SW/SE—45th Space Wing/Chief of Safety

45 SW/SEG—45th Space Wing/Ground Safety

45 SW/SEO—45th Space Wing/Mission Flight Control and Analysis

45 SW/SEOE—45th Space Wing/ELV Operations and Analysis

45 SW/SEOO—45th Space Wing/Mission Flight Control

45 SW/SEOS—45th Space Wing/STS Operations Support and Analysis

45 SW/SES—45th Space Wing/Systems Safety

45 SW/SESE—45th Space Wing/Engineering Support

45 SW/SESL—45th Space Wing/Missile Systems Division, Large Vehicle Systems

45 WS—45th Weather Squadron

a/2c—aspect ratio

A—area

A-50—Aerozine 50

A_c—casualty area

A_p—area of population center

ACGIH—American Conference of Governmental Industrial Hygienists

ACI—American Concrete Institute

ACO—Aeronautical Control Officer

ADS—automatic destruct system

AF—Air Force

AFB—Air Force base

AFD—electromechanical arm and fire device

AFI—Air Force instruction

AFJMAN—Air Force joint manual

AFMAN—Air Force manual

AFOSH—Air Force Occupational Safety and Health

AFPD—Air Force Policy Directive

AFSPC—Air Force Space Command

AFSPCI—Air Force Space Command instruction

AFTO—Air Force technical order

AGE—aerospace ground equipment

AGL—above ground level

AHU—air handling unit

AIS—Abbreviated Injury Scale

AISC—American Institute of Steel Construction

ALARA—as low as reasonably achievable

ANSI—American National Standards Institute

Ap—area

API—American Petroleum Institute

ASD—allowable stress design

ASME—American Society of Mechanical Engineers

ASNT—American Society for Nondestructive Testing

ASTM—American Society for Testing and Materials

AVE—aerospace vehicle equipment

AWS—American Welding Society

BDA—blast danger area

BEA—boat exclusion area

BIT—built-in-test

BTHLD—below-the-hook-lifting-device

C—(1) Centigrade, (2) carbon

C/10—battery amp hour capacity divided by 10

C/20—battery amp hour capacity divided by 20

CAD—cartridge-activated device

CAL-OSHA—California Occupational Safety and Health Administration

cc—cubic centimeters

CCAFS—Cape Canaveral Air Force Station

CEP—circular error probability

C_d—drag coefficient

CDITS—command destruct independent test set

cDR—conceptual design review

CDR—critical design review

CDS—command destruct system

CFM—cubic feet per minute

CFR—Code of Federal Regulations

C_l —coefficient of lift

CMAA—Crane Manufacturers Association of America

COLA—collision avoidance

COPV—composite overwrapped pressure vessel

COTS—computer off-the-shelf

CPIA—Chemical Propulsion Information Agency

CPU—central processing unit

Cr—Chromium

CSP—certified space professional

CW—continuous wave

da/dt—crack growth rate (delta change in crack dimension "a" per delta time "t")

DAIP—Danger Area Information Plan

dB—decibel

dBA—decibels on the A scale

dBm—decibels relative of one milliwatt

DC—direct current

DDESB—Department of Defense Explosive Safety Board

DEP—Directed Energy Plan

DIN—Deutches Institut fur Normung

DoD—Department of Defense

DoDD—Department of Defense Directive

DOT—Department of Transportation

DSCC-VQ—Defense Supply Center Columbus, Office VQ

E—electric field

EAFD—electronic arm and fire device

EBW—exploding bridgewire

EBW-FU—exploding bridgewire firing unit

E_c—(1) expected average number of casualties; (2) casualty expectation; (3) instantaneous critical electric field;

ECP—Engineering Change Proposal

EEAP—emergency evacuation assembly point

EED—electroexplosive device

EEP—emergency evacuation plan

EFG—earth-centered rotating

EFI—exploding foil initiator

EGSE—electrical and electronic ground support equipment

EIA—Electronic Industries Alliance

ELS —equivalent level of safety

EMC—electromagnetic compatibility

EMI—electromagnetic interference

EOD—explosive ordnance disposal

EPA—Environmental Protection Agency

EPC—emergency power cutoff

ER—Eastern Range

ERP—emergency response plan

ESAD—electronic safe and arm device

ESD—electrostatic discharge

ESMC—Eastern Space and Missile Center

ETS—explosive transfer system

F—fuel

FAA —Federal Aviation Administration

FCA—flight caution area

FCDC—flexible confined detonation cord

FDEP—Florida Department of Environmental Protection

FEMA—Federal Emergency Management Agency

FEOP—facility emergency operating plan

FFDP—Final Flight Data Package

FFPA—final flight plan approval

FHA—flight hazard area

FM—(1) Factory Mutual; (2) frequency modulation

FMECA—failure modes, effects, and criticality analysis

FOC—fiber optic cable

FOCA—fiber optic cable assembly

FOT&E—follow-on test and evaluation

FPA—flight plan approval

FSA—fuel storage area

FSDP—Facility Safety Data Package

FSPO—Flight Safety Project Officer

FSPOC—Flight Safety Project Officer Console

FSS—flight safety system

ft—foot, feet

ft-lb—foot pounds force

FTR—flight termination receiver

FTS—flight termination system

FTSR—Flight Termination System Report

FTU—flight termination unit

F_u—ultimate tensile strength

F_y—tensile yield strength

G or g—standard acceleration of gravity

G^2/Hz—standard acceleration of gravity squared, divided by cycles per second; units of power spectral density

GH_2—gaseous hydrogen

GHe—gaseous helium

GHz—gigahertz

GIDEP—Government Industry Data Exchange Program

GN_2—gaseous nitrogen

GOP—Ground Operations Plan

GPS—global positioning system

Gr/EP—graphite epoxy

Grms—G root mean square

GSE—ground support equipment

GSS—ground support system

HDBK—handbook

HMI—Hoist Manufacturing Institute

HMS—Hazard Monitor System

HMX—cyclotetramethylenetetranitramine

HNS – —2,2,4,4,6,6 hexanitrostilbene

HOS—Hazardous Operations Support

HPWT—high performance work team

HST—Hoist Standards

HVDS—hypergolic vapor detection system

HWCI/CSCI—hardware configuration item/critical software configuration item

Hz—hertz

IBC—International Building Code

IEEE—Institute of Electrical and Electronics Engineers

IIP—instantaneous impact point

ILL—impact limit line

INSRP—Interagency Nuclear Safety Review Panel

IR—infrared

ISI—inservice inspection

ISP—Intended Support Plan

IV&V—independent verification and validation

JP—jet propellant

JTA—Joint Technical Architecture

K_c—critical stress intensity factor

KE—kinetic energy

kft—thousand feet

KDP—Kennedy Documented Procedure

KHB—Kennedy Handbook

K_I—stress intensity

K_{Ic}—plane-strain fracture toughness

K_{Ie}—surface-crack tension specimen fracture toughness

K_{ISCC}—stress-corrosion cracking threshold

K_{max}—maximum stress intensity factor

KSC—Kennedy Space Center

ksi ——kips (thousand pounds) per square inch

kV—kilovolts

kV/m—kilovolts/meter

LARA—launch risk analysis

lbf—foot pound

lb/ft²—pounds per square foot

LBB—leak before burst

LBS—Launch Base Support

LCOSPP—launch complex operations safety program plan

LD—Launch Director

LDCG—Launch Disaster Control Group (Eastern Range)

LEL—lower explosive limit

LFU—laser firing unit

LH_2—liquid hydrogen

LHe—liquid helium

LID—laser initiated device

LIO—laser initiated ordnance

LIOS—laser initiated ordnance system

LISN —Launch Information Support Network

LM—length of the model

LN_2 —liquid nitrogen

LO_2—liquid oxygen

LOCC—Launch Operations Control Center

LOX—liquid oxygen

LRFD—load and resistance factor design

LRR—Launch Readiness Review

LSP—launch support plan

LSRO—Lead Range Safety Office

LST ——Launch Support Team (Western Range)

LWT—Launch Weather Team

M—mach number

MAC—maximum allowable concentration

MAWP—maximum allowable working pressure

MC—Monitor and Control Officer

MEOP—maximum expected operating pressure

MFCO—Mission Flight Control Officer

MHE—material handling equipment

MHI—Material Handling Institute

MIL-HDBK—military handbook

Mil-Spec—military specification

MIL-STD—military standard

MMA—Mass Memory Assembly

MMH—monomethylhydrazine

Mn—manganese

MOP—maximum operating pressure

MPE—maximum predicted environment; maximum permissible exposure

MRTFB—Major Range and Test Facility Base

MSDS—material safety data sheet

MSFC—Marshal Space Flight Center

MSP—Mission Support Position

MSPSP—Missile System Prelaunch Safety Package

MST—mobile service tower

MTB—Materials Testing Branch

N—number

N_2H_4 —hydrazine

N_2O_4—nitrogen tetroxide

NACE—National Association of Corrosion Engineers

NASA—National Aeronautics and Space Administration

NASC—National Aeronautics and Space Council

NDE—non-destructive examination

NEC—National Electric Code

NEI—non-explosive initiator

NFPA—National Fire Prevention Association

NFS—Near Field Signature

Ni—nickel

NIOSH—National Institute of Occupational Safety and Health

NOTAM—Notice to Airmen

NOTU—Naval Ordnance Test Unit

NPT—National Pipe Thread

NRC—Nuclear Regulatory Commission

NRTL—Nationally Recognized Testing Laboratory

NSC—National Security Council

NTM—Notice to Mariners

O—oxidizer

O&M—operating and maintenance

O&SHA—operating and support hazard analysis

OCR—office of corollary responsibility

OCV—open circuit voltage

OD—operations directive

OI—operating instruction

OIS—Operational Information System

OPLAN—operations plan

OPR—office of primary responsibility

Ops Sup—operations supplement

ORD—Operations Requirement Document

OSC—Operations Safety Console

OSHA—Occupational Safety and Health Administration

OSM—Operations Safety Manager

OSP—operations safety plan

OST—Operations Safety Technician

OSTP—Office of Science Technology Policy

P—phosphorus

PA—public address

PAD—percussion-activated device

PAFB—Patrick Air Force Base

PD—Presidential Directive

PDB—Project Definition Book

PDR—preliminary design review

PE—professional engineer

PETN—pentaerythritoltetranitrate

PFDP—Preliminary Flight Data Package

PFPA—preliminary flight plan approval

PHA—preliminary hazard analysis

PHE—propellant handlers ensemble

P_I —probability of impact

PI—program introduction

PIND—particle impact noise detection

PL—public law

PLC—programmable logic controller

PM—program manager

POC—point of contact

PPE—personal protective equipment

PRD—program requirements document

psf—pounds per square foot

psi—pounds per square inch

psia—pounds per square inch absolute

psig—pounds per square inch gauge

PSM—process safety management

PTR—program trouble report; public traffic route

QA—quality assurance

QE—quadrant elevation

QML—Qualified Manufacturers List

QPL—Qualified Product List

R—(1) distance (feet); (2) load ratio

RADSAFCOM—Radiation Safety Committee (Western Range)

