



AEROSPACE RECOMMENDED PRACTICE

ARP4386™

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Superseding ARP4386C

(R) Terminology and Definitions for Aerospace
Fluid Power, Actuation and Control Technologies

RATIONALE

This document has been revised to incorporate comments that were held over from Revision C and also includes other technical and editorial changes.

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1. SCOPE

This SAE Aerospace Recommended Practice (ARP) provides the technical terms and nomenclature, together with their definitions and abbreviations/acronyms that are used in aerospace fluid power, actuation and control systems.

NOTE: ARP490 and ARP4493 are sources for definitions specifically for electrohydraulic servovalves.

1.1 Field of Application

The data contained herein applies to all types of aerospace vehicles and their fluid power, actuation and control subsystems and components.

1.2 Purpose

The purpose of this document is to facilitate communications and to standardize the application of fluid power, actuation and control system related terms in a consistent manner throughout the SAE publications and throughout the producer and user sectors of the aerospace industry.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AIR5872	Aerospace Hydraulic Pump Controls
ARP490	Electrohydraulic Servovalves
ARP598	Aerospace Microscopic Sizing and Counting of Particulate Contamination for Fluid Power Systems
ARP4493	Aerospace - Direct Drive Servovalves
AS1290	Graphic Symbols for Aircraft Hydraulic and Pneumatic Systems
AS4059	Aerospace Fluid Power - Contamination Classification for Hydraulic Fluids
AS5440	Hydraulic Systems, Military Aircraft, Design and Installation, Requirements For

2.1.2 EASA Publications

Available from European Aviation Safety Agency, Ottoplatz, 1, D-50679 Cologne, Germany, Tel: +49 221 8999 000, www.easa.europa.eu.

CS 25	Certification Specifications for Airworthiness of Large Aeroplanes
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2.1.3 FAR Publications

Available from Federal Aviation Regulations, <https://www.faa.gov>.

14 CFR Part 25 Airworthiness Standards, Transport Category Airplanes

2.1.4 RTCA Publications

Available from RTCA, Inc., 1150 18th Street, NW, Suite 910, Washington, DC 20036, Tel: 202-833-9339, www.rtca.org.

RTCA/DO-331 Model-Based Development and Verification Supplement to DO-178C and DO-278A

2.1.5 U.S. Government Publications

Copies of these documents are available online at <http://quicksearch.dla.mil>.

MIL-F-8815 Military Specification: Filter and Filter Elements, Fluid Pressure, Hydraulic Line, 15 Micron Absolute And 5 Micron Absolute, Type II Systems; General Specification For

2.1.6 Other Publications

Marks' Standard Handbook for Mechanical Engineers

Van Nostrand's Scientific Encyclopedia

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Aerospace Technical Report.

2.2.1 ISO Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ISO 5598 Fluid power systems and components - Vocabulary

ISO 6771 Pressure and Temperature Classifications - Fluid Systems and Components - Aerospace

ISO 8625-1 Aerospace - Fluid Systems - Vocabulary - Part 1 - General terms and definitions relating to pressure

ISO 8625-2 Aerospace - Fluid Systems - Vocabulary - Part 2 - General terms and definitions relating to flow

ISO 8625-3 Aerospace - Fluid Systems - Vocabulary - Part 3 - General terms and definitions relating to temperature

ISO 8625-4 Aerospace - Fluid Systems - Vocabulary - Part 4 - General terms and definitions relating to control/actuation systems

3. TERMINOLOGY - DEFINITIONS AND ABBREVIATIONS/ACRONYMS

NOTE: A list of the terms provided in ARP4386 is provided in Appendix A.

3.1 Organization of Terms

3.1.1 Multiple Applicability of a Term

When a term is applicable to more than one branch or segment of the technology it may have different meanings and definitions in each. Where this occurs the multiple listings with appropriate designations are shown under the same primary term.

3.1.2 Use of Substitution Symbol

The symbol "~" has been used as a substitution for the repetitive lead word of any term or expression listed. For example: "PRESSURE" ... next term listed: "~, ULTIMATE" standing for "PRESSURE, ULTIMATE" ..., next term listed: "~ AMPLIFIER" standing for "PRESSURE AMPLIFIER", etc.

This practice has also been applied when two or more separate lead words were repeated in successive listings such as "ACTUATOR, MECHANICAL" ... next item: "~, ~, RACK- AND-PINION" ... standing for "RACK-AND-PINION MECHANICAL ACTUATOR", etc.

3.2 A

3.2.1 Abbreviations

ACT	Active control technology
ADIRU	Air data/inertial reference unit
ADM	Air data module
A/F	Airframe
AFCS:	Automatic flight control system
AOA:	Angle of attack
AOG	Aircraft on ground
A/P	Airplane, also Autopilot
ARINC	Aeronautical Radio Incorporated
ATE	Automatic test equipment
3.2.2	Acronyms
ACE	Actuator Control Electronics

3.2.3 Definitions

ABLATING MATERIALS: Special materials on the surface of a spacecraft that can be sacrificed (carried away, vaporized) during re-entry into the earth's atmosphere.

NOTE: Kinetic energy is dissipated and excessive heating of the main structure of the spacecraft is thereby prevented.

ABORT: The failure to accomplish a mission or portion of a mission for any reason.

NOTE: It may occur at any point from initiation of operation to destination.

ACCESSIBILITY: A measure of the relative ease of admission to an item for the purpose of operation or maintenance.

ACCUMULATOR: A hydraulic component used for storing and releasing hydrostatic energy.

~, **HYDROPNEUMATIC:** An accumulator in which the stored operating medium is hydraulic fluid, pressurized by means of a compressed (usually inert) gas.

~, **BLADDER:** A hydropneumatic accumulator in which the separation between the liquid and gas sides is achieved by a flexible bladder.

~, **METAL BELLOWS:** A hydropneumatic accumulator in which the separation between the liquid and gas sides is achieved by a welded metal bellows.

~, **PISTON:** A hydropneumatic accumulator in which the separation between the liquid and gas sides is achieved by a sliding piston incorporating a sealing method.

~, **SELF DISPLACING:** A tandem type hydropneumatic piston accumulator that is designed to maintain a constant volume of active fluid in the hydraulic circuit.

NOTE: Figure 1 shows the various elements of a self-displacing accumulator.

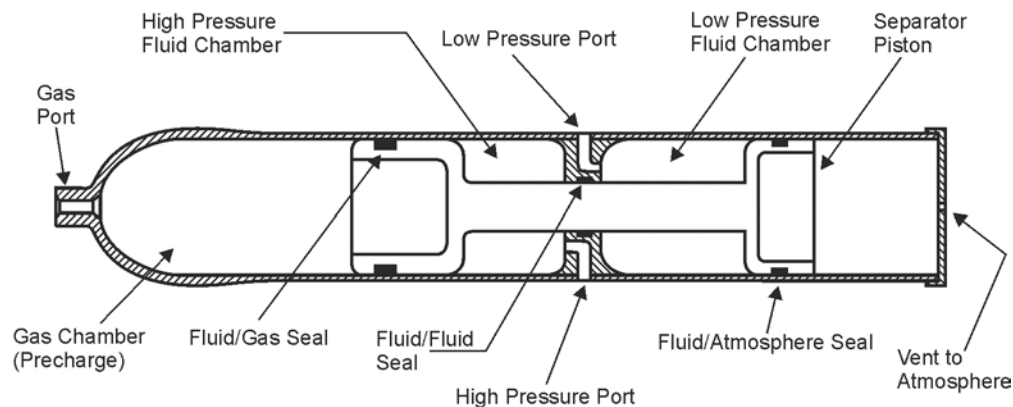


Figure 1 - Self-displacing accumulator

~, **SPRING-LOADED:** An accumulator in which the hydraulic fluid is subjected to pressure by a spring-loaded piston.

~, BLOW DOWN: This is similar to a direct blow down system except that the stored cold gas is applied to a vessel containing hydraulic fluid with provision for fluid separation.

NOTES:

1. When actuated by the stored gas, the hydraulic fluid then powers the actuation components and is then usually dumped overboard after providing the actuation power.
2. This system is primarily used for short duty cycles where the higher stiffness resulting from the use of hydraulic fluid is desired.

ACTIVE:

The following are alternative definitions of ACTIVE:

1. An adjective which describes a system or portion of a system which is in control in contrast to being in standby
2. The operational status of a servocontrol device after a failure if the device is activated or remains in control.

~ CONTROL TECHNOLOGY: An airplane design concept in which vehicle performance, weight, and economic characteristics are optimized through a reliance on automatic subsystems within the flight control system to:

- Augment the airplane's stability,
- Reduce the design loads through load reduction or redistribution and structural mode damping,
- To manage the airplane's configuration for aerodynamic efficiency.

NOTE: Active control functions include:

- a. Pitch stability augmentation
- b. Lateral and/or directional stability augmentation
- c. Angle-of-attack limiting
- d. Wing-load alleviation
- e. Maneuver-load control
- f. Gust-load alleviation
- g. Flutter-mode control
- h. Ride smoothing

~ DEVICE: The general class of Fluidics device which responds to a signal or signals separate from the fluid stream which powers the output.

ACTUATION SYSTEM: An actuation system comprises a control system which receives input power from a power generation and distribution system to control an output load.

NOTES:

1. An actuation system includes a controller, power modulator, actuator, and feedback elements (if needed) and a motion converter.
2. Figure 2 illustrates a typical actuation system.

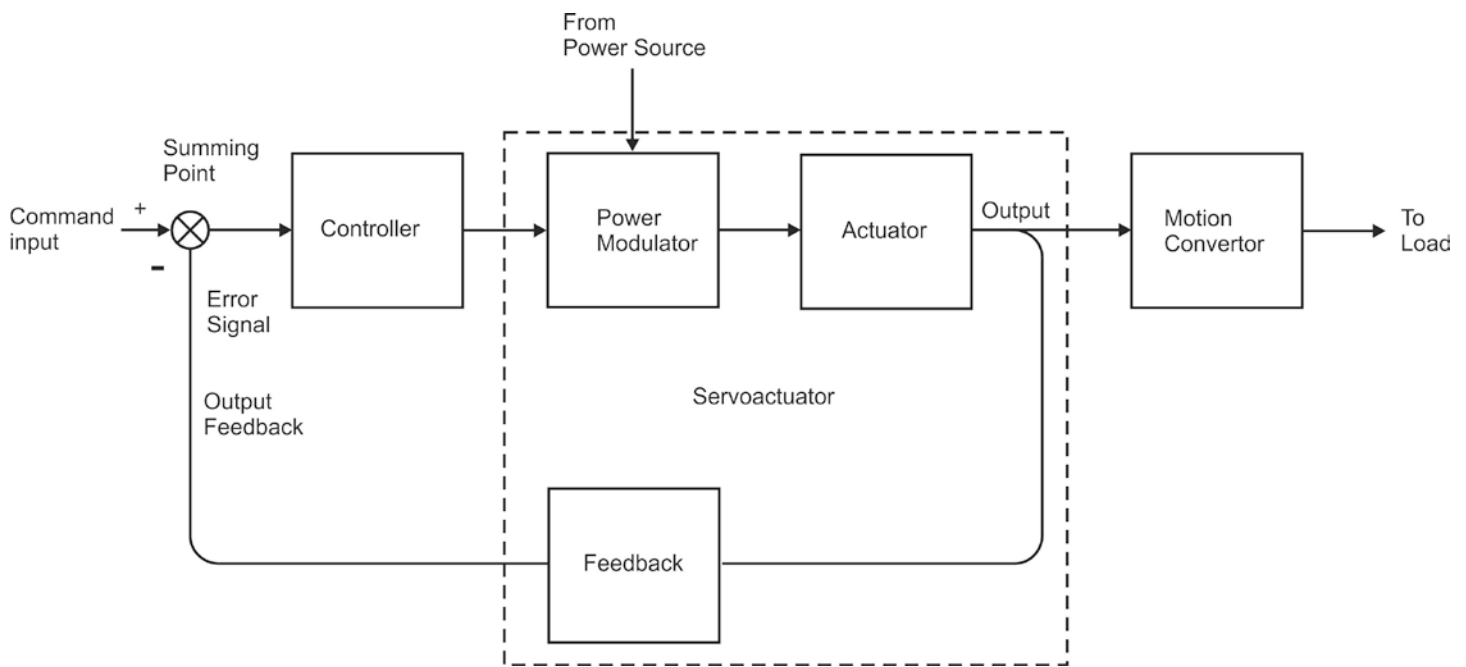


Figure 2 - Essential actuation system

~, POWER-BY-WIRE: A system that utilizes integrated servoactuators that are electrically powered instead of hydraulically powered.

