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The Global Voice of Pilots

Aircraft Design & Operation
Briefing Leaflet

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IFALPA requirements regarding pilot authority and flight control architecture

Introduction

This Briefing Leaflet is intended to clarify the meaning of phrases that are often used but are not always clearly defined. Often different people use various interpretations and the end result is a different understanding of the true meaning. Clearly, this can severely hamper the understanding between various parties. Equally transparent therefore, is the need to define a common basis for these notions so that there is an accurate understanding of the meaning of a particular phrase or term. This Briefing Leaflet is a first attempt to establish clear and precise definitions of the requirements of IFALPA in regard to pilot authority, aircraft control and flight control architecture.

Means of signal transportation:

The technical means to transfer the input signal from the input device (ie control wheel and yoke, or side-stick controller, centre-stick, or future technical development) to the final flight path control device (ie flight control surface, thrust vector nozzle, engine controls or other future devices). It might be a physical cable, an electrical cable, a glass fibre-optic cable or any other future device. The only governing parameter is that is it the means of transferring the input signal from the input device to the controlling device.

Control authority & flight control architecture:

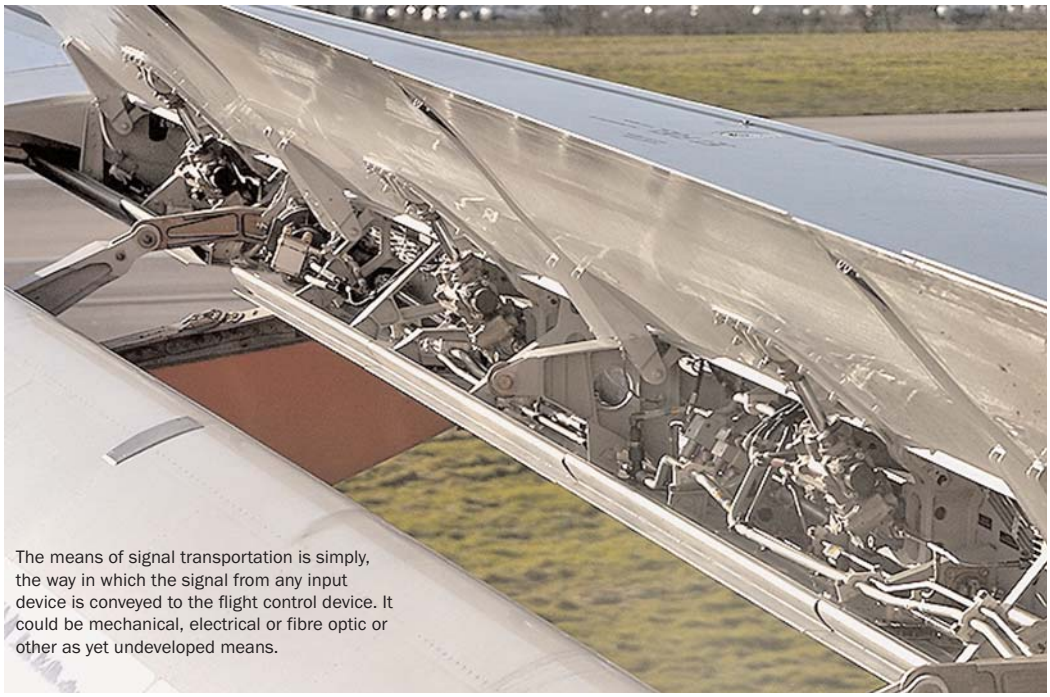
► *DIRECT CONTROL: Pilot authority unquestioned*

Direct proportional relationship between flight control input device and flight path control device. This control is in no way biased, augmented, validated, etc. This excludes devices like rudder travel limiter, elevator feel units, and aileron spoiler mixer, as well as computerised g – load limiters, roll rate limiters and so on.

Over stressing all or part of the aircraft is possible.

