

GLOSSARY

Ablating Materials—Special heat-dissipating materials on the surface of a spacecraft that can be sacrificed (carried away, vaporized) during re-entry.

Ablation—Melting of ablative heat shield materials during re-entry of spacecraft into earth's atmosphere at hypersonic speeds.

Abort—The cutting short of an aerospace mission before it has accomplished its objective.

Accelerometer—An instrument to sense accelerative forces and convert them into corresponding electrical quantities usually for controlling, measuring, indicating, or recording purposes.

Acceptance Test—A test or series of tests to demonstrate that performance is within specified limits.

Acquisition and Tracking Radar—A radar set which searches for, acquires, and tracks an object by means of reflected radio frequency energy from the object, or tracks by means of a radio-frequency signal emitted by the object.

Actuators—Devices which transform an electrical signal into a mechanical motion using hydraulic or pneumatic power.

Adapter Skirt—A flange or extension of a stage or section that provides a ready means of fitting another stage or section to it.

Aerothermodynamic Border—An altitude of about 100 miles in which the atmosphere becomes so rarefied that there is no longer any significant heatgenerating air friction or thermal influence on the skin of fast-moving vehicles.

Airborne Data—Data obtained from space systems during flight.

Ambient—Environmental conditions such as pressure or temperature.

Amorphous—Without definite form; in reference to supercooled liquids and colloidal substances, without real or apparent crystalline form.

Anacoustic Zone—The zone of silence in space;

the region above 100 miles altitude where the distance between the rarefied air molecules is greater than the wavelength of sound, and sound waves can no longer be propagated.

Analog Computer—A computing machine that works on the principle of measuring, as distinguished from counting, in which the measurements obtained, as voltages, resistances, etc., are translated into desired data.

Aphelion—Point on an elliptical orbit around sun which is greatest distance from sun. (Earth's aphelion is about 94,500,000 miles from sun.)

Apocynthion—The point at which a satellite (e.g., a spacecraft) in its orbit is farthest from the moon; differs from apolune in that it is an earth-originated orbit.

Apogee—The point at which a moon or artificial satellite in its orbit is farthest from earth.

Apolune—The point at which a satellite (e.g., a spacecraft) in its orbit is farthest from the moon; differs from apocynthion in that the orbit is originated from the moon.

Asteroid—One of the many thousands of minor planets which revolve around the sun, mostly between the orbits of Mars and Jupiter.

Astroagation—Navigating in space.

Astronaut—One who flies or navigates through space.

Astronautics—The art or science of designing, building, or operating space vehicles.

Astronics—The science of adapting electronics to aerospace flight.

Astrobiology—A branch of biology concerned with the discovery or study of life on planets.

Astronomical Unit—Mean distance of earth from the sun, equal to 92,907,000 miles.

Astrophysics—Application of laws and principles of physics to all aspects of stellar astronomy.

Atmosphere—The envelope of gases which surrounds the earth and certain other planets.

Atmosphere Refraction—Refraction of light from a distant point by the atmosphere, caused by its passing obliquely through varying air densities.

Attenuator—An adjustable resistive network for reducing the amplitude of an electrical signal without introducing appreciable phase or frequency distortion.

Attitude—The position of an aerospace vehicle as determined by the inclination of its axes to some frame of reference; for Apollo, an inertial, space-fixed reference is used.

Axis—Any of three straight lines, the first running through the center of the fuselage lengthwise, the second at right angles to this and parallel to the horizontal airfoils, and the third perpendicular to the first two at their point of intersection (aircraft).

Azimuth—An arc of the horizon measured between a fixed point (e.g., true north) and the vertical circle through the center of an object.

Backout—Reversing the countdown sequence because of the failure of a component in the vehicle or a hold of unacceptable duration.

Ballistic Trajectory—The curved portion of a vehicle trajectory traced after the propulsion force is cut off.

Biatomic Oxygen—The normal oxygen molecule, consisting of two oxygen atoms, which exists in the lower layers of the atmosphere. It constitutes nearly 21 percent of the atmospheric air and is the essential agent in respiration.

Binary Star—Two stars revolving around a common center of gravity.

Bioastronautics—Astronautics considered for its effect on animal or plant life.

Biosphere—That part of the earth and its atmosphere in which animals and plants live.

Bit—A unit of information carried by an identifiable character, which can exist in either of two states - a "one" or a "zero." An abbreviation of binary digit.

Blanketing—When a desired signal is blanketed, or eliminated, from reception by the presence of an overriding, stronger undesired signal.

Bleed-Cycle Operation—Refers specifically to liquid-propellant rocket engines in which a turbopump is driven by hot gases bled from the combustion chamber of the main thrust chamber.

Blip—A spot of light or other indicator on a radar scope (cathode-ray tube).

Blowoff—Separation of an instrument section or package from the remainder of the rocket vehicle by application of an explosive force.

Blow-Out Disc—A mechanism, consisting of a thin metal diaphragm, used as a safety device to relieve excessive gas pressure.

Boilerplate—A full-size mockup that has all of the mechanical characteristics of the true item but none of the functional features.

Booster—An engine that assists the normal propulsive system of a vehicle or other system of a vehicle.

Bootstrap—A self-generating or self-sustaining process.

