

# Chapter 16

## Stabilisation systems

### 16.1 Definitions

16.1.1 "Stabilisation control system" is a system intended to stabilise the main parameters of the craft's attitude: heel, trim, course and height and control the craft's motions: roll, pitch, yaw and heave. This term excludes devices not associated with the safe operation of the craft, e.g. motion reduction or ride control systems.

The main elements of a stabilisation control system may include the following:

- .1 devices such as rudders, foils, flaps, skirts, fans, water jets, tilting and steerable propellers, pumps for moving fluids;
- .2 power drives actuating stabilisation devices; and
- .3 stabilisation equipment for accumulating and processing data for making decisions and giving commands such as sensors, logic processors and automatic safety control.

16.1.2 "Self-stabilisation" of the craft is stabilisation ensured solely by the craft's inherent characteristics.

16.1.3 "Forced stabilisation" of the craft is stabilisation achieved by:

- .1 an automatic control system; or
- .2 a manually control assisted system; or
- .3 a combined system incorporating elements of both automatic and manually assisted control systems.

16.1.4 "Augmented stabilisation" is a combination of self-stabilisation and forced stabilisation.

16.1.5 "Stabilisation device" means a device as enumerated in 16.1.1.1 with the aid of which forces for controlling the craft's positions are generated.

16.1.6 "Automatic safety control" is a logic unit for processing data and making decisions to put the craft into the displacement or other safe mode if a condition impairing safety arises.

### 16.2 General requirements

16.2.1 Stabilisation systems should be so designed that in case of failure or malfunctioning of any one of the stabilisation devices, or equipment, it would be possible either to ensure maintaining the main parameters of craft's motion within safe limits with the aid of working stabilisation devices or to put the craft into the displacement or other safe mode.

16.2.2 In case of failure of any automatic equipment or stabilisation device, or its power drive the parameters of craft motion should remain within safe limits.

16.2.3 Craft fitted with an automatic stabilisation system should be provided with an automatic safety control unless the redundancy in the system provides equivalent safety. Where an automatic safety control is fitted, provision should be made to override it and to cancel the override from the main operating station.

16.2.4 The parameters and the levels at which any automatic safety control gives the command to decrease speed and put the craft safely in the displacement or other safe mode should take account of the safe values of heel, trim, yaw and combination of trim and draught appropriate to the particular craft and service; also to the possible consequences of power failure for propulsion, lift or stabilisation devices.

16.2.5 The parameters and the degree of stabilisation of the craft provided by the automatic stabilisation system should be satisfactory having regard to the purpose and service conditions of the craft.

16.2.6 The requirements for control system and warning devices are set out in Chapter 11 and 14.3. Failure mode and effect analysis should include the stabilisation system.

*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.*

### **16.3 Lateral and height control systems**

16.3.1 Craft fitted with an automatic control system should be provided with an automatic safety control. Probable malfunctions should have only minor effects on automatic control system operation and should be capable of being readily counteracted by the operating crew.

16.3.2 The parameters and levels at which any automatic control system gives the command to decrease speed and put the craft safely into the displacement or other safe mode should take account of the safety levels as given in section 2.4 of annex 3 and of the safe values of motions appropriate to the particular craft and service.

## **16.4 Demonstrations**

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

16.4.2 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.