NOTES:

1. Power conversion from electrical to mechanical may include mechanical devices such as ballscrews, gears, chains, cables, etc., or through a motor/pump and hydraulics.
2. See Integrated Actuator Package.

ACTUATOR: The component of the actuation system that does work, or dissipates energy, or traps fluid to control, move or hold a load.

NOTE: Actuator output motion is achieved by the conversion of energy from the power system into mechanical work through torque or force.

~, CONTINUOUS MOTION: A rotary actuator (compare also Rotary Actuator) capable of infinite rotation in either direction.

~, DOUBLE ENDED: An actuator with a single cylinder and a piston that has two rods extending to atmosphere.

~, ELECTROHYDRAULIC SERVO: An integrated hydraulic servoactuator which incorporates an electrohydraulic servovalve to control hydraulic power from the aircraft hydraulic power system in a closed loop fashion.

~, ELECTROHYDROSTATIC: A linear or rotary hydraulic actuator, which uses an Electrohydrostatic Module (EHM) to power the actuator.

~, ELECTROMECHANICAL: An actuator which utilizes AC or DC electric motors to produce, at its output, mechanical work, torque, or force, or motion.

~, ~, DIRECT DRIVE: This is an EMA with the translating part of the nutscrew (linear actuators) or the motor shaft (rotating output actuator) directly connected to the load.

~, ~, GEAR DRIVE: This is an EMA with a mechanical reducer inserted between the motor and the load.

~, FLUID: A component, which converts controlled fluid power (hydraulic or pneumatic) into an equivalent mechanical output.

~, FLUIDIC: A component, which converts fluid power derived from a fluidic control source into an equivalent mechanical output.

~, HYDRAULIC, ELECTRICAL BACK-UP: A conventional FBW hydraulic actuator combined with the electric power-by-wire control capability of an EHA for backup mode operation.

~, IRREVERSIBLE DRIVE: A drive which, without input torque (or force), cannot be back-driven from the output by a torque (or force) less than the maximum design load at the output.

~, REVERSIBLE DRIVE: A drive which, without input torque (or force), can be back-driven from the output by a torque (or force) less than the maximum design load at the output.

~, LINEAR: An actuator which develops rectilinear motion and force as its outputs.

NOTES:

1. A hydraulic linear actuator typically comprises a cylinder, piston rod, piston head, and two hydraulic fluid ports to provide extension and retraction capability.
2. A mechanical linear actuator typically comprises a rotational to translational mechanical transformer of a nut-screw type (for example, a power screw, ball screw, or roller screw) to provide extension and retraction capability.
3. It is also referred to as a power stage in redundant actuator designs.

~, ~, BEARING MOUNTED: An actuator mounted between the support structure and load with spherical bearings at each end.

NOTE: This type of actuator can articulate in two axes.

~, ~, SINGLE ENDED: An actuator with a single cylinder and a piston which has only one rod extending to atmosphere.

~, ~, DOUBLE ENDED: An actuator with a single cylinder and a piston that has two rods extending to atmosphere.

~, ~, EQUAL AREA: An actuator having equal effective piston areas and equal force output for both directions of motion.

~, ~, UNEQUAL AREA: An actuator having different effective piston area for each direction of motion.

NOTES:

1. An unequal area actuator may be either single-ended or double-ended.
2. Since an unequal area actuator will have a higher force output in one direction, it is usually used where a significant bias load is anticipated.
3. An actuator having an area ratio of 2:1 used with a three-way control valve is equivalent to an equal area actuator since the force output and actuation power consumption will be equal in both directions.
4. Unequal area actuators are sometimes referred to as unbalanced actuators.

~, ~, THREE-WAY SERVO: A servoactuator having a single control port connecting to a three-way servovalve.

NOTES:

1. The control port is connected to the large actuator area and system pressure is usually applied to the small area.
2. A three-way linear servoactuator is usually, but not necessarily, a single- ended actuator.

~, ~, FOUR-WAY SERVO: A servoactuator having two control ports connecting to a four-way servovalve.

NOTE: A four-way linear servoactuator is usually, but not necessarily, a double ended actuator.

~, ~, FIXED BODY: An actuator with the body rigidly attached to the load bearing support and the piston rod attached to the moving load.

NOTE: The output necessarily lies along one axis with no articulation possible.

~, ~, MOVING BODY: An actuator with the body attached to the moving load and the piston rod attached to the support structure.

NOTE: The output necessarily lies along one axis with no articulation possible.

~, ~, TRUNNION MOUNTED: An actuator having the body mounted through a trunnion to the actuator support.

NOTE: The output rod can articulate in one axis only.

~, ~, PARALLEL: Two or more linear actuators arranged in parallel which drive a single output.

NOTES:

1. The parallel actuator cylinders are typically mounted to each other as one assembly with their individual output pistons tied together in a force or torque summing fashion.
2. They are also referred to as side-by-side actuators.

~, ~, SIDE-BY-SIDE: See Parallel Actuator.

~, ~, TANDEM: Two or more collinear actuators arranged in series which drive a single output through the use of a common collinear piston rod.

NOTES:

1. A tandem actuator typically has two cylinders mounted to each other as one assembly and a single common piston rod which has two pistons (one for each cylinder).
2. For dual hydraulic power systems, two separate cylinders are commonly used to provide redundant actuator design with rip stop construction.
3. A single common cylinder is sometimes used to reduce the actuator diameter for installation purposes (e.g., in a thin wing surface installation); however, this design does not provide redundancy.

~, MULTICHANNEL: An actuator, which contains more than one signal or control path.

NOTE: It is also referred to as a multilane actuator.

~, POSITION SUMMING: A multichannel arrangement which sums the position outputs of multiple actuators into a single output.

~ REDUNDANT: A multichannel and multi power stage actuator design wherein the control channels are typically identical, each receiving the same input command.

NOTE: The power stages may be configured as a parallel actuator, tandem actuator, redundant rotary actuator or a power drive unit with redundant motors.

~, ROTARY: An actuator which develops rotary motion and torque as outputs.

NOTES:

1. The term "rotary actuator" implies that the actuator is capable of limited output rotation.
2. If the device is capable of continuous rotation, it is usually referred to as a motor.

~, ~, PUSH-PUSH: An actuator wherein two linear pistons act on the opposite ends of a crank arm attached to a rotary output shaft.

~, ~, RACK-AND-PINION, FLUID: An actuator wherein the rotary motion is achieved by piston-driven linear racks engaging a rotary output gear.

~, ~, RACK-AND-PINION, MECHANICAL: A mechanical actuator generally consisting of reduction input gearing, outputting to a rotary pinion gear that connects with a rack to provide linear output actuation force.

NOTE: It may also be used with linear motion rack, coupling to a pinion to provide rotary output torque.

~, ~, VANE: An actuator wherein fluid pressure is applied to either side of a vane or vanes which are integral with or geared to a rotary output shaft.

NOTE: Vane cavities are separated by center dams which limit the rotation of the actuator.

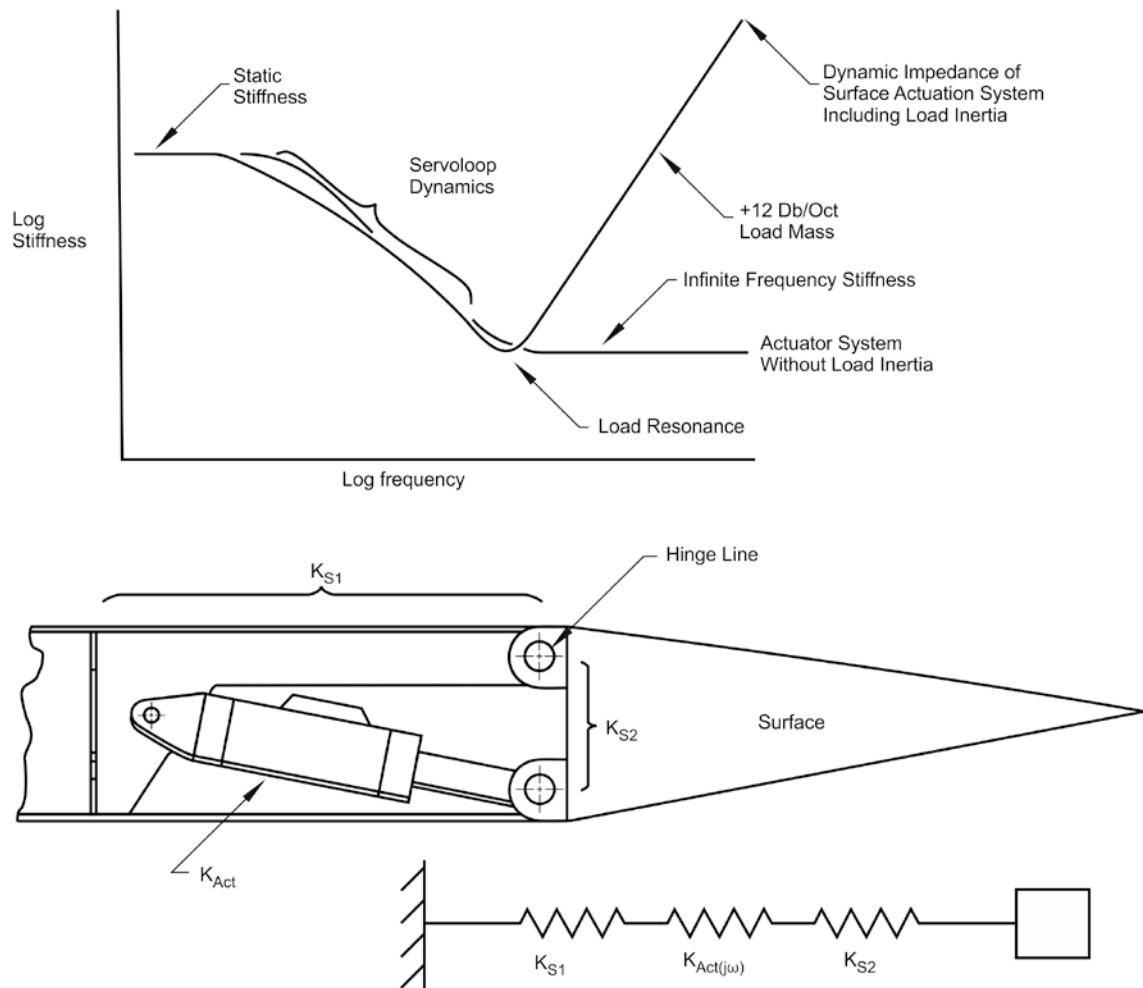
~, SINGLE CHANNEL: An actuator which contains a single torque- or force-generating device.