Boresight Tower—A tower on which there are mounted a visual target and an electrical target (antenna fed from a signal generator); these targets are used for the parallel alignment of the electrical axis of a receiving antenna and the optical axis of a telescope mounted on that antenna.

Braking Ellipses—A series of orbital approaches to a planet's atmosphere to slow a rocket before landing.

Burnout—The point when combustion ceases in a rocket engine.

Burst Diaphragm—Same as a blow-out disc.

Canard—A short, stubby wing-like element affixed to an aircraft or spacecraft to provide better stability.

Capsule—A small pressurized cabin with an acceptable environment, usually for containing a man or

animal for extremely high-altitude flights, orbital space flight, or emergency escape.

Captive Firing—Test firing of a complete vehicle where all or any part of the propulsion system is operated at full or partial thrust while the missile is restrained in the test stand.

Captive Test—A test conducted while the vehicle is secured to a test stand; primarily intended to verify proper operation of the propulsion and flight control subsystems under full-thrust conditions.

Capture—(1) The act of a central force field capturing a passing or colliding body or particle. (2) Of a central force field, as of a planet: to overcome the velocity or centrifugal force of a passing or colliding body or particle and bring its behavior under control of the force field or integrate the body's mass into the force field.

Cavitation—The rapid formation and collapse of vapor pockets in a flowing liquid under very low pressures; a frequent cause of serious structural damage to rocket components.

C Band—A radio frequency band of 3.9 to 6.2 gigacycles per second.

Celestial Guidance—The guidance of a vehicle by reference to celestial bodies.

Celestial Mechanics—The science that deals primarily with the effect of force as an agent in determining the orbital paths of celestial bodies.

Celestial Sphere—Imaginary sphere of infinite radius, assumed for navigational purposes and center of which coincides with the center of earth.

Center of Mass—Commonly called the center of gravity, it is the point at which all the given mass of a body or bodies may be regarded as being concentrated as far as motion is concerned.

Centrifugal Force—A force which is directed away from the center of rotation.

Centrifuge—A large motor-driven apparatus with a long rotating arm used to produce centrifugal force.

Centripetal Force—A force which is directed toward the center of rotation.

Characteristic Length—In propulsion, the ratio of the chamber volume to its nozzle throat area. A measure of the length of travel available for the combustion of propellants.

Characteristic Velocity—Sum of all velocities that have to be obtained or overcome for purposes of braking by a rocket intended for a particular journey.

Checkout—A sequence of operational and calibration tests to determine the condition and status of a system.

Chemical Fuel—(1) A fuel that depends on an oxidizer for combustion or for development of thrust, such as liquid or solid rocket fuel, jet fuel, or internal-combustion-engine fuel. Distinguished from nuclear fuel. (2) An exotic fuel that uses special chemicals.

Chemosphere—A stratum of the atmosphere marked for its photochemical activity. (By some meteorologists, the chemosphere is considered to be an extension of the stratosphere.)

Chuffing—The characteristic of some rockets to burn intermittently and with an irregular puffing noise.

Circular Velocity—Critical velocity at which a satellite will move in a circular orbit, it is extremely difficult to attain because of the accuracy of control needed.

Circumlunar—Trips or missions in which a vehicle will circle the moon.

Cislunar Space—Space between the earth and the orbit of the moon.

Closed Ecological System—A system that provides for the metabolism of the body in a spacecraft cabin by means of a cycle in which exhaled carbon dioxide, urine, and other waste matter are converted chemically or by photosynthesis into oxygen and food.

Closed Loop—Automatic control units linked together with a process to form an endless chain.

Closed Respiratory Gas System—A completely self-contained system within a sealed cabin, capsule, or spacecraft that will provide adequate oxygen for breathing, maintain adequate cabin pressure, and absorb the exhaled carbon dioxide and water vapor.

Cloud Chamber—The path of subatomic particles are made visible in this kind of chamber by depositing a “cloud” of water particles on them.

Cluster—Two or more engines bound together so as to function as one propulsive unit.

Comet—A loose body of gases and solid matter revolving around the sun.

Command—A pulse or signal initiating a step or sequence.

Companion Body—A nose cone, last-stage rocket, or other body that orbits along with an earth satellite.

Comparator—An electronic processing instrument that compares one set of data with another.

Condensation Trail (Contrails or Vapor Trails)—A visible cloud streak, usually brilliantly white in color, which trails behind a vehicle in flight under certain conditions; caused by the formation of water droplets or sometimes ice crystals due to sudden compression, then expansive cooling, of the air through which the vehicle passes, and of introduction of water vapors through condensation of certain fuels.

Console—Term applied to a grouping of controls, indicators, and similar electrical or mechanical equipment.

Constellation—Any one of the arbitrary groups of fixed stars, some 90 of which are now recognized. A division of the heavens in terms of any one of these groups.

Control Rocket—A rocket used to guide, accelerate, or decelerate a launch vehicle or spacecraft.

Control System—A system that serves to maintain

attitude stability during forward flight and to correct deflections.

Controlled Leakage System—A system that provides for the body’s metabolism in an aircraft or spacecraft cabin by a controlled escape of carbon dioxide and other waste.

Converter—A unit that changes the language of information from one form to another.

Coriolis Effect—The deflection of a body in motion due to the earth’s rotation, diverting horizontal motions to the right in the northern hemisphere and to the left in the southern hemisphere.

