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GLOSSARY AND DEFINITIONS
SPACE, MISSILE, AND NUCLEAR TERMINOLOGY

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MASTER

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FOREWORD

This Glossary of Missile and Space Terms and Abbreviations is the initial installment, for use in the Nuclear Propulsion Division, of recommended terminology and definitions in the space-missile area. It has been prepared to meet expressed needs for standardized communication, and to provide a common ground on which our positions in these areas may be based.

Recognizing the dynamic nature of terminology for the areas covered, it is obviously difficult at this stage to provide terms and definitions which will meet every need. In view of this situation it is the desire of the division to expand and amplify the Glossary. Users are requested to submit recommended changes, corrections, or additions, to the Documentation Dept. 752, of the Nuclear Propulsion Division.

I - DEFINITIONS

aftercooling - The process of cooling a nuclear reactor after it has been shut-down. Excess heat generated by continuing radioactive decay of fission products is carried away by pumping a coolant through the reactor.

afterheat - The heat produced by continuing radioactive decay of fission products in the reactor core after shutdown.

airframe - The assembled structural and aerodynamic components of an aircraft or missile which support its different systems and subsystems.

air scattering - Process of dispersing radioactive particles as they collide with molecules and atoms in the air.

ALOO - Albuquerque Operations Office of AEC. Provides technical direction of AEC work done by Los Alamos Scientific Laboratory on Rover project.

alpha emitter - A radioactive substance that emits alpha particles.

alpha particle - A positively charged particle emitted from the nucleus during radioactive decay. It consists of two neutrons and two protons, hence is identical to the nucleus of a helium atom. Range of alpha radiation is small in air.

ambient (adj.) - Values of existing conditions, such as pressure or temperature.

annealing - A process for relieving stresses or radioactivity in structure through application of heat and/or electrical current.

apogee - The highest point of a trajectory for an elliptical orbit. The term refers to that point in the orbit of any celestial body which is at the greatest distance from the center of the earth; apogee is opposed to perigee, which is the point in the orbit that is nearest the center of the earth. Notice that the apogee is a point, not a distance. See: maximum ordinate.

APOLLO (NASA) - Project APOLLO, intended to carry a crew of three men on a moon orbit, is to be launched by SATURN rockets, capable of flying around the moon and serving as a manned laboratory orbiting earth. Aerojet is one of 15 potential bidders for the systems contract for design, engineering, and fabrication, which will be initiated in FY '62. Aeronutronics (Ford) has 18-month "guide line" study and working model contract after completion of structural test.

arming - The process of changing a fuze or a warhead from a safe condition to a state of readiness for initiation.

arming signal - A radio signal for arming the warhead.

ARMS - Activities and Resources Management System. The features of PERT AND PEP systems (q.v.) are combined with financial, manpower, and other resource data, to establish this program planning system. See also NARMS.

assembly - A combination of parts or subassemblies that may be taken apart without destruction, and which has no application or use of its own, but is essential for the completeness of a more complex item with which it is combined.

ASTR - Aircraft Shield Test Reactor, a device developed for nuclear aircraft tests at Convair-Fort Worth. Reactor has flown in conventionally powered B-36 during two-year test period.

Astronautics - The art of science of designing, building, and operating space vehicles.

atmospheric braking - The action of atmospheric drag in decelerating a body that is approaching a planet; can be deliberately used, where sufficient atmosphere exists, to lose much of the vehicle velocity before landing.

atomic percentage - The percentage of atoms of one element in a mixture of two or more elements.

attenuation - Reducing radiation intensity by passing it through matter, absorption and scattering.

attitude - The in-flight position of a missile as described by giving the inclinations of its axes to some frame of reference. If not otherwise specified, this frame of reference is fixed to the earth.

attitude control system - The reaction system which insures that the re-entry body will be pointing in the proper direction at the time it re-enters the atmosphere. The term has also been used in documents on guidance and control to refer to the system that controls the attitude of the missile immediately after launch.

auto-igniting propellant - Any propellant that ignites at room temperature with adequately small time delay.

average core flux - Average value of neutron flux across the core of a reactor.

background effect - Interference from foreign or stray radioactivity.

backup item - (For R&D Programing Purposes) An additional item under development to perform the general functions of another item under development. The item may be secondary to an identified primary item or a parallel development to enhance the probability of success in performing the general function.

ballistic missile - Any missile which does not rely on aerodynamic surfaces for lift, and which utilizes reaction propulsion as a power source. Such a missile, normally guided by external or internal means during the first portion of its flight, follows a ballistic trajectory determined by gravitational and atmospheric drag forces after launch power is cut off, hence the term ballistic missile.

As a class, ballistic missiles range from simple devices, as in the case of a stone hurled or propelled by a sling shot, or a rifle bullet; to complex devices, as in the case of an intercontinental ballistic missile.

ballistic trajectory - The curved portion of a missile trajectory traced after the propulsive force is cut off and the body is acted upon only by gravity, aerodynamic drag, and wind.

bare core - A reactor core with reflector removed.

beta energy - The energy of a beta particle in electron volts.

beta particle - A high-speed particle emitted from the nucleus during radioactive decay. This radiation consists of electrons and positrons (positive or negatively charged). Emission of the negative particle entails the change of a neutron into a proton inside the nucleus. Emission of the positive particle entails the change of a proton into a neutron.

bimetal - A material or system composed of two different metals, i.e., molybdenum-plutonium.

black box - A deprecated term used loosely to refer to any sub-component that is equipped with "connects" and "disconnects" so that it can be readily inserted or removed from a specified place in a larger system - say, the complete missile, or some major subdivision of it - without benefit of knowledge of its detailed internal structure.

blockhouse - A building, usually heavily reinforced, that houses the electronic equipment and controls for preparation and firing of the missile, together with auxiliary apparatus.

boil-off - The vapor loss from liquid oxygen (or from any volatile liquid) as the temperature of the propellant mass rises.