Leaving the safe flight envelope up to departure from controlled flight is possible

**In this case sufficient information and warnings must be provided to the pilot / crewmember to help them to recognise that exceedance of the safe flight envelope or the structural limits of the aircraft is imminent and / or already has occurred. These warnings should be layered regarding the severity of the situation.*



The means of signal transportation is simply, the way in which the signal from any input device is conveyed to the flight control device. It could be mechanical, electrical or fibre optic or other as yet undeveloped means.

► ***AUGMENTED CONTROL: Pilot authority degraded but not violated***

Flight control device input by the pilot is checked, biased, limited, augmented by mechanical devices like rudder travel limiter, aileron spoiler mixer, elevator feel unit, etc or well computerised flight control laws for example g – load limiters, roll rate limiters, speed stability function, or artificial generated control forces, etc. The aircraft protects itself against unintentional overloading (structural integrity of the aircraft) and warns the pilot that certain flight envelope and/or structural limits are infringed.

1. Exceedance of these limits by the pilot is still possible.

2. Intentional over-stressing the aircraft or parts thereof is still possible.

3. Intentional exceedance of the flight envelope and/or structural limits is still possible.

4. Warnings regarding failures of these augmentation systems shall be provided for the pilot/crew.

* *Partial and/or total deactivation of these systems in case of failure and/or malfunction of these systems must be available in form of dedicated controls and / or procedures. Additional warnings to the pilot / crew should be provided, if exceedance of the flight control envelope and/or the structural limits of the aircraft or parts thereof is imminent or has already occurred. These warnings should be layered in regard to the severity of the situation.*

► ***REGULATED CONTROL: Pilot authority is limited***

Pilot input to the flight control input device is treated as a flight path trajectory change demand. Various flight path control devices will operate to optimise the trajectory change, taking into account various environmental circumstances ie aircraft energy status, speed, aircraft weight, configuration, centre of gravity, etc, as well as the magnitude and rapidity of the input and/or the magnitude of the trajectory change, etc. (The system may reconfigure in case of failure of components of the flight path control devices, so that aircraft response will be equivalent to a normal aircraft status [ie-military aircraft].)

1. Exceedance of the flight envelope parameters is no longer possible.

2. Exceedance of the aircraft's structural limits is no longer possible.

3. Partial and / or total deactivation of the system shall be possible.

4. Warnings shall be incorporated to inform the pilot / crew of system failures.

5. The required warnings for regulated and / or direct control architectures must be provided for the degraded system.

* *In the case of such a flight control architecture, the possibility to re-establish pilot authority must be provided.*

Selectability of different levels of authority:

The aircraft commander shall be given the authority and capability to select the level of augmentation for the flight control system. Whenever higher levels of augmentation are incorporated in the flight control structure, the overlaying philosophy and the design shall cater for the possibility that the built in systems cannot detect all possible malfunctions. Therefore the re-establishment of pilot authority, also by pilot action, must be provided by appropriate devices and/or procedures.

This is necessary because of the possibility of unforeseen failures and/or misbehaviour of these systems or part thereof. This will then give the system and the pilot/crew a clearly defined fallback position to operate from. The fallback position may be layered to proceed via the augmented control to the direct control, or immediately to the direct control regime, regarding the severity of the situation. This shall also be catered for, if the flight control architecture will automatically reconfigure itself in case of a known failure.
The system should be capable of being reconfigured back to a higher level, if the failed, unreliable or faulted part of the equipment can be determined and removed from the system. The status of the system shall be clearly indicated to the crew, failures and malfunctions as far as possible made known and ambiguity must be avoided. If any doubt as to the reliability of the system remains, the procedures shall clearly state that, in order to maintain a safe status:

► Automatic reconfiguration of pilot authority must be clearly indicated by the system.

► Based on established procedures, the level of pilot authority must be selectable by pilot action.

► The level of pilot authority must be clearly indicated by the system without any ambiguity.

► If it is possible to regain a higher level of augmentation, the procedures shall indicate the status of the system.