Corpuscular Cosmic Rays—Primary cosmic rays from outer space which consist of particles, mainly atomic nuclei (protons) of hydrogen and helium, positively charged and possessing extremely high kinetic energy.

Corpuscular Radiations—Consisting of a flux of small particles.

Cosmic Rays—Extremely fast particles continually entering the upper atmosphere from interstellar space; atomic nuclei which have very great energies because of their enormous velocities; potentially dangerous to life during extended exposure.

Creep—The property of a metal which allows it to be permanently deformed when subjected to a stress.

Cryogenics—The subject of a physical phenomena in the temperature range below about -50 degrees C. More generally, cryogenics or its synonym cryogery refers to methods of producing very low temperatures.

Cyclic Testing—Repeated testing of an object at regular intervals to be assured of its reliability.

Damping—Restraining.

Data Link Equipment—Electronic equipment that coordinates data collection, reduction, and analysis.

Deadband—In a control system, the range of values through which the measure can be varied without initiating an effective response.

Declination—In astronomy and celestial navigation, the angular distance of a celestial body from the

celestial equator measured through 90 degrees and named "north" or "south" as the body is north or south of its celestial equator measured on an hour circle.

Deep Space—Used to refer to any space other than that in the vicinity of earth.

Delta V (ΔV)—Velocity change

Destruct—The deliberate action of detonating or otherwise destroying a missile or other vehicle after launch.

Dielectrically Heated—Heating while producing power (i.e., the fuel cell).

Diffusion Process—The exchange of molecules in gas mixtures or solutions across a border line between two or more different concentrations.

Digital Computer—A computer in which quantities are represented numerically and which can be used to solve complex problems.

Doppler Drift—The drift of a vehicle as determined through use of Doppler's (German mathematician Christian Doppler) principle by means of radar.

Doppler Effect—The apparent change in frequency of vibrations, as of sound, light, or radar, when the observed and observer are in motion relative to one another.

Doppler Principle—A principle of physics that, as the distance between a source of constant vibrations and an observer diminishes or increases, the frequencies appear to be greater or less.

Doppler Shift—A shift of a luminous body's line in a spectrum toward the red, indicating an increase in distance.

Dosimeter—An instrument that measures the amount of exposure to nuclear or X-ray radiation; also called an intensitometer or dosage meter.

Down-Link—The part of a communication system that receives, processes, and displays data from a spacecraft.

Drag—The aerodynamic force in a direction opposite to that of flight and due to the resistance of the body to motion in air.

Drift Error—A change in the output of an instrument over a period of time, usually caused by random wander or by a condition of the environment.

Drogue—The hollow (female) part of a connector into which a probe (male) part fits.

Dry-Fuel Rocket—A rocket that uses a mixture of fast-burning power. Used especially as a booster rocket.

Dual Thrust—A rocket thrust derived from two propellant grains using the same propulsion section of a missile.

Dual Thrust Motor—A solid rocket motor built to obtain dual thrust.

Earth-Fixed Reference—An oriented system using some earth phenomena for positioning.

Eccentric—Of an orbit, deviating from the line of a circle so as to form an ellipse.

Ecliptic—Plane of the earth's orbit around the sun, used as a reference for other interplanetary orbits; also the name for the apparent path of the sun through the constellations as projected on the celestial sphere.

Ecosphere—The great circle on the celestial sphere which describes the apparent path of the sun in the course of the year.

Effective Atmosphere—That part of the atmosphere which effectively influences a particular process of motion.

Effective Exhaust Velocity—The velocity of an exhaust stream after the effects of friction, heat transfer, non-axially directed flow, and other conditions have reduced it.

Effector—The mechanical means of maneuvering a vehicle during flight: an aerodynamic surface, a gimbaled motor, or an auxiliary jet.

Electrojet—Current sheet or stream moving in an ionized layer in the upper atmosphere of a planet.

Electrolyte—A substance in which the conduction of electricity is accompanied by chemical action; the paste which forms the conducting medium

between the electrodes of a dry cell, storage cell, or electrolytic capacitor.

Emissivity—The relative power of a surface or a material composing a surface to emit heat by radiation.

Entry Corridor—The final flight path of the spacecraft before and during earth re-entry.

Ephemeris—A publication giving the computed places of the celestial bodies for each day of the year, or for other regular intervals.

Escape Orbit—One of various paths that a body or particles escaping from a central force field must follow in order to escape.

Escape Velocity—The speed a body must attain to overcome a gravitational field, such as that of earth; the velocity of escape at the earth's surface is 36,700 feet per second.

Event Timer—An instrument that times an event and records time taken to perform the cycle or event; can record several events simultaneously.

Exerciser—A machine that simulates the strains and vibrations to which a missile is subjected, and used to test for structural integrity.

Exhaust Stream—The stream of gaseous, atomic, or radiant particles that emit from the nozzle of a rocket or other reaction engine.

Exosphere—The outermost fringe or layer of the atmosphere, where collisions between molecular particles are so rare that only the force of gravity will return escaping molecules to the upper atmosphere.

Exotic Fuel—Unusual fuel combinations for aircraft and rocket use.

Explosive Bolts—Bolts surrounded with an explosive charge which can be activated by an electrical impulse.

