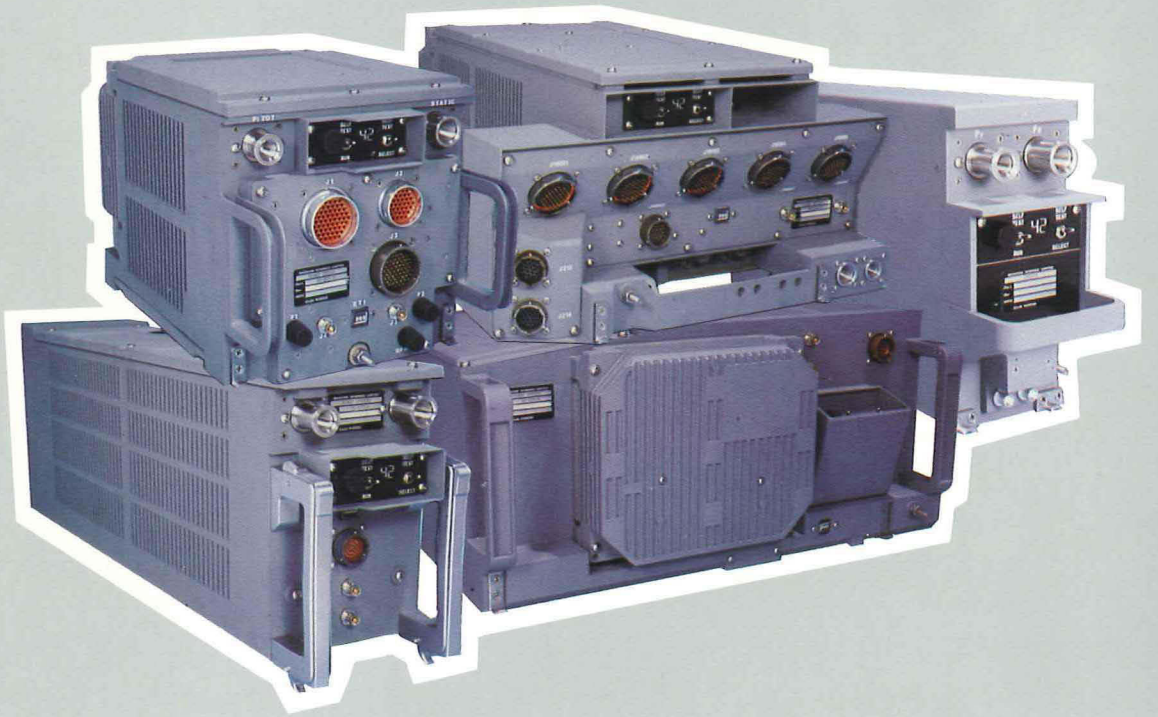
MARCONI AVIONICS

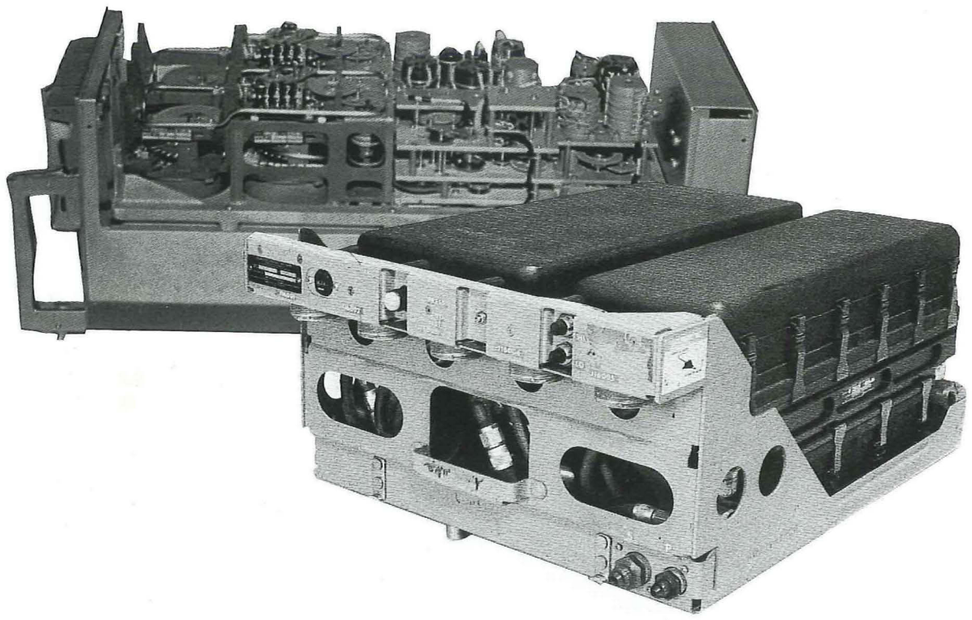
Standard Central Air Data Computer



- SCADC is a reconfigurable Air Data Computer made from a set of standard modules
- SCADC can fit or retrofit entire aircraft fleets
  - as an all digital ADC
  - as a plug-in replacement for an analog ADC

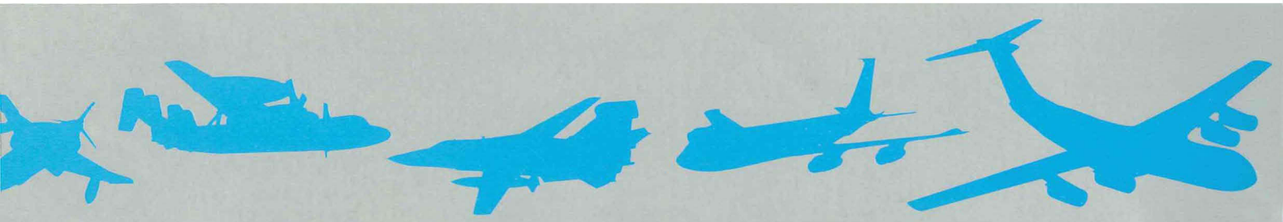
Marconi Avionics has created a major new generation of Air Data Computers designed for the combined USAF and USN Standard Central Air Data Computer (SCADC) program.

