ENGINE - FUEL AND CONTROL - TO PROVIDE A NEW ELECTRONIC ENGINE CONTROL (EEC) WITH THE A5 SCN11 SOFTWARE CONFIGURATION - CATEGORY CODE 4 - MOD.ENG-73-0086

1. Planning Information

A. Effectivity

(1) Aircraft: Airbus A319, A320 and A321

(2) Engine: V2522-A5 Engines before Serial No.V10225*
V2524-A5 Engines before Serial No.V10225*
V2527-A5 Engines before Serial No.V10225*
V2530-A5 Engines before Serial No.V10225*
V2533-A5 Engines before Serial No.V10225*

*The Serial Number data shown is of a preliminary nature and is provided for advanced planning only. A future revision to this Service Bulletin will confirm final serial number effectivity

NOTE: The intermix of Electronic Engine Controls is to be done only by the instructions given in Reference (5), Airbus Service Bulletin A320-73-1053.

B. Reason

(1) Condition

(a) 1.0 STARTING ENHANCEMENTS

1 1.1 ENHANCED AUTOSTART LOGIC: V2500-A5 engines have experienced failed ground autostarts during flight test as well as during revenue service operation. The problem has been most apparent during operation at high altitude airports or for operation with quick turnaround times.

2 1.2 MANUAL START LOGIC ENHANCEMENTS: Manual starts in the field have not always been successful due to premature closure of the Starter Air Valve.

3 1.3 IGNITION TIMER LOGIC FOR STARTER DISCRETE FAULTS: A starter valve discrete feedback fault will inhibit the commanding of fuel on for an autostart on the ground. Manual ground starts and in-flight starts are unaffected.

(b) 2.0 RATINGS AND SCHEDULES:

1 2.1 GROWTH ENGINE AND A319 ENTRY INTO SERVICE RATINGS: Revised EPR ratings are required for the V2533-A5, V2522-A5 and V2524-A5.

2 2.2 ENGINE RATING VS A/C TYPE DISAGREE INDICATION: A positive means is required to confirm that the selected engine rating on both engines is appropriate for the aircraft model on which it is installed.

3 2.3 INTENTIONALLY OMITTED

4 2.4 UNRATED N1 MODE ALTITUDE LAPSE RESET: If the engine is not shutdown between flights and/or the EEC is not reset after landing, and the EEC were to revert to the N1 Unrated mode during the subsequent takeoff, a potential thrust discrepancy up to +3% relative to the desired rating could result on the effected engine. Any discrepancy is washed out by throttle movement and therefore does not affect flight regimes other than takeoff.

5 2.5 EPR-N1C2 SYNTHESIS REVISION: V2533-A5 flight test illustrated that engine power in the N1 mode was overboosted relative to that of the EPR mode for operation at the 33K takeoff rating.

(c) 3.0 OVERBOOST PROTECTION LOGIC FOR THE A319: For V2500-A5 installation on the A319 aircraft, Airbus Industrie has requested to put in place additional features to limit excessive overthrust due to fuel system or other possible failures.

(d) 4.0 EGT BIASING FOR 22K, 24K, 24EK 7 33K RATINGS: To preclude the need for changes to the aircraft cockpit display computers, biasing of the EEC's ARINC output must be implemented for the V2533-A5 and the A319 ratings.

(e) 5.0 THROTTLE RESOLVER ANGLE FAULT ACCOMMODATION: Current aircraft procedures require that the engine be shutdown prior to landing in response to an ENG THR LEVER Fault or ENG THR LEVER DISAGREE warning if autoland is not used.

(f) 6.0 THRUST REVERSER LOGIC

1 6.1 THRUST REVERSER ADDITIONAL SHUT OFF VLAVE MONITORING: Potential incorporation of an additional aircraft controlled Shut Off Valve to the Thrust Reverser system, upstream of the existing Hydraulic Control Unit, will rely on the EEC functional verification and fault annunciation.

2 6.2 THRUST REVERSER STOW TIME MONITORING: A clear NO DISPATCH indication is required for Thrust Reverser system faults which result in Thrust Reverser stow time exceedances.

3 6.3 THRUST REVERSER MENU MODE NUISANCE FAULT: If the maintainer deploys the reverser during the Thrust Reverser Menu Mode test and does not do anything more for 60 seconds, the EEC will abort the test automatically. When this happens, a nuisance REV UNLOCKED message appears in the cockpit.