~, SMART: An electrohydraulic servoactuator containing the feedback loop closure and some or all of the redundancy management electronics in a line replacement unit.

~ STIFFNESS: The ability of the actuator to resist externally applied loads; see also system and drive stiffness.

NOTES:

1. See also system and drive stiffness.
2. Figure 3 shows the following:
 - How the stiffness of an actuator varies over the input frequency range
 - The various elements that contribute to the overall actuator stiffness



ω is the oscillation frequency, in radians per second and j is the square root of minus one.

Figure 3 - Actuator stiffness

~, TURBOMECHANICAL: An actuator that utilizes high speed turbine typically powered by warm gas generators.

NOTE: The turbine output speed is converted to mechanical motion by a combination of mechanical gearing and clutches.

~, ~, CLUTCH COUPLED: A turbomechanical actuator wherein a constant speed turbine is coupled to the load through a double-acting servocontrolled clutch.

NOTES:

1. The clutch controls both the speed and direction of the load.
2. A large gear reduction between the high speed turbine and the load is included in the actuator.

~, ~, DOUBLE TURBINE: A turbomechanical actuator utilizing two turbines of opposite directional sense that are mechanically coupled together.

NOTES:

1. A control valve is used to proportionally control gas flow to either of the two turbines, thus providing control of load speed and direction.
2. Speed reduction between the turbine and load is usually included.

~, MECHANICAL: A mechanical device used to amplify force, primarily through the use of reduction gearing or threaded screw jacks.

NOTES:

1. The actuator output may be linear or rotary.
2. The actuator input is generally rotary, using an electric, a hydraulic or a pneumatic motor.

~, ~, POWER SCREW: A mechanical actuator consisting of a threaded shaft and a threaded nut and arranged so that a rotary input motion is converted to a linear output.

NOTES:

1. The output force can be transformed by this action, for example, high output forces can be produced by low input torques by use of low pitch screw.
2. The thread forms of the nut/screw arrangement may be ACME, modified ACME, Buttress, V-thread, etc.
3. Power screw actuators are sometimes referred to as Jack Screw Actuators.

~, ~, BALL SCREW: A linear mechanical actuator consisting of a ball race threaded shaft, a ball race threaded nut, coupled together through spherical bearing balls, and incorporates a bearing ball recirculation device(s).

NOTES:

1. It is sometimes called a ball-bearing screw actuator.
2. The device normally converts rotational input motion to linear output motion but, in some cases, is used in the reverse manner to provide rotary output motion from a linear input motion
3. A ball screw mechanical actuator is normally considered to be significantly more efficient than a power screw actuator.

~, ~, GEARED ROTARY: A mechanical device utilized for amplifying torque through a series of gears converting high speed, low torque input into high torque, low speed output.

NOTE: It is sometimes referred to as a power hinge.

~ TYPES: Actuators are frequently classified into linear and rotary output devices.

NOTE: See Figures 4 and 5.

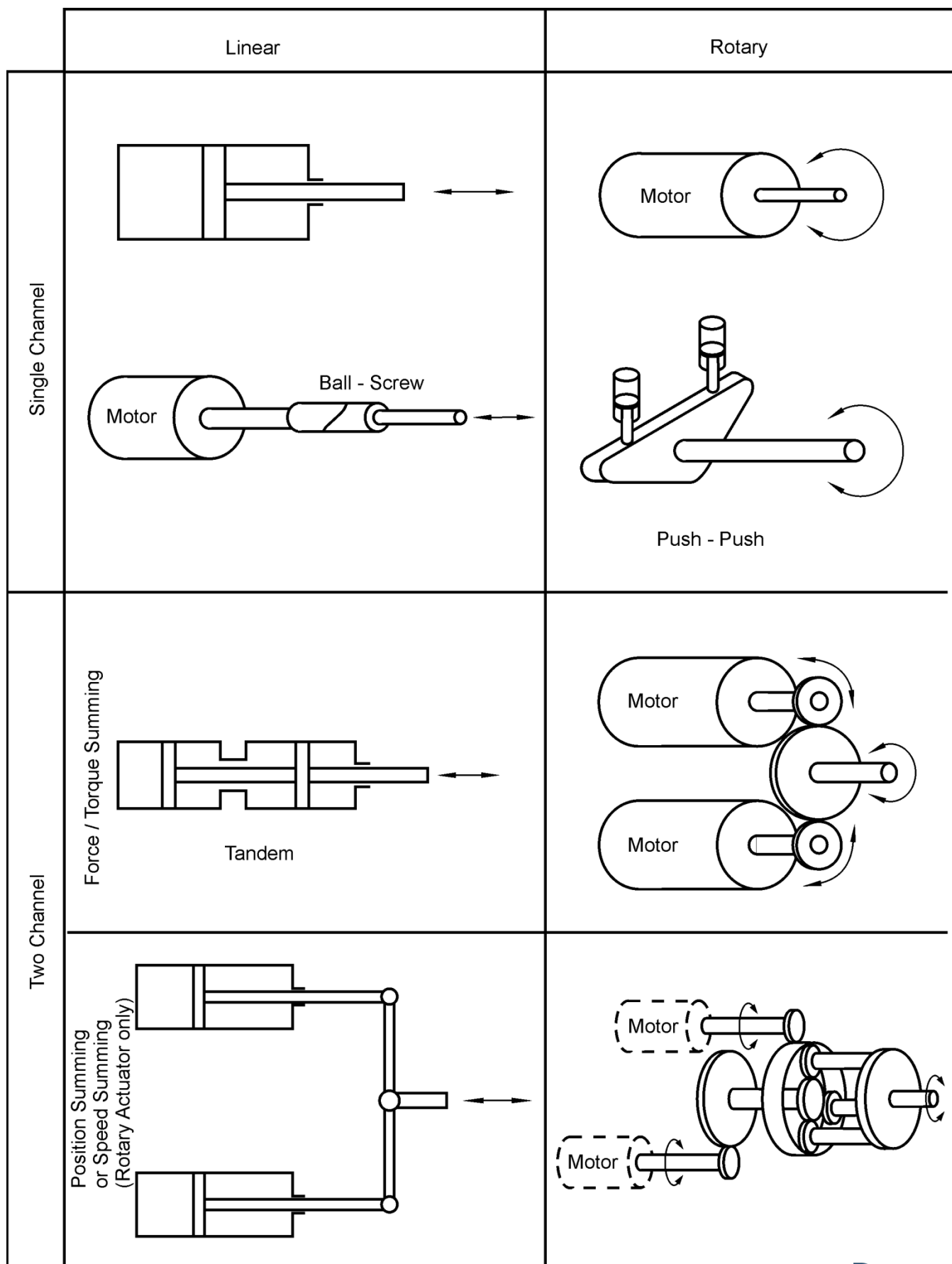


Figure 4 - Actuator types

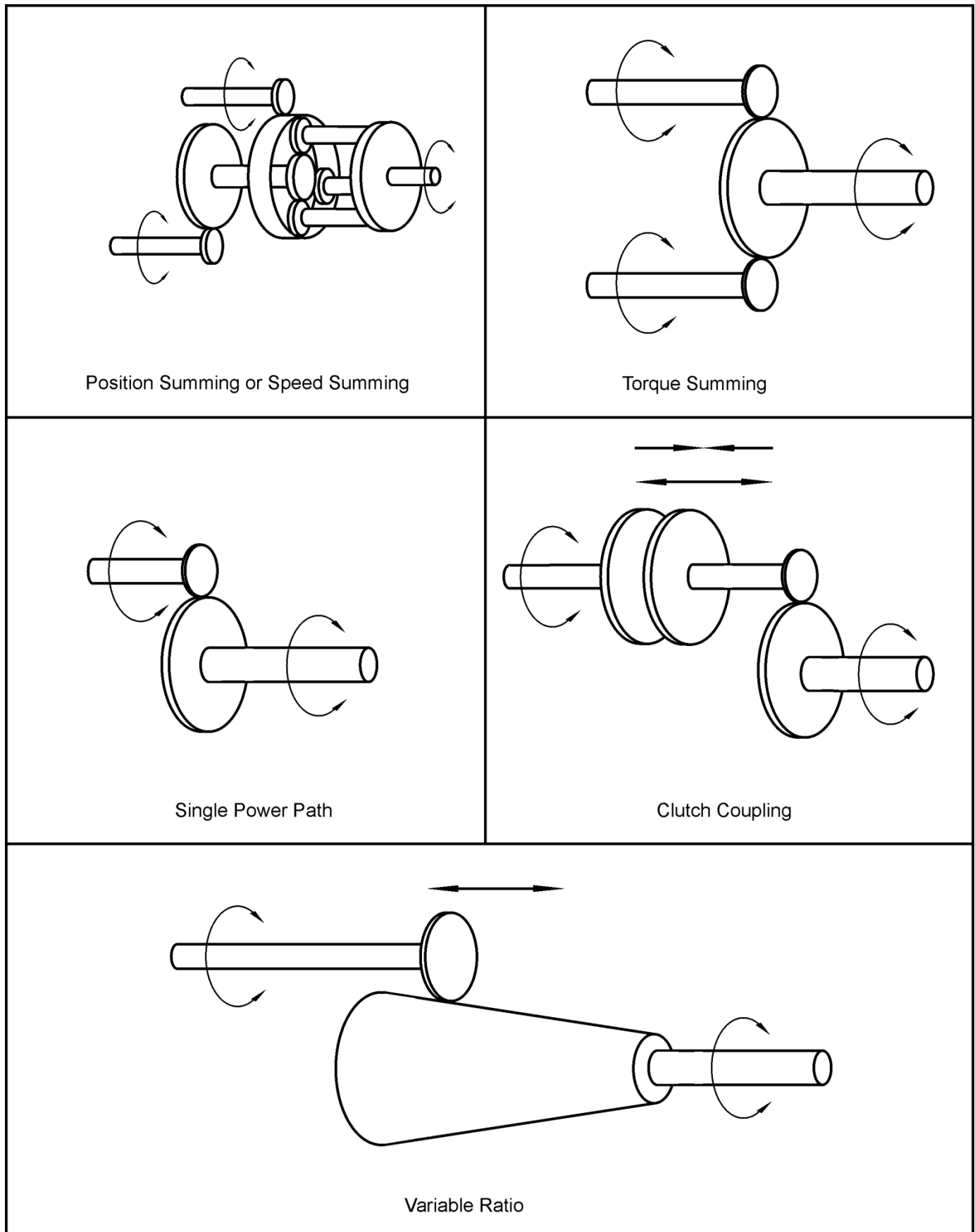


Figure 5 - Rotary drive classification

ADAPTIVE CONTROL: A control system which maintains the optimum system performance by automatically changing system parameters.

~ **FLIGHT CONTROL SYSTEM:** A flight control system having the capability to vary its performance parameters in flight and thus adapt to the changing flight conditions so that the vehicle's structural integrity and stability limitations are not exceeded during critical phases of flight.