BOLA - A concept for manned nuclear space vehicle wherein a long cable separates the manned capsule from the reactor. Need for heavy shielding is thus reduced.

booster engine impact area - The area, downrange and along the line of flight, where the booster engines will strike the surface of the earth after having been detached from the missile at staging.

burnout point - The point on the missile trajectory at which the fuel supply of a specified engine - booster, sustainer, or vernier - is exhausted or cut off.

burnout weight - Weight of the missile at the time the usable fuel supply is exhausted, but including any residual, unusable fuel.

burnup - Depletion of fuel in a reactor by fission, or the percentage of depletion.

buzz - An oscillating motion in ramjet aerodynamics induced by airflow instability. The resulting shock and pulsations can destroy the engine.

CANEL - Connecticut Aircraft Nuclear Engine Laboratory where Pratt & Whitney has been investigating materials for the indirect-cycle nuclear aircraft engine. Built 1955 at Middletown, Conn.

captive test - A test conducted while the missile is secured to a test stand. Primarily intended to verify proper operation of the propulsion and flight control subsystems under full thrust conditions. May also test the operation of any or all of the remaining airborne subsystems. Not necessarily a FLIGHT READINESS FIRING; which see.

capture - Acquisition of an additional particle by a nucleus.

Carnot efficiency - an idealized heat cycle (Carnot cycle) expressed as the ratio of work delivered to the heat received from the source.

cep - The radius of the circle within which half of the missiles are expected to fall. This concept is called "circular error, probable" and sometimes, "circle end point." Both terms are so poor that it is better to use "cep" as the name of the concept.

celestial guidance - The guidance of a missile or vehicle by reference to celestial bodies. (The missile is equipped with gyroscopes, telescopes, mechanically or electrically recorded navigational tables, computers, and other instruments and devices that sight stars, calculate position, and direct the missile. The SNARK, for example, is equipped with CELESTIAL GUIDANCE).

cermet - A fused combination of ceramic and metal. Used where high temperatures are encountered.

checkout - A test or procedure for determining whether a person or device is capable of performing a required operation or function. When used in connection with equipment, a checkout usually consists of the application of a series of operational and calibrational tests in a certain sequence, with the requirement that the response of the device to each of these tests be within a predetermined tolerance. For personnel, the term checkout is sometimes used in the sense of briefing or explanation to the person involved, rather than a test of that person's capabilities.

cladding - A bonded coating on nuclear fuel materials to protect from loss of fission products by corrosion or erosion.

collimation - The process of adjusting an instrument or device so that its reference axis is aligned in a desired direction within a predetermined tolerance.

collision, elastic - A collision between two particles in which no change occurs in the internal energy of the particles, or in the sum of their kinetic energies. Also referred to as a billiard-ball collision.

collision, inelastic - A collision between two particles in which changes occur both in the internal energy and in the sums of their kinetic energies.

command-destruct signal - A radio signal used to operate intentionally the destruction device carried in the missile.

concept - A broad overall expression of the mission to be performed, and how it may be accomplished.

console - Term applied to a grouping of controls, indicators, and similar electrical or mechanical equipment, which is used to monitor readiness of or control specific functions such as checkout, countdown, or launch operations. Consoles are usually designed around desk-like arrays as the working position for the operator.

control swing - The amount of control-rod movement, from start-up to operating point of a reactor, that is necessary to prevent reactor shutdown at high temperatures.

countdown - The step-by-step process leading to missile launching; it is performed in accordance with a predesignated time schedule and measured in terms of x-time (q.v.).

countermeasures - That part of military science which by the employment of devices or techniques has as its objective the impairment of the operational effectiveness of enemy activity. Electronic countermeasures refers to that major subdivision of the use of electronics which involves actions taken to reduce the effectiveness of enemy equipment or tactics employing or affected by electromagnetic radiation.

critical - Capable of sustaining a chain reaction.

criticality factor - In a reactor, the numerical value of the effective multiplication factor (K_e), denoting the degree to which the reactor has achieved a self-sustaining chain reaction.

critical mass - The amount of concentrated fissionable material that can just support a self-sustaining fission reaction.

critical reactor - The steady-state condition of a reactor in which the neutron fission process is self-sustaining.

critical temperature - The temperature at which the least resistant component of the reactor core begins to melt down with over heat or after heat.

cross section - The probability of occurrence of an interaction between a nucleus and an incident particle or photon. The cross-section quantity may be considered as the effective target area that the nucleus presents for the reaction. It is measured in area units expressed as barns ($1 \text{ barn} = 10^{-24} \text{ cm}^2$).

cryogenics - The subject of physical phenomena in the temperature range below -50°C (-58°F). More generally, cryogenics, or its synonym cryogeny, refers also to methods of producing very low temperatures.

cryogeny - A synonym for cryogenics (q.v.).

cryogenic temperature - Very low temperature range, below -50°C . Concerns temperatures in the range of liquefied gases.

curie - A unit of radioactivity defined as the amount of radioactivity which undergoes 3.7×10^{10} disintegrations per second.

cutoff - The shutting off of a liquid or solid propellant combustion process of a rocket engine, thereby causing a rapid drop toward zero thrust. In large rocket engines a significant impulse may occur during the delay from full thrust to zero thrust. Different from BURNOUT, which see.

daughter element - The decay product of a specific radioactive element that decays by other than gamma emission.

decay - Decrease of a radioactive substance because of nuclear emission of alpha or beta particles, positrons, or gamma rays.

depleted uranium - Uranium containing a lower percentage of the U^{235} isotope than is naturally found in mined uranium (0.07 per cent).

destruct - The deliberate action of detonating or otherwise destroying a missile or vehicle after it has been launched, but before it has completed its course, especially during test flights (DESTRUCTS are executed when the missile gets off its plotted course or functions in a way as to become a hazard).