(g) 7.0 VARIABLE STATOR VANE SYSTEM LOGIC

1 7.1 STATOR VANE ACTUATOR (SVA) TRACK CHECK DE-LATCHING: The ECAM warning ENG 1(2) COMPRESSOR VANE remains displayed even though the conditions that originally drove the message no longer exist.

2 7.2 GROWTH ENGINE VARIABLE STATOR VANE SCHEDULE CHANGE: The current variable stator vane schedule does not provide adequate N2 Redline margin at low altitude, high power operation for the growth (V2533-A5) engine.

(h) 8.0 TRANSIENT CONTROL LOGIC:

1 8.1 EPR COMPENSATION ENHANCEMENT: Flight test indicates that the EPR loop stability can be enhanced at the higher power conditions required for the growth (V2533-A5) engine.

2 8.2 TRANSIENT TOPPING LOOP LOGIC FOR ALL RATINGS: At critical high altitude takeoff conditions, N1 transient overshoots can result in N1 redline exceedance during engine acceleration to takeoff power.

(i) 9.0 AIR DATA COMPUTER ASSOCIATED LOGIC

1 9.1 ENGINE P2 PROBE MEASUREMENT CORRECTION LOGIC: Flight test data for the V2533-A5 and V2527E-A5 ratings indicated that aircraft takeoff performance was deficient relative to expectations based on runway accleration characteristics.

2 9.2 INTENTIONALLY OMITTED

3 9.3 ARINC TRANSMISSION OF SELECTED PARAMETER SOURCES FOR RATINGS: Verification of correct rating calculation in the EEC currently requires external calculations which may not always be fully representative of EEC internal logic.

(j) 10.0 WEIGHT ON WHEELS ACCOMMODATION LOGIC: When the aircraft is on the ground, an intermittent Engine Interface Unit Label 31 can result in Weight On Wheels toggling between ground and air.

(2) Background

(a) 1.0 STARTING ENHANCEMENTS

1 1.1 ENHANCED AUTOSTART LOGIC: Diagnostic tests conducted on both development and production standard engines have identified HPC stall during or immediately after light up as the primary cause of failed start attempts. The HPC stall line was found to be particularly sensitive to residual engine temperatures such that an engine which has been shut down for a relatively short time (approximately 2 hours or less) is more susceptible to failure during subsequent start attempts. Rotor bow has also been identified as a potential concern during start attempts with warm engines.

2 1.2 MANUAL START LOGIC ENHANCEMENTS: Current EEC logic requires detection of the transition of the Manual Start Push Button discrete from OFF to ON in order to initiate a manual start. A/C 28 VDC electrical transients, or a quick selection of the Manual Start Push Button after IGN selection, can result in one or both channels of the EEC missing this transition. This results in no command, or loss of command, to the Starter Air Valve and thus termination of of the manual start sequence.

3 1.3 IGNITION TIMER LOGIC FOR STARTER DISCRETE FAULTS: Implementation of t accomplished using the existing ignition timer that is triggered off the start valve discrete feedback. If there is a fault associated with the starter valve discrete feedback, the timer never times out and fuel is never commanded ON. Previous auto start logic commanded fuel ON based on N2.

(b) 2.0 RATINGS AND SCHEDULES:

1 2.1 GROWTH ENGINE AND A319 ENTRY INTO SERVICE RATINGS: Aircraft performance analysis from A321 & A319 flight test identified the need to modify the associated ratings to achieve the desired aircraft performance.

2 2.2 ENGINE RATING VS A/C TYPE DISAGREE INDICATION: Introduction of multiple engine ratings within the EEC in support of the A320/321/319 aircraft models introduces the potential for inappropriate installation on the aircraft.

3 2.3 INTENTIONALLY OMITTED

4 2.4 UNRATED N1 MODE ALTITUDE LAPSE RESET: Current EEC logic assumes the engine will be shutdown and the EEC reset between flights to re-initialize the N1 Unrated mode takeoff reset designed to emulate the EPR mode lapse rate for the subsequent takeoff.

5 2.5 EPR-N1C2 SYNTHESIS REVISION: The EPR-N1C2 synthesis curve used in defining the N1 mode powersettings was determined to be inaccurate at high EPR levels representative of 33K maximum takeoff. This resulted in target N1 powersettings which exceeded N1 speeds typical of EPR mode operation at the 33K takeoff rating.

(c) 3.0 OVERBOOST PROTECTION LOGIC FOR THE A319: The V2500-A5 engine and fuel system are designed to satisfy the maximum takeoff requirements of the A321 and A320 aircraft. For installation on the smaller A319 aircraft, the potential overboost which can occur as a result of an EEC on other fuel system failure reflects a much greater thrust increase relative to the normal takeoff rating.