RAMP—Requirements Analysis Management Plan

RASCAD—Range Safety Control and Display

RCC—Range Commanders Council

RCO—Range Control Officer

RDX—cyclotrimethylenetrinitramine

RF—radio frequency

RIA—Robotic Industries Association

RID—review item discrepancy

RIPP—range instantaneous impact point/prediction

RLV—reusable launch vehicle

RMP—risk management plan

ROCC—Range Operations Control Center

RP—rocket propellant

RPIE—real property installed equipment

RPO—Radiation Protection Officer

RPV—remotely piloted vehicle

RSC—Radiation Safety Committee (Eastern Range)

RSD—Range Safety display

RSLCC—Range Safety launch commit criteria

RSOR—Range Safety Operations Requirements

RSWC—Range Safety wind check

RT—radiographic testing

RTP—real time processing

RTS—range tracking system

RV—reentry vehicle

S—sulfur

S&A—(1) safe and arm device; (2) status and alert

SAR—safety assessment report

SAS—Safety Analysis Summary

SCAPE—self-contained atmospheric protective ensemble

SCCB—Software Configuration Control Board

SCCSF—safety critical computer system function

SCN—specification change notice

SDD—software design description

SDP—software development plan

SEAOC—Structural Engineers Association of California

sec—second, seconds

Se-N—strain life

SEU—single event upset

SFP—single failure point

SHA—system hazard analysis

Si —silicon

SLC—space launch complex

SLE—service life extension

SMAB—solid rocket motor assembly building

SMARF—solid rocket motor assembly and readiness facility

S-N—stress life

SNT-TC—Society for Nondestructive Testing-Testing Certification

SPIF—spacecraft processing integration facility

SPOF—single point of failure

SPR—software problem report

SRMU—solid rocket motor upgrade

SS—statistical sample

SSHA—subsystem hazard analysis

SSPP—System Safety Program Plan

SSTO—signal strength telemetry output

STD—software test description

STD—Standard

STP—software test plan

STR—software test results

STS—Space Transportation system

SW—Space Wing

SW/XP—Space Wing/Programs and Plans

SWI—Space Wing instruction

T.O.—technical order

TBI—through bulkhead initiator

TDTS—telemetry data transmitting system

THC—toxic hazard corridor

THZ—toxic hazard zone

TIA—Telecommunications Industry Association

TIM—technical interchange meeting

TLV—threshold limit value

TMO—Transportation Management Office

TOPS—Transistorized Operational Phone System

UBC—Uniform Building Code

UDMH—unsymmetrical dimethylhydrazine

UDS—Universal Documentation System

UHF—ultra high frequency

UL—Underwriters Laboratories

UN—United Nations

US—United States

USAF—United States Air Force

USC—United States Code

UT—ultrasonic test

UV—ultraviolet

Vac—volts, alternating current

VAFB—Vandenberg Air Force Base

Vdc—volts, direct current

VEA—vessel exclusion area

VHF—very high frequency

VSWR—voltage standing wave ratio

W—weight

WR—Western Range

X ——vehicle station

Terms

"A" Basis Allowables—the minimum mechanical strength values guaranteed by the material producers or suppliers such that at least 99 percent of the material they produce or supply will meet or exceed the specified values with a 95 percent confidence level.

"B" Basis Allowables—the mechanical strength values specified by material producers and suppliers such that at least 90 percent of the materials they produce or supply will meet or exceed the specified values with a 95 percent confidence level.

acceptable hazard—determination of the acceptability of any hazard imposed by a launch vehicle/missile or orbital vehicle launched from or onto the range is solely the responsibility of the Space Wing Commander; the acceptability varies with operational requirements and/or national need and is determined by the Space Wing Commander on a case-by-case basis.

acceptable launch risk—the figure of 30×10^{-6} used by the AFSPC ranges as the acceptable launch level for each hazard without high management review and approval; the figure of 1×10^{-6} used by the AFSPC ranges as the acceptable risk level for an individual without high management review and approval.

acceptance tests—the required formal tests conducted on hardware to ascertain that the materials, manufacturing processes, and workmanship meet specifications and that the hardware is acceptable for its intended use; also the formal required tests conducted on software to ascertain that the code meets specifications and is acceptable for its intended use.

accepted risk—a residual hazard that has been accepted by the Program Manager and the Space Wing Commander.

accumulated risk—the combined collective risk to all individuals exposed to a particular hazard through all phases of an operation.

adequate source—a data source that enables the Mission Flight Control Officer to determine when a launch vehicle violates established in-flight safety criteria.

Aerozine 50—a 50-50 blend of hydrazine and unsymmetrical dimethylhydrazine.

aggregated risk—the accumulated risk due to all hazards associated with a flight; see also *accumulated risk*.

all-fire level—the minimum direct current or radio frequency energy that causes initiation of an electroexplosive initiator or exploding bridgewire initiator or laser initiated device with a reliability of 0.999 at a confidence level of 95 percent as determined by a Bruceton test. Recommended operating level is all-fire current, as determined by test, at ambient temperature plus 150 percent of the minimum all-fire current.

allowable load—(stress) – the maximum load (stress) that can be allowed in a material for a given operating environment to prevent rupture or collapse or detrimental deformation; allowable load (stress) in these cases are ultimate load (stress), buckling load (stress), or yield load (stress), respectively.

allowable strength—the ratio of material strength to the specified factor of safety.

antenna—a device capable of radiating or receiving radio frequency energy.

applied load—the static or dynamic load applied to a structure, excluding load amplification factors.

applied load—(stress) – the actual load (stress) imposed on the structure in the service environment.

arm/disarm device—an electrically or mechanically actuated switch that can make or break one or more ordnance firing circuits; operate in a manner similar to safe and arm devices except they do not physically interrupt the explosive train.

arming plug—a removable device that provides electrical continuity when inserted in a firing circuit.

automatic destruct system—a flight safety system that is installed on each propulsion system on the launch vehicle, including stages, upper stages, and payload systems; the automatic destruct system is installed during assembly; this system functions autonomously during flight to render the powered stage non-propulsive in the event of the inadvertent breakup of a vehicle.

ballistic coefficient—a design parameter indicating the relative magnitude of inertial and aerodynamic effects; used in performance analysis of objects moving through the atmosphere; also referred to as beta (β); it is given by the expression W/CdA, where W is the weight, Cd is the drag coefficient, and A is the reference area of the object in motion through the atmosphere.

battery capacity—(1) rated capacity: the capacity assigned by the battery manufacturer based on a set of specific conditions such as discharge temperature, discharge current, end of discharge voltage, and state of charge at start of discharge; (2) measured capacity: the capacity determined by the specific qualification tests, including any time the battery is under load during qualification; the end of discharge voltage is the minimum voltage that flight termination system components have been qualified to.

blast danger area ——a hazardous clear area; clearance prior to establishment of a major explosive hazard such as vehicle fuel/oxidizer load and pressurization; the area subject to fragment and direct overpressure resulting from the explosion of the booster/payload.

boat exclusion area—an area that consists of the downrange hazard or caution areas; private surface vessels are prohibited in downrange hazard and caution areas. The flight safety analysis evaluates the risk to a boat in the downrange hazard or caution area by plotting the boat's position on a map and examining the corresponding risk contour. Downrange vessels supporting the operation may support in the caution area.

brittle fracture—(1) a type of failure mode in structural materials that usually occurs without prior plastic deformation and at extremely high speed, (2) a type of failure mode such that burst of the vessel is possible during cycling [normally this mode of failure is a concern when cycling to the maximum expected operating pressure (MEOP) or when the vessel is under sustained load at MEOP], and (3) a type of fracture that is characterized by a flat fracture surface with little or no shear lips (slant fracture surface) and at average stress levels below those of general yielding.

brittle materials—see *materials, brittle*.

Bruceton test method—a statistical method for determining the all-fire and no-fire characteristics of an electroexplosive device using a small sample size, but with high reliability.

burst factor—a multiplying factor applied to the MEOP to obtain the design burst pressure; synonymous with ultimate pressure factor.

casualty ——a serious injury or worse, including death, to a human.

casualty area—area about a hypothetical impact point of a fragment in which a defined injury to persons may occur.

Category A EED/ordnance—electroexplosive devices or ordnance that, by the expenditure of their own energy or because they initiate a chain of events, may cause serious injury or death to personnel or damage to property.