This well co-ordinated avionics update program for mature aircraft, enhances airborne performance and creates substantial cost savings. Obsolete avionics inherently cause degraded reliability, and require high cost spares and continual maintenance activity. This in turn results in totally unacceptable life cycle costs, and poor aircraft availability.



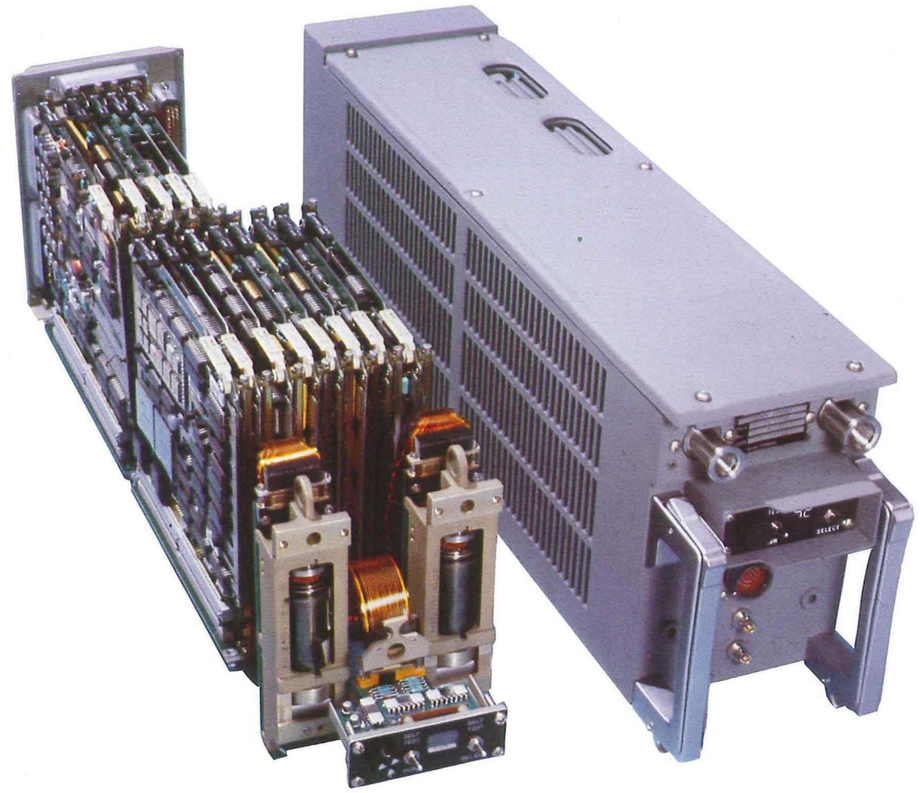
Marconi Avionics is manufacturing the SCADC to provide high performance, low cost maintainability and outstanding reliability in a simple plug-in retrofit package.

In addition to solving the problems of obsolete equipment on more than 30 aircraft variants, SCADC provides an ideal basis for standardization on new aircraft. It is a unique combination of advanced technology, design standardization, and logistics science.



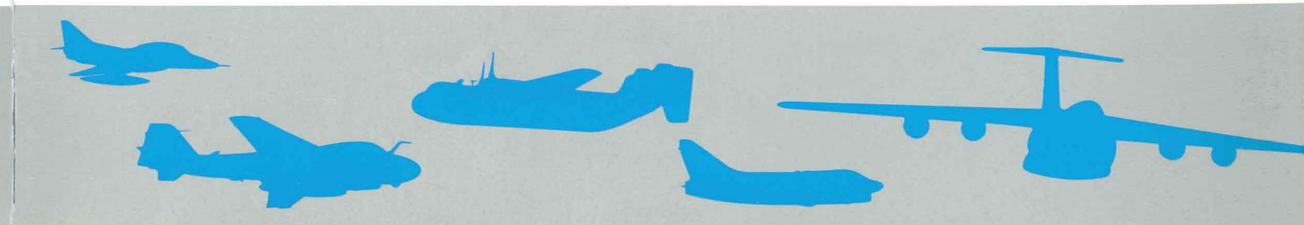
SCADC Benefits

Life cycle cost savings in excess of 50% even on limited life aircraft, are achieved by SCADC.

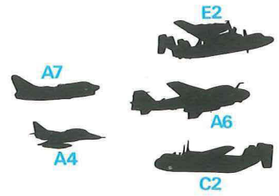


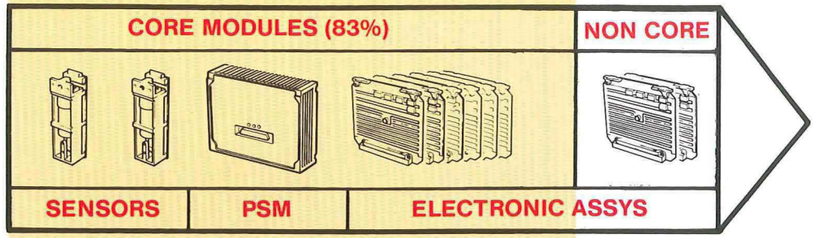
Major retrofit cost saving factors:

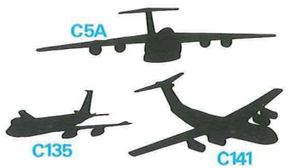
- ★ Up to 70% equipment purchase cost savings.
- ★ Typically 50 fold increases in reliability.
- ★ Mean Time To Repair reduction of around 90%.
- ★ Hardware and maintenance commonality between aircraft types of over 80%.
- ★ Simple, plug-in, retrofit for any aircraft.

