

Chapter 5

Directional control systems

5.1 General

5.1.1 Craft should be provided with means for directional control of adequate strength and suitable design to enable the craft's heading and direction of travel to be effectively controlled to the maximum extent possible in the prevailing conditions and craft speed without undue physical effort at all speeds and in all conditions for which the craft is to be certificated. The performance should be verified in accordance with annex 8.

5.1.2 Directional control may be achieved by means of air or water rudders, foils, flaps, steerable propellers or jets, yaw control ports or side thrusters, differential propulsive thrust, variable geometry of the craft or its lift system components or by a combination of these devices.

5.1.3 For the purpose of this chapter, a directional control system includes any steering device or devices, any mechanical linkages and all power or manual devices, controls and actuating systems.

5.1.4 Attention is drawn to the possibility of interaction between directional control systems and stabilisation systems. Where such interaction occurs or where dual purpose components are fitted, the requirements of 12.5 and Chapters 16 and 17 are also to be complied with as applicable.

5.2 Reliability

5.2.1 The probability of total failure of all directional control systems should be extremely remote when the craft is operating normally, i.e. excluding emergency situations such as grounding, collision or a major fire.

See Annex 3 for FMEA. This requirement should be adequately covered within the FMEA, although the use of the term 'extremely remote' should not be taken in the context of numerical probabilities described in Annex 3.

5.2.2 A design incorporating a power drive or an actuation system employing powered components for normal directional control should provide a secondary means of actuating the device unless an alternative system is provided.

The FMEA should comply with the requirements of Annexes 3 and 4. Normally compliance will be achieved by provision of redundant systems as detailed in 4.5 of Annex 4, and numerical assessment will not be required. Consideration should be given to the independence of redundant systems as required by 4.5.2 of Annex 4. It is recommended that FMEA's should be forwarded to HQ for advice, particularly those which comply by means of numerical assessment.

5.2.3 The secondary means of actuating the directional control device may be manually driven when the Administration is satisfied that this is adequate, bearing in mind the craft's size and design and any limitations of speed or other parameters that may be necessary.

5.2.4 The directional control systems should be constructed so that a single failure in one drive or system, as appropriate, will not render any other one inoperable or unable to bring the craft to a safe situation. The Administration may allow a short period of time to permit the connection of a secondary control device when the design of the craft is such that delay will not in their opinion hazard the craft.

5.2.5 A failure mode and effect analysis should include the directional control system.

5.2.6 If necessary to bring the craft to a safe condition, power drives for directional control devices, including those required to direct thrust forward or astern, should become operative automatically, and respond correctly, within 5 s of power or other failure. Back-up electrical systems may be required for the starting-up time of an auxiliary diesel according to 12.2 or an emergency diesel generator according to 12.3.6.

5.2.7 Directional control devices involving variable geometry of the craft or its lift system components should, so far as practicable, be so constructed that any failure of the drive linkage or actuating system will not significantly hazard the craft.

5.3 Demonstrations

5.3.1 The limits of safe use of any of the control system devices, should be based on demonstrations and verification process in accordance with annex 8.

5.3.2 Demonstration in accordance with annex 8 should determine any adverse effects upon safe operation of the craft in the event of an uncontrollable total deflection of any one control device. Any limitation on the operation of the craft as may be necessary to ensure that the redundancy or safeguards in the systems provide equivalent safety should be included in the craft operating manual.

5.4 Control position

5.4.1 All directional control systems should normally be operated from the craft's operating station.

5.4.2 If directional control systems can also be operated from other positions, then two-way communication should be arranged between the operating station and these other positions.

5.4.3 Adequate indications should be provided at the operating station and these other positions to provide the person controlling the craft with verification of the correct response of the directional control device to this demand, and also to indicate any abnormal response or malfunction. The indications of steering response or rudder angle indicator should be independent of the system for directional control. The logic of such feedback and indications should be consistent with the other alarms and indications so that in an emergency operators are unlikely to be confused.