destructor - An explosive or other device for destroying a missile or one of its components intentionally.

detonation - An extremely rapid reaction, in which an oxidizer and a fuel combine with large evolution of heat. A high-order detonation, or "true detonation," proceeds with very high speed, generally several thousand feet per second. A low-order detonation is a partial, or relatively slow, explosion, generally caused by accidental or inadequate initiation. The term detonation is not to be confused with deflagration, which may consume the same explosive materials, but at a rate usually of the order of inches per second. Nor should detonation be applied to rupture of rocket engines or other containers from the effects of gas pressure, even when produced rapidly by burning propellant.

diffusion - A high percentage of scattering of particles during passage through a substance.

digital computer - A computer in which quantities are represented numerically and which can be used to solve complex problems relating to the missile flight path.

dissociation - The process of ionizing a molecule of matter into two ions, one positively charged and one negatively charged.

effective neutron cycle time - The lifetime of an average neutron within a reactor from the time it is produced to the time it is fission-captured.

electrical kw-year - A unit for electrical power rating: one kilowatt of electrical energy produced continuously for one year.

electromagnetic radiation - Radiation resulting from fission or radioactive decay that is of wave form rather than particle form.

electron-positron pair - Pair production resulting from a gamma ray interacting with a charged field. The pair consists of two electrons - one with the normal negative charge, and the other with a positive charge.

electron volt (ev) - The energy needed to raise one electron through a potential difference of one volt. Nuclear energy is usually expressed in million electron volts (mev).

end item - A final combination of end products, component parts, and materials, that is ready for its intended use. Examples are a missile, a mobile guidance unit, a launcher.

exhaust-duct - A tunnel, passage tube, or opening through which exhaust gases may be expelled from an underground launcher.

fall-out - A deposit of radioactive material created by a nuclear explosion, which has settled out of the air or from contaminated water.

fast neutron - Usually a neutron of 100 kev or greater energy.

fast reactor - A reactor containing no moderator. Thus all fissions take place at energies on the order of 100 kev or greater.

fast reactor period - A reactor period in which the rate of power increase is large enough to make the control of the reactor extremely difficult.

fission products - Particles which result from a fissioned nucleus. The fissioned nucleus splits into two lesser nuclei that are usually radioactive and highly energetic.

fission wastes - The irradiated fuel elements removed from a reactor that must be contained and disposed of while they are still radioactively "hot."

fixed equipment - A deprecated term. See: installed equipment.

flight readiness firings (FRF) - Missile system tests of short duration conducted with the propulsion system operating while the missile is secured to the launcher. Such tests are performed to determine (to the extent possible) the readiness of the missile system and launch facilities prior to flight test. See CAPTIVE TEST and FLIGHT TEST.

flight test - Test of an aircraft or missile by actual flight or launch; they are usually heavily instrumented, and are planned to achieve specific test objectives and gain operational information on the vehicle.

flux - The number of radioactive particles per unit volume times their mean velocity.

flux, gamma - The total gamma energy emitted per square centimeter per second.

flux, neutron - The sum of the distances traveled by all the neutrons in one cubic centimeter in one second. Normally the figure must be energy qualified, e.g., thermal, intermediate, or fast neutron flux.

free-stream capture area - The cross-sectional area of a column of air injected by a ramjet engine.

fuze - A mechanism that initiates detonation of an explosive under predetermined conditions.

gamma energy - The energy of a gamma ray, ranging from 10^4 to 10^7 electron volts.

gamma radiation - Electromagnetic radiation of wave form emitted by a radio-active nucleus; similar to X rays, but of higher energy and shorter wave length.

gantry - A crane-type structure, with platforms on different levels, used to erect, assemble, and service large rockets or missiles. It may be placed directly over the launching site and rolled away before firing.

GE-ANPD - General Electric Aircraft Nuclear Propulsion Department formed in 1951. Research and development work was carried on at the Air Force owned and GE operated plant at Evendale, Ohio.

GNAL - Georgia Nuclear Aircraft Laboratory. An Air Force-owned radiation-effects facility built in 1956 at Dawsonville, Georgia, and operated by Lockheed Aircraft Corp. It is designed to irradiate and test large aircraft components and major subsystems anticipated for use in nuclear-powered airborne vehicles.

Government-furnished Aeronautical Equipment (GFAE) - Equipment furnished by the Government for installation in airborne vehicles and for which the title remains with the government.

Government-furnished Equipment (GFE) - Equipment furnished by the Government for an end item, and for which the title remains with the Government.

Government-furnished Property (GFP) - Property in the possession of, or acquired by, the Government and delivered or otherwise made available to the Contractor.

ground-handling equipment - That equipment which is used to accomplish a prime mover function, e.g.; a gantry, a missile transporter, forklift.

ground shock problem - The problem of determining the magnitude, direction, and duration of the ground shock at a given point on the surface or below the surface of the earth resulting from a nuclear explosion of a given magnitude and burst position.

ground start - A propulsion starting sequence through ignition to main stage which is initiated and cycled through to completion on the ground. This is in contrast to an "in-flight" or "air" start where the starting sequence and power buildup occur in flight at sometime after launch. In large rocket vehicles this ground start is commonly effected from pressurized propellant tanks external to the missile, permitting the vehicle to take off with its internal propellant load intact.

ground support equipment (GSE) - All ground equipment that is part of the complete weapon system and that must be furnished to insure complete support of the weapon system. Included are all implements or devices required to inspect, test, adjust, calibrate, appraise, gage, measure, repair, overhaul, assemble, disassemble, transport, safeguard, record, store, actuate, service, launch, and otherwise support and maintain the functional operating status of a weapon system, subsystem, end item, or component.