Explosive Bridge Wire—Wire which heats to a high temperature and burns, thus igniting a charge.

Extension Skirt—Adapter used to connect elements of the spacecraft.

Extravehicular—Indicates that an element, such as an antenna, is located outside the vehicle.

Fairing—A piece, part, or structure having a smooth, streamlined outline, used to cover a nonstreamlined object or to smooth a junction.

Fallaway Section—Any section of a rocket vehicle that is cast off and falls away from the vehicle in flight.

Final Trim—Action that adjusts a vehicle to the exact direction programmed for its flight.

Flash Point—The temperature at which the vapor of a fuel or oil will flash or ignite momentarily.

Float Bag—A collar located around the spacecraft used to keep the spacecraft upright in the water and prevent sinking.

Free-Flight Rocket—A rocket without electronic control or guidance.

Free-Flight Trajectory—The part of a ballistic missile's trajectory that begins with thrust cutoff and ends at re-entry.

Free Gyro—Sometimes referred to as space reference gyro in that the free gyro will maintain its orientation with respect to the stars rather than with respect to the earth.

Frequency Spectrum—The area encompassed by frequencies, from very low to very high, in terms of cycles (vibration) in a unit of time.

Free-Return Trajectory—A return to earth without power; this trajectory would be used in the event of a failure of the spacecraft propulsion system.

Fuel Cell—An electrochemical generator in which the chemical energy from the reaction of air (oxygen) and a fuel is converted directly into electricity.

G or G Force—Force exerted upon an object by gravity or by reaction to acceleration or deceleration, as in a change of direction: one G is the measure of the gravitational pull required to move a body at the rate of about 32.16 feet per second.

Galaxy—(1) The group of several billion suns, stars, star clusters, nebulae, etc., to which the earth's sun belongs; (2) any of several similar groups of stars forming isolated units in the universe.

Gamma Radiation—Electromagnetic radiation, similar to X rays, originating from the nucleus and having a high degree of penetration.

Gas Chromatograph—An oscillating filter-photometer that separates and analyzes gasses.

Geocentric—Relating to or measured from the center of the earth: having, or relating to, the earth as a center.

Geodetic—Pertaining to or determined by that branch of mathematics which determines the exact positions of points and the figures and areas of large portions of the earth's surface, or the shape and size of the earth and the variations of terrestrial gravity.

Geophysical Constant—A quantity that expresses a fixed value for a law or magnitude that applies to the physics of the earth.

Geophysics—The physics of the earth, or science treating of the agencies which modify the earth.

Gimbal—Mechanical frame containing two mutually perpendicular intersecting axes of rotation (bearing and/or shafts).

Gimballed Motor—A rocket motor mounted on gimbal; i.e., on a contrivance having two mutually perpendicular axes of rotation, so as to obtain pitching and yawing correction moments.

Glycol—Ethylene glycol, a coolant mixed with water in varying proportions, depending on rate of cooling desired.

Grain—The body of a solid propellant used in a rocket, fashioned to a particular size and shape so as to burn smoothly without severe surges or detonations.

Gravitation—Force of attraction that exists between all particles of matter everywhere in the universe.

Gravity—That force which tends to pull bodies toward the center of mass; that is, to give bodies weight.

Gravity Anomalies—Deviations between theoretical gravity and actual gravity due to local topographic and geologic conditions.

Gravity Simulation—Use of centripetal force to simulate weight reaction in a condition of free fall.

Ground Trace—The theoretical mark traced on the surface of the earth by a flying object or satellite as it passes over the surface.

Guidance System—A system which measures and evaluates flight information, correlates this with target data, converts the result into the conditions necessary to achieve the desired flight path, and communicates this data in the form of commands to the flight control system.

Guidance Tapes—Magnetic or paper tapes that are placed in the computer and on which there previously has been entered information needed in guidance.

Gyro-Compassing—Use of gyro with axle pointed due north in directional guidance.

Gyroscope—A device consisting of a wheel so mounted that its spinning axis is free to rotate about either of two other axes perpendicular to itself and to each other; once set in rotation, its axle will maintain a constant direction, even when the earth is turning under, when its axle is pointed due north, it may be used as a gyro compass.

Heat Exchanger—A device for transferring heat from one substance to another, as by regenerative cooling.

Heat Sink—A contrivance for the absorption or transfer of heat away from a critical part or parts, as in a nose cone where friction-induced heat may be conducted to a special metal for absorption.

Heaviside—Kennelly Layer—Region of the ionosphere that reflects certain radio waves back to earth.

Heliocentric—Measured from the center of the sun.

Honeycomb Sandwich—A type of construction in which the space between the upper and lower

surfaces is occupied by a strengthening material of a structure resembling a honeycomb mesh.

Horizon Photometer—An instrument to determine the distinction between the sky and the horizon; thus, measures light by means of monitoring the infrared emanations.

Hydrosphere—The aqueous (watery) envelope of a planet.

Hydrostatic Effects—The pressures exerted by a column of liquid (water, blood, etc.) under normal gravitational conditions on the surface of the earth or in a gravitational field during an acceleration.

Hyperacoustic Zone—The region in the upper atmosphere between 60 and 100 miles where the distance between the rarefied air molecules roughly equals the wave length of sound, so that sound is transmitted with less volume than at lower levels. Above this zone, sound waves cannot be propagated.