Category B EED/ordnance—electroexplosive devices or ordnance that, by the expenditure of their own energy or because they initiate a chain of events, will not cause serious injury or death to personnel or damage to property.

certified inspector—a person qualified and certified in nondestructive examination inspection techniques according to the American Society for Nondestructive Testing, recommended practices (SNT-TC-1A).

collective risk—the total combined risk to all individuals within a category (for example, launch-essential personnel, general public) exposed to a particular hazard during a specific period of time or event; unless otherwise noted, the mean number of casualties predicted (E_c) to result from a given hazard.

collision avoidance—the process of determining and implementing courses of action by the Satellite Control Authority to avoid on-orbit collisions.

command control system—the portion of a flight safety system that includes all components needed to send a flight termination control signal to an onboard vehicle flight termination system; a command control system starts with flight termination activation switches at the mission flight control console and ends at each command-transmitting antenna; it includes all intermediate equipment, linkages, and software and any auxiliary transmitter stations that ensure a command signal will reach the onboard vehicle flight termination system from liftoff until the launch vehicle achieves orbit or can no longer reach a populated or other protected area.

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.

command destruct system—a portion of a flight termination system that includes all components on board a launch vehicle that receive a flight termination control signal and achieve destruction of the launch vehicle; a command destruct system includes all receiving antennas, receiver decoders, explosive initiating and transmission devices, safe and arm devices and ordnance necessary to achieving destruction of the launch vehicle upon receipt of a destruct command; a command destruct system is one type of a command terminate system.

command system—the portion of the flight safety system consisting of the airborne flight termination system and the ground flight termination system command transmitter system that sends arm and terminate commands.

command terminate system—a portion of a flight termination system that includes all components on board a launch vehicle that receive a flight termination control signal and achieve termination of the flight of a launch vehicle; a command terminate system includes all receiving antennas, receiver decoders, explosive initiating and transmission devices, safe and arm devices and ordnance necessary to achieving destruction of the launch vehicle or other devices to stop propulsion or otherwise terminate flight upon receipt of a terminate command.

commercial user—a non-federal government organization that provides launch operations services.

compatibility—the ability of two or more materials or substances to come in contact without altering their structure or causing an unwanted reaction in terms such as permeability, flammability, ignition, combustion, functional or material degradation, contamination, toxicity, pressure, temperature, shock, oxidation, or corrosion.

composite material—the combinations of materials differing in composition or form on macro scale. The constituents retain their identities in the composite; normally, the constituents can be physically identified, and there is an interface between them.

CONDO 8—one model of radar produced by Furuno U.S.A., Inc. and located on the Eastern Range.

contamination—the introduction of impurities, undesirable material, suspect material, or material potentially out of specification that may render the system or equipment unusable for its intended purpose or in such a state that special measures need to be taken before the equipment or system can be restored to normal service.

control area clears—a hazardous clear area; clearance of defined areas to protect personnel from hazardous operations.

control authority ——a single commercial user on-site director and/or manager, a full time government tenant director and/or commander, or United States Air Force squadron/detachment commander responsible for the implementation of launch complex safety requirements.

conventional facility or structure—office buildings, libraries, auditoriums, warehouses, cafeterias, utility buildings, and other facilities whose structures are characterized by well established design precedents and loading conditions and whose function is non-hazardous.

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

crew rest—that period of time immediately prior to the beginning of duty as assigned; for

launch-essential personnel, it is mandatory that the rest period include the time necessary for meals, transportation, and 8 hours of uninterrupted rest prior to reporting for duty. In preparation for launch operations, rest periods start no earlier than 2 hours after the assigned personnel are released from an earlier launch or range operation. Only the Chief of Safety or Space Wing Commander has the authority to waive the safety rest period requirements for Mission Ready (Category A) personnel; see also *rest period*.

critical condition—the most severe environmental condition in terms of loads, pressures, and temperatures, or combination thereof imposed on structures, systems, subsystems, and components during service life.

critical facility/structure ——a hazardous facility or structure; a facility or structure used to store or process explosives, fuels, or other hazardous materials; a facility or structure used to process high value hardware; a facility or structure that contains or is used to process systems determined by Range Safety to be hazardous or critical; or a facility or structure determined by Range Safety to be critical.

critical flaw—a specific shape of flaw with sufficient size that unstable growth will occur under the specific operating load and environment.

critical hardware—any hazardous or safety critical equipment or system; non-hazardous DoD high value items such as spacecraft, missiles, or any unique item identified by DoD as critical; non-hazardous, high value hardware owned by Range Users other than the DoD may be identified as critical or non-critical by the Range User; see also *safety critical*.

critical hold scrub point— the time in the countdown when a hold would normally be expected to result in a scrubbed launch attempt.

critical load—a load consisting of critical hardware and/or any personnel.

critical stress intensity factor—the stress intensity factor at which an unstable fracture occurs.

crossrange—the distance measured along a line whose direction is either 90 degrees clockwise (right crossrange) or counter-clockwise (left crossrange) to the projection of a launch vehicle's planned nominal velocity vector azimuth onto a horizontal plane tangent to the ellipsoidal earth model at the launch vehicle's sub-vehicle point; the terms, *right crossrange* and *left crossrange*, may also be used to indicate direction.

crossrange direction—measured along the Y axis of the X, Y, Z coordinate system. Left crossrange is measured in the direction of the negative Y axis and right crossrange is measured in the direction of the positive Y axis.

cryogen—a super cold liquid such as liquid nitrogen or oxygen.

crystal salts—the formation of salt oxidation by the cathode/electrolyte process in batteries; the resulting salt can inhibit the electrochemical process, be a corrosive to the metal plates, and affect the salt solubility that, in turn, affects the passivation film.

damage tolerance—a measure of the ability of structures to retain load carrying capability after exposure to sudden loads (for example, ballistic impact).

Danger Area Information Plan—an Eastern Range document prepared by Operations Safety specifying roadblocks and the fallback area associated with hazardous areas for each launch complex during launch operations.

decibel ——a unit of relative power; the decibel ratio between power levels, P1 and P2, is defined by the relation dB = 10 log (P1/P2).

dedicated—serving a single function, such as a power source serving a single load.

design burst pressure—the calculated pressure (the analytical value that was calculated using an acceptable industry and/or government practice to determine its design pressure) that a component must withstand without rupture and/or burst to demonstrate its design adequacy in a qualification test; during qualification testing, the actual burst pressure for a tested component must demonstrate that the design burst pressure is less than the actual burst pressure; safety factors are based on design burst pressure, not actual burst pressure of a particular component.

design load—see *applied load*.

design safety factor—a factor used to account for uncertainties in material properties and analysis procedures; often called *design factor of safety* or simply *safety factor*.

destabilizing pressure—a pressure that produces comprehensive stresses in a pressurized structure or pressure component.

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 and 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 flight.

detent—a releasable element used to restrain a part before or after its motion; detents are common arming mechanisms; safe and arm device safing pins use a spring-loaded detent to secure the pin in the device.

detonating cord—a flexible fabric tube containing a filler of high explosive material intended to be initiated by an electroexplosive device; often used in destruct and separation functions.

detonation—an exothermic chemical reaction that propagates with such rapidity that the rate of advance of the reaction zone into the unreacted material exceeds the velocity of sound: (1) the rate of advance of the reaction zone is termed *detonation velocity*; (2) when this rate of advance attains such a value that it will continue without diminution through the unreacted material, it is termed the *stable detonation velocity*; (3) when the detonation velocity is equal to or greater than the stable detonation velocity of the explosive, the reaction is termed a *high-order detonation*; (4) when it is lower, the reaction is termed a *low-order detonation*.

detonator—an explosive device (usually an electroexplosive device) that is the first device in an explosive train and is designed to transform an input (usually electrical) into an explosive reaction.

detrimental deformation—includes all structural deformations, deflections, or displacements that prevent any portion of the structure from performing its intended function or that reduces the probability of successful completion of the mission.

development test—a test to provide design information that may be used to check the validity of analytic technique and assumed design parameters, to uncover unexpected system response characteristics, to evaluate design changes, to determine interface compatibility, to prove qualification and acceptance procedures and techniques, or to establish accept and reject criteria.

downrange—the distance measured along a line whose direction is parallel to the projection of a launch vehicle's planned nominal velocity vector azimuth into a horizontal plane tangent to the ellipsoidal earth

model at the launch vehicle sub-vehicle point; may also be used to indicate direction.

downrange direction—measured in the direction of the positive X axis of the X, Y, Z coordinate system.

drag impact points—debris impact points corrected for atmospheric drag.

ductile behavior—for the purpose of this publication, materials exhibiting ductile behavior are those that exhibit a minimum ultimate strain of 20 percent elongation prior to failure.

ductile failure—see *failure, ductile*.

ductile fracture—a type of failure mode in structural materials generally preceded by large amounts of plastic deformation and in which the fracture surface is inclined to the direction of the applied stress.

ductile materials—see *materials, ductile*.

ductility—the ability of a material to be plastically deformed without fracturing in tension or compression, respectively; two commonly used indices of ductility are the *ultimate* elongation and the reduction of cross-sectional area; the usual dividing line between ductility and brittleness is 5 percent elongation (See ***Metallurgy for Engineers*, *Mechanics of Materials*, and *Mechanical Engineering and Design*** in References.).

dudding—the process of permanently degrading an electroexplosive initiator to a state where it cannot perform its designed function.

duty time ——the time personnel are at work from the time they arrive at their duty location until the end of the duty tour; duty time begins on first arriving at the base or office for transportation to later launch support positions.

dwell time—(1) the period during which a launch vehicle impact point is over a populated or other protected area; (2) the period during which an object is subjected to a test condition.

Eastern and Western Range 127-1—Eastern and Western Range 127-1, Range Safety Requirements refers to the previous Range Safety requirements directive that controlled range and Range User activities at the Eastern and Western Ranges.