ground waves - The waves formed in the ground by an explosion. They are of three types: longitudinal waves (compression), transverse waves (shear), and surface waves (similar to water ripples). They can be induced by direct ground shock (as in a ground or sub-surface burst) or by blast transmitted through the air (as in any type of burst).

guidance - As related to a missile, the process, exclusive of control, of intelligence and maneuver intended for reaching a specified target, with special connotation on changes in course based on data that may be observed and computed either externally or in the missile itself.

half-life - The average time required for decay of one half the atoms in a radioactive element.

hardness - The property of an installation, facility, or equipment that will prevent an unacceptable level of damage from aerial bombardment.

hard gamma - A high-energy gamma capable of deep penetration in dense material.

hard structure - A structure designed to withstand nuclear weapon effects of a stated magnitude.

heat sink - A radiator or condenser, designed to absorb the excess heat energy of the working fluid. Also called heat dump.

high-order detonation - See detonation.

hot and cold junctions - The ends of a thermocouple, one being heated and one not heated. The difference in temperature at the ends creates an electric-potential difference along the thermocouple, allowing electrons to flow from one end to the other.

hot "crits" - Critical-reactor experiments to prove out theoretical reactor designs.

hot shop - A building in which the components of a nuclear reactor or other irradiated device can be disassembled and reassembled. The work is done remotely from behind shielded walls, usually thick concrete.

HTRE - Heat Transfer Reactor Experiments, a joint Air Force-AEC development and test program conducted since 1951 to determine the characteristic and feasibility of the reactor core, shielding, and control designs for the direct-cycle nuclear turbojet.

hunting - A term used in servo-system technology to describe a condition of instability - for instance, sustained wobbling - resulting from improper correction in the control device.

hypergolic propellant - A deprecated synonym for auto-igniting propellant (q.v.).

impact area, jettisoned parts - The area along the line of flight where jettisoned parts will strike the surface of the earth after separation from the missile at staging. One may speak for example, of the stage-one impact area.

indirect manhours - The hours expended on auxiliary work done in support of manufacturing, product support, and engineering, i.e., labor in performance of essential services, management, or administration; it is labor not identifiable with the product.

inertial guidance system - A dead-reckoning missile-guidance system that employs sensitive elements which respond to the earth's gravitational field and to inertial effects in accordance with the Newtonian laws of motion. The system therefore is not dependent on information obtained from transmitters outside the missile.

installed equipment - Nonexpendable or expendable recoverable equipment permanently attached to or integrated into real property in such a manner that it cannot be removed without causing substantial physical damage or change to the real property.

integrated flux (nvt) - The total number of neutrons per unit area that interact with particles constituting the sample.

intelligence - The product resulting from the collection, evaluation, analysis, integration, and interpretation of all available information that concerns one or more aspects of foreign nations or of areas of operation, and that is immediately or potentially significant to planning and operations.

interceptor missile - A surface-to-air guided missile employed in an air defense mission.

interface - (In an equipment sense). A common boundary between two or more items; may be used to designate end- or start-points of responsibility, as for example, between a prime contractor and the subs; or between departments, or different tasks in a statement of work. May be mechanical, such as the physical surfaces and spacings in the mating of several parts, modules, components, or subsystems; or may be electrical, such as the matching of signal levels, impedances, or power levels of two or more subsystems.

interference (electronic) - Any electrical or electromagnetic disturbance that causes undesirable responses in electronic equipment. "Electrical interference" refers specifically to interference caused by the operation of electrical apparatus that is not designed to radiate electromagnetic energy.

intermetallic compound - An alloy of two metals in a solid phase which is characterized by hardness, brittleness, and limited solubility with the other phases present. The compound, which is held together by metallic bonding, forms a complicated crystal structure.

ion - An atom or group of atoms not electrically neutral.

ionizing radiation - Radiation which ionizes the material through which it passes.

irradiation - The process of subjecting a material to a radiation flux.

isotopes - Atoms of the same element but of different atomic mass. Atoms of an element in which the nuclei contain the same number of protons but different numbers of neutrons.

kev - Thousand electron volts.

Kiwi-A - The first reactor developed under the Rover (nuclear-powered rocket) project. It operates on an open cycle where the propellant (hydrogen gas) heated in the reactor core is expanded through a nozzle to the atmosphere. This reactor was not intended for flight.

Kiwi-A' - Later variant of Kiwi-A.

Kiwi-B - new series of nuclear-rocket reactor; to be incorporated in early versions of the NERVA engine design.

kwe - Kilowatts of electrical energy.

LAMP (U. S. Army Corps. of Engineers). Lunar analysis and mapping program; to include preparation of 1:5,000,000 scale map of visible side of Moon; balloon photography and radio interrogation and determination of requirements for a lunar orbiting system; carry a program to the point of readiness to launch. Objectives of Project: (1) Make a rapid and accurate (+ or -300 ft) three-dimensional survey of entire lunar surface. (2) Determine characteristics of lunar surface. (3) Produce topographic-terrain and surface property maps to be used in selecting scientific landing sites on Moon.

lapse - Meteorological condition of a decreasing air temperature with increase in altitude.