Hyperbola—A conic section made by a plane intersecting a cone of revolution at an angle smaller than that of a parabola.

Hypergolic—Refers to bipropellant combinations which ignite spontaneous upon contact or mixing.

Hypersonic—Speeds faster than Mach 5 or five times the speed of sound.

Hypoxia—Oxygen deficiency in the blood cells or tissues of the body in such a degree as to cause psychological and physiological disturbances.

Ice Frost—A thickness of ice that gathers on the outside of a rocket vehicle over surfaces super-cooled by liquid oxygen or hydrogen inside the vehicle.

Incidence Angle—The angle between earth and the path of a vehicle.

Inertia—The tendency of an object to remain put or if moving to continue on in the same direction.

Inertial Guidance—A sophisticated automatic navigation system using gyroscopic devices, etc., for high-speed vehicles. It absorbs and interprets such data as speed, position, etc., and automatically adjusts the vehicle to a predetermined flight path. Essentially, it knows where it's going and where it

is by knowing where it came from and how it got there. It does not give out any signal so it cannot be detected by radar or jammed.

Inertial Orbit—The type of orbit described by all celestial bodies, according to Kepler's laws of celestial motion. This applies to all satellites and spacecraft provided they are not under any type of propulsive power, their driving force being imparted by the momentum at the instant propulsive power ceases.

Inertial Space—An assumed stationary frame of reference. A non-rotating set of coordinates in space relative to which the trajectory of a space vehicle is calculated.

Injection—The process of injecting a spacecraft into a calculated orbit.

Integrating Accelerometer—A mechanical and electrical device which measures the forces of acceleration along the longitudinal axis, records the velocity, and measures the distance traveled.

Intergalactic Space—That part of space conceived as having its lower limit at the upper limit of interstellar space, and extending to the limits of space.

Interior Ballistics—That branch of ballistics concerned with behavior, motion, appearance, or modification of a rocket when acted upon by ignition and burning of a propellant. Sometimes called "internal ballistics." In rocketry, interior ballistics deals with the missile's behavior in reaction to gas pressures inside the rocket, escape-ments, shift in the center of gravity as propellants are consumed, etc.

Interleaver—The act of combining computer data to produce, from several sources, a single result.

Interplanetary Space—That part of space conceived, from the standpoint of the earth, to have its lower limit at the upper limit of translunar space, and extending to beyond the limits of the solar system several billion miles.

Interstellar Flight—Flight between stars; strictly, flight between orbits around the stars.

Interstellar Space—That part of space conceived, from the standpoint of the earth, to have its lower limit at the upper limit of interplanetary space, and extending to the lower limits of intergalactic space.

Inverter—A device that changes dc current to ac, or vice versa.

Ion Engine—A type of engine in which the thrust to propel the missile or spacecraft is obtained from a stream of ionized atomic particles, generated by atomic fusion, fission or solar energy.

Ionic Conduction Path—That part of the vehicle where radio communication is not possible due to the ionization of the air - the transmitting medium. The ions interfere with the radio frequency signal.

Ionization—Formation of electrically charged particles; can be produced by high-energy radiation, such as light or ultra-violet rays, or by collision or particles in thermal agitation.

Ionized Layers—Layers of increased ionization within the ionosphere. Believed to be caused by solar radiation. Responsible for absorption and reflection of radio waves and important in connection with communication and tracking of satellites and other space vehicles.

Ionosphere—An outer belt of the earth's atmosphere in which radiations from the sun ionize, or excite electrically, the atoms and molecules of the atmospheric gases. The height of the ionosphere varies with the time of day and the season, but its lower limit is generally considered to lie between 25 and 50 miles. It is divided into several layers with respect to radiation and reflective properties. A characteristic phenomenon is its reflection of certain radio waves.

Isostatic—Under equal pressure from every side.

Isothermal Region—The stratosphere considered as a region of uniform temperature.

Jet Steering—The use of fixed or movable jets on a space vehicle, ballistic missile, or sounding rocket to steer it along a desired trajectory, during both propelled flight (main engines) and after thrust cutoff.

Kelvin Scale—(After Baron Kelvin, English physicist and inventor.) A temperature scale that uses centigrade degrees but makes the zero degree signify absolute zero.

Keplerian Trajectory—Elliptical orbits described by

celestial bodies (and satellites) according to Kepler's first law of celestial motion.

Kepler's Law—The three laws of planetary motion discovered by Kepler:

(1) The orbit of every planet about the sun is an ellipse, the sun occupying one focus. (2) A line from each planet to the sun sweeps over equal area in equal times. (3) The squares of the times required for the different planets to complete their orbits are proportional to the cubes of their mean distances from the sun.

Leveled Thrust—A rocket power plant equipped with a programmer or engine control unit that maintains the output at a relatively constant thrust.

Lift-Drag Ratio—The ratio of lift to drag, obtained by dividing the lift by the drag or the lift coefficient by the drag coefficient.

Light Year—Distance traveled in one year by light, which covers 186,284 miles in one second; equal to 5,880,000,000,000 miles.

Linear Explosive Charge—The shaping of a charge; shaping the explosive pattern of charge to achieve an explosive profile.