ADIABATIC: Without the exchange of heat between the medium and its surroundings, such as a thermodynamic process taking place.

~, **HEAD:** The head of gas available to do work expressed by Equation 1:

$$H_{ad} / 1/ = \left(\frac{\gamma}{\gamma - 1} \right) \frac{R}{M} T \left[1 - \left(\frac{P_2}{P_1} \right)^{\frac{(\gamma - 1)}{\gamma}} \right] \quad (\text{Eq. 1})$$

where:

H_{ad} = Adiabatic head, feet (m)

γ = Gas ratio of specific heats, dimensionless

R' = Universal gas constant (1544 foot-pound/mole °R) /1/

M = Molecular weight of gas, lb/mole (kg/mole)

T = Gas temperature, °R (°K)

$\frac{P_2}{P_1}$ = Exhaust-to-inlet pressure ratio, dimensionless

/1/ In SI metric units, R' is replaced by (R'/g) , where:

$R' = 8.31 \text{ kJ/mole (°K)}$

$g = 9.81 \text{ m/s}^2$

~ **PROCESS (in a gas):** An expansion or compression in which no heat transfer takes place.

NOTES:

1. This is the standard for determining energy extraction or absorption in gases and represents the theoretical (100% efficient) reversible process.
2. For air $n = 1.4 = k/(k-1)$ where $k = 3.5$ such that $P/P_0 = (T/T_0)^{k/(k-1)}$.
3. See Polytropic expansion and compression.

AERODYNAMIC

~ **HEATING:** The rise in skin temperature of an aircraft due to friction of air at high speed.

~ **MISSILE:** A missile which uses aerodynamic forces to maintain its flight path, generally employing propulsion guidance and a winged configuration.

AERODYNAMICS: That field of dynamics which treats the motion of bodies relative to the air they pass through, and the forces that act upon them, especially as they relate to flight.

AEROSPACE:

The following are alternative definitions of AEROSPACE:

1. An operationally indivisible medium consisting of the total expanse beyond the earth's surface.
2. A generic term relating to all aspects of the aviation industry.

~ VEHICLE: A vehicle which functions both in the sensible atmosphere and in the space equivalent or space environment.

AILERON: A control surface set into or near the trailing edge of an airplane wing to produce roll moments about the longitudinal axis.

NOTES:

1. Ailerons usually work in pairs; when the aileron on one wing is deflected upward, the aileron on the other wing is simultaneously deflected downward.
2. See also Control Surface.

~ ANGLE: The angular displacement of the aileron surface relative to the wing surface.

~ CONTROL

The following are alternative definitions of AILERON CONTROL:

1. Aerodynamics - A control for producing a rolling moment on the airplane through the use of ailerons,
2. Flight Control - A mechanism for moving the ailerons.

~, FRISE: A type of aileron having its leading edge projection well ahead of the hinge axis.

NOTE: When the trailing edge of the Frise aileron is deflected upward its leading edge protrudes below the wing's lower surface, thereby producing increased drag, which tends to add aiding yaw to counter the adverse yaw produced by the opposite wing aileron.

~ YAW: Yawing moment caused by aileron deflection.

NOTES:

1. Depending upon the aircraft configuration, aileron yaw may be either aiding or adverse.
2. For positive aileron deflection, aiding yaw produces a positive yawing moment; adverse yaw produces a negative moment.

AIR: The gaseous fluid surrounding the Earth.

NOTES:

1. The average volumetric composition to 90 km altitude is 78.084% N₂, 20.948% O₂, 0.934% Ar, 0.0314% CO₂, 0.00182% Ne, 0.00052% He., 0.000114% Kr, 0.0002% CH₄.
2. The moisture content is not specified but is listed as % relative humidity or mass of H₂O (vapor) per unit mass of dry air.

~ COOLED: To denote that the heat energy released by the subject is transferred to the surrounding air atmosphere.

NOTE: See also Motor.

~ DRAG: The drag exerted by air molecules upon a moving object, as upon an aircraft or rocket moving through the air, or upon an earth satellite that comes within the earth's atmosphere during orbit.

~ BREATHING MISSILE: A missile with an engine requiring the intake of air for combustion of its fuel, as in a ramjet or turbojet.

NOTE: This is in contrast with the rocket missile which carries its own oxidizer and can operate beyond the atmosphere.

AIRBORNE:

The following are alternative definitions of AIRBORNE:

1. Applied to personnel, equipment, etc., transported by air; e.g., airborne infantry.
2. Applied to material being or designed to be transported by aircraft, as distinguished from weapons and equipment installed in and remaining a part of the aircraft.
3. Applied to an aircraft from the instant it becomes entirely sustained by air until it ceases to be so sustained.

NOTE: A lighter-than-air aircraft is not considered to be airborne when it is attached to the ground, except that moored balloons are airborne whenever sent aloft.

AIRCRAFT: A vehicle capable of transporting personnel or equipment through the atmosphere, without the use of ground supports, such as legs, wheels, or tracks.

~ VECTORING:

The following are alternative definitions of AIRCRAFT VECTORING:

1. The act of directing control of inflight aircraft through control commands of azimuth headings.
2. The act of changing direction of the aircraft in pitch and yaw.

NOTE: See also Body Axes.

~ GROUND EQUIPMENT: Equipment required on the ground to support the operation and maintenance of an aircraft and its airborne equipment.

~ ON GROUND: The aircraft cannot fly until replacement parts are received to complete the maintenance action.

AIRFOIL: A surface or body, as a wing, propeller blade, rudder, or the like, especially designed to obtain a reaction, as lift or thrust, from the air through which it moves.

NOTE: Figure 6 provides the related nomenclature.

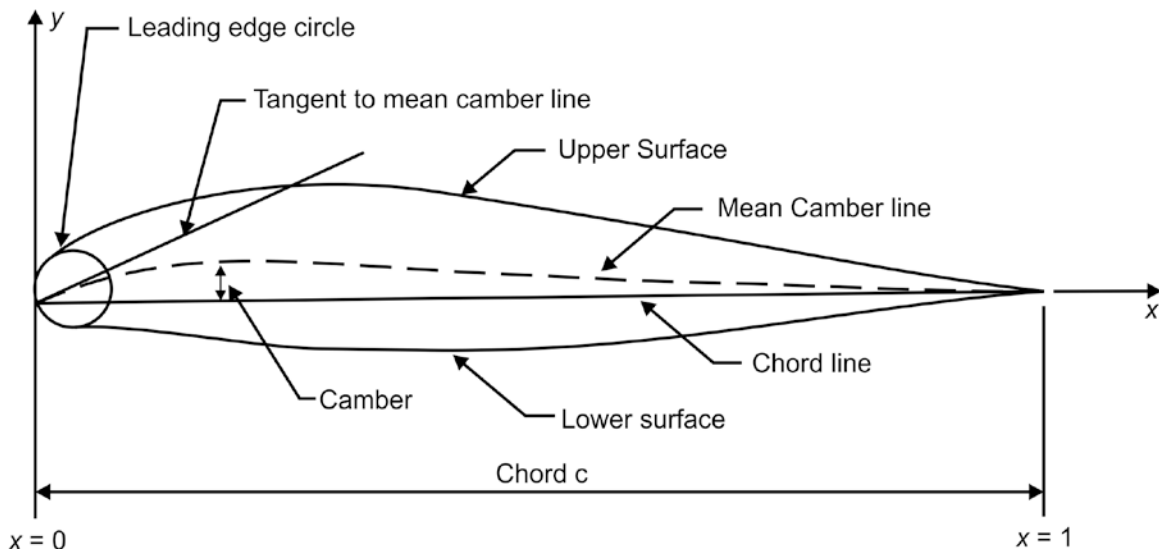


Figure 6 - Airfoil section

AIRFRAME:

The following are alternative definitions of AIRFRAME:

1. The structural components of an airplane, including the framework and skin of various parts, such as the fuselage, empennage, wings, landing gear (minus tires), and engine mounts.
2. The framework, envelope, and cabin of an airship.
3. The assembled principal structural components, less propulsion system, control, electronic equipment, and payload.

AIRSPEED: The speed of an aircraft relative to its surrounding air mass.

NOTE: The unqualified term "air speed" can mean any one of the following:

- a. **Indicated Airspeed:** The airspeed shown by an airspeed indicator
- b. **Calibrated Airspeed:** Indicated Airspeed corrected for instrument installation error
- c. **Equivalent Airspeed:** Calibrated Airspeed corrected for compressibility error

~, TRUE: Equivalent Airspeed corrected for error due to air density (altitude and temperature); the true speed of the vehicle through the air.

ALIGNMENT: Performing the adjustments that are necessary to return an item to specified operation.

AMBIENT: Pertaining to, of the surroundings; as in ambient temperature, ambient pressure.

AMPLIFIER: An active component which provides a variation in output power greater than the impressed control signal variation.

NOTES:

1. The signal medium as well as the output may be electric, hydraulic, pneumatic, or optical power.
2. The polarity of the output may be either positive or negative relative to the control signal.
3. The level (pressure, voltage, current, or flow) of the control signal may be greater or less than the respective output levels.

~, **AXISYMMETRIC FOCUSSED-JET:** An amplifier, which utilizes control of the attachment of an annular fluid jet to an axisymmetric flow separator (that is, control of the focus of the jet) to modulate the output.

NOTE: It is usually employed as a digital amplifier.

~, **CURRENT:** An electronic amplifier designed to drive with its output devices that respond to changes in current rather than voltage.

~, **ELECTRONIC:** A solid state device used to amplify electric signals.

~, **FLOW:** A component designed specifically for amplifying flow signals, usually with low impedance output.

~, **IMPACT MODULATOR:** An amplifier which utilizes auxiliary flow at a nozzle throat for a control signal to modulate the output flow.

NOTE: The pressure level of the control signal may either be above or below local throat pressure to result in a positive or negative (suction) quiescent control flow.

~, **JET INTERACTION:** An amplifier, which utilizes control jets to deflect a power jet and modulate the output, usually employed as an analog amplifier.

~, **LAMINAR FLOW:** A jet amplifier where the nozzle Reynolds number is maintained at such a level that laminar flow conditions exist in the device.

~, **OPTICAL:** An opto-electronic device frequently employed to isolate electronic circuits of differing ground potentials so as to prevent mutual interference.

~, **POWER:** A component designed specifically for increasing signal power.

~, **PRESSURE:** A component designed specifically for amplifying pressure signals, usually with high impedance output.

~, **TURBULENCE:** A fluid amplifier which utilizes control of the laminar-to-turbulent transition of a power jet to modulate the output.

~, **VORTEX:** An amplifier which utilizes the pressure drop across a controlled vortex for modulating the output.

~, **WALL ATTACHMENT:** An amplifier which utilizes control of the attachment of a free jet to a wall (Coanda effect) to modulate the output.

NOTE: It is usually employed as a digital amplifier.

~ **VENTS:** Auxiliary ports used to establish a reference pressure in a particular region of the amplifier.

NOTE: It is analogous to an electrical ground potential.

AMPLITUDE RATIO: The ratio of the sinusoidal output amplitude to the sinusoidal command amplitude at a particular frequency.

NOTE: The amplitude ratio (AR) may be given in decibels (dB) where:

$$\text{dB} = 20 \log_{10} \text{AR} \quad (\text{Eq. 2})$$

ANALOG: The general class of devices or circuits whose output is a continuous function of its input; for example, a proportional fluidic amplifier.