Eastern Range—part of the National Launch Range facilities, operated by the 45th Space Wing, part of Air Force Space Command, and located at Patrick Air Force Base, Florida; the range includes the operational launch and base support facilities located at Cape Canaveral Air Force Station, Florida, radar tracking sites and ground stations located in the eastern Caribbean as well as the Jonathan-Dickson Missile Tracking Annex (Jupiter, Florida) and Argentia, Newfoundland sites.

electrical component—a component such as a switch, fuse, resistor, wire, capacitor, or diode in an electrical system.

Environmental Health—on the Western Range, the Range User is responsible for performing the EH tasks described in this document for contractor operations; on the Eastern Range, the responsible agency is 45 MG/SGPB and a range contractor.

equivalent level of safety—an approximately equal level of safety; may involve a change to the level of expected risk that is not statistically or mathematically significant as determined by qualitative or quantitative risk analysis; equivalent level of safety replaces the former “meets intent” certification process.

errant launch vehicle—(1) a launch vehicle that, during flight, violates established flight safety criteria

and/or operates erratically in a manner inconsistent with its intended flight performance; (2) continued flight of an errant launch vehicle may grossly deviate from planned flight, with the possibility of increasing public risk to unacceptable limits; (3) a launch vehicle that has violated safety criteria (a destruct line) and cannot be destroyed.

expendable launch vehicle—a launch vehicle designed for single flight use.

explosion proof apparatus ——an enclosure that will withstand an internal explosion of gases or vapors and prevent those gases or vapors from igniting the flammable atmosphere surrounding the enclosure, and whose external temperature will not ignite the surrounding flammable atmosphere.

explosive quantity distance site plan—a formal plan for explosives facilities and areas required in accordance with AFMAN 91-201 and DoD6055.9-STD, detailing explosives quantity operating and storage limits and restrictions and resultant distance clearance requirements.

explosive warhead launch approval—the mandatory prior written approval given by Space Wing Commanders to Range Users who launch vehicles carrying explosive warheads.

explosives—all ammunition, demolition material, solid rocket motors, liquid propellants, pyrotechnics, and ordnance as defined in AFMAN 91-201 and DoD-STD 6055.9.

explosives facility—any facility that contains explosives or is quantity distance sited or licensed to contain explosives.

F minus Time —the time in normal work days prior to the scheduled launch day.

facility operator—government organization or contractor responsible for maintaining and/or controlling use of a facility.

factor of safety—the ratio of the yield or ultimate strength of the structure to the applied load; see factor of safety (ultimate) and factor of safety (yield).

factor of safety (ultimate)—the ratio of the ultimate stress to the maximum calculated stress based on limit loads; Ultimate Factor of Safety = Ultimate Strength/Limit Load Stress.

factor of safety (yield)—the ratio of the yield stress to the maximum calculated stress based on limit loads. Yield Factor of Safety = Yield Strength/Limit Load Stress.

fail-safe—a design feature in which a system reacts to a failure by switching to or maintaining a safe operating mode that may include system shut down.

failure—the inability of a system or system component to perform a required function within specified limits.

failure, ductile—materials exhibiting a ductile failure mode are those that (1) have ductile behavior under the environmental and operating conditions; i.e., ultimate strain of 20 percent elongation or greater, and appropriate notch toughness, and (2) provide warning of an incoming failure via visually detectable (by eye and without magnification aids) deformation of structural components; see also *ductile behavior*.

family performance data—the results of launch vehicle component and system tests and previous flight that represent similar characteristics for a launch vehicle component or system; the data is continuously updated as additional samples of a given component or system are tested or flown; family performance data is used as a baseline for comparison to the results of subsequent tests and flights of the given component or system.

fatigue—the progressive localized permanent structural change that occurs in a material subjected to constant or variable amplitude loads at stresses having a maximum value less than the ultimate strength of the material.

fatigue life—the number of cycles of stress or strain of a specified character that a given material sustains before failure of a specified nature occurs.

fault ——the manifestation of an error in software that may cause a failure.

fault tolerance—the built-in ability of a system to provide continued correct operation in the presence of a specified number of faults or failures.

final flight plan approval ——the approval for a specific mission based on a detailed analysis of the proposed launch trajectory, impact locations for nominally jettisoned stages, and the ability to establish flight control criteria.

Fire^{+}—the command to initiate destruct energy to EBW used in a typical high voltage firing unit.

Fire^{0}— the command to remove inhibit used in a typical high voltage firing unit.

firing circuit—the current path between the power source and the initiating device.

firmware—computer programs and data loaded in a class of memory that cannot be dynamically modified by the computer during processing; for Systems Safety purposes, firmware is to be treated as software.

fittings—pressure components of a pressurized system initialized to connect lines, other pressure components, and/or pressure vessels within the system.

flaw—an imperfection or unintentional discontinuity that is detectable by nondestructive examination.

flight azimuth ——the instantaneous angular direction of the flight trajectory of a launch vehicle measured in degrees from true North.

flight caution area—a hazardous launch area; the controlled surface area and airspace outside the flight hazard area (FHA) where individual risk from a launch vehicle malfunction during the early phase of flight exceeds 1×10^{-6}; when activated, only personnel essential to the launch operation (launch-essential) with adequate breathing protection are permitted in this area; see also *flight hazard area and launch-essential personnel*.

flight hazard area—a hazardous launch area; the controlled surface area and airspace about the launch pad and flight azimuth where individual risk from a malfunction during the early phase of flight exceeds 1×10^{-5}; because the risk of serious injury or death from blast overpressure or debris is so significant, only launch-essential personnel in approved blast-hardened structures with adequate breathing protection are permitted in this area during launch.

flight plan approval —an approval process that results from a written application by the Range User; a two-phase approach stemming from a Preliminary Flight Plan Approval and a Final Flight Plan Approval.

flight safety plan — (1) a plan that identifies the flight safety roles to be performed by the Range User's flight safety personnel; the flight safety rules, limits, and criteria identified by a Range User's flight safety analysis; (2) and the specific flight safety requirements to be implemented for launch.

flight safety system—the system consisting of the airborne and ground flight termination systems,

airborne and ground tracking system, and the airborne and ground telemetry data transmission systems.

flight termination action—the transmission of thrust termination and/or destruct commands to a launched 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, or other systems or components that are onboard a launch vehicle and used to terminate flight.

foreign government agency or company—a Range User entity who is not a US citizen, not a US company, or not a foreign-registered company with a majority holding by a US company or citizen.

fracture, brittle—for the purpose of this document, those materials that exhibit a failure mode outside of ductile failure.

fracture control—the application of design philosophy, analysis method, manufacturing technology, quality assurance, and operating procedures to prevent premature structural failure due to the propagation of cracks or crack-like flaws during fabrication, testing, transportation and handling, and service.

fracture mechanics—an engineering concept used to predict flaw growth of materials and structures containing cracks or crack-like flaws; an essential part of a fracture control plan to prevent structure failure due to flaw propagation.

fracture toughness—a generic term for measures of resistance to extension of a crack.

function—any electronic commands, such as arm, destruct, safe, and test, issued by the Mission Flight Control Officer and transmitted to the airborne elements of a flight termination system.

fuse—a system used to initiate an explosive train.

gate ——the portion of a flight safety limit boundary through which a launch vehicle's tracking icon may pass without flight termination.

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 who are not associated with the specified launch; see also *launch-essential personnel* and *neighboring operations personnel*.

handling structures—structures such as beams, plates, channels, angles, and rods assembled with bolts, pins, and/or welds; includes lifting, supporting and manipulating equipment such as lifting beams, support stands, spin tables, rotating devices, and fixed and portable launch support frames.

hangfire—a condition that exists when the ignition signal is known to have been sent and reached an initiator but ignition of the propulsion system is not achieved.

hardware (computer)— physical equipment used in processing.

hazard, hazardous—equipment, system, operation, or condition with an existing or potential condition that may result in a mishap.

hazard analysis—the analysis of systems to determine potential hazards and recommended actions to eliminate or control the hazards.

hazard area ——an area where known products can cause harm to the on- and off-base public.

hazard proof ——a method of making electrical equipment safe for use in hazardous locations; these methods include explosion proofing, intrinsically safe, purged, pressurized, and non-incendive and must be rated for the degree of hazard present.

hazard severity—the categorization of severity based on potential consequences and probabilities.

hazardous clear areas—safety clearance zones for ground processing that are defined in the Operations Safety Plans for each operating facility; include Blast Danger Area, Control Area Clears, and Toxic Hazard Corridor/Zone.

hazardous facility or structure—a facility or structure used to store, handle, or process hazardous materials or systems and/or perform hazardous operations.

hazardous launch area clearance—required clearances; concurrence from the Chief of Safety must be obtained for all personnel required or requesting to be in a hazardous launch area during a launch operation; launch-essential personnel may be permitted within the impact limit lines and the FCA, but only within the FHA if located in approved blast-hardened structures with adequate breathing apparatus; neighboring operations personnel located at required work areas and non-essential personnel may be permitted inside the impact limit lines with Space Wing Commander approval.

hazardous launch areas—safety clearance zones during launch operations with defined mishap probabilities, including the flight caution area, flight hazard area, vessel/boat exclusion area, and impact limit lines.

hazardous leak before burst—a pressure vessel that exhibits a leak before burst failure mode and contains a hazardous material.

hazardous materials—liquids, gases, or solids that may be toxic, reactive, or flammable or that may cause oxygen deficiency either by themselves or in combination with other materials.

hazardous operations—those operations classified as hazardous according to the following criteria: (1) consideration of the potential or kinetic energy involved; (2) changes such as pressure, temperature, and oxygen content in ambient environmental conditions; (3) presence of hazardous materials; for example, operations involving equipment or systems with potential for a release of energy or hazardous material that can result in a mishap.