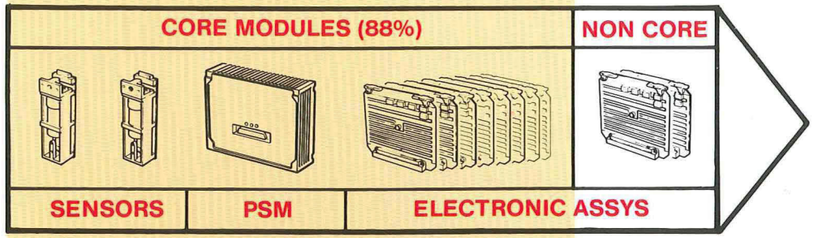


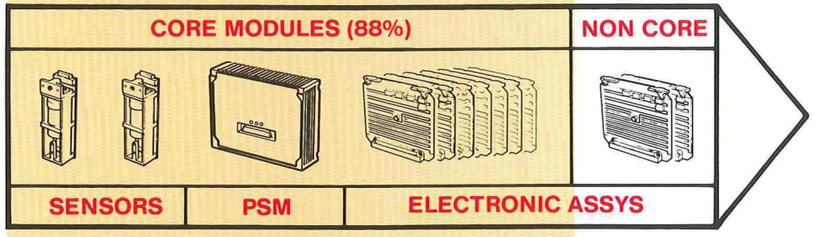
THE SCADC FAMILY

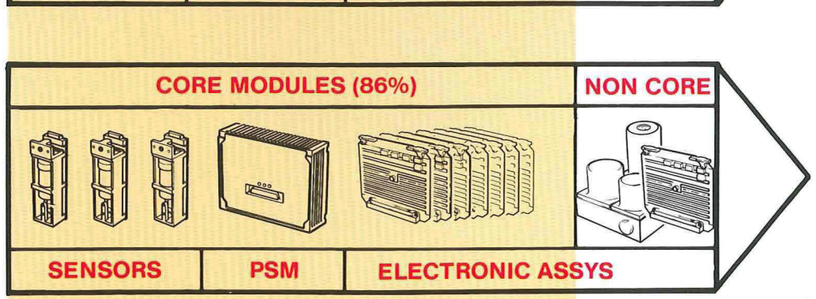


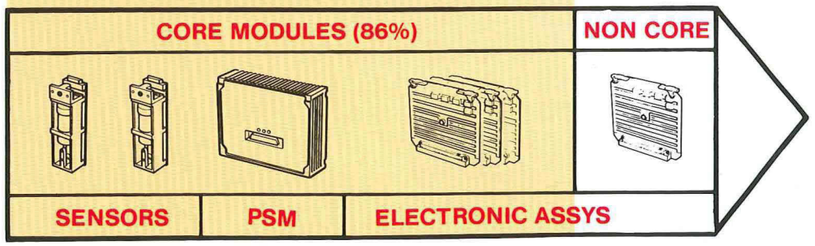












CP-XXX1

SCADC Concept

SCADC is a core set of standard Air Data Computer modules which can be packaged to satisfy air data computing requirements for any aircraft.

The 30 plus aircraft variants being updated by the USAF and USN in the current SCADC program are retrofitted by only 4 different SCADC configurations.

The SCADC core hardware set provides over 80% of the hardware in every Air Data Computer application.

The remaining hardware comprises one or two special-to-type modules per configuration, which accommodate any unique aircraft interfaces. Each configuration has its own tailored mechanical package.

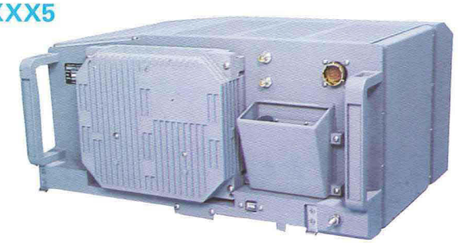
Simple passive adaptor trays enable particular configurations of SCADC to meet the installation requirements of a variety of aircraft.

New aircraft designs already include the highly efficient Marconi Avionics all digital CP-XXX6 SCADC configuration for MIL-STD-1553B data bus avionic systems.

