

 AEROSPACE INFORMATION REPORT	AIR4366		REV. A
	Issued	1996-05	
	Cancelled	2007-08	
Superseding AIR4366			
Issues and Concerns Associated with Electronic Propulsion Control System Partitioning			

RATIONALE

The AIR4366 subject material has been superseded by another standard work produced by the RTCA SC200 which has now published D0-297. An assessment of the content of AIR4366 against DO 297 was made and summarized in a matrix, see attachment 08.air4366 from the September 06 meeting. Quoting from the September 06 minutes, "The matrix shows what each of the documents is trying to achieve and then provides a comparison between them. in the vast majority of areas, the SC200 document covers all points contained with the AIR in a more detailed and robust manner." In would be a pointless exercise to update the AIR4366 since a much more comprehensive document already exists, hence it is suggested that AIR4366 be cancelled.

CANCELLATION NOTICE

The document has been declared "CANCELLED" as of August 2007. By this action, this document will remain listed in the Numerical Section of the Aerospace Standards Index.

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REV.
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Issues and Concerns Associated with Electronic Propulsion Control System Partitioning

FOREWORD

Traditionally engine controls have been a dedicated part of an engine. The interfaces between the engine controls and the airframe have been straight forward, generally consisting of throttle linkage, fuel lines, and electrical connectors.

As technology has progressed, electronic controls have supplanted hydromechanical systems. Control system logic has become more sophisticated, and engine-airframe interfaces for an optimum system are no longer clearly evident. Distributed systems, in which "the propulsion control" is no longer an identifiable entity, are now possible and may offer significant advantages in aircraft performance, cost, weight, reliability, etc., for some applications.

This AIR, prepared by the Electronic Engine Control Committee's Panel on System Partitioning, is not intended to discourage the distribution or partitioning of propulsion control systems, but rather to ensure that all the issues are properly considered to avoid new and perhaps subtle problems which may lie ahead.

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SAE AIR4366 Revision A

1. SCOPE:

This SAE Aerospace Information Report (AIR) enumerates areas of concern which need to be addressed when the aircraft propulsion control system functions are distributed. Distributed items may include electronic control sensors, electrical or hydraulic power sources, computer hardware and software, etc. This report identifies many factors which should be considered to determine the best system architecture for any given application.

2. REFERENCES:

2.1 U.S. Government Publication:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-1553B

2.2 FAR Publications:

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591.

FAR 23

FAR 25

FAR 27

FAR 29

FAR 33

2.3 ARINC Publication:

Available from Aeronautical Radio, Inc., 2551 Riva Road, Annapolis, MD 21401.

ARINC 629

3. ISSUES AND CONCERNS:

The topics contained in the main body of this report are labeled "Issues and Concerns". They represent those items which, as seen by the engine control community, can present problems if not properly addressed up front. They are by no means considered insurmountable obstacles, and offer great opportunities for cooperative, creative solutions to the technical challenge.

The main body is organized to follow the flow of a program. It begins with (1) system definition and design, followed by (2) development, (3) certification/qualification, and finally addresses (4) configuration control, (5) maintainability/supportability, and (6) warranty/liability issues. However, it is important that all issues be addressed in the system definition phase.

3. (Continued):

A propulsion control system consists of those components such as sensors, control units, actuators, and computation means which maintain the commanded level of propulsive performance provided to the airframe by the engines.

3.1 System Definition and Design:

Presented within this section are general considerations which should be addressed as partitioning of the propulsion control system is defined. Although top level requirements are not influenced by partitioning, subsystem requirements and interface definitions take on new significance depending upon system configuration.

- 3.1.1 System Requirements: System requirements must be defined which specify system performance that is necessary to achieve real-time execution of control algorithms for the control of fuel flow, stator vanes, bleeds, and other variable geometry. Consideration should also be given to requirements for additional secondary functions, such as engine condition monitoring, instrumentation, and other data.

System performance should be defined in terms of the dynamic response and accuracy required from the various elements of the control system - input commands, sensors, computers, actuators. These requirements will in turn lead to the definition of additional requirements regarding computational cycle times, data update rates, etc.

Criticality of control system functions dictate the system reliability and safety requirements. Based on these requirements, needs for fault tolerance will be developed, including possible redundancy of sensors, computational resources and actuation systems. Consideration must be given to the level(s) of redundancy - dual, triple, quad, dual-dual, etc. System redundancy can result from communication of data between computers. An important consideration is the provisions made for redundant sources of electrical power, to ensure continuity of supply to achieve specified requirements.

System integration and resource sharing must be partitioned in such a manner as to maintain independence between engines in multi-engine applications in order to prevent faults from propagating between engines.

Failure modes of the control system should be defined in terms of observable end results, e.g.:

- a. No observable effect for a single failure
- b. Fail fixed
- c. Fail to a predefined condition
- d. No large uncontrolled thrust or power changes