Hazardous Operations Support—a Western Range contractor responsible for specific security operations.

hazardous pressure systems—the systems used to store and transfer hazardous fluids such as cryogens, flammables, combustibles, hypergols; systems with operating pressures that exceed 250 psig; systems with stored energy levels exceeding 14,240 ft lb; systems that are identified by Range Safety as safety critical; see also *safety critical*.

hazardous procedure—a designation for a particular type of Range User procedure; a document containing specific steps in sequential order used to safely process hazardous materials or conduct hazardous operations; hazardous procedures have specific content requirements delineated in Volume 6, Attachment 2 and require Range Safety approval.

head winds—winds blowing from the reference launch azimuth.

high voltage exploding bridgewire—an initiator in which the bridgewire is designed to be exploded (disintegrated) by a high energy electrical discharge that causes the explosive charge to be initiated.

hoist angle—an angle at which the load line is pulled during hoisting.

hold—a temporary delay in the countdown, test, or practice sequence for any reason.

holdfire—an interruption of the ignition circuit of a launch vehicle.

hot flow—a flow of live commodity in a newly assembled system to normally passivate system walls and components and to remove residual non-active contaminants or flushing fluid; the hot flow is not intended for leak checks because of the potential hazards due to leaks.

Hydraset—the trade name for a closed circuit hydraulically operated instrument installed between a crane hook and load that allows precise control of lifting operations and provides an indication of applied load; precision load positioning device.

hydraulic—operated by water or any other liquid under pressure; includes all hazardous fluids as well as typical hydraulic fluids that are normally petroleum-based.

hydrogen embrittlement—a mechanical-environmental failure process that results from the initial presence or absorption of excessive amounts of hydrogen in metals, usually in combination with residual or applied tensile stresses.

hygroscopic—absorbs moisture from the air.

hypergolic—a propellant that ignites spontaneously upon contact, such as certain rocket fuels and oxidizers.

igniter—a device containing a specifically arranged charge of ready burning composition, usually black powder, used to amplify the initiation of a primer.

imminent danger—any condition, operation, or situation that occurs on the range where a danger exists that could reasonably be expected to cause death or serious physical harm, immediately or before the imminence of such danger can be eliminated through control procedures; these situations also include health hazards where it is reasonably expected that exposure to a toxic substance or other hazard will occur that will cause harm to such a degree as to shorten life or cause a substantial reduction in physical or mental efficiency even though the resulting harm may not manifest itself immediately.

impact dispersion area —an area surrounding an impact point that accounts for uncertainties in factors influencing the final impact of a debris piece; the extent and configuration of the area is based on the launch vehicle and/or payload dispersion.

impact limit line—a hazardous launch area; the boundary within which trajectory constraints and flight termination systems are used to contain an errant launch vehicle and vehicle debris. Launch essential and neighboring operations personnel are permitted within the impact limit lines. With Space Wing Commander approval, non-essential personnel may be permitted within this area; however, the collective risk will not exceed acceptable standards for the general public; see also *general public, launch-essential personnel, neighboring operations personnel, non-essential personnel, public*.

inadvertent separation destruct system —an automatic destruct system that uses mechanical means to trigger the destruction of a launch vehicle stage; see *automatic destruct system*.

independent—not capable of being influenced by other systems.

indication—the response or evidence from the application of a nondestructive examination including visual inspection.

individual risk—the risk that any single person will suffer a consequence; unless otherwise noted, individual risk is expressed as the probability that any individual will become a casualty from a given hazard (E_c expected casualties) at a specific location and event.

in-family—a launch vehicle component or system test result indicating that the component or system's performance conforms to the family performance data that was established by previous test results.

inhibit—an independent and verifiable mechanical and/or electrical device that prevents a hazardous event from occurring; device has direct control and is not the monitor of such a device.

initial crack size—a crack dimension determined by nondestructive examination methods or proof test logic.

initial flaw—a flaw in a structural material before the application of load and/or environment.

initiator—includes low voltage electroexplosive devices and high voltage exploding bridgewire devices.

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

interrupter—a mechanical barrier in a fuse that prevents transmission of an explosive effect to some elements beyond the interrupter.

intrinsically safe—incapable of producing sufficient energy to ignite an explosive atmosphere and two fault tolerant against failure with single fault tolerance against its most hazardous failure at 1.5 times the maximum voltage or energy.

ionizing radiation—gamma and X-rays, alpha and beta particles and neutrons.

jettisoned body—vehicle components separated at planned event times; examples of components include stages, fairings, thrust termination ports, solid rocket motors, and associated hardware.

L minus Time—the absolute time prior to the scheduled launch time. L minus Time may be measured in seconds, minutes, hours, and days and includes all scheduled countdown holds; L minus Time will always be equal or greater than T minus Time.

Laser Class (1-4) ——the laser categories assigned in ANSI Z136.1; Class 4 being the most dangerous.

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

launch area—the facility or location where launch vehicles and payloads are processed and launched; includes any supporting sites; also known as *launch head*. The launch area extends to the over-water areas used during submarine-launched ballistic missile intercontinental ballistic missile tests and launches where the range controls the launch for countdown.

launch area safety—safety requirements involving risks limited to personnel and/or property located on the launch base; involves multiple commercial users, government tenants, or United State Air Force squadron commanders; this is the on-base component of public safety.

launch azimuth ——the horizontal angular direction initially taken by a launch vehicle at liftoff; measured clockwise in degrees from true North.

launch complex—a defined area that supports launch vehicle or payload operations or storage; includes launch pads and/or associated facilities.

launch complex safety—safety requirements involving risk that is limited to personnel and/or property located within the well defined confines of a launch complex, facility, or group of facilities; for example, within the fence line; involves risk only to those personnel and/or property under the control of the control authority for the launch complex, facility, or group of facilities.

launch danger zone—a combination of the sea surface area and air space measured from the launch point and extending downrange along the intended flight azimuth; the size of the launch danger zone is based on the potential hazard to ships and aircraft.

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, persons specifically authorized by the Space Wing Commanders to perform scheduled activities, and those personnel in training; the Range Users and Space Wing Commanders jointly determine, with Range Safety concurrence, the number of launch-essential personnel allowed within safety clearance zones or hazardous launch areas; see also *safety clearance zones, hazardous launch area*, and *launch-essential personnel*.

launch head—see *launch area*.

launch processing —all preflight preparation of a launch vehicle at a launch site, including buildup of the launch vehicle, integration of the payload, and fueling.

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

launch vehicle—a vehicle that carries and/or delivers a payload to a desired location; a generic term that applies to all vehicles that may be launched from the Eastern and Western ranges, including but not limited to airplanes; all types of space launch vehicles; manned space vehicles; missiles; rockets and their stages; probes, aerostats, and balloons; drones; remotely piloted vehicles; projectiles, torpedoes, and air-dropped bodies.

launch window—a period of time during which the flight of a launch vehicle may be initiated.

lead angle—an angle in which the load line is pulled during hoisting. Commonly used to refer to an angle in line with the grooves in the drum or sheaves.

lead time—the time between the beginning of a process or project and the appearance of its results.

leak before burst ——a failure mode in which it can be shown that any initial flaw will grow through the wall of a pressure vessel or pressurized structure and cause leakage rather than brittle fracture/burst before leak; normally determined at or below maximum expected operating pressure.

limit load—the calculated maximum loads to which a structure may be subjected during its lifetime of service; i.e., the applied load (static or dynamic) multiplied by applicable load amplification factors; see *limit load (design load)*.

limit load (design load)—the maximum load or combination of loads a part or structure is expected to experience at any time during its intended operation and expected environment; limit load = (load factor) x (rated load).

lines—the tubular pressure components of a pressurized system provided as a means for transferring fluids between components of the system.

liquid electrolyte—an electrolyte that stays in liquid form throughout an electrical reaction.

load factor—a factor that accounts for unavoidable deviations of the actual load from the nominal value. Examples of load factors include wind, shock, seismic, and dynamic load factors.

loading spectrum—a representation of the accumulated loadings anticipated for the structure under all expected operating environments; significant transportation and handling loads are included.

low cycle fatigue (strain-life fatigue) curve—a curve normally plotted in terms of cyclic strain amplitude versus the number of cycles to failure.

low noise amplifier ——amplifier used in the initial stages of electronic signal processing to minimize the introduction of noise.

major leak or spill—a leak or spill that could affect regions beyond the immediate work area, constitute a hazard to personnel, or involve damage to facilities or equipment; a major leak or spill is more than one gallon.

major mishap—an event or incident that has the potential of resulting in a fatality or major damage such as the loss of a processing facility, launch complex, launch vehicle, or payload.