ANALYTICAL REDUNDANCY: A concept wherein an estimate of a physical parameter (e.g., aircraft attitude, acceleration, etc.) is computed by combining and filtering information from other sensed data, which have a known physical relationship to the signal of interest.

NOTES:

1. In this way, a signal may be synthesized from other sensor signals rather than be obtained from direct measurement.
2. In control systems, the synthesized signal can be used to add a level of redundancy.

ANGLE OF ATTACK

The following are alternative definitions of ANGLE OF ATTACK:

1. The acute angle between the chord of an airfoil and a line representing the undisturbed relative airflow.

NOTES:

- a. Refer to Figures 7 and 8.
 - b. See also Body Axes.
2. The acute angle in the x-z plane between the longitudinal axis of an aircraft and the projection of the aircraft velocity vector on the x-z plane.

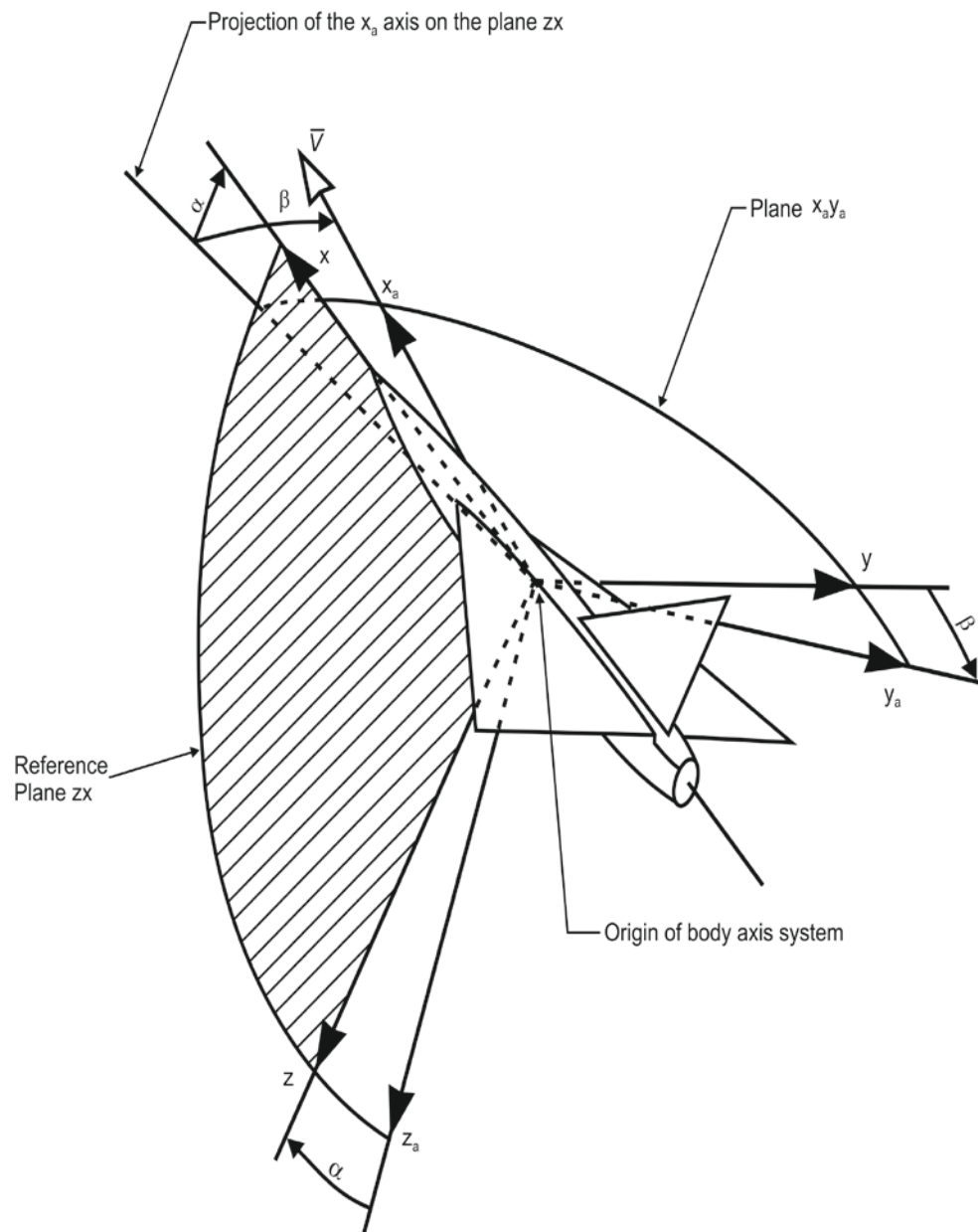
ANODE: An electrode at which an oxidation reaction (loss of electrons) occurs. In secondary cells either electrode may become the anode depending upon direction of current flow.

APOGEE: The point at which a missile trajectory or a satellite orbit is farthest from the center of the gravitational field of the controlling body or bodies.

ARTIFICIAL GRAVITY: A simulated gravity set up within an aerospace vehicle, as by rotating a cabin about the longitudinal axis of a spacecraft, the centrifugal force generated being similar to the force of gravity.

ARTIFICIAL INTELLIGENCE: A characteristic of a knowledge-based concept or process that involves decision making and reasoning based on stored knowledge.

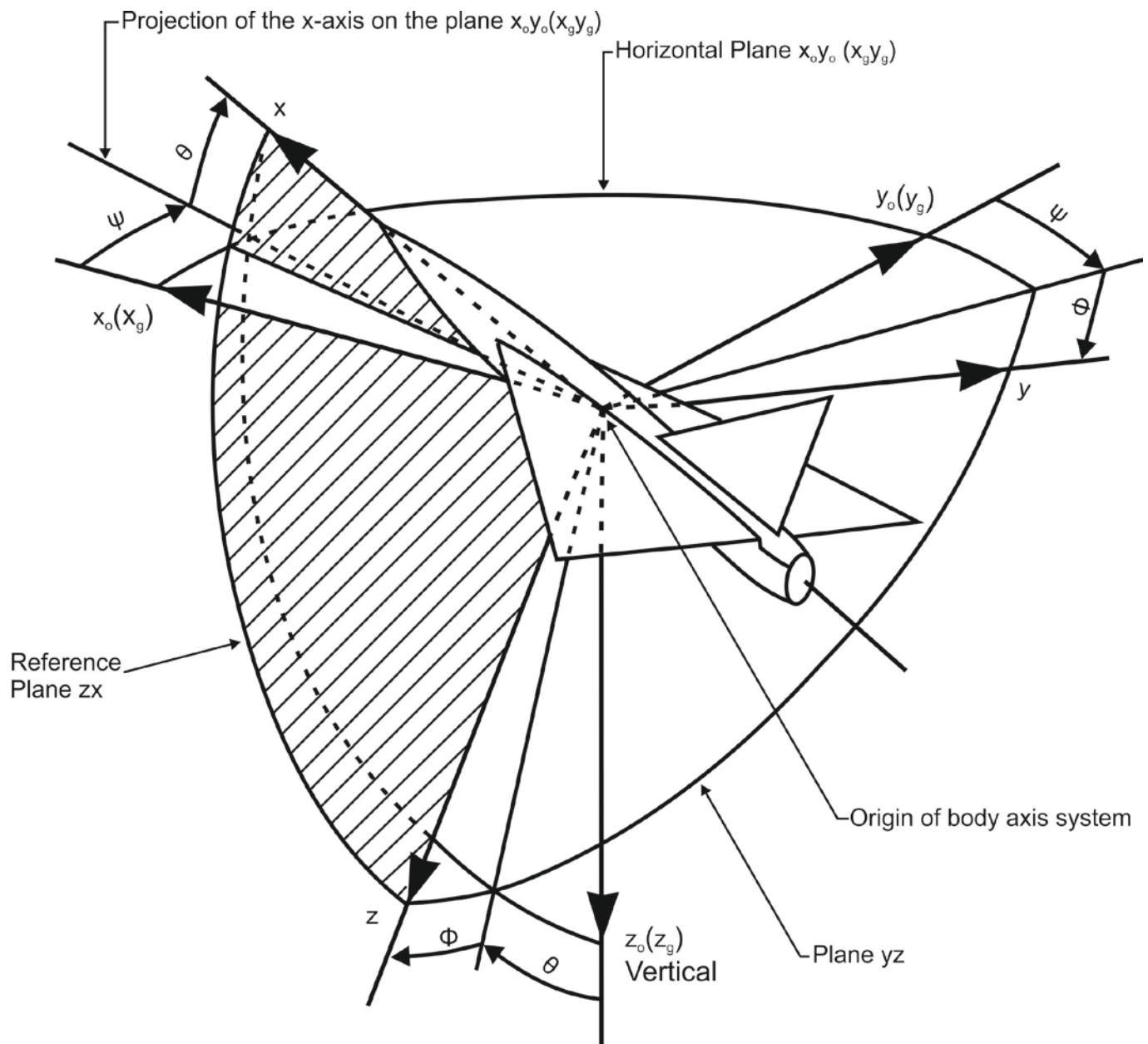
NOTE: A system possessing such a characteristic is sometimes referred to as an "expert system"; i.e., it uses knowledge and inference procedures to solve problems or diagnose conditions by their symptoms.



NOTES:

1. The angles shown are positive.
2. When the origin of the systems is not in the reference plane, the z - x plane is parallel to it and the angles are unchanged.

Figure 7 - Orientation of the vehicle velocity with respect to the body axis system



Vehicle-carried Earth-axis system (x_o, y_o, z_o)

Body axis system (x, y, z)

NOTES:

1. The angles shown are positive.
2. When the origin of the systems is not in the reference plane, the z - x plane is parallel to it and the angles are unchanged.

Figure 8 - Orientation of the body axis system to the vehicle-carried normal earth axis system

ASPECT RATIO

The following are alternative definitions of ASPECT RATIO:

1. Aerodynamics - The relationship of the wing span to the surface area of the wing, generally expressed as the ratio of the square of the wing span over the surface area as shown in Equation 3.

$$AR = \frac{b^2}{S} \quad (\text{Eq. 3})$$

NOTE: It may also be expressed in terms of the tip chord and root chord.

where:

$$AR = \frac{2b}{(C_t + C_r)} \quad (\text{Eq. 4})$$

AR = Aspect Ratio

b = Wing span

S = Wing area

C_t = Tip chord

C_r = Root chord

2. Particle/filter technology - The ratio between the length of a particle and its width as measured at a right angle to the axis of the length.

ASTRIONICS: The science of adapting electronics to aerospace flight.

ASTRONAUTICS: The art or science, of designing, building, or operating space vehicles.

ATMOSPHERE: The gaseous fluid surrounding celestial bodies, specifically the air surrounding the Earth.

NOTE: It used as a measure of pressure; i.e., 1 Atm = 14.696 psia (101. 325 kPa absolute).

~, STANDARD: This is the accepted/agreed upon standardized pressure, temperature and other physical constants of the earth atmosphere at sea level.

NOTES:

1. The standard atmosphere parameters are provided in Table 1.
2. The standard atmosphere has been defined for altitudes to 3.3 x 10⁶ feet (1 x 10⁶ m).