Liquified Gases—These are gases which have been converted to liquids under certain pressure and temperature conditions.

Liquid Hydrogen (LH₂)—A liquid rocket fuel that develops a specific impulse, when oxidized by liquid oxygen, ranging between 317 and 364 seconds depending upon the mixture ratio. Hydrogen gas becomes liquid at 423 degrees below zero.

Liquid Oxygen (LOX)—Oxygen supercooled and kept under pressure so that its physical state is liquid. Oxygen gas becomes liquid at 279 degrees below zero.

Loxing—Vernacular term for the task of loading liquid oxygen into fuel tanks of a missile from a ground supply.

Lunar Base—A projected installation on the surface of the moon for use as a base in scientific or military operations.

Lunar Gravity—The attraction of particles and masses towards the gravitational center of the moon.

Mach—(After Ernst Mach, 1858 - 1916, Austrian physicist.) A unit of speed measurement for a moving object equal to the speed of sound in the medium in which the object moves.

Mass—A measure of the quantity of matter in a body.

Mass Ratio—Initial mass of a vehicle at the instant of liftoff divided by the final mass at some point of the powered ascent or at burnout and thrust cutoff.

Mechanical Border—That layer in the atmosphere where air resistance and friction become negligible (from 120 to 140 miles altitude).

Mesosphere—Applied to two different layers on the upper atmosphere: (1) a layer that extends approximately from 19 to 50 miles above the earth's surface; (2) a layer that extends approximately from 250 to 600 miles, lying between the ionosphere and the exosphere.

Metabolism—Chemical and physical processes continuously going on in living organism; assimilated food built up into protoplasm, used, and broken down into waste matter.

Micrometeoroid—Meteoroids less than 1/250th of an inch in diameter.

Miniaturized Data Interleaving System—Where several results are combined to indicate one single result - as in computers; a transistorized version.

Mission Time—Period of time for completing a mission.

Monopropellant—A rocket propellant in which the fuel and oxidizer are premixed ready for immediate use.

Moon—The natural celestial body that orbits as a satellite above the earth, revolving around it about once every 29-1/2 days, reflecting the sun. The moon's mean distance from the earth is about 238,857 miles. The moon's diameter is about 2160 miles and its mass about 1/81 that of earth and the volume about 1/49. Its mean velocity is about 2285 statute miles per hour, its apogee 252,710 miles, perigee 221,463 miles.

Multiplexing—The simultaneous transmission of two or more signals within a single channel. The three

basic methods of multiplexing involve the separation of signals by time division, frequency division, and phase division.

Noise (Radio Transmission)—The noise behind the signal, caused by the signal, but not including the signal; can be man-made or atmospheric.

Nose Cone—The shield that fits over, or is, the nose of an aerospace vehicle.

Nova—A star which undergoes a sudden and enormous increase in brightness; about twenty-five appear every year in our galaxy. Supernova is a star which explodes with a liberation of most of its energy into space.

Null-Circle—Theoretical point in space where gravitational attraction of one planet balances that of another planet. There can be no real null point, circle, or region because the solar system is dynamic; parts of it are always moving in relation to other parts.

Omnidirectional—All-directional, not favoring any one direction (also called nondirectional).

Optical Navigation—Navigation by optical means, as opposed to mathematical methods.

Orbital Curve—One of the tracks on a primary body's surface traced by a satellite that orbits about it several times a day in a direction other than true east or west, each successive track being displaced to the west by an amount equal to the degrees of rotation of the primary body between each orbit.

Oxidizer—In a rocket propellant, a substance such as liquid oxygen or nitric acid that yields oxygen for burning the fuel.

Ozone Layer—Layer in the atmosphere about 20 miles above sea level which strongly absorbs solar ultraviolet radiation.

Ozonosphere—A stratum in the upper atmosphere at an altitude of approximately 40 miles having a relatively high concentration of ozone.

Parabola—A conic section made by a plane intersecting a cone parallel to an element of the cone.

Parabola of Escape—Critical orbit in a central force field; the parabolic orbit is such that a body has escape velocity at every point along it.