LASL - Los Alamos Scientific Laboratory, owned by AEC, located at Los Alamos, New Mexico, and operated under contract by the University of California. Rover (nuclear-powered rocket) reactor work is under its direction.

lattice - A geometric pattern, in which fuel and moderator are interspersed in a heterogeneous reactor. The pattern of negative and positive ions held together by electrostatic forces. The normal arrangement of atoms in a molecule.

launch - The initial motion in transition from static repose to dynamic flight; the moment when the missile is no longer supported by the launcher; the take-off.

launch complex - A launch station with an associated guidance station.

launcher - A specific facility from which can be launched one missile at a time. It includes all the installed equipment necessary for missile countdown.

launcher and missile storage structure, surface or underground - A single structure combining the functions of the launcher and the missile storage structure.

launcher silo - A poor synonym for underground launcher.

launch site - A deprecated synonym for launch station.

launch station - One or more launchers with associated storage, assembly, and maintenance facilities.

launch station, augmented - A launch station with facilities for launching two or more missiles.

leakage - Loss of neutrons by outward diffusion from a reactor core.

line of sight - The distance to the horizon from an elevated point, including the effects of atmospheric refraction; the imaginary line from an observer or radar to a point.

liquid propellant - Any liquid ingredient fed to the combustion chamber of a rocket engine.

logistics - In its most comprehensive sense, those aspects of military operations that deal with: (1) design and development, acquisition, storage, movement, distribution, maintenance, evacuation, and disposition of materiel; (2) movement, evacuation, and hospitalization of personnel; (3) acquisition or construction, maintenance, operation, and disposition of facilities; and (4) acquisition or furnishing of services. It comprises both planning, including determination of requirements, and implementation.

logistics, or logistic, concept - General statement of approved policy on logistics for a specified weapon system. The logistics concept establishes the over-all logistics policies, objectives, assumptions, and requirements for the particular weapon system, based upon the weapon system requirements presented in the operations concept.

low-order detonation - A partial or slow explosion; it usually is the result of an accident or of inadequate initiation. See: detonation.

lox - A deprecated term for liquid oxygen (better to use LO_2).

LRL - Lawrence Radiation Laboratory, owned by AEC, located at Livermore, Calif., and operated under contract by the University of California. Pluto (nuclear-powered ramjet) reactor work is under its direction.

maintenance, engineering - The logistic function of developing maintenance systems, procedures, practices, techniques, and policies

MARINER (NASA). Early planetary probes to Mars and Venus - weighing 1100 lb. Launched by ATLAS-AGENA B. First one may be flown in 1962. RANGER (a part of MARINER) - A hard landing of scientific instruments on the Moon - late 1962.

mass ratio - The ratio between the initial mass of a rocket (takeoff mass) and the final mass of the vehicle or payload (burn-out weight) after power is exhausted or cut off.

materiel - All items necessary for the equipment, maintenance, operation, and support of military activities without distinction as to their application for administrative or combat purposes.

materiel control - That phase of military logistics which embraces the act of managing, regulating, and directing the production, procurement, and distribution of materiel necessary to meet operating requirements.

maximum ordinate - The distance from the center of the earth to the apogee of the missile trajectory or, alternatively, this distance minus the radius of the earth.

MPE - Maximum permissible exposure. A radiation dose which is thought to cause no appreciable biological damage in humans, usually accepted at 25 rem.

metallic fuels - Fuels which are a mixture, a pressed powder, or an alloy of a fissionable material, e.g., uranium-235, plutonium 239, and a metal, such as aluminum, nichrome, or stainless steel.

Mev - Million electron volts. See electron volt.

milestone - (In the programing sense) A significant and frequently critical event having qualitative or quantitative aspects; when a milestone is completed indicates the accomplishment of a step in progress toward a broader, predetermined goal.

military characteristics - Those characteristics of equipment upon which depend its ability to perform desired military functions. Military characteristics include physical and operational characteristics but not technical characteristics.

moderator - A material that has a high cross section for slowing down fast neutrons, with a minimum of absorption (heavy water or beryllium).

module - A combination of components, contained in one package, or so arranged that together they are common to one mounting, which provide a complete function or functions to the subsystems or systems in which they operate. Sometimes called BLACK BOX, a vernacular term which should not be used.

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one-line layouts - Preliminary drawings or sketches depicting structural arrangements and locations in simple form.

operations, or operational, capability - The extent to which a system or weapon can fulfill its assigned operational role.

operational missile - A missile that, in contrast to a research and developmental missile, can be used to fulfill its mission.

operations, or operational, concept - A general over-all statement of approved policy pertaining to a specified weapon system and containing the guidance necessary for the preparation of the logistics, installations, and personnel concepts and the operations plan for that weapon system. The operations concept contains such information as a general description of the weapon system and its application, the organizational structure, the operational capabilities and the utilization of the system, the communications and electronics associated with the system, and the theater and time deployment for the system.

overpressure - The pressure in the blast wave from an explosion, usually expressed in pounds per square inch above atmospheric pressure. During some period of the passage of the wave past a point, the overpressure may be negative; that is, the absolute pressure at that point may be less than atmospheric pressure.

pair production - The creation of a positron and an electron, usually called an electron pair, from the annihilation of a gamma-ray photon, as in the strong electric field near an atomic nucleus.

particles - Mass or energy particles that are "elementary" to the atom or are the observed products of subatomic reaction. Mass particles regarded as constituents of the atom include the neutron (n), the electron (e), and the proton (p). Among the particles emitted from reaction are the positron (e⁺), the photon (γ) as a quantum of radiated energy, and the alpha (α) and beta (β) nuclear "fragments."

perigee - The point in an elliptical orbit which is nearest to the earth; opposed to apogee, which is the point in the orbit farthest from the earth.

PEP - Program Evaluation Procedure. A variation of PERT (q.v.), adapted by Aerojet for the Skybolt and Dyna-Soar Programs.

PERT - Program Evaluation Review Technique. A program-control procedure, which by digital computer, establishes critical paths among the myriad events required for a complex program, such as NERVA.

PERT - Pre-Flight Reactor Testing.

photons - Electromagnetic waves, which are propagated through space in definite bundles of energy, or quanta, and that exhibit characteristics of both wave and particle.

planning factor - A properly selected multiplier, used in planning to estimate the amount and type of effort involved in a contemplated operation. Planning factors are often expressed as rates, ratios, or lengths of time.

plasma - A neutrally charged gas in which the ionization potential of the gas atoms has been exceeded. Each atom is thus allowed to separate into a positively charged ion and an electron.