Table 1 - Standard Atmosphere Properties

	English Units	SI Units
Height, Z	0 ft	0 m
Temperature, T	518.67 °R	288.15 °K
Pressure, p	14.696 psi	101 325 kPa
Density, ρ	4.426 10 ⁻⁵ lb/in ³	1.225 Kg/m ³
Molecular Weight, M	28.7 lb/lbmol	28.7 kg/kmol
Gravity, g	32.2 ft/s ²	9.80665 m/s ²
Speed of Sound, C _s	1116.45 ft/s	340.29 m/s



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.

ATTITUDE: The position of a body as determined by the inclination of the axes to some frame of reference.

NOTES:

1. If not otherwise specified, this frame of reference is fixed to the earth such that the vertical axis coincides with the gravitational vector and the horizontal plane is tangential to the earth surface.
2. See Figures 7, 8, and 9.

~ **CONTROL:** A control mode of the flight control system, which directs and maintains the desired attitude of the vehicle.

~ **HOLD:** An automatic flight control mode, which maintains a desired attitude for the vehicle.

AUTOMATIC TEST EQUIPMENT: Equipment that automatically carries out a program of testing for possible malfunction, with minimum reliance upon human intervention.

AUTOPILOT: A portion of an aircraft's flight control system which automatically initiates flight corrections by sensing deviations from a fixed reference and then performs the necessary functions including computations and actuation in order to maintain the aircraft on a steady preset course and attitude without assistance from the pilot.

NOTE: The term autopilot is short for automatic pilot.

AVAILABILITY: A measure of the degree to which an item is in an operable and committable state at the start of a mission when the mission is called for at an unknown (random) time.

AVIONICS: The application of electronics to aviation and astronautics.

AVERAGING SYSTEM: The type of fault-tolerant system using two or more active channels wherein the individual channel outputs are summed to provide an average output.

NOTES:

1. All channels are normally operative so some performance degradation may occur after a failure.
2. An example of an averaging system is the use of multiple control surfaces on an airplane, each individually actuated.

AXIAL: Located or arranged in parallel with the axis.

NOTES:

1. For example, the rotation of a motor.
2. See also hydraulic motors, axial piston motor.

3.3 B

3.3.1 Abbreviations

BTU British thermal unit, English unit of thermal energy = 1055 Joules

BUFCS Backup flight control system

3.3.2 Acronyms

BIT Built-In Test

BUSAS Backup Stability Augmentation System

3.3.3 Definitions

BACKLASH: The uncontrolled load motion due to clearance in actuation elements, including the load attach point.

NOTE: This is usually expressed in terms of absolute load motion.

BACKUP

~ **STIFFNESS:** The mechanical stiffness of the actuator attachment point(s) through which load reaction forces are transmitted.

~ **SYSTEM:** A mode of control which is engaged upon failure of the primary operational system.

NOTES:

1. It is usually used to refer to a system which is as independent as possible from the primary system.
2. It is sometimes used as protection against multiple generic failures.

BALLISTIC

~ **MISSILE:** Any missile, which does not rely upon aerodynamic surfaces to produce lift.

NOTE: It consequently follows a ballistic trajectory when thrust is terminated.

~ **TRAJECTORY:** The trajectory traced after the propulsive force is terminated and the body is acted upon only by gravity and aerodynamic drag.

BANDWIDTH: The frequency range over which the actuation system has acceptable dynamic response.

NOTES:

1. This spectrum extends from DC up to a specified frequency, which is usually the frequency where the open loop amplitude ratio has unity gain (0 dB).
2. For a first-order system, this is the frequency where the closed loop response is down 3 dB with 45° phase lag.

BATTERY: A collection of chemical cells, normally connected in series, for the production or storage of electrical energy. (Van Nostrands Scientific Encyclopedia)

~, **FAST CHARGE:** A battery which can be charged at a fast charging rate and which gives a signal that can be used to terminate the fast charge without damage to the battery.

~, **QUICK CHARGE:** A battery that can be charged fully in 3 to 5 hours by a constant- current charger and is also capable of continuous overcharge at this quick charge rate.

BEARING:

The following are alternative definitions of BEARING:

1. Aircraft - A horizontal angle of a given direction measured clockwise from a reference azimuth datum.
2. Component - A stationary mechanical support for a rotating or a translating member such as a motor shaft or engine drive shaft, rudder, etc.

BELT DRIVE: A mechanical system that uses a continuous loop belt and pulleys to transmit power.

BENCH CHECK: A functional check of an item in the shop to determine whether the item may be returned to service, or whether it requires adjustment, repair, overhaul, or replacement.

BIAS OR PRELOAD: A steady-state load that is unidirectional and constant over full load travel.

BINDER: A composition that holds together a charge of finely divided particles and increases the mechanical strength of the resulting propellant grain when it is consolidated under pressure.

NOTE: Binders are usually resins, plastics, or asphaltics used dry or in solution.

BIPROPELLANT: A propellant consisting of two unmixed or uncombined chemicals (a fuel and an oxidizer) fed to the gas generator (combustion chamber) separately.

NOTE: Bipropellants are usually liquids.

BISTABLE AND TRISTABLE CONTROL: A control system in which the power to control the load is fully on in either polarity (bistable), or fully on in one polarity, off, or fully on in the other polarity (tristable).

NOTES:

1. These systems are sometimes called on-off systems or bang-bang systems.
2. When the time duration of the application of power is modulated by the input, the system is called pulse width modulated (PWM).

BLEED

~ LINE: A line, selectively open to overboard, which serves only for removing foreign substances from a system or unit, as for removal of entrapped air from a hydraulic circuit.

~ PORT: A port for removal of air, water, etc., in servicing.

NOTE: This is applicable for locations where the local removal of accumulation of air, water, etc., is required in servicing, for example, in brakes, actuators, and pneumatic reservoirs.

BLOW BY: A condition where fluid leaks at a high rate across a sealing surface permitting high pressure fluid to pass (blow by) from one cavity to one of much lower pressure and usually occurs during rapid pressure reversals.

BODE PLOT: A Bode plot is a graphical method of displaying frequency response of a specified subsystem.

NOTE: It consists of a combined plot of normalized amplitude ratio in dB, and the phase lag (in degrees or radians), versus frequency (in radians/sec or Hz).

BODY AXES: The body axes system is a set of orthogonal axes rigidly fixed in the airplane with the origin located at the center of gravity and extending forward, downward, and to the right.

NOTES:

1. See Figure 9 and Table 2.
2. See also Angle of Attack.

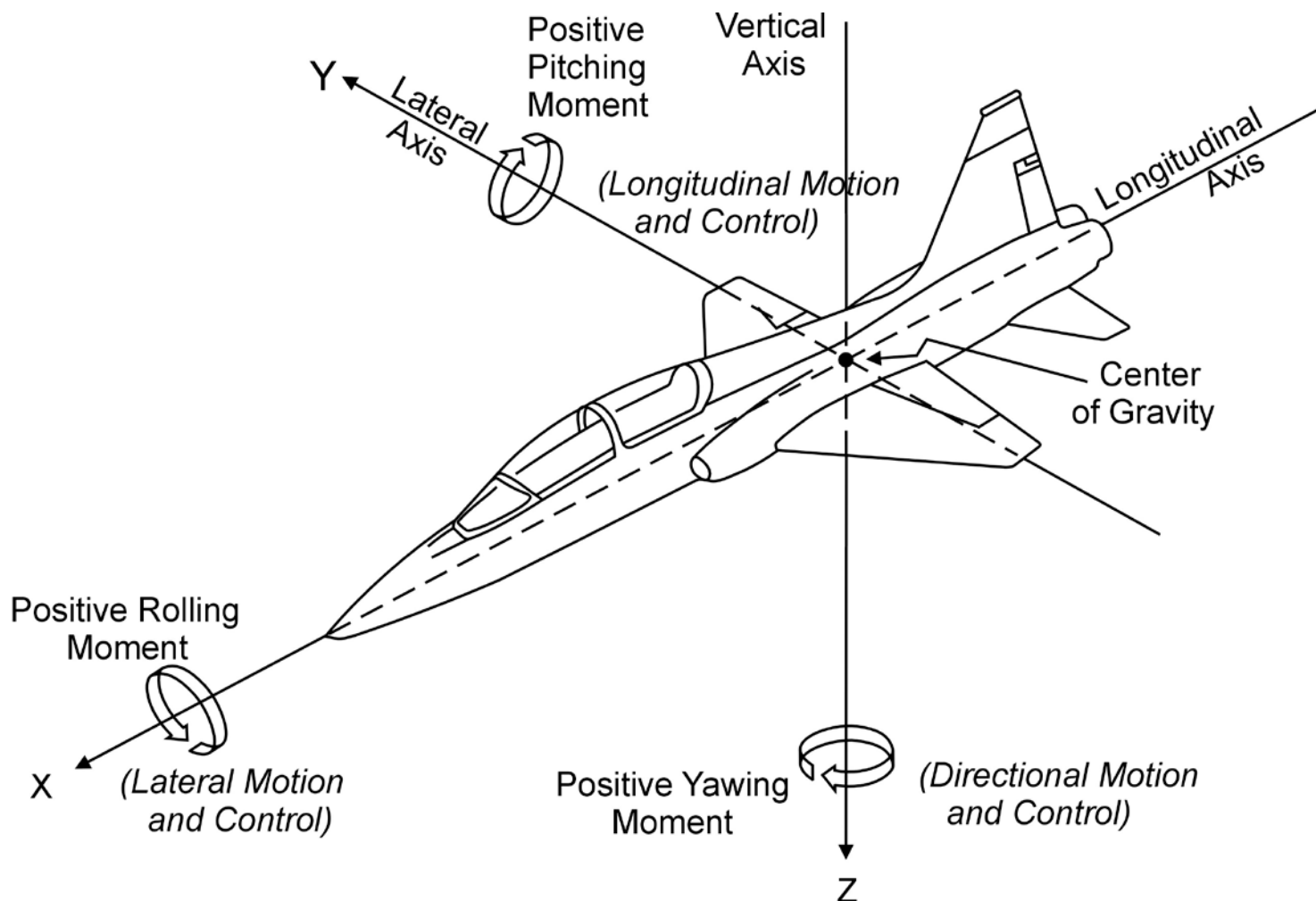


Figure 9 - Aircraft body axes

Table 2 - Notation for body axes

Axis Designation	Longitudinal	Lateral	Vertical
Symbol	X	Y	Z
Sign Convention	Forward +	To Right +	Down +
Motion About Axis	Rolling Motion	Pitching Motion	Yawing Motion
Sign Convention	Right Roll + ($Y \rightarrow Z$)	Nose Up + ($Z \rightarrow X$)	Nose Right + ($X \rightarrow Y$)
Angular Displacement	Roll Angle	Pitch Angle	Yaw Angle
Sign Convention	Right Roll +	Nose Up	Nose Right +

BOOSTER CHARGE: The ignition component, ignited by the primer charge, which either pressurizes the generator to operating pressure or generates a higher energy shock pulse.

BOOST-GLIDE VEHICLE: A rocket-boosted winged vehicle capable of leaving the atmosphere and re-entering under aerodynamic control in an unpowered or gliding condition.

BRAKE: A fluid, magnetic or mechanical device that absorbs energy and thereby resists motion.

~, **ANTISKID:** A wheel brake system that avoids skidding by automatic reduction of the hydraulic or electromechanical system braking pressure when sensing initial skidding, or generally applied to braking torque adjustment to prevent skidding.