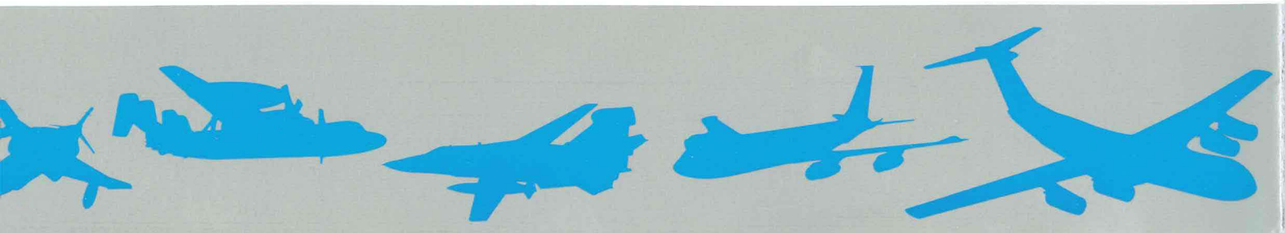
CP-XXX3

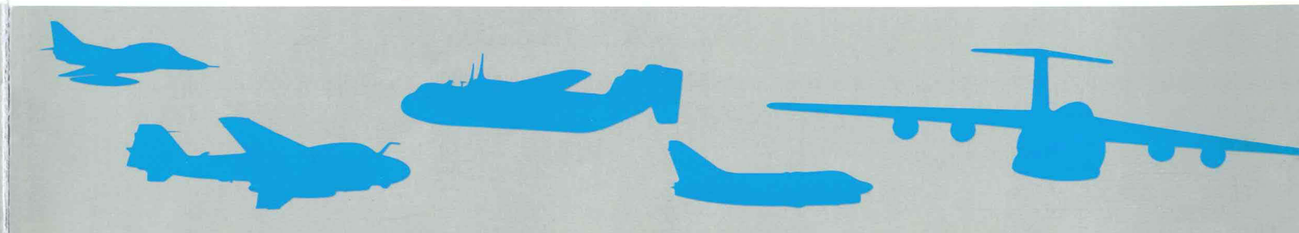
CP-XXX4

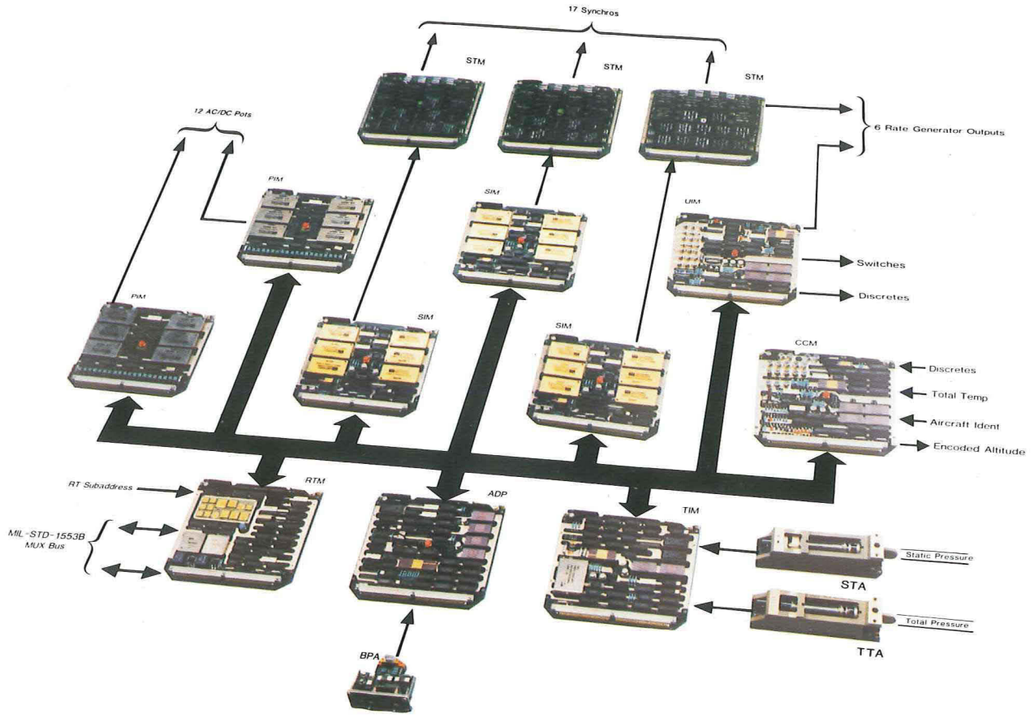
CP-XXX5



CP-XXX6







CP-XXX3 System

SCADC System Design

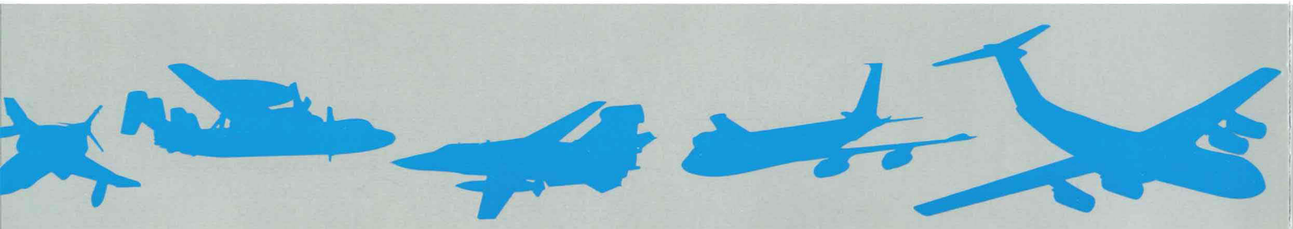
To achieve the very high commonality across aircraft types a unique software re-configurable systems design has been engineered for the Marconi Avionics SCADC.

Output parameters, ranges, and scalings are selected for each aircraft type by the software, which recognises the host aircraft type from a code wired into the aircraft connector pins.

Totally isolated analog signals, which duplicate existing interfaces, are generated on the Synchro Interface (SIM), Synchro Transformer (STM), and Potentiometer Interface (PIM) Modules. Any special interfaces, if required, are handled by one special-to-type Unique Interface Module (UIM). Use of the circuits on all the output modules is governed by aircraft-dependent data held on the Configuration Control Module (CCM).

MIL-STD-1553 interfaces are processed by the Remote Terminal Module (RTM) which features a Marconi Avionics developed LSI chip set. The Air Data Processor centres on the Z8002 microprocessor and also holds most of the core software.

Precision pressure measurement is provided by Solartron oscillating cylinder transducers on the Static Transducer Assembly (STA) and Total Transducer Assembly (TTA). The inherent vibration immunity of this type of transducer makes it an ideal choice for rigorous aircraft environments. Many thousands of these transducers have been produced for military aircraft programs over the past decade. Transducer frequency output measurement is accurately performed on the Transducer Interface Module (TIM).



The Marconi Avionics SCADC system design has been optimized to ensure that the conflicting requirements of low module count and low non-core content are both satisfied.

Software

The SCADC software is carefully engineered into a modular structure. The first level of this structure consists of the major program segments, and a cataloged database. The major program segments are sub-divided into logical modules, most of which are universally applicable across all SCADCs, and are therefore located on the core hardware. Aircraft-dependent data and program modules are located on the non-core Configuration Control Module (CCM). In operation, the catalog links together the data and routines required for the particular aircraft on which the SCADC is installed.

This functional structure and physical partitioning of the software provides outstanding flexibility and adaptability to present and future SCADC software needs.

Simple changes to the link-indexes and to the database (both held on the non-core CCM) permit new requirements to be accommodated without any impact to the core hardware or core software.

