THE USE OF REDUNDANCY IN AIRCRAFT FLYING CONTROL SYSTEMS

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SUMMARY

An outline is given of the basic categories of redundancy and examples of its use in aircraft flying control systems from the early pioneering days to the present time. The use of redundancy in automatic flight control devices has followed the earlier mechanical concepts and various systems are described. It is demonstrated that redundancy is a vital and continuing aspect of future designs, no matter what the future technological advances might be and examples are given of possible applications of automatic control systems where failure probabilities are so low that they can be relied upon for artificial performance control. The greatly improved performance and operational efficiency which could result from such possibilities can be achieved with present-day engineering techniques, but the main problem at the moment is achieving acceptance of such techniques rather than proof of capability. The adverse effect of redundancy on maintainability is discussed but it is suggested that the true value of redundancy can only be found from overall systems analysis and not by separate assessment of particular aspects of a design such as capital cost, serviceability or maintainability. Overall value analysis should be the main criterion.

1. INTRODUCTION

In all situations where human lives depend upon the correct operation of a "system", adequate provision must be made in the design to ensure that there is no reasonable probability of a catastrophe. In practice this often cannot be achieved unless the design incorporates some form of redundancy, which is so organised, that it is always necessary to have at least two sensibly concurrent failures before a complete breakdown, and possibly a tragedy, can occur.

Such designs are said to have a reserve capability and can be described as fail-safe. All fail-safe designs incorporate some form of redundancy, though sometimes it is not easily recognisable.

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