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TERMINOLOGY FOR FLIGHT CONTROL SYSTEMS

1. **SCOPE:** This ARP presents definitions of terminology used in conjunction with flight control systems. Terminology associated with fault-tolerant systems has been emphasized. No details of specific design approaches are given. Likewise, no recommendations are included for flight control system performance and design requirements.

2. **ABBREVIATIONS:**

ACT	-	active controls technology
AFCS	-	automatic flight control system
BIT	-	built-in-test
CAS	-	control augmentation system
CBL	-	control-by-light
CBW	-	control-by-wire
DFO	-	dual fail operative
FBW	-	fly-by-wire
FCS	-	flight control system
FS	-	fail safe
IAP	-	integrated actuator package
MFCS	-	manual flight control system
PBW	-	power-by-wire
SAS	-	stability augmentation system
SFO	-	single fail operative

3. **TERMINOLOGY:**

Active: An adjective which describes; A system or portion of a system which is in control in contrast to being in standby.

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Active Controls Technology (ACT): 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, to reduce the designing loads through load reduction or redistribution and structural mode damping, and to manage the airplane's configuration for aerodynamic efficiency. Active control functions include:

- Pitch Stability Augmentation
- Lateral and/or Directional Stability Augmentation
- Angle-of-Attack Limiting
- Wing-Load Alleviation
 - Maneuver-Load Control
 - Gust-Load Alleviation
- Flutter-Mode Control
- Ride Smoothing

Automatic Flight Control Systems (AFCS): Automatic Flight Control Systems consist of electrical, mechanical and hydraulic components which generate and transmit automatic control commands which provide pilot assistance or relief through automatic or semiautomatic flight path control or which automatically control airframe response to disturbances. This classification includes automatic pilots, stick or wheel steering, autothrottles, structural mode control and similar control mechanizations.

AFCS functions include:

- Airspeed Hold
- All-Weather Landing
- Altitude Hold
- Altitude Select
- Attitude Hold (Pitch and Roll)
- Automatic Carrier Landing
- Automatic Instrument Low Approach
- Automatic Navigation
- Automatic Terrain Following
- Automatic Vectoring/Traffic Control
- Heading Hold
- Heading Select
- Mach Hold

AFCS Pre-engage Synchronization: The process of biasing a new input signal to correspond with the AFCS output position prior to switching to the new input signal. The bias is ramped out after switching.

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

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

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

Backup System: A mode of control which is engaged upon failure of the primary operational system. Usually used to refer to a system which is as independent as possible from the primary system. Sometimes used as protection against multiple generic failures.

Built-In-Test (BIT): An operational status checkout or test system which is integrated into a control system or function. Usually used to verify operational status of as many aspects of a control function as possible within the limits of integrated test capability. May be initiated automatically or on command.

Channel: One signal or control path of a redundant set. A channel is an entity within itself and contains elements individual to that channel. A model may be used as a reference channel in a detection-correction system.

Channel Buffering: A technique used to minimize the possibility of a failure in one channel from inducing a failure in another channel.

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:

- Primary/Secondary
- Active/Standby
- Normal/Alternate

Channel Summing: The combining of multiple channels to provide a control function. Examples of channel summing techniques are:

- Flow Summing
- Flux Summing
- Force Summing
- Position Summing
- Torque Summing
- Velocity Summing

Control Augmentation System (CAS): A vehicle flight control system wherein the control system responds to the error between the commanded vehicle motion and the actual vehicle motion.