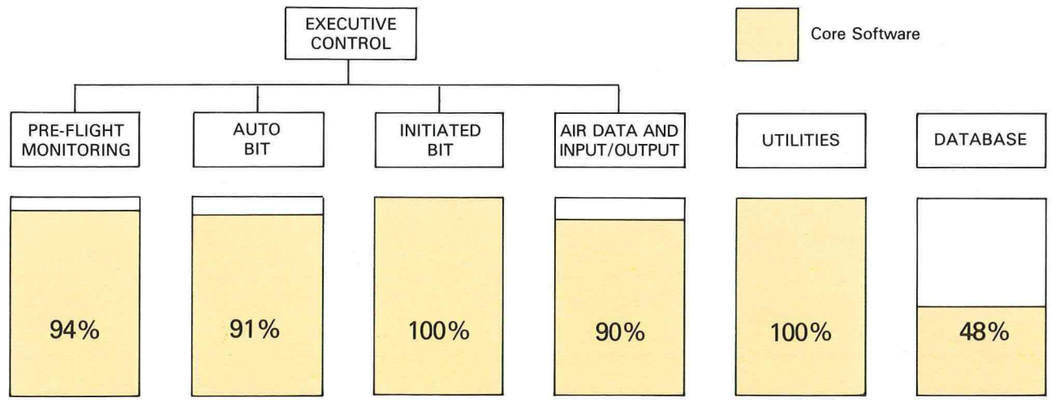
Built-In Test

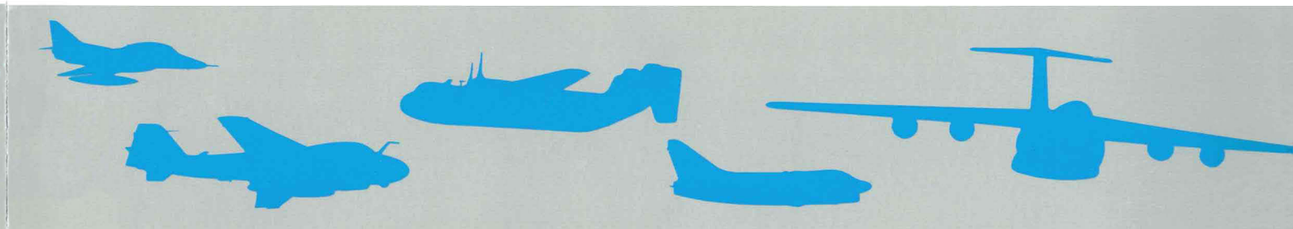
Extensive Built-In Test (BIT) is provided in the innovative Marconi Avionics SCADC design.

The automatic BIT identifies and collects failures either from the dedicated BIT hardware, or from the many other checks performed as a continuous background task, such as memory sumchecks, RAM read/write checks, and output wraparound checks. Failure analysis is performed during ground crew initiated BIT to fault find to the suspect module.

Each module within the Marconi Avionics SCADC contains its own BIT hardware. A failure in a module, or in the BIT circuits monitoring the module, will result in that module's failure code being displayed. The fault can then be cleared by simple module replacement and any chance of ambiguity is removed.