Pluto project - AEC's experimental program established in 1956 to design, build, and test experimental reactors that will demonstrate feasibility of applying nuclear energy to a ramjet engine for missile propulsion. AEC has responsibility for reactor design and development, and the Air Force has development responsibility for the non-nuclear components of the ramjet engine. Technical work is centered at the Lawrence Radiation Laboratory.

poison - Those atoms (of such elements as boron) that have large capture cross sections for thermal neutrons. In capturing thermal neutrons unproductively, these atoms decrease the number available to cause fission.

positron - A particle equal in mass to an electron and bearing an equal but positive electrical charge.

power density - The rated power of a reactor or isotropic power source per unit weight of the fuel-bearing material, e.g., kilowatt-hours per pound or gram.

Project ORION - An ARPA-sponsored space program to launch a space station, with propulsion coming from a series of controlled atomic explosions. Feasibility studies are now under way at Convair Div. General Dynamics.

propellant - The oxidant and fuel expended in a rocket to obtain propulsion. When the oxidant and fuel are combined in a single substance, this substance is termed a monopropellant.

PROSPECTOR (NASA). A Saturn boosted, moon exploration vehicle (soft landing) planned for 1965, and under study by JPL and Marshall Space Flight Center for JPL. First priority payload is a mobile laboratory able to explore near terrain (would have a travelling radius of some 50 miles). Prospector may now serve as a support system for Apollo program after originally being considered a Surveyor follow-on designed to rove about the moon.

proton - An atomic particle of positive charge equal to the negative charge of the electron, but of 1837 times the mass.

prototype - A model of some end item that is suitable for complete evaluation of form, design, and performance. A prototype model utilizes approved parts and is representative of the final equipment. It follows an experimental model and precedes the production model.

radiation - The emission of energy quanta in the form of waves through space or a material medium; not only electromagnetic radiation, but also streams of subatomic particles (alpha rays, beta rays) and the emitted subatomic particles themselves.

radiation dose - The amount of radiation absorbed by a material system, or tissue in a given amount of time.

radiation syndrome - Symptoms which occur in man as a result of radiation.

radioactive particulates - Minute radioactive particles.

radioactivity - The process in which nuclei of certain elements undergo spontaneous disintegration, accompanied by corpuscular or electromagnetic emanations (radiation).

radioisotope - A radioactive isotope that decays in a predictable decay scheme.

radio-inertial guidance system - A command type of guidance system consisting essentially of: (i) a radar tracking unit, comprised of radar equipment on the ground, one or more transponders in the missile, and necessary communication links to the guidance station; (ii) a computer that accepts missile position and velocity information from the tracking system; and furnishes to the command link appropriate signals to steer the missile; (iii) the command link, which consists of a transmitter on the ground and an antenna and receiver on the missile; actually, the command link is built into the tracking unit; (iv) an inertial system for partial guidance in case of radio guidance failure.

radionuclide - A radioactive nuclide.

Rankine cycle - An idealized thermodynamic cycle consisting of two constant-pressure processes and two isentropic processes. The principle appears when a cycle fluid is boiled by use of isotope heat and drives a turbine generator by the expansion of the resulting vapor through a nozzle.

rare earths - The 15 metallic elements of atomic numbers 57 through 71 having such similar chemical properties that they are considered to occupy the position of a single element in Group III of the chemical periodic table.

reactor core - The central portion of a nuclear reactor, exclusive of the reflector and shields, containing the fissionable material and the moderator.

re-entry vehicle - A ballistic missile subsystem which was originally called the "nose cone." It normally is understood to include a heat shield, a warhead, an arming and fuzing system, a re-entry attitude control system when necessary, and some device for separation of the re-entry vehicle from the main missile structure.

reflector - A material of high scattering cross section that surrounds a reactor core to reduce the escape of neutrons.

reflected core - A reactor core surrounded by a reflector that throws back into the core a percentage of the escaping neutrons.

REIC - Radiation Effects Information Center established by the Air Force in May 1957 at the Battelle Memorial Institute, Columbus, Ohio.

rem-Roentgen-equivalent-man - A dose equal to that quantity of radiation which, when absorbed by a human being, produces the same effect as the absorption of one roentgen of high-voltage X rays.

rep-Roentgen-equivalent-physical - A proposed unit of an ionizing radiation dosage. Generally defined as a dose that induces energy absorption of 93 ergs per gram of tissue. Used extensively for the specification of permissible doses of ionizing radiations other than X rays or gamma rays.

retro-rockets - Small rockets used for separation of portions of the missile, as in staging.

r/hr - Roentgen per hour.

RIFT - Reactor In Flight Testing - a program to determine best configuration of a flight reactor for a nuclear rocket. The NERVA program involves cooperation with the RIFT contractors.

roentgen - A unit of radiation of X rays or gamma rays, that produces one electrostatic unit in a cubic centimeter of dry air under standard condition of temperature and pressure.

ROVER Project - A joint AEC-NASA project established in 1955 to demonstrate the feasibility of applying nuclear energy to rocket propulsion. Technical work is centered at the Los Alamos Scientific Laboratory. NERVA program - development of a flight test program - is part of the Rover project. This is a follow-on to the success of the Kiwi reactor tests. AETRON Division of AGC has contract for architectural and engineering services for ROVER test stand at Jackass Flats (\$7 - \$8 million). ROVER nuclear propulsion system is expected to be flight tested as an upper stage of a SATURN vehicle.

scattering - Change in direction of a particle because of a collision with another particle or nuclear system.

self-destruct signal - See command-destruct signal.

shadow shield - A shield, other than the reactor shield, that is placed between the radiation source and a specific area to be protected. Useful in space, it is less effective in the earth's atmosphere because air scattering deflects radiation around it.

SM - Strategic missile.

SMALL (USAF) - Third-generation ICBM program - as yet, not many details are known.

SMART (USAF) - Manned Satellite Maintenance and Repair Techniques. A study for maintaining and repairing satellites in orbit by sending men in space ships up to fix them.