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

margin of safety—the percentage by which the allowable load (stress) exceeds the limit load (stress) for specific design conditions; Yield Margin of Safety = [(Yield Strength/Limit Load Stress) x (Yield Factor of Safety)] - 1; Ultimate Margin of Safety = [(Ultimate Strength/Limit Load Strength) x (Ultimate Factor of Safety)] – 1.

margin of safety (1) (primary definition)—the percentage by which the allowable strength (yield or ultimate) of a member exceeds the applied load; see ***Roark's Formulas for Stress and Strain*** in References.

$$MS = (1 - \frac{Applied\_Load}{Allowable\_Strength})x100$$

margin of safety (2) (alternate definition)—the additional allowable strength of the structure over that allowable strength (yield or ultimate) required to carry the limit loads; see ***Mechanical Engineering Design*** in References.

$$MS = \frac{Allowable\_Strength}{Applied\_Load} - 1$$

material handling equipment ——equipment used to handle lift, support, or manipulate critical or non-critical hardware; includes, but is not limited to, cranes, hoists, sling assemblies, Hydrasets and load cells, handling structures, and personnel work platforms.

material toughness—the ability of a material to carry load or deform plastically in the presence of a notch. it can be described as the critical stress-intensity factor under conditions of plane stress (K_c) or plane strain (K_{1c}).

materials, brittle—those materials that undergo little plastic tensile or shearing deformation before rupture; see also *ductile behavior*.

materials, ductile—those materials that undergo considerable plastic tensile or shearing deformation before rupture, and have sufficient notch toughness to fracture in a ductile manner at operating

temperatures and under impact loading; see *ductile behavior* in this volume and ***Mechanics of Materials*** in References.

maximum allowable working pressure—the maximum pressure at which a component or system can continuously operate based on allowable stress values and functional capabilities.

maximum expected operating pressure—the highest pressure that a pressure vessel, pressurized structure, or pressure component is expected to experience during its service life and retain its functionality, in association with its applicable operating environments; synonymous with maximum operating pressure or maximum design pressure; includes the effect of temperature, pressure transients and oscillations, vehicle quasi-steady, and dynamic accelerations and relief valve operating variability.

meets intent certification—no longer used; see *equivalent level of safety*

Megger—high voltage resistance meter.

minor leak or spill—a leak or spill that does not affect regions beyond the immediate work area, constitute a hazard to personnel, or involve damage to facilities or equipment; a minor leak or spill is less than one gallon.

misfire ——a condition that exists when it is known that the ignition signal has been sent but did not reach an initiator and ignition of the propulsion system was not achieved.

mishap—an unplanned event or series of events resulting in death, injury, occupational illness, or damage to or loss of equipment or property or damage to the environment.

mismating—the improper installation and/or connection of connectors.

Missile System Prelaunch Safety Package—a data package demonstrating compliance with the system safety requirements of Volume 3, serves as a baseline for safety related information on the system throughout its life cycle.

Mission Flight Control Officer—the officer responsible for initiating range "Command" destruct for an errant boost, solid rocket motor/solid rocket booster, and/or upper stage vehicle.

Mission Rules—a document of agreements between the Range User and Space Wing Commander or a designator specifying, in detail, those requirements and procedures not covered by this document.

mission scrub—the termination of a launch operation.

mission support (Category B) personnel ——all support personnel engaged in direct support of mission ready personnel.

mission ready (Category A) personnel—see AFSPCI 10-1202, ***Crew Force Management***, for the types of mission ready personnel and the specific positions designated as mission ready.

monitor circuit—a circuit used to verify the status of a system, such as an inhibit directly; control circuits can be monitored but they can not serve as a monitor circuit.

nationally recognized testing laboratory—see *testing laboratory (nationally recognized)*.

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; see also *operationally critical task*.

no-fire level—the maximum direct current or radio frequency energy at which an electroexplosive initiator shall not fire with a reliability of 0.999 at a confidence level of 95 percent as determined by a Bruceton test and shall be capable of subsequent firing within the requirements of performance specifications.

noise margin—the margin between the worst case noise level and logic circuitry threshold.

nominal vehicle ——a properly performing launch vehicle whose instantaneous impact point does not deviate from the intended instantaneous impact point locus.

noncompliance—a noticeable or marked departure from requirements, standards, or procedures; includes equivalent level of safety determinations (formerly meets intent certifications), and waivers.

non-credible—determined to be so improbable that such an occurrence is virtually impossible, based on careful analysis of the potential hazard and mode of prevention such as permanent physical barriers and/or enforced separation distance; cost and convenience are not valid rationales for a determination of non-credible.

non-critical hardware—equipment and systems used for standard industry use; equipment or systems that are determined not to be hazardous, of high value, or safety critical.

nondestructive examination—any testing, inspection, or evaluation that does not cause harm to or impair the usefulness of an object satisfies the meaning of the word *nondestructive*; in common usage, nondestructive testing often refers just to test methods and test equipment with only a general reference to materials and/or parts; (1) *nondestructive inspection* relates to specific written requirements, procedures, personnel, standards, and controls for the testing of a particular material of a specific part; (2) *nondestructive evaluation* is concerned with the decision making process, the determination of the meaning of the results, of the final acceptance or rejection of the material of part, and may be qualitative or quantitative.

non-essential personnel—those persons not deemed launch-essential or neighboring operations personnel; includes the general public, visitors, the media, and any persons who can be excluded from Safety Clearance Zones with no effect on the operation or parallel operations.

non-hazardous procedure—a designation for a particular type of Range User procedure; a document containing general or specific steps in sequential order to ensure proper execution of a non-hazardous, non-safety critical process; non-hazardous procedures do not have specific content requirements and do not require Range Safety approval.

non-incendive—will not ignite group of gases or vapors for which it is rated. Similar to *intrinsically safe*, but does not include failure tolerance ratings; used in rating electrical products for Class I, Division 2 locations only.

non-operating environment—an environment that a launch vehicle component experiences before flight and when not otherwise being subjected to acceptance tests; non-operating environments include, but need not be limited to, storage, transportation, and installation.

normal vehicle ——a properly performing launch vehicle whose instantaneous impact point does not deviate more than +/- three standard deviations from the intended instantaneous impact point locus.

Office of the Chief of Safety—the range office headed by the Chief of Safety; this office ensures that the Range Safety Program meets range and Range User needs and does not impose undue or overly restrictive requirements on a program.

operating environment—an environment that a launch vehicle component will experience during acceptance testing, launch countdown, and flight; includes shock, vibration, thermal cycle, acceleration, humidity, and thermal vacuum.

operating life—(1) the period of time beginning with activation of the component or installation of the component on a launch vehicle, whichever is earlier, for which the component is capable of satisfying all its performance specifications through the end of flight; (2) the period of time in which prime power is applied to electrical or electronic components without maintenance or rework.

operation ——a scheduled activity where range assets are necessary to support Range User requirements for a specified time period.

operation hazard—a hazard derived from an unsafe condition created by a system or operating environment or by an unsafe act.

operationally critical task—a task that is essential for continuing critical and subsequent launch processing operations.

operations safety plan—the detailed safety procedures used for missile operations; these plans are written by the Range Contractor and Operations Safety; includes Explosives Safety Plans, Facility Safety Plans, and Safety Operational Plans.

optical coverage ratio—the percentage of the surface area of the cable core insulation covered by a shield.

orbital insertion—the sequence of events in time and space, whereby a vehicle achieves a combination of velocity and position such that without additional thrust, at least one orbit of the earth will be made.

ordnance—all ammunition, demolition material, solid rocket motors, liquid propellants, pyrotechnics, and explosives as defined in AFMAN 91-201 and DoD 6055.9-STD.

ordnance component—a component such as a squib, LOS, detonator, initiator, igniter, or linear shape charge in an ordnance system.

ordnance operation—any operation consisting of shipping, receiving, transportation, handling, test, checkout, installation and mating, electrical connection, render safe, removal and demating, disposal, and launch of ordnance.

out-of-family—a component or system test or flight result where the component or system's performance does not conform to the family performance data that was established by previous test or flight results and is an indication of a potential problem with the component or system requiring further investigation and corrective action.

passive component —a flight termination system component that does not contain active electronic piece parts such as microcircuits, transistors, and diodes; includes, but need not be limited to, radio frequency antennas, radio frequency couplers, and cables and rechargeable batteries, such as nickel cadmium batteries.

passive device—a device that permits signals to transient through it without modifying the signals.

payload—the object(s) within a payload fairing carried 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 the Eastern or Western Ranges; includes but is not limited to satellites, other spacecraft, experimental packages, bomb loads, warheads, reentry vehicles, dummy loads, cargo, and any motors attached to them in the payload

fairing.

performance specification—a statement prescribing the particulars of how a component or part is expected to perform in relation to the system that contains the component or part; includes specific values for range of operation, input, output, or other parameters that define the component's or part's expected performance.

personnel work platforms—platforms used to provide personnel access to flight hardware at off-pad processing facilities as well as at the launch pad; they may be removable, extendible, or hinged.

plus count—the portion of a launch operation beginning with vehicle ignition and concluding with Range Safety's release of all instrumentation.

pneumatic—operated by air or other gases under pressure.

populated area —an outdoor location, structure, or cluster of structures that may be occupied by people; sections of roadways and waterways that are frequented by automobile and boat traffic are populated areas; agricultural lands, if routinely occupied by field workers, are also populated areas.

positive control—the continuous capability to ensure acceptable risk to the public is not exceeded throughout each phase of powered flight or until orbital insertion.

power source—(1) a battery; (2) the point of direct current (DC) to alternating current (AC) conversion for capacitor charged systems.

preliminary flight plan approval —the approval given when Range Safety accepts flight limits and conditions, flight trajectories, booster configurations, flight termination system configurations, and other flight characteristics.

pressure component—a component such as lines, fittings, valves, regulators, and transducers in a pressurized system; normally pressure vessels or pressurized structures are excluded, because of the potential energy contained; they generally require additional analysis, test and inspection.

pressure system—any system above 0 psig that is classified as follows: low pressure, 0 to 500 psi; medium pressure, 501 to 3000 psi; high pressure, 3001 to 10,000 psi; ultra-high pressure, above 10,000 psi. The degree of hazard of a pressure system is proportional to the amount of energy stored, not the amount of pressure it contains; therefore, low pressure, high volume systems can be as hazardous to personnel as high pressure systems; see *pressurized system*.

pressure vessel—a container that stores pressurized fluids and (1) contains stored energy of 14,240 foot pounds (19,130 joules) or greater based on adiabatic expansion of a perfect gas; or (2) contains gas or liquid which will create a mishap (accident) if released; or (3) will experience a MEOP greater than 100 psia; excluded are special equipment including batteries, cryostats (or dewars), heat pipes, and sealed containers; or (4) per the ASME definition, summarized briefly; pressure containers that are integral pumps or compressors, hot water heaters and boilers, vessels pressurized in excess of 15 psi (regardless of size), and vessels with a cross-sectional dimension greater than 6 inches (regardless of length of the vessel or pressure).

pressurized structure—a structure designed to carry both internal pressure and vehicle structural loads; the main propellant tank of a launch vehicle is a typical example.

pressurized system—a system that consists of pressure vessels or pressurized structures, or both, and other pressure components such as lines, fittings, valves, and bellows that are exposed to and structurally

designed largely by the acting pressure; electrical or other control devices required for system operation are not included; a pressurized system is often called a *pressure system;* see *pressure system*.

primacord—an explosive detonating cord.

primary battery—a battery that is not intended to be recharged and that is disposed of in controlled conditions when the battery has delivered all of its electrical energy.

program—the coordinated group of tasks associated with the concept, design, manufacture, preparation, checkout, and launch of a launch vehicle and/or payload to or from, or otherwise supported by the Eastern or Western ranges and the associated ground support equipment and facilities.