- Parallax**—The apparent displacement of an object, or the apparent difference in its direction of motion, if viewed from two different points.
- Pendulous Accelerometer**—A device employed to determine linear acceleration.
- Pericyynthion**—The point at which a satellite (e.g., a spacecraft) in its orbit is closest to the moon; differs from perilune in that the orbit is earth-originated.
- Perigee**—The point at which a moon or an artificial satellite in its orbit is closest to the earth
- Perilune**—The point at which a satellite (e.g., a spacecraft) in its orbit is closest to the moon: differs from pericynthion in that the orbit is moon-originated.
- Perihelion**—That point on an elliptical orbit around the sun which is nearest to the sun.
- Photon**—Minute particles which form streams to become light rays. These streams theoretically may be harnessed to power a spacecraft.
- Photon Engine**—A projected species of reaction engine in which thrust is to be obtained from a stream of light rays.
- Photosphere**—The outermost luminous layer of the sun's gaseous body.
- Pitch**—The movement of a space vehicle about an axis (Y) that is perpendicular to its longitudinal axis.
- Pitchup**—A correction movement of a missile in which it assumes a vertical ascent.
- Planetoid**—A starlike body, one of the numerous small planets nearly all of whose orbits lie between Mars and Jupiter (also called asteroid and minor planet).
- Plasmajet**—High-temperature jet of electrons and positive ions that has been heated and ionized by the magneto-hydro-dynamic effect of a strong electrical discharge.
- Plasma Physics**—The science dealing with the study of fully ionized gases.
- Premodulation Processor**—Part of the communications system; processed data for further use.
- Primary**—The body around which a satellite orbits.
- Propagation**—In missile terminology, to describe the manner in which an electromagnetic wave such as a radar signal, timing signal, or ray of light travels from one point to another.
- Propellant Utilization System**—The automatic electromechanical system that is installed to control precisely the mixture ratio of the liquid propellants, as they are consumed during a firing.
- Pseudo-Random Noise**—Noise produced by a definitely calculated process, while satisfying one or more of the standard tests for statistical randomness.
- Pulse-Code Modulation Telemetry (PCM)**—Pulse modulation in which the signal is sampled periodically, and each sample is quantized and transmitted as a digital code.
- Pyro Batteries**—Batteries used to fire pyrotechnic elements.
- Pyro Cartridges**—Pyrotechnic cartridges.
- Q Band**—See radio frequencies.
- Q-Ball**—A device for measuring the angle of attack of a vehicle.
- Radial Beam Extensions**—Connecting links between command and service modules.
- Radial Velocity**—The velocity of approach or recession between two bodies, especially between an observer and a source of radiation in a line connecting the two.
- Radio Command**—A radio signal to which a guided missile, drone, or the like, responds.
- Radio Frequencies**—Normally expressed in kilocycles per second at and below 30,000 kc/s, and megacycles per second above this frequency. Frequency subdivisions are: very low frequency (VLF), below 30 kc/s; low-frequency (LF), 30 to 300 kc/s; medium frequency (MF), 300 to 3000 kc/s; high frequency (HF), 3000 to 30,000 kc/s; very high frequency (VHF), 30 to 300 mc/s; ultra high

frequency (UHF), 300 to 3000 mc/s; super high frequency (SHF), 3000 to 30,000 mc/s; extremely high frequency (EHF), above 30,000 mc/s. During World War II, radio frequency bands were designated by letters (e.g., K band, L band, P band, Q band, S band, V band, and X band). These designations were used originally to maintain military secrecy but currently have no official standing.

Radio Telescope—A radio receiving station for detecting radio waves emitted by celestial bodies or by space probes in space.

Rate Gyro Signals—Signals that indicate the rate of angular motion.

Reaction Engine—An engine or motor that derives thrust by expelling a stream of moving particles to the rear.

Receiver-Decoder—A combination receiver that accepts the signal and then decodes to a given command.

Re-entry—The return of a spacecraft that re-enters the atmosphere after flight above it.

Regenerative Cooling—The cooling of a rocket engine by circulating the fuel or oxidizer fluid in coils about the engine prior to use in the combustion chamber.

Remaining Body—That part of a missile or other vehicle that remains after the separation of a fall-away section or companion body.

Redundant—A second means for accomplishing a given task.

Resolver—(1) A means for resolving a vector into two mutually perpendicular components; (2) A transformer, the coupling between primary and secondary of which can be varied; (3) A small section with a faster access than the remainder of the magnetic-drum memory in a computer.

Reticle Pattern—Pattern established by the crew alignment sight. Used in docking procedure.

Retrofit—To add on or modify.

Retrograde Impulse—The impulse employed to slow a spacecraft or vehicle by applying a thrust in an

opposite direction from the direction of motion of the spacecraft.

Retrograde Motion—Orbital motion opposite in direction to that normal to spatial bodies within a given system.

Retrorocket—A rocket that gives thrust in a direction opposite to the direction of the object's motion.

Reverse Thrust—Thrust applied to a moving object in a direction opposite to the direction of the object's motion.

Roentgen—A unit used in measuring radiation, as of X rays.

Roll—The movements of a space vehicle about its longitudinal (X) axis.

Rope—Reflectors of electromagnetic radiation consisting of long strips of metal foil.

RP-1 Fuel—Kerosene-like fuel.

S Band—A radio-frequency band of 1550 to 5200 megacycles per second.

Scintillating Counter—An instrument that measures radiation indirectly by counting the light flashes emitted when radiation particles are absorbed into any of several phosphors.

Scrub—To cancel out a scheduled launch either before or during countdown.

Second of Arc—A measure of an angle 1/60th of a minute.

Seeker—A guidance system which moves on energy emanating or reflected from a target or station.

Solenoid—A lunar satellite.

Sensible Atmosphere—That part of the atmosphere that may be felt, i.e., that offers resistance.

Sensor—A sensing element. In a navigational system, that portion which perceives deviations from a reference and converts them into signals.

Sequencer—A mechanical or electronic device that may be set to initiate a series of events and to make the events follow in a given sequence.

Servos—A short term for servomechanism or servomotors.

Serial Command Words—Specific instructional data to the up-link system.

Shear-Compression Pads—Pads which are sheared during separation of the service and command modules.

Sideband—Two frequencies, located on both sides of the carrier frequency; upper sideband, lower sideband.

Sidereal—A measurement of time. A sidereal day, for example, is the time it takes the earth to make a complete revolution.

Solar Corona—Outer atmospheric shell of the sun.