SNAP Program - (Systems for Nuclear Auxiliary Power) A program established to develop low-power devices of light-weight and long life that will produce from a few watts to several kilowatts of electricity and will operate as reliable, long-enduring power sources for instrument packages in satellites and space probes. Serves both Air Force and NASA needs.

SOP - standing operating procedure. A set of instructions covering those features of operations that lend themselves to a definite or standardized procedure without loss of effectiveness. The procedure is applicable unless prescribed otherwise in a particular case. Thus the flexibility necessary in special situations is retained.

specific heat - The ratio between the amount of heat that it takes to raise the temperature of a given substance one degree and that required to raise an equal mass of water one degree.

specific power - The energy delivered per pound of fuel in a reactor.

staging - Act of jettisoning, at a predetermined flight time or trajectory point, certain missile components (engines, tanks and associated equipment) that are no longer needed.

STAR - Space Thermionic Auxiliary Reactor. A General Electric project aimed at developing small electric reactors for space. Development centered in Pleasanton, Calif.

static conversion - Energy conversion in which no moving parts of equipment are utilized.

static tests - Ground tests intended to investigate the structural integrity of a missile. Sometimes used as synonymous with Captive Test, q.v.

steady state - The stable operating condition of a reactor in which the neutron inventory remains constant.

stoichiometric ratio - A law of chemical composition whereby elements will only combine with each other in definite, established ratios which are whole numbers of each constituent element.

Strontium 90 - An isotope which is an important radioactive constituent of fallout. Because of its long half-life (28 years) and its chemical similarity to calcium (it is deposited in bones) - it is considered the most dangerous single constituent of fallout.

structure activation - Radioactivity induced in the structure of the aircraft in which the reactor is operated.

subcritical - The status of a reactor that has slipped below critical. If not regulated with control rods, the reactor will shut itself down on an exponential decrease.

SUNRISE (ARPA). - A program limited to basic research which will explore all technical areas considered vital to national defense, and particularly those which appear not to be adequately covered in current or programmed basic research activities of both government and private profit and non-profit agencies.

SUNFLOWER - Solar auxiliary power system for space craft.

supercritical - The status of a reactor that has proceeded past the critical point, generating one new fission per previous fission. If not contained with control rods, the reactor will run away.

SURVEYOR (NASA). A Moon vehicle (750 lb), capable of a soft lunar landing, to be carried by ATLAS-CENTAUR. Landings planned for 1963-1964.

system phasing - Adjusting the acquisition of all components to the longest lead-time item, and identifying and scheduling all action necessary to achieve a complete system by a programmed date.

t-time, T-time - Time measured from the first motion, or "lift-off" of the missile when it is being launched. Only (+)t-times are used. Prior events are timed in (-)x-time and (+)x-time (q.v.).

TALANT - Thiokol, Allison, Linde, and Nuclear Dev. Corp. Team for conducting studies on the Rover Project and SR's 150, 182, and 199.

thermal mw-year - A power of one megawatt of thermal energy produced continuously for one year.

Tory II - A Lawrence Radiation Laboratory reactor experiment to demonstrate the feasibility of nuclear-ramjet propulsion and to verify materials, neutronics, and other design information.

umbilical cord - A cable fitted with a quick-disconnect plug, through which missile equipment is controlled and tested while the missile is still attached to the launching equipment.

Van Allen radiation belts - Two concentric, doughnut-shaped layers of radioactive particles surrounding the earth that were discovered and measured by the Explorer satellites and Pioneer space probes. The first belt is 2000 miles thick and begins at 1400 miles altitude; the second is 4000 miles thick and begins at 8000 miles altitude.

void fraction - The fraction of the frontal area of a reactor that is open to air flow. Also referred to as free-flow area.

VOYAGER. A spacecraft under study by JPL to be carried by SATURN (as a Mariner follow-on) and capable of orbiting Mars and Venus, probably in 1965.

weapon system - Equipment, skills, and techniques, the composite of which forms an instrument of combat. The complete WEAPON SYSTEM includes all related equipment, materiel, services, and personnel required solely for the operation of the air vehicle, or other major element of the system, so that the instrument of combat becomes a self-sufficient unit of striking power in its intended operational environment.

working fluid - A fluid, such as air or a liquid metal, which is heated by the reactor and from which heat is removed by a device which converts the heat into some other form of energy.

X - The letter "X" when used as a prefix in the designation of a vehicle indicates that it is an experimental model. Example: XSM-65.

x-time, X-time - Time measured from the beginning of the missile engine firing sequence. Both (-)x-time and (+)x-time are used. See: t-time.

yttrium 90 - Daughter of Strontium 90 (q.v.).

II. COMMONLY USED ABBREVIATIONS

AAM	Air-to-air missile
AEMA	Army Ballistic Missile Agency, Huntsville, Alabama
ACF	American Car & Foundry (Albi Division is manufacturer of Kiwi reactor)
ADC	Air Defense Command
AEC	Atomic Energy Commission
AEDC	Arnold Engineering Development Center (ARDC)
AETRON	Architect-Engineer plant of AGC (Covina, Calif.)
AF	Air Force
AFB	Air-force base
AFEMD	Air Force Ballistic Missile Division of HQ ARDC
AFMTC	Air Force Missile Test Center (Patrick AFB)
AFFTTC	Air Force Flight Test Center (Edwards AFB)
AFMDC	Air Force Missile Development Center (Holloman AFB)
AFSWC	Air Force Special Weapons Center (Kirtland AFB)
AGC	Aerojet-General Corporation
AGO	Adjutant General's Office
AGN	Aerojet-General Nucleonics
AICEM	Anti-intercontinental ballistic missile
AMC	Air Materiel Command
AMF	American Machine & Foundry Co.
AMR	Atlantic Missile Range
AN	Army-Navy (used in specifications)
ANL	Argonne National Laboratory
ANP	Aircraft Nuclear Propulsion (program)
APG	Aberdeen Proving Ground, Aberdeen, Maryland
APGC	Air Proving Ground Center - Eglin AFB
APS	Accessory power supply
ARDC	Air Research and Development Command
ARGMA	Army Rocket and Guided Missile Agency, Huntsville, Ala.
ARMS	Activities and Resources Management System
ARO	Army Research Office, Washington, D.C.