SCADC Software Functional Structure



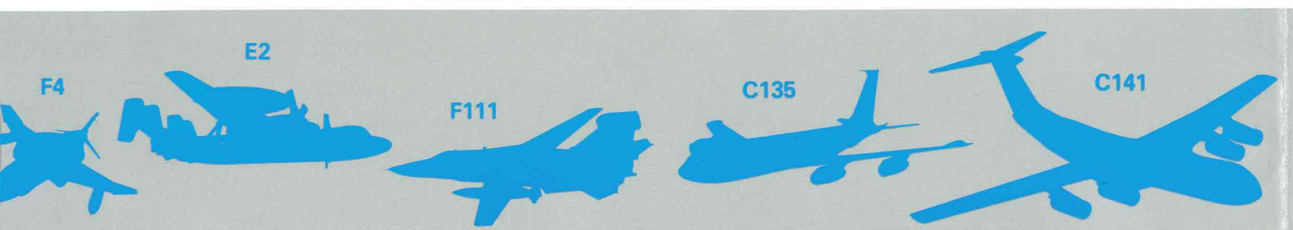


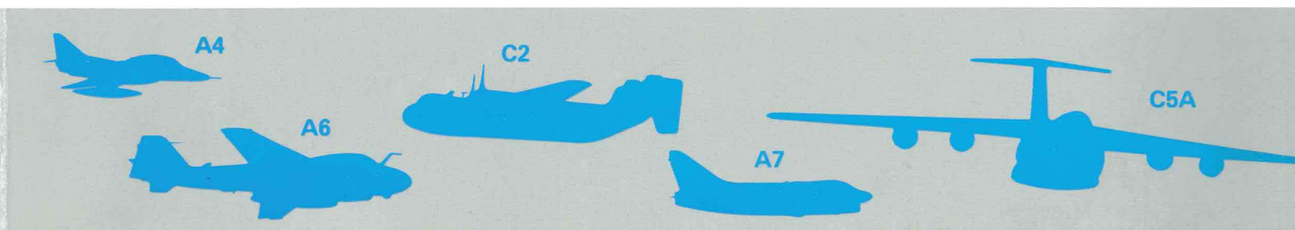
Technical Data

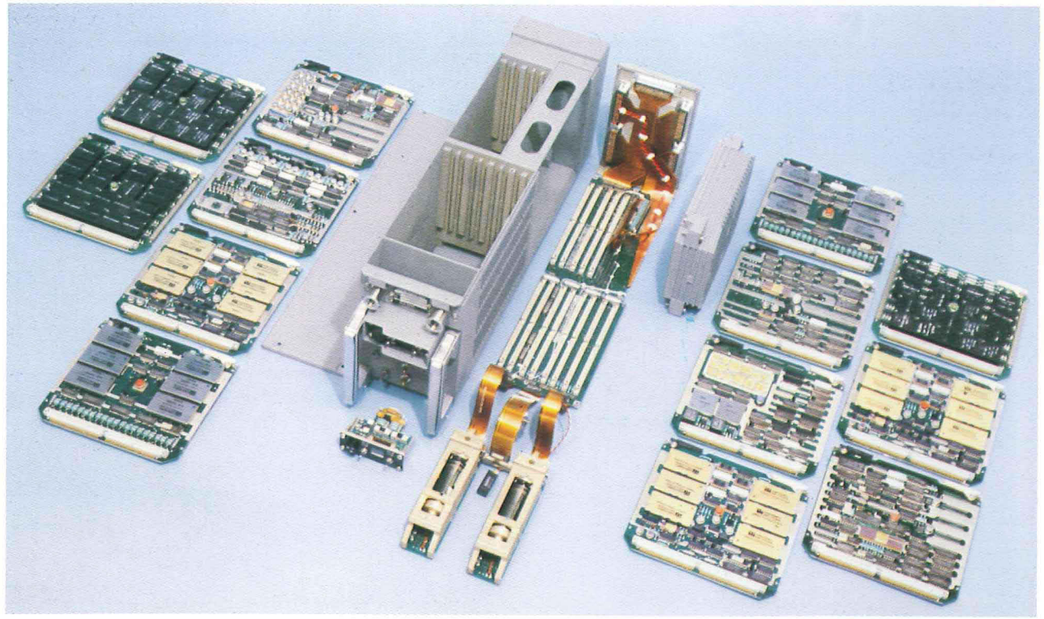
SCADC Unit	CP-XXX1	CP-XXX3	CP-XXX4	CP-XXX5	CP-XXX6
USAF/USN Type	CPU 140/A	CPU 141/A	CPU 142/A	CPU 143/A	TBA
Aircraft Capability	A-4M, OA-4M, TA-4J, A-6E, KA-6D, EA-6A, EA-6B, A-7D, A-7E, A-7K, TA-7C, C-2A, E-C2	C-5A, C-135, KC-135, C-141A, C-141B	F-111A, F-111D, F-111E, F-111F, FB-111A, EF-111A	F-4C, F-4D, F-4E, F-4J, F-4N, F-4S, RF-4B, RF-4C	ALL DIGITAL AIRCRAFT
Normal Power Consumption	61W	79W	64W	47W	30W
Size (in) (mm)	7.5 × 7.5 × 9.5 191 × 191 × 242	7.5 × 5.0 × 19.5 191 × 127 × 496	7.5 × 14.0 × 19.0 191 × 356 × 483	7.5 × 17.0 × 12.0 191 × 432 × 305	7.5 × 3.5 × 12.5 191 × 29 × 318
Weight (lb) (kg)	21 9.4	27 12.0	31 14.3	32 14.3	11 5.0
Predicted Reliability*	6100 hrs	4200 hrs	4400 hrs	4100 hrs	10,900 hrs
MIL-STD-155 3B	✓	✓	✓	✓	✓
Altitude Encoder	✓	✓	✓		✓
Synchro Outputs	6	17	17	6	
Potentiometric Outputs	10	12	12	18	
Discretes/Switches	9	21	21	9	
Rate Generator	1	6	1		
Altimeter, Power Switching	✓	✓			
Rheostatic Outputs	2				
Serial Digital Interfaces	2				

An ARINC 429 Serial Digital Interface is available as an alternative to the MIL-STD-1553B interface.

*To ease direct comparison all figures are quoted as Air Inhabited Fighter at 25°C, except for CP-XXX3 which is Air Inhabited transport.





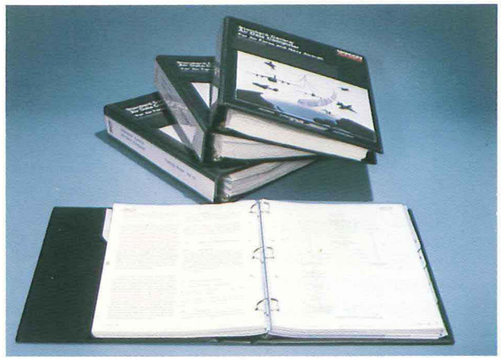


Product Support

SCADC support costs are minimized by thorough maintainability design, powerful Built-In Test features at both Organizational and Intermediate Levels, and by an advanced Integrated Logistic Support (ILS) package.

Over 95% detection and isolation of operational failures can be achieved by automatic (continuous) Built-In Test. The ground crew initiated BIT facility enables 98% of all Line Replaceable Unit failures to be detected and isolated.

At Intermediate Maintenance level, the initiated BIT analyzes failures and displays a code on the SCADC front panel identifying the suspect modules. Ambiguity is eliminated by design. Over 90% of failure modes are identified directly to a single failed module. A further 5% of failures are attributed to a prioritized choice of two modules, and in the final few per cent of failure cases, no more than three modules, properly prioritized, need be examined.



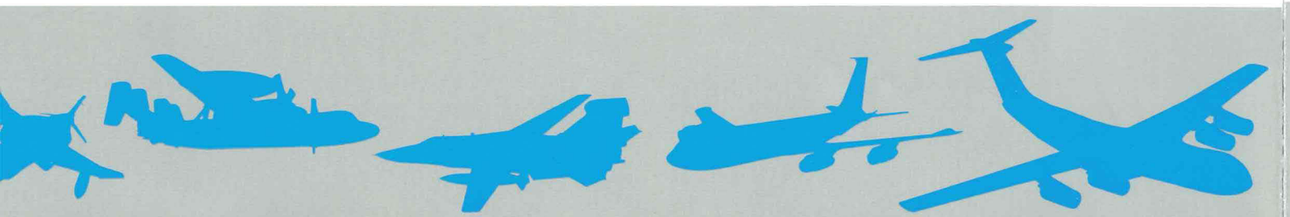
Marconi Avionics has applied advanced technology, reliability engineering and maintenance experience to enable two level maintenance to be a viable consideration for SCADC. This concept is being supported by 100,000 hours of environmental testing under all operating conditions on 60 production SCADC units.

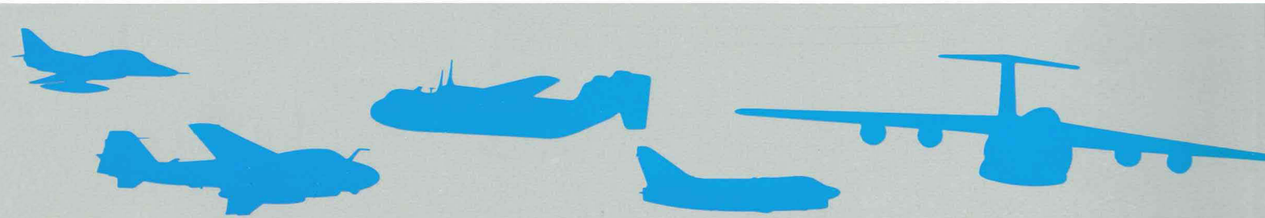
All SCADC units and modules have been designed to be interface compatible with Automatic Test Equipment systems.