Solar Noise—Electromagnetic radiation which radiates from the atmosphere of the sun at radio frequencies.

Solenoid—A coil of wire, which, when current flows through it will act as a magnet and tend to pull an iron core that is movable to a central position; used for switching.

Sounding Rocket—A research rocket used to obtain data on the upper atmosphere.

Space Biology—A branch of biology concerned with life as it may come to exist in space.

Space-Fixed Reference—An oriented reference system in space independent of earth phenomena for positioning.

Space Platform—Large satellite with both scientific and military applications, conceived as a habitable base in space.

Space-Time Dilemma—According to Einstein's theory of relativity, time slows down increasingly in systems (e.g., extremely high-performance spacecraft) moving at velocities approaching the speed of light, relative to other systems in space (e.g., the earth). This slowdown is not apparent to the inhabitants of the moving system (the spacecraft) until they return to the redundant system in space from which they started (the earth).

Spatiography—The "geography" of space.

Specific Impulse—A means of determining rocket performance. It is equivalent to the effective exhaust velocity divided by gravity expressed in pounds per second.

Sphygmomanometer—An instrument for measuring arterial blood pressure.

Squib—A small explosive device whose primary function is to produce heat; usually used to achieve ignition in a larger combustible process.

Stabilized Gyro—Normally refers to stabilization to effect coincidence between the vertical axis of the gyro and the vertical established by an earth-seeking pendulum. In another axis, the gyro may be stabilized with respect to the electromagnetic field surrounding the earth, or with the true north direction through appropriate computers.

Stabilized Platform—Major part of an all-inertial guidance system, composed of an assembly of gimbal frames that hold three accelerometers in a fixed position in relation to inertial space. The accelerometers are mounted perpendicular to each other to measure accelerations along the three reference axes. These accelerations can be fed to a computer to determine instantaneous velocity and position in space.

Star Tracker—A telescopic instrument on a missile or other flightborne object that locks onto a celestial body and gives guidance to the missile or other object during flight. A star tracker may be optical or radiometric.

Stationary Orbit—In reference to earth known as a 24-hour orbit; a circular orbit around a planet in the equatorial plane and having a rotational period equal to that of the planet. For earth, the stationary orbit is about 26,000 miles in radius. A body moving in a stable stationary orbit appears fixed in the sky to an observer on the surface of the planet.

Step Rocket—A rocket with two or more stages.

Stratosphere—A calm region of the upper atmosphere characterized by little or no temperature change in altitude.

Sunseeker—Two-axis device actuated by servos and controlled by photocells to keep instruments pointed toward the sun despite rolling or tumbling of an aerospace vehicle in which instruments are carried.

Subsonic—Speed less than that of sound.

Sustainer Rocket—A rocket engine used as a sustainer, especially on an orbital glider or orbiting spacecraft that dips into the atmosphere at its perigee.

Synergic Curve—A curve plotted for the ascent of an aerospace vehicle determined to give the missile or other vehicle maximum economy in fuel with maximum velocity.

Telemetry—A system for taking measurements within an aerospace vehicle in flight and transmitting them by radio to a ground station.

Thrust Vector—The directional line of thrust of the spacecraft.

Torquing Commands—A command given to the gyros to maintain attitude.

Transceiver—A unit combining the radio or radar transmitter and receiver, such as used in a transponder.

Transducer—A device by means of which energy can be made to flow from one or more transmission systems to other transmission systems.

Transearth Coast—The flight, under no power, between moon and earth.

Transistor—An electronic device that controls an electron current by the conducting properties of germanium or like material.

Translunar Space—That part of space conceived as a spherical layer centered on the earth, with its lower limits at the distance of the orbit of the moon, but extending to several hundred thousands of miles beyond.

Translation—For Apollo, movement of the spacecraft along the X axis acceleration.

Translational Control—A joystick located in the crew compartment to enable the pilot to control flight.

Transponder—A radio transmitter-receiver which transmits identifiable signals automatically when the proper interrogation is received.

Tumbling—An unsatisfactory attitude situation in which a vehicle continues on its flight, but turns end over end about its center of gravity with its longitudinal axis remaining in the plane of flight.

Ullage—The volume in a closed tank or container above the surface of a stored liquid. Also the ratio of this volume to the total volume of the tank.

Ultrasonic—Very high sound waves; not audible to humans.

Umbilical Cord—A cable fitted to a vehicle with a quick-disconnect plug, through which electrical power, oxygen, etc., is transmitted.

Up-Link Data—Telemetry information from the ground.

Van Allen Radiation Belts—Two doughnut-shaped belts of high-energy particles trapped in the earth's magnetic field which surround the earth; first reported by Dr. James A. Van Allen of the University of Iowa.

Vectory Steering—Vernacular for a steering method where one or more thrust chambers are gimbal-mounted so that the thrust force may be tilted in relation to the center of gravity of the spacecraft to produce a turning moment.

Wicking (or Wicking Axis)—Capillary action where fluid travels along a path.

X Axis—A designation for the longitudinal axis in a coordinate system of axes.

Yaw—Displacement of a space vehicle from its vertical (Z) axis.

Y Axis—A designation for the lateral axis in a coordinate system of axes.

Z Axis—A designation for the vertical axis in a coordinate system of axes.