Project Firing Tables—a document that contains mission unique flight constants and launch window schedule.

proof factor—a multiplying factor applied to the limit load or maximum expected operating environment to obtain proof load or proof pressure for use in the acceptance testing.

proof pressure—(1) the product of maximum expected operating environment and a proof factor accounting for the difference in material properties between test and service environment (such as temperature); used to give evidence of satisfactory workmanship and material quality; for example, demonstrating that the component and/or system will not deform, leak or fail; (2) may be used to establish maximum initial flaw sizes for safe-life demonstration.

propellant servicing—any dynamic operation involving propellants such as transfer, sampling, pressurization, decontamination, connecting and disconnecting lines, and venting.

propellant storage tank—any container of propellants greater than one gallon. Application of the requirements of this document to storage tanks will normally vary with the size of the tank and associated hazards. Containers less than one gallon will also be subject to operational controls, as appropriate, as would any container of flammable liquid.

protected area ——a populated or other area not controlled by a launch operator that is not evacuated during flight and that must, in order to protect the public, be protected from the effects of nominal and non-nominal launch vehicle flight.

public—all persons not in the launch essential personnel category; see also *neighboring operations personnel* and *general public*.

public safety—safety involving risks to the general public of the US or foreign countries and/or their property (both on- and off-base); includes the safety of people and property that are not involved in supporting a launch along with those that may be within the boundary of a launch site.

qualification tests—the required tests used to demonstrate that the design, manufacturing, and assembly have resulted in hardware conforming to specification requirements.

quantization—an error introduced into a measurement when analog data is converted to discrete digital levels; since these digital levels are discrete values, values that fall in between are assigned to the closest pre-assigned level.

radians—a unit of angular measure.

radiation source—materials, equipment, or devices that generate or are capable of generating ionizing radiation including naturally occurring radioactive materials, by-product, source materials, special nuclear materials, fission products, materials containing induced or deposited radioactivity, nuclear

reactors, radiographic and fluoroscopic equipment, particle generators and accelerators, radio frequency generators such as certain klystrons and magnetrons that produce X-rays, and high voltage devices that produce X-rays.

radio frequency silence—turning off or powering down of radio frequency emitters within a particular area; local radio frequency silence is normally required when the launch vehicle and mobile transmitters are operating in the area.

radioactive equipment or device—equipment or devices that generate, or are capable of generating, ionizing radiation including radiographic and fluoroscopic equipment, particle generators and accelerators, radio frequency generators such as certain klystrons and magnetrons that produce X-rays, and high voltage devices that produce X-rays.

radioactive material—materials that generate, or are capable of generating, ionizing radiation including naturally occurring radioactive materials, by-product materials, source materials, special nuclear materials, fission products, materials containing induced or deposited radioactivity, and nuclear reactors.

radioactive material launch approval—approval granted by Range Safety to Range Users intending to launch radioactive materials.

range or ranges—in this publication, *range* or *ranges* refers to the Eastern Range at Cape Canaveral Air Force Station, Kennedy Space Center, and Patrick Air Force Base, and the Western Range at Vandenberg Air Force Base.

Range Commander—see *Space Wing Commander*.

range contractor—the Launch Base Support and Range Technical Services contractors and all subcontracted agencies required for operation and maintenance of the ER and WR; for the purposes of this publication, the term *range contractor* also refers to National Aeronautical and Space Administration and Kennedy Space Center contractors as applicable.

range instantaneous impact point/prediction—the range from the launch point to the instantaneous impact point along the earth ellipsoid.

Range Safety critical systems—includes all airborne and ground subsystems of the flight safety system.

Range 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

Range Safety Program—a program implemented to ensure that launch and flight of launch vehicles and payloads present 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 Safety Representative ——a government employee or member of the US Air Force assigned to the 30/45 Space Wing/Wing Safety office or a contractor employee designated and authorized by 30/45 Space Wing/Wing Safety to act on behalf of the organization.

range tracking system—includes the tracking aid and/or GPS and associated subsystems as defined in RCC 324.

Range Users—any individual or organization that conducts or supports any activity on resources (land, sea, or air) owned or controlled by AFSPC 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 use AFSPC 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.

rated load—the maximum static load or force that can be imposed on the part or structure at any time during its intended operation and expected environment.

rated load (static or dynamic)—the load to which the structure was designed to withstand.

Recertification File—a file that contains data showing that a specific piece of material handling equipment/material ground support equipment meets the periodic test and inspection requirements of this document.

redundant —a situation in which two or more independent means exist to perform a function.

referee fluid—a compatible fluid, other than that used during normal system operations, that is used for test purposes because it is safer due to characteristics such as less (or non-) explosive, flammable, or toxic and/or easier to detect.

remote control—control of a system from a remote and safe location.

render safe—an action to bring to a safe condition.

required (in reference to instrumentation or capability)—a system that must be made operationally ready to support Range Safety.

residual strength—the maximum value of nominal stress, neglecting the area of the crack, that a cracked body is capable of sustaining.

residual stress—the stress that remains in a structure after processing, fabrication, assembly, testing, or operation; for example, welding induced residual stress.

resource safety—the protection of facilities, support equipment, or other property from damage due to mishaps; also known as *resource protection*.

rest period —the period of time immediately prior to the beginning of the duty period; for launch-essential personnel, it is mandatory that the rest period include the time necessary for meals, transportation, and 8 hours of uninterrupted rest prior to reporting for duty. Rest periods in preparation for launch operations will start no earlier than 2 hours after the assigned personnel are released from an earlier launch or range operations. Only the Chief of Safety or Space Wing Commander has the authority to waive the safety rest period requirements for Mission Ready (Category A) personnel; see also *crew rest*.

risk—a measure that takes into consideration both the probability of occurrence and the consequence of a hazard to a population or installation. Risk is measured in the same units as the consequence such as number of injuries, fatalities, or dollar loss. For Range Safety, risk is expressed as casualty expectation or shown in a risk profile; see also *collective risk* and *individual risk*.

risk analysis—a study of potential risk.

risk study —the analysis of systems (hardware, software, firmware, and procedures) to determine potential hazards that could result in loss of personnel, injury to personnel, loss or degradation of the

system or loss of life or injury to the public; see also *hazard analysis*.

risk-cost benefit concept—the concept used to determine the granting of waivers or equivalent level of safety determinations (formerly meets intent certifications) to Range Safety requirements by comparing the risks, benefits, and costs of the mission. If the application of a Range Safety requirement results in a significant reduction of risk at an acceptable level of cost, it may be judged by Range Safety to be sufficient to impose a requirement; however, if the benefit is insignificant and/or the cost is high, the requirement may be waived or an equivalent level of safety determined, all with consideration to public safety. The risk of concern may be the mean or average risk, or it may be a risk corresponding to a high consequence at a low probability (a catastrophic risk); the assurance of a very low probability may be required for a very high consequence even if a high cost may be entailed.

safe & arm device—a device that provides mechanical interruption (safe) or alignment (arm) of the explosive train and electrical interruption (safe) or continuity (arm) of the firing circuit.

safe/arm plug—normally two plugs; the arm plug is inserted in the firing circuit to provide continuity; the arm plug is removed and the safe plug inserted that shorts the electroexplosive device leads and provides static bleed capability, although some circuits have this protection inherent in their design; shorting plugs and connectors that are placed on electroexplosive leads after disconnecting the cable are not the same as safing plugs, although they may perform similar functions.

safety clearance zones—the restricted areas designated for day-to-day prelaunch processing and launch operations to protect the public, launch area, and launch complex personnel; these zones are established for each launch vehicle and payload at specific processing facilities, including launch complexes; includes hazard clearance area and hazardous launch area.