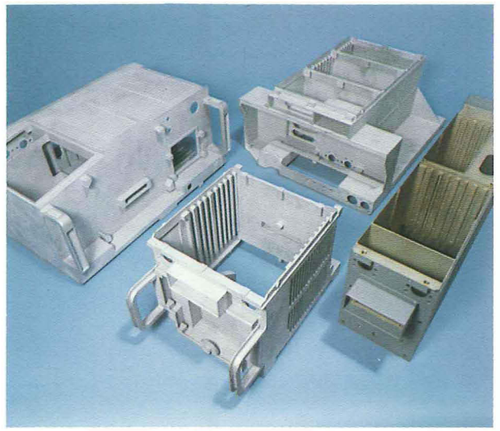
Peculiar Ground Support Equipment for SCADC unit testing is also available. This test equipment is being operationally evaluated at 25 different SCADC maintenance and test stations, and provides a very low cost support equipment option where operational scenarios require PGSE at unit level.

The SCADC Integrated Logistic Support package optimizes Product Data, Logistic Support Analysis Records, Training Courses, and Spares Provisioning. This ILS package in conjunction with thorough Life Cycle Cost analysis, ensures maximum aircraft availability for all SCADC applications, at minimum cost.

Marconi Avionics' logistics engineering capability has been developed over numerous United States DoD programs including C-5A, AH-1S, A-4, A-7, F-16, and A-10. The SCADC logistics support plans are the result of the very latest computer aided logistics engineering programs.







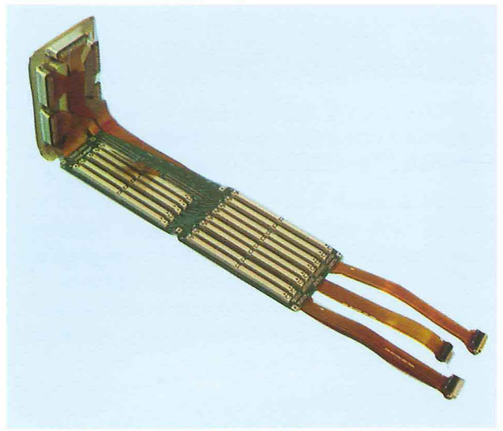
Producibility

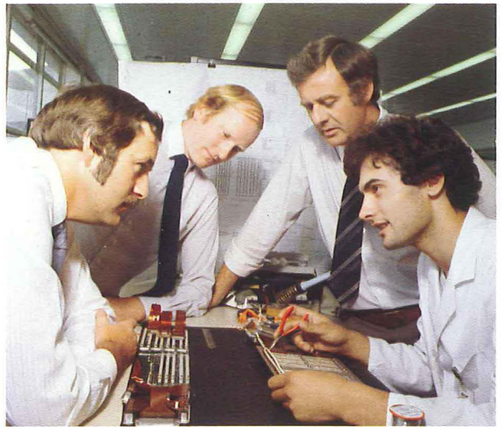
To ensure that SCADC production proceeds at minimum cost and at maximum throughput, highly qualified and experienced production engineers are designated as key members of the design team.

Extensive Computer Aided Design resources have been used to enhance every design development process of SCADC, generating carefully value engineered equipment with the traditional reliability and quality of all the products of Marconi Avionics.

Typical results of this design-for-production process were the immediate application to SCADC of precision chassis castings, high reliability repairable flexi-circuit interconnect assemblies, and the intense use of LSI technology.

Confidence in producibility and value engineering has enabled Marconi Avionics to manufacture all 60 of the initial SCADC units to full production standards. This ensures that SCADC aircraft compatibility and qualification test processes are truly representative of each of the thousands of SCADCs produced. This guarantees very low risk procurement with minimum lead times.





Manufacture

Highly automated production processes enable the Marconi Avionics Air Data Computer manufacturing facility readily to produce SCADC units at the high rates required for rapid retrofit.

Production engineers, totally dedicated to the program, have optimized all assembly and test procedures for the SCADC modules and units.

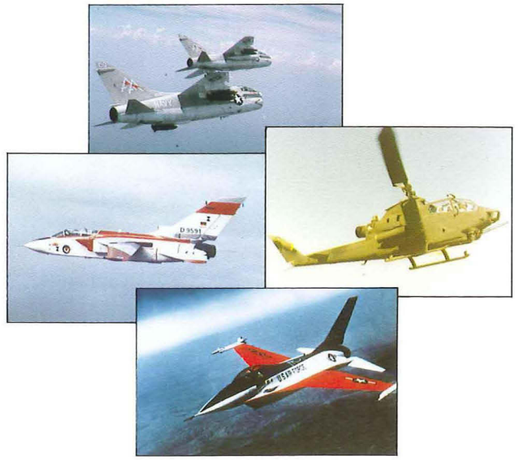
Each unit produced undergoes extensive Manufacturers Acceptance Screening Testing to ensure that equipment is fielded with maximum possible reliability. Quality assurance engineers work closely with resident on-site US Government Source Inspectors to ensure that peak manufacturing quality is maintained throughout the procurement program.

Extensive Computer Aided Management facilities provide the precise Stock Control, Process Management, and Sub-Contract Control essential for on cost and on schedule production.

Company Background

Marconi Avionics has a history of completing military avionic equipment contracts in the USA on schedule and on cost. The company, working closely with Marconi Avionics Inc. in Atlanta, has supplied digital avionic equipment for the A-4, A-7, F-16, AH-1S and YC-14 and is now producing new Head-Up Displays for the F-16 and A-10. These contracts alone represent over 4000 digital systems currently in service with the US Forces.

Within Europe Marconi Avionics is the largest supplier of avionic equipment, with systems designed and manufactured for aircraft as widely ranged as the Concorde SST and the Tornado combat aircraft.



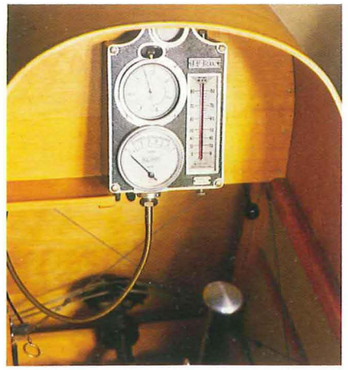
Part of the head office plant, Airport Works, Rochester, Kent.