~, **PARKING:** A static brake that when actuated continuously holds a load or prevents motion.

~, **TORQUE LIMITING:** A mechanical device that permits free flow of torque below a predetermined level.

NOTES:

1. Once that level is exceeded, the excess torque is routed to ground through a brake or the torque is disrupted in slippage as in a slip clutch.
2. There are two basic types of torque limiters:
 - Load weighing,
 - Capstan coil.

~ **PORT:** An outlet port carrying modulated brake actuating pressure. Applicable to brake valves and pressure-generating cylinders.

~ **VALVE:** A valve for control of wheel brake actuating pressure.

NOTE: A brake valve is usually a mechanical or pressure operated variable pressure reducing valve with provision for opening brake pressure outlet port to "Return" when outlet pressure exceeds the pressure setting at the moment.

BREECH: A reloadable pressure vessel used to contain a propellant cartridge.

BUBBLE POINT: The value of pressure at which a constant stream of bubbles first appears from a filter mesh that is immersed a given depth below the surface of a given liquid with known temperature, density, and surface tension.

BUFFETING: A forced vibration of aircraft structural components caused by unsteady aerodynamic forces due to wake effects, Mach number effect, or pre-stall conditions.

BULK MODULUS: It is a measure of the compressibility of a fluid.

NOTES:

1. The bulk modulus of a trapped fluid volume is expressed by Equation 5:

$$\frac{\text{incremental pressure}}{(\text{incremental volume/total volume})} \quad (\text{Eq. 5})$$

2. The Units of Bulk Modulus are psi or kPa.

3. Depending on the conditions under which the measurement of bulk modulus B is performed, it is necessary to distinguish between isentropic (adiabatic) B_s and isothermal B_t . The relationship $B_s/B_t = k$ which is the ratio of c_p , (the specific heat at constant pressure) and c_v (the specific heat at constant volume), which for most gases is approximately 1.2.

BUILT-IN-TEST: An operational status checkout or test system which is integrated into a control system or function.

NOTES:

1. It is normally used to verify operational status of as many aspects of a control function as possible within the limits of integrated test capability.
2. It may be initiated automatically or on command.

BURN-IN: The operation of an item under stress to stabilize its characteristics.

BURNING: The rapid release of energy through chemical reaction between fuel and an oxidizing agent.

NOTE: See Combustion.

~ **RATE:** This is the propagation rate of a pyrotechnic or propellant mixture.

~ **TIME:** This is the elapsed time between initiation and completion of the reaction of the pyrotechnic or propellant mixture.

NOTE: The burning time depends on many factors such as:

- Length of column,
- Degree of consolidation,
- Temperature,
- Pressure,
- Percentage of ingredients,
- Their particle size.

~, **NEUTRAL:** The burning of a propellant grain in which the reacting surface area remains approximately constant during combustion.

~, **PROGRESSIVE:** The burning of a propellant grain in which the reacting surface area or burning rate increases during combustion.

NOTE: The mass flow rate produced increases as the web increases.

~, **REGRESSIVE:** A condition in which the mass flow produced by the propellant grain decreases as the web is consumed due to decreasing area, decreasing burn rate, or both.

BURNOUT: The point in time when the fuel of a rocket propelled vehicle is used up.

~ **VELOCITY:** The velocity attained by a missile at the point of burnout.

~ **WEIGHT:** The weight of a missile at the time of burnout, but including any unusable fuel.

BUZZ: This is the undesirable vibration of a flight control surface induced and maintained by aerodynamic forces.

3.4 C

3.4.1 Abbreviations

C* C-Star

C rate Coulomb rate

CAS Control augmentation system.

CBL Control by light

CBW Control by wire

CCV Control configured vehicle

CM Conditions monitored or conditions monitoring.

CTC Canadian Transport Commission

3.4.2 Acronyms

None

3.4.3 Definitions

CAMBER: Camber is the maximum rise of the mean line from the chord line as shown in Figure 6.

CANARD: An airfoil surface located forward of the wing.

CAPACITY: The product of current multiplied by the time current is flowing.

NOTE: The capacity of a cell or battery is usually expressed in ampere hours.

CAPSTAN COIL: The capstan coil operates on the principle that a mechanical coil, under a torque in an unwind direction, radially expands and engages the housing, thus grounding the input torque above a predetermined level.

NOTE: In this case, the load weighing and braking are both accomplished by the capstan coil.

~ (WRAP SPRING) NO BACK: A capstan coil is essentially a coil spring placed in a housing with a slight interference fit.

NOTES:

1. Motion in either direction (to unwind the spring), initiated at the output end, will prevent back-driving motion.
2. Motion in either direction (to wind the spring) initiated at the input end will result in coupling and drive.

CARTRIDGE:

The following are alternative definitions of CARTRIDGE:

1. Component - A replaceable unit used in a pressure vessel which is capable of producing pressurized gas when ignited.

NOTE: An example is the solid propellant cartridge used with an aircraft engine starter.

2. Hydraulic - An integrated hydraulic component that is installed in a manifold assembly.

NOTE: They can be an insert, slip-in or screw in type.

CASE: A pressure vessel designed to contain a propellant charge before and during burning.

CATALYST: A substance, which by its mere presence, changes the rate of a reaction (decomposition) and may be recovered unaltered in nature or amount at the end of the reaction.

CATASTROPHIC FAILURE:

The following are alternative definitions of CATASTROPHIC FAILURE:

1. Component - A sudden change in the operating characteristics of material resulting in a complete lack of useful performance.
2. Aircraft - A failure condition which would result in multiple fatalities, usually with the loss of the aeroplane.

CATHODE: An electrode at which a reduction reaction (gain of electrons) occurs.

NOTE: In secondary cells either electrode may become the cathode depending upon direction of current flow.

CAVITATION:

The following are alternative definitions of CAVITATION:

1. The process of vaporization, bubble generation and bubble implosion which occurs in a flowing fluid as a result of a decrease and subsequent increase in local pressure.

NOTES:

- a. Cavitation inception occurs when the fluid drops below the saturated vaporization pressure, vaporizes and creates a "cavity". When the bubble implodes, the kinetic energy of the fluid filling the vaporized void and is converted into very localized pressure and thermal energy in the form of micro jets and shock waves. The condensation process is also exothermic which also increases the fluid temperature. The micro jets can cause material erosion in the form of small pits or divots.
 - b. The cavitation process is somewhat analogous to "water hammer" except that the fluid is stopping itself at the nucleus of the implosion plus the added condensation effects.
2. Damaging pits and divots created in a material when vaporized fluid bubbles are suddenly imploded under pressure.

NOTES:

- a. Cavitation also creates a great amount of noise, vibration and efficiency loss. Pumps may scream or sound as if rocks are passing through them (impeller type). Popping sounds are also an indication of cavitation.
- b. Cavitation should not be confused with the expansion and contraction of an air bubbles within the system. Air in the fluid can actually act as an accumulator and reduce cavitation damage.

CELESTIAL NAVIGATION: A form of navigation using the celestial bodies for reference.

NOTE: In missile terminology, it is a system wherein a guided missile, suitably instrumented and containing all necessary guidance equipment, may follow a predetermined course with reference primarily to the relative positions of the missile and certain preselected celestial bodies.

CELESTIAL SPHERE: An imaginary sphere of infinite radius concentric with the earth, on which all celestial bodies except the earth are imagined to be projected.

CELL: An electrochemical device composed of positive and negative plates, a separator, and an electrolyte, which is capable of storing electrical energy.

NOTE: When encased in a container and fitted with terminals, a cell is the basic "building block" of a battery.

~ REVERSAL: The reversal of polarity of the terminals of a cell in a multicell battery due to over- discharge.

CENTER OF

~ LIFT: The mean of all the centers of pressure on an airfoil.

~ MASS: 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.

NOTE: This is commonly called the center of gravity.

~ PRESSURE: The point on the chord of an airfoil section which is at the Intersection of the chord (prolonged if necessary) and the line of action of the combined air forces (resultant air force).

CHAIN DRIVE: A series of links used to transmit power from one rotating member to another.

NOTES:

1. In many applications the links are so joined as to form a continuous loop between the driving shaft (input) and a driven shaft (output).
2. Chain drive systems may be used to transmit power through the chain, either in a forward driving condition or as a holding, controlling, back-driven system.

CHANNEL: One signal or control path of a redundant set.

NOTES:

1. A channel is an entity within itself and contains elements individual to that channel.
2. A model may be used as a reference channel in a detection-correction system.
3. It is also referred to as a lane.

~ BUFFERING: A technique used in fault-tolerant systems that minimizes the possibility of a failure in one channel to induce a failure in another channel.

~ PRIORITY: The order of authority of the various channels in a redundant system where the channels are not equivalent. Examples of channel prioritizing are:

- a. Primary/secondary
- b. Active/standby
- c. Normal/alternate

~ SUMMING: The combining of multiple channels to provide a control function.

NOTE: Examples of channel summing techniques are:

- a. Flow summing
- b. Flux summing
- c. Force summing
- d. Position summing
- e. Torque summing
- f. Velocity summing

CHARGE: The amount of material introduced periodically into a process. (Van Nostrands Scientific Encyclopedia)

~, ACCUMULATOR: The pressurized gas contained within the accumulator.

~, FLOATING: The use condition of a storage battery wherein charge is maintained by a continuous, long-term constant-potential charge.

~, PRIMER: A secondary component in an ignition train, which is ignited by an initiator, starts pressurization of a generator, and ignites the ignition booster charge.

~, QUICK: A charging rate that ranges from 0.2 to 0.5 C rate.

~ RETENTION: The tendency of a charged cell to resist self-discharge.

~, SLOW: An "overnight" return of energy to a battery at 0.05 to 0.1 C rates.

~, STANDBY: A low overcharge current rate, on the order of 0.01 to 0.03 C, applied continuously to a vented-cell battery to maintain its capacity in a ready-to-discharge state.

NOTES:

1. It is often called "trickle" charging.
2. Sealed cells used for emergency standby power are usually given a continuous "slow" charge (0.05 to 0.1 C) rather than the lower current "standby" charge.

~, SPLIT RATE: A charging method in which the battery is charged at a high rate and then automatically reduced to a lower charge rate as the battery approaches full charge.

~, SUSTAINER: A component (optional) of an ignition train that maintains the operating pressure until thermal equilibrium is obtained.

~, TOPPING: A reduced rate charge that completes (tops) the charge on a cell and one that can be continued in overcharge without damaging the cell.

CHARGING: The process of supplying electrical energy for conversion to stored chemical energy.

~ FAST: The rapid return of energy to a battery at the C Rate or greater.

NOTE: See C Rate definition under Battery Performance.

CHECK A: A light maintenance check, typically conducted overnight.

NOTE: See Letter Check.

CHECK C: A heavy maintenance check.

NOTE: See Letter Check.

CHORD: The longest straight line between the leading and trailing edges of an airfoil section.

NOTE: See also Airfoil and Figure 6.

CIRCULAR VELOCITY: The critical velocity at which a satellite will move in a circular orbit around its primary.

NOTE: Circular velocity is a special case of orbital velocity and one which is not likely to be obtained in practice due to accuracy of control needed.

CISLUNAR SPACE: Space between the earth and the orbit of the moon.

CLEAN AIRCRAFT:

The following are alternative definitions of CLEAN AIRCRAFT:

1. An aircraft in flight configuration versus landing configuration (i.e., landing gear and flaps retracted, etc.);
2. An aircraft whose external stores are removed (i.e., not attached).