II Commonly Used Abbreviations (cont.)

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ARPA	Advanced Research Projects Agency
ASM	Air-to-surface missile
ASTIA	Armed Services Technical Information Agency
AUM	Air-to-underwater missile
BMD	Ballistic Missile Division, Inglewood, Calif., USAF
BMEWS	Ballistic Missile Early Warning System
BRL	Ballistic Research Laboratory, Aberdeen, Maryland
BuOrd	Bureau of Ordnance
BuPers	Bureau of Naval Personnel
BuShips	Bureau of Ships
BuWeps	Bureau of Naval Weapons
C	Confidential
CFE	Contractor-furnished equipment
CIA	Central Intelligence Agency
CNO	Chief of Naval Operations
CONAD	Continental Air Defense Command
CPFF	Cost-plus-fixed fee (contract)
C-RD	Confidential-restricted data
DA	Department of the Army, Washington, D.C.
DAC	Douglas Aircraft Corp.
DASA	Defense Atomic Support Agency, Washington, D.C.
DEW	Distant Early Warning
DOD	Department of Defense
ECP	Engineering change proposal
E-MAD	Maintenance and Disassembly Building - Test Cell "E"
ERDL	Engineer Research and Development, Laboratories, Fort Belvoir, Va.
ev	Electron volt
FAA	Federal Aviation Agency
FBM	Fleet Ballistic Missile
FMS	Fleet Ballistic Missile System
FP	Fixed price (contract)
FY	Fiscal year

GAM	Ground-To-Air Missile
GFE	Government-furnished equipment
GFP	Government-furnished property
GHE	Ground-handling equipment
GOX	Gaseous oxygen (not to be used in outgoing documents)
GSE	Ground-support engineering
ICBM	Intercontinental-ballistic missile
IDEP	Interservice Data Exchange Program
IREM	Intermediate Range Ballistic Missile
JAN	Joint Army-Navy (used in specifications)
JCAE	Joint Committee on Atomic Affairs
JCS	Joint Chiefs of Staff
JOC	Joint Operations Center
LASL	Los Alamos Scientific Laboratory
LOX	Liquid-oxygen (not to be used in outgoing documents)
LRP	Liquid Rocket Plant (Sacramento)
MAD	Maintenance and Disassembly Building
mev	Million electron volts
MIP	Magnetic induction plasma engine (competitive with Ion Engines)
MS	Military Standard (used in Specifications)
MSFC	Marshall Space Flight Center
NAMTC	Naval Air Missile Test Center, Pt. Mugu, California
NARMS	NERVA Activities and Resources Management System
NAS	Naval Air Standard (used in Specifications)
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NDRC	National Defense Research Council
NEL	Naval Electronics Laboratory, San Diego, California
NERVA	Nuclear Engines Rocket Vehicle Application
NNRDC	National Nuclear Rocket Development Center
NOL	Naval Ordnance Laboratory
NORAD	North American Air Defense Command

NOTS	Naval Ordnance Test Station, Inyokern, California
NPG	Naval Proving Ground, Dahlgren, Va.
NPO	Nuclear Propulsion Office (liaison NASA-AEC in Space)
NPSP	Net positive suction pressure (on pumps)
NRL	Naval Research Laboratory, Anacostia, D.C.
NSC	National Security Council
NSG	Naval Security Group
NSRB	National Security Resources Board
NTS	Nevada Test Site
OCRD	Office, Chief of Research and Development, Washington, D.C.
OCSA	Office, Chief of Staff, Army, Washington, D.C.
OSA	Office, Secretary of the Army
OSD	Office of Secretary of Defense
OSR	Office of Security Review, Department of Defense
PD	Program directive
PEP	Program evaluation procedure
PERT	Program evaluation review technique
PFRT	Pre-flight reactor testing
PR	Purchase request
QC	Quality control
RFC	Request for call
RFP	Request for proposal
RFQ	Request for quotation
RIFT	Reactor in-flight test
RFS	Rover Flight Safety Office
RX	Reactor
RXI	Inert reactor
RXL	Line reactor
S	Secret
SAC	Strategic Air Command
SAGE	Semi-Automatic Ground Environment Air Warning System
SAM	Surface-to-air missile
SLBM	Submarine-launched ballistic missile
SM	Strategic missile

SNPO	Space Nuclear Propulsion Office
SNPO-C	Space Nuclear Propulsion Office - Cleveland
S-RD	Secret - restricted data
SRP	Solid Rocket Plant (Sacramento)
SSM	Surface-to-surface missile
STE	Specialized test equipment
STL	Space Technology Laboratories
STOL	Short take-off and landing
SUM	Surface-to-underwater missile
TAC	Tactical Air Command
TCA	Thrust-chamber assembly
TM	Technical manual
TO	Technical order
TSE	Test-support equipment
UOC	Ultimate operating capability
UDMH	unsymmetrical dimethyl hydrazine (propellant)
USASA	U.S. Army Security Agency, Arlington, Va.
VAFB	Vandenberg Air Force Base
VT	Proximity fuzeing device
VTOL	Vertical take-off and landing
WADD	Wright Air Development Division (formerly WADC)
WSEG	Weapons Systems Evaluation Group, (Dept. of Defense) Washington, D.C.
WSMR	White Sands Missile Range, White Sands, N. M.
WSPO	Weapons Systems Project Office
WSPG	White Sands Proving Grounds, New Mexico