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.

safety critical computer system function—a computer function containing operations that, if not performed, if performed out of sequence, or if performed incorrectly, may result in improper or lack of required control functions that may directly or indirectly cause a hazard to exist.

safety critical facility—a hazardous facility or a facility that is used to store, handle, or process systems determined to be safety critical by Range Safety.

safety critical procedure—a designation for a particular type of Range User procedure; a document containing steps in sequential order used to reliably process safety critical systems or conduct safety critical operations; non-hazardous safety critical procedures have no specific content requirements but do require Range Safety review and approval.

safety factor—for pressure systems, the ratio of design burst pressure over the maximum allowable working pressure or as design pressure; for mechanical systems, it can also be expressed as the ratio of tensile or yield strength over the maximum allowable stress of the material.

safety holds—the holdfire capability, emergency voice procedures, or light indication system of each launch system used to prevent launches in the event of loss of Range Safety critical systems or violations of mandatory Range Safety launch commit criteria.

safety kernel—an independent computer program that monitors the state of a system to determine when potentially hazardous system states occur or when transitions to potentially hazardous system states may

occur; the safety kernel is designed to prevent the system from entering a hazardous state and/or return it to a known safe state.

safety margins (destruct)—margins used to avoid overly restrictive flight termination limits; normally based on launch vehicle three-sigma performance characteristics.

safety operating plan—a type of operations safety plan; standard operating procedure.

safing procedures—the process of taking a system that is in a hazardous configuration and performing those tasks necessary to bring it to a condition which is safe for further activities; safing procedures are part of the backout procedures for a system.

secondary battery—a battery that may be restored after discharge by the passage of electrical current in the opposite direction to that of discharge.

self-test capability—the capability of a microprocessor to employ a self-test to detect errors and to output the results via telemetry.

separate power source—a dedicated and independent source of power.

serious mishap—an event or incident that has the potential of resulting in injury to personnel and damage to high value property or that might require the use of contingency or emergency procedures.

service life—(1) the total life expectancy of a part or structure; service life starts with the manufacture of the structure and continues through all acceptance testing, handling, storage, transportation, operations, refurbishment, retesting, and retirement; (2) the period of time between the initial lot acceptance testing and the subsequent age surveillance testing for ordnance.

shall—mandatory action.

shelf life, battery—the specified period of time a battery may be stored in a logistical environment and still perform to all required specifications when placed in service.

shelf life, explosive—the period of time between explosive loading and end use.

shield (RF)— a metallic barrier that completely encloses a device for the purpose of preventing or reducing induced energy.

should—recommended action.

sigma—standard deviation.

single failure point—in general, a component that, if failed, could lead to the overall failure of the system (for example, in a mechanical system, a component such as a lug, link, shackle, pin, bolt, rivet, or a weld that, if failed, could cause a system inability to support a load using load path analysis).

single failure point analysis—in general, an analysis to identify single failure points; for mechanical systems, a load path analysis; a stress analysis of the resultant system after the first load path failure (of a single failure point); twice the resultant dead weight shall be used in the analysis to account for the sudden redistribution of the load and an allowable stress of 90 percent of the ultimate material stress shall be used.

single flight azimuth—an operation or mission in which the flight azimuth remains fixed throughout the launch window.

single point ground—the one interconnection for a grounded circuit with other circuits.

single point of contact—the Range User’s one point of contact for range operations.

sling—a lifting assembly and associated hardware used between the load and the hoisting device hook.

soft goods—the nonmetal materials in a pressure system that are used to form a seal or seat for metal-to-metal contact or between other hard surfaces.

software design description—a representation of a software system created to facilitate analysis, planning, implementation, and decision-making; a blueprint or model of the software system; used as the primary medium for communicating software design information.

software single point of failure—a single instantiation of any software element or component that renders the system, including the operators, incapable of operating as intended; occurs when failure of one or more software entities prevents the system from operating as intended due to a single specific instance of a fatal operational condition.

solid electrolyte—an electrolyte that is absorbed in a gelatinous or semi-solid composition.

Space and Missile Systems Center—an Air Force organization that develops and acquires space launch vehicles, satellites, and range systems for the United States Air Force.

Space Launch Squadron—an Air Force Space Command unit that provides oversight of space launch operations at the Eastern and Western ranges.

space safety professional ——a safety professional who has been trained and formally certified to meet the criteria outlined in the Launch Complex Safety Training and Certification Program Document.

Space Wing Commander—in this document, the term *Space Wing Commander* refers exclusively to the commanders of the 30th Space Wing and the 45th Space Wing; the term *Range Commander* refers to the commander of the Eastern or Western Range in accordance with Department of Defense Directive 3200.11 and is the same individual as the Space Wing Commander; the terms *Range Commander* and *Spacelift Commander* refer to tasks or functions performed by the Space Wing Commander; see AFSPCI 10-1202, ***Crew Force Management***, for further information.

standing by—being at the scene and not on call.

static firing—testing of a propulsion system by securing it to a rigid structure and preventing powered flight.

storage life—for a flight termination system component, the period of time after manufacturing is complete until the component is activated or installed on a launch vehicle, whichever is earlier, during which the component may be subjected to storage environments and must remain capable of satisfying all its performance specifications.

stress-corrosion cracking—a mechanical-environmental induced failure process in which sustained tensile stress and chemical attack combine to initiate and propagate a crack or a crack-like flow in a metal part.

stress intensity factor—a parameter that characterizes the stress-strain behavior at the tip of a crack contained in a linear elastic, homogeneous, and isotropic body.

stress versus cycles—normally plotted in the form of a curve/diagram and is cyclic stress amplitude versus the number of cycles to failure.

structural component—a component such as a bolt, lug, hook, shackle, pin, rivet, or weld in a piece of material handling equipment.

structural sling—a rigid or semi-rigid fixture that is used between the load and hoisting device hook; such as spreader bars, equalizer bars, and lifting beams.

super high frequency ——3 GHz to 30 GHz.

support agency ——any agency acting in support of a primary Range User.

surface inspection—a nondestructive examination method, other than visual, used for detection of surface and near surface discontinuities.

system hazard—a hazard associated with a hardware system and that generally exists even when no operation is occurring; system hazards that may be found at a launch site include, but are not limited to, explosives and other ordnance, solid and liquid propellants, toxic and radioactive materials, asphyxiants, cryogens, and high pressure.

T minus Time —countdown clock time; T minus 0 is launch time; time prior to the scheduled launch time not including built-in holds in the countdown; normally measured in seconds, minutes, and hours.

T minus X—a time late in the minus count after which a holdfire switch will not be activated.

tail winds ——winds blowing toward the launch azimuth.

telemetry ——vehicle systems measurements made available to ground based users via S-band downlinks.

Telemetry Doppler Nominal Acceleration and Radar—a Kalman filter used for Range Safety tracking displays at the Western Range.

testing laboratory (nationally recognized)—laboratories such as Underwriters Laboratories, Inc., or Factory Mutual Engineering Corporation, that use nationally recognized testing standards and provide bench mark(s) to certified products as evidence of successful testing.

threshold limit value—time weighted average concentrations that must not be exceeded during any 8-hour work shift of a 40-hour work week.

threshold sensitivity—the minimum radio frequency input signal level at which a command receiver decoder meets all performance specifications.

to safe—to bring to a safe condition.

Torr—1 millimeter of Mercury pressure.

toxic hazard corridor—a hazardous clear area; clearance of a sector in which toxic material may reach predetermined concentration levels.

toxic hazard zone—a generic term that describes an area in which predicted concentration of propellant or toxic byproduct vapors or aerosols may exceed acceptable tier levels; predictions are based on an analysis of potential source strength, applicable exposure limit, and prevailing meteorological conditions; toxic hazard zones are plotted for potential, planned, and unplanned propellant releases, and launch operations.

transponder—the portion of the airborne range tracking system that receives and decodes interrogations and generates replies to the interrogations; the transponder permits the ground instrumentation radar to furnish significantly greater precision and accuracy data at much greater distances and prevents mistracking of powered vehicles due to interference of exhaust plumes or spent stages.

trilateration—the use of ranging data from three geographically suitable radar sites to produce high quality tracking data.

ultimate factor of safety—see *factor of safety, ultimate*.

ultimate load—the product of the limit load and the design ultimate load factor. It is the load that the structure must withstand without rupture or collapse in the expected operating environment.

ultimate strength—the maximum stress developed by the material before rupture, based on the original area, in tension, compression, or shear; see ***Modern Steels and Their Properties, Carbon and Alloy Steel Bars and Rods*** in References.

unexecutable code—any form of software instructions or data resident in computer memory that is neither executed as a program nor vectored to or read as data by a program.

uprange—the distance measured along a line that is 180 degrees to the downrange direction; the term *uprange* may also be used to indicate direction.

uprange direction ——measured in the direction of the negative X axis of the X, Y, Z coordinate system.

variable flight azimuth—an operation or mission in which the *flight azimuth* of the trajectory varies either continuously or step-wise (in discreet steps) throughout the launch window.

vehicle ——launch vehicle and/or payload.

vessel exclusion area—a combination of the sea surface area and airspace measured from the launch point and extending downrange along the intended flight azimuth; the size of the vehicle exclusion area is based on hazard containment or a combination of acceptable impact probability and personnel risk.

visible damage—for composite pressure vessels; anomalies that are visible to the naked eye under not less than 15 foot candles at a distance no greater that 24 inches and not less than a 30 degree angle; lighting up to 50 foot candles may be used for the detection of small anomalies.

volumetric inspection—a nondestructive testing method to determine the presence of discontinuities throughout the volume of a material.

waiver—a designation used when, through an error in the manufacturing process or for other reasons, a hardware noncompliance is discovered after hardware production, or an operational noncompliance is discovered after operations have begun at the Eastern or Western ranges.

Western Range—part of the National Launch Range facilities, operated by the 30th Space Wing, part of Air Force Space Command, and located at Vandenberg Air Force Base, California; the range includes the operational launch and base support facilities located at Vandenberg Air Force Base and those radar tracking sites and ground stations located on sites uprange and downrange along the Pacific Coast, including United States Navy facilities at Point Mugu.

wet stand time—(1) the time from activation and initial load pulse to the beginning of qualification operational environmental testing of a liquid electrolyte battery; (2) for the actual use of batteries, the wet stand time is from the time of activation and initial load test to end of use.

WP-S—a classification for a fitting(s) that is manufactured from seamless product by a seamless method of manufacturer (marked with class symbol, WP-S).

WP-WX—a classification for a fitting(s) that contains welds where all welds have been radiographed (marked with class symbol, WP-WX).

yield factor of safety—see *factor of safety, yield*.

yield point—see *yield strength*.

yield strength—the stress at which there is an appreciable increase in strain with no increase in stress; typically defined as the stress that will induce a specified permanent set (yield point, usually 0.2 percent strain offset); see ***Mechanics of Materials*** **and** ***Modern Steels and Their Properties, Carbon and Alloy Steel Bars and Rods*** in References.