CLEANLINESS LEVEL: The amount of particles by size range and number in a given volume of fluid as determined by a particle count to a requirements document such as AS4059.

CLUTCH: A mechanical device that transfers or interrupts mechanical power from an input shaft to an output shaft.

NOTE: See Figure 10 for various types of clutches.

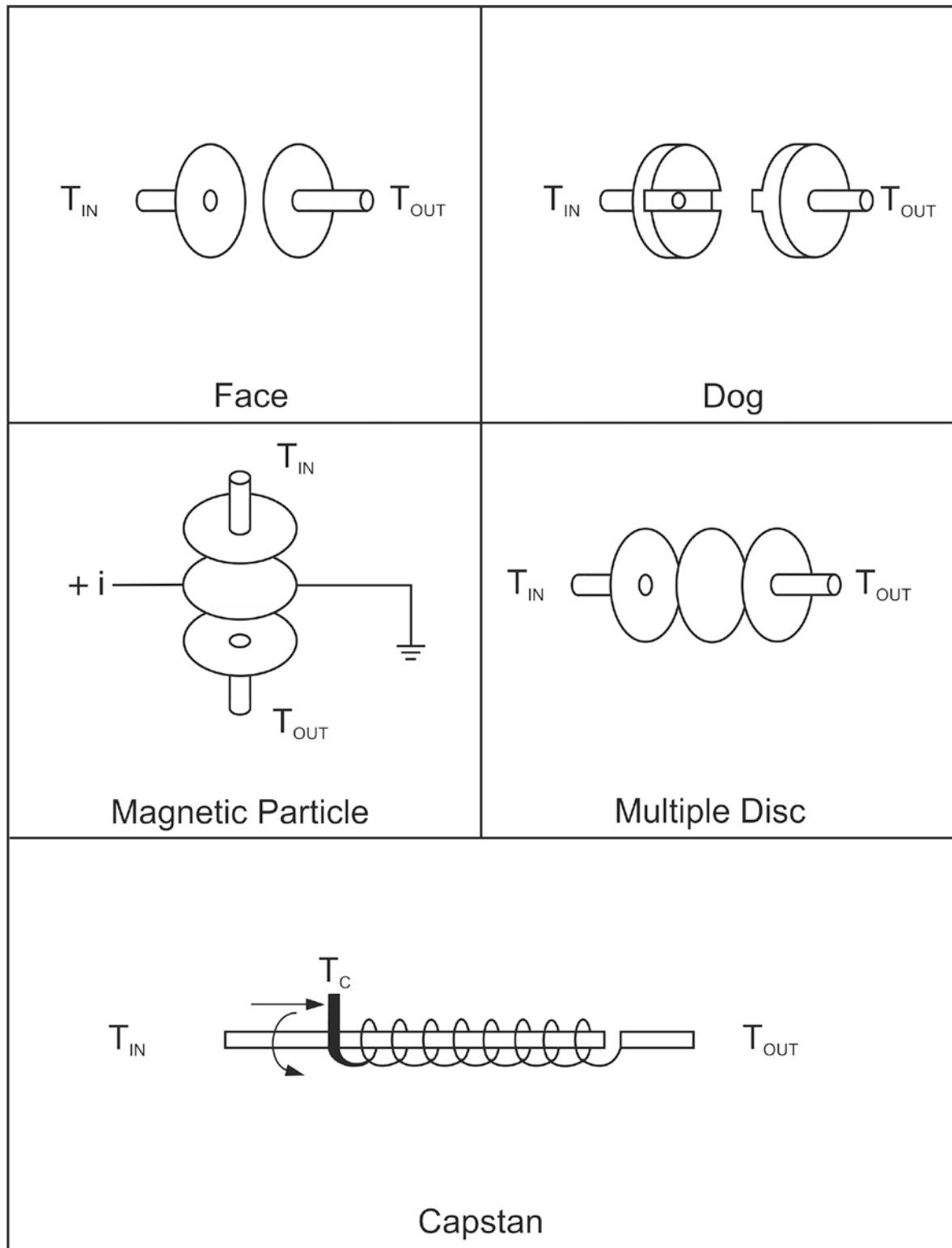


Figure 10 - Clutches

~ CAPSTAN: A coaxial spring and shaft with a preloaded fit wherein power can be transmitted through the shaft spring interface.

~, DOG: Two interfacing elements which transmit mechanical power when in contact by means of pins, teeth, dowels, or other load carrying elements.

~, FACE: Two interfacing, rotating elements which transmit mechanical power when in contact by means of friction surfaces.

~ COUPLED TURBO-MECHANICAL ACTUATOR: A turbo-mechanical actuator wherein a constant speed turbine is coupled to the load through a double-acting servo-controlled clutch.

NOTE: The clutch controls both the speed and direction of the load. A large gear reduction between the high speed turbine and the load is included in the actuator.

~ COUPLING DRIVE: A motion transmission, which allows interruption of the load path for control purposes.

COASTING FLIGHT: The flight of a rocket missile or other vehicle between burnout or thrust cutoff of one stage and ignition of another, or between burnout and summit altitude or maximum range.

COIL IMPEDANCE: The complex ratio of coil voltage to coil current.

NOTE: It is important to note that the coil impedance of an electromechanical device may vary with signal frequency, signal amplitude, coil resistance (which changes with temperature) and back emf generated by the moving armature.

COIL RESISTANCE: The DC resistance of the coil of an electromechanical or electrohydraulic device, expressed in ohms.

COMBUSTION: A continuous, rapid chemical process accompanied by the evolution of energy which is commonly the union of a fuel and an oxidizing agent.

COMMAND: An input which represents the desired output of the control system.

COMPANION BODY: A nose cone, last stage rocket, or other body that orbits along with an earth satellite.

COMPRESSED GAS:

The following are definitions for the various states of compressed gas:

~ IN SOLUTION: A non-liquefied gas (such as Acetylene), which is dissolved in a solvent.

~ LIQUEFIED: A gas which, under the charging pressure, is partially liquid at a temperature of 70 °F (21 °C).

NOTE: A flammable compressed gas which is normally non-liquefied at 70 °F (21 °C), but which is partially liquid under the charging pressure and temperature, shall follow the requirements for liquefied compressed gases.

~ NONLIQUEFIED: A gas not in solution which, under the charging pressure, is entirely gaseous at a temperature of 70 °F (21 °C).

~ PRESSURIZED LIQUID: A compressed gas not in solution, which cannot be liquefied at a temperature of 70 °F (21 °C), and which is maintained in the liquid state at a pressure not less than 40 lb-in² (abs) (2.07 m Hg abs) by maintaining the gas at a temperature less than 70 °F (21 °C).

COMPOSITE SOLID PROPELLANTS: They are commonly defined as those propellants in which a granular inorganic oxidizer is suspended in an organic fuel binder, neither of which would burn without the presence of the other.

NOTE: Typical oxidizers are ammonium nitrate and ammonium perchlorate; fuel binders are usually either rubber or plastic.

CONDITION MONITORING: Condition monitoring is a data gathering process.

NOTES:

1. It is not a preventive maintenance process.
2. It allows failures to occur and relies on analysis of operating experience information to indicate the need for appropriate action.
3. If the removal rate is deemed to be excessive, the component may temporarily be assigned a hard-time removal limit until corrective action can restore its removal performance to an acceptable level.

~ ITEM: A Condition Monitoring item has neither a hard-time removal nor scheduled test to determine its continued serviceability.

NOTES:

1. All removals are for unscheduled cause.
2. All units removed should, upon arrival in the shop, be given a check in accordance with the procedures in the appropriate shop manual. If the unit "passes", it is returned to service.
3. Failure to pass the check requires the unit to be repaired to a state that it will pass and be serviceable.

CONDITIONING: A maintenance procedure consisting of deep discharge, short, and constant-current charge used to correct cell imbalance which may have been acquired during battery use.

~, FLUID: The removal of contaminants such as water and air/gases combined with filtration to remove particulate (solid contaminants) from hydraulic and lubrication oils.

~, SIGNAL: The manipulation of an analog signal in such a way that it meets the requirements of the next stage for further processing.

CONFIDENCE FACTOR: The percentage figure that expresses confidence level.

~ LEVEL: The probability that a given statement is correct, usually associated with statistical predictions.

~ TEST: A test primarily performed to increase the confidence that the unit under test is operating acceptably.

CONFINED DETONATOR FUSE: A mild detonating fuse completely contained within a shock absorbing sheath to prevent damage to the surroundings when the fuse is detonated.

CONTAMINANT: Any material, usually a solid, that is suspended or dissolved in a fluid system and is not there by design.

CONTRAORBIT MISSILE: Missile sent backward along the calculated orbit of an approaching spacecraft, satellite, or aerospace weapon for the purpose of destroying it in a head-on collision with an explosive warhead or by missile.

NOTE: Contraorbit attacks are considered much easier to accomplish than orbital attacks.

CONTROL: A system or device which exerts a restraining, governing, or directive influence. (Van Nostrands Scientific Encyclopedia).

~, DIRECTIONAL: Control of the directional motion of an aircraft.

NOTE: Directional control is primarily achieved through control of yaw and sideslip.

~ AUGMENTATION SYSTEM: A function of the flight control system, including command shaping, sensors, actuators, etc., that performs in such a manner so as to augment the static and dynamic stability, and maneuver response of the aircraft.

NOTE: When considered as an entity it is essentially a closed loop tracking control system, responding to pilot commands.

~ AUTHORITY: The amount of control surface or thrust vector deflection that can be produced by AFCS signals relative to the total available control deflection.

NOTE: This phrase is often preceded by the word electrical, or abbreviations such as CAS or SAS, in order to be more explicit.

~ COLUMN: A control lever for the pilot having a wheel (or the equivalent) mounted at the upper end; turning of the wheel provides control about the longitudinal axis while forward and back motion provides control about the lateral axis.

~ CONFIGURED VEHICLE: A vehicle so designed (configured) as to produce performance benefits by exploiting the capabilities of the aircraft's flight control system to augment the inherent aerodynamic design characteristics of the basic aircraft.

~ PORT: A port for connection of pilot line for operation or control of the unit.

NOTE: This is applicable to remote control units, such as valves and pumps.

~ PRESSURE: The pressure required to control or influence any motion or change in motion.

~ REVERSAL: The change in the direction of the lift increment from that normally produced by a movable control surface.

NOTE: It results from the elastic torsional deflection of the fixed surface caused by the aerodynamic moments applied when the movable control surface is deflected.

~ ROCKET: A vernier rocket, retro-rocket, or other such rocket used to guide, accelerate, or decelerate a ballistic missile, spacecraft, or the like.

~ STICK: A cockpit control lever of a particular type used to produce longitudinal and lateral control inputs to the aircraft.

~ SURFACE:

The following are alternative definitions of SURFACE:

1. Aeronautics - The movable segment or segments of an airfoil that are used to control the flight path or attitude of a vehicle (e.g., flaps, ailerons, elevators, rudder, trim tabs, spoilers).

NOTE: See Figure 11.

2. Fluid Mechanics - An arbitrary boundary of a fluid system used in defining the mass flow into and out of the enclosed control volume and the forces acting upon the fluid system.

~ SYSTEM: A system in which deliberate guidance or manipulation is used to achieve a prescribed value of a variable.

NOTE: A control system has at least one input and one output.