Aerial view of the plant at Christopher Martin Road, Basildon, Essex.

Principal factory at Elstree Way, Borehamwood, Herts.

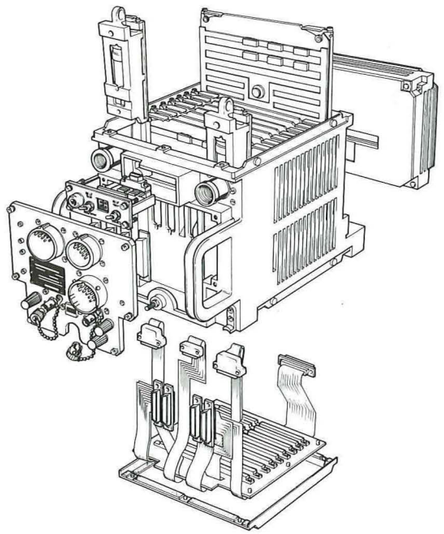
Marconi Avionics Inc. factory at Atlanta, Georgia, USA.

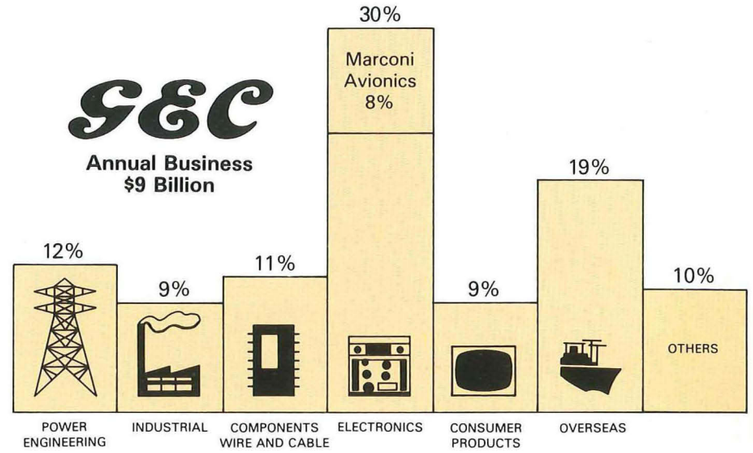
The 23 Marconi Avionics product divisions, located at four major sites, manufacture Automatic Flight Control Systems, Navigation Systems, Radar Systems, Airborne Radio Equipment, Airborne Surveillance Equipment, Head-Up Displays, CRT Displays, Weapons Management Systems and Automatic Test Equipment, as well as Air Data Computers. This widespread avionic systems experience has enabled a wealth of expertise to be applied to SCADC development, which ensures correct systems performance for the varied user systems across all SCADC aircraft installations.



Instrument Systems Division, the SCADC product division, based at the headquarters of Marconi Avionics in Rochester, Kent, has produced more than 3000 Central Air Data Computers over the past 2 decades.

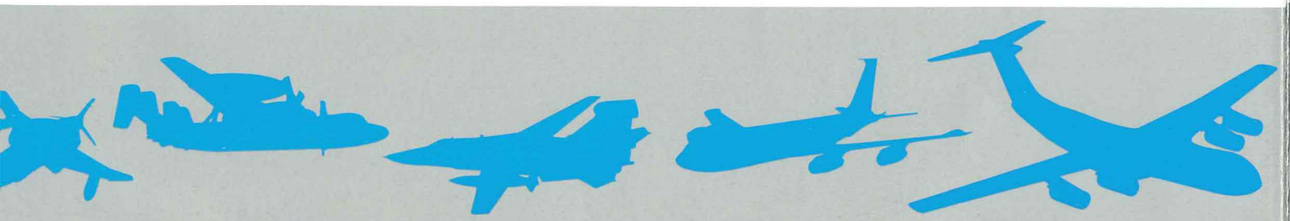
The tradition of Air Data measurement runs deep in Marconi Avionics. Balloonists in the 1880's were using pocket altimeters manufactured by Elliott Brothers, the Marconi Avionics founding company, and many World War One pilots flew with the company's early instrument panels.

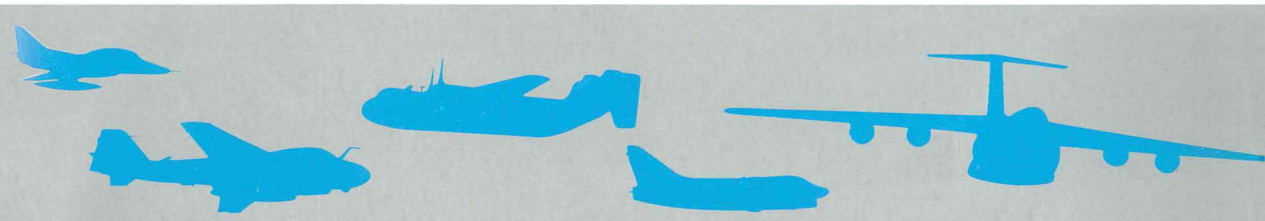




The massive resources of the Marconi Avionics British parent company, GEC, the General Electric Company, provide a totally secure SCADC procurement and support foundation. GEC is Britain's largest engineering company with annual business of over 9 billion dollars.

The SCADC program is being realized by the unique Marconi Avionics combination of high technology, product support, program management, company resources, and experience. This guarantees that SCADC manufacture will be on time and on cost for all aircraft applications.





Marconi Avionics Limited
Airport Works, Rochester,
Kent ME1 2XX, England

A GEC-Marconi Electronics Company

Telephone: England, Medway (0634) 44400
Telegrams: Elliauto Rochester
Telex: 96333/4

Marconi Avionics Inc.
4500 North Shallowford Road,
Atlanta,
Georgia 30338

Telephone: (404)-394-7800

Marconi Avionics Inc.
Suite 1375,
Wintersbank Tower,
Dayton,
Ohio 45423

Telephone: (513)-224-1110

MARCONI
AVIONICS

Designed and Printed by Buckland Press Ltd., London and Dover, England