(d) 4.0 EGT BIASING FOR 22K, 24K, 24EK 7 33K RATINGS:The V2533-A5 growth engine has a higher certified EGT redline limit (670 C) relative to the current standard V2500-A5 production engine (650 C certified limit). In addition, increased thrust requirements for the A319 V2522-A5, V2524-A5, and V2524E-A5 takeoff ratings have resulted in the need for higher EGT limits for those ratings as well.

(e) 5.0 THROTTLE RESOLVER ANGLE FAULT ACCOMMODATION: Current EEC Throttle Lever Angle fault detection and accommodation logic results in permanent latching of a Throttle Resolver Angle fault and a Throttle Resolver Angle accommodation at certain flight conditions that can result in the engine being set to a level of thrust that can not be accommodated at landing.

(f) 6.0 THRUST REVERSER LOGIC

1 6.1 THRUST REVERSER THIRD LINE OF DEFENSE SHUT OFF VALVE MONITORING: Third Line of Defense system design and potential retrofit considerations dictate use of the existing Hydraulic Control Unit pressure switch processing by the EEC to provide aircraft Shut Off Valve functional verification and fault annunciation.

2 6.2 THRUST REVERSER STOW TIME MONITORING: The current ENG 1(2) REVERSER FAULT ECAM warning which is triggered for Thrust Reverser stow time exceedances is not latched and will be displayed only until the Thrust Reverser completes its stow cycle.

3 6.3 THRUST REVERSER MENU MODE NUISANCE FAULT: Current EEC logic stops transmitting Throttle Lever Angle over ARINC when the Thrust Reverser Menu Mode test times out. The Flight Warning Computer assumes the throttle is not in reverse if it does not receive a valid indication that it is in reverse. Therefore, when the test is aborted the Flight Warning Computer sees the reverser deployed with the throttle not in reverse and sets the associated warning.

(g) 7.0 VARIABLE STATOR VANE SYSTEM LOGIC

1 7.1 STATOR VANE ACTUATOR (SVA) TRACK CHECK DE-LATCHING: SVA track check faults which set this message are latched faults which can only be cleared by an EEC reset.

2 7.2 A321-200 (V2533-A5) VARIABLE STATOR VANE SCHEDULE CHANGE: The increase thrust required for the A321-200 (V2533-A5) can not be achieved with the current variable stator vane schedule without a resulting increase in N2 at low altitude, high power.

(h) 8.0 TRANSIENT CONTROL LOGIC:

1 8.1 EPR COMPENSATION ENHANCEMENT: The EPR loop compensation was not designed to accommodate the engine dynamics at the higher growth engine rating.

2 8.2 TRANSIENT TOPPING LOOP LOGIC FOR ALL RATINGS: Although adequate N1 margin exists for steady state operation, the potential exists for N1 redline exceedance during acceleration to takeoff power when operating at critical ambient temperature conditions.

(i) 9.0 AIR DATA COMPUTER ASSOCIATED LOGIC

1 9.1 ENGINE P2 PROBE MEASUREMENT CORRECTION LOGIC: Analysis of V2533-A5 and V2527E-A5 takeoff data indicated an erroneous engine P2 measurement at low Mach number, high airflow conditions due to apparent inlet boundary effects associated with the engine inlet P2 probe. The discrepancy in engine P2 measurement resulted in a shift in the thrust Vs indicated EPR relationship, producing a loss of takeoff thrust at rated EPR.

2 9.2 INTENTIONALLY OMITTED:

3 9.3 ARINC TRANSMISSION OF SELECTED PARAMETER SOURCES FOR RATINGS: The selected source of the P2, T2 and PAMB used by the EEC to calculate the engine rating in not currently available on the EEC ARINC output bus.

(j) 10.0 WEIGHT ON WHEELS ACCOMMODATION LOGIC: When the A/C is on the ground, if the Engine Interface Unit Label 031 becomes invalid, Mach Number is immediately used to set Weight On Wheels. When Label 031 is received again, Mach Number is no longer used by use of the Engine Interface Unit Weight On Wheels is delayed by 1/2 second during which time the default of AIR is set.

(3) Objective

(a) 1.0 STARTING ENHANCEMENTS

1 1.1 ENHANCED AUTOSTART LOGIC: Incorporate the following starting enhancements: (1) addition of a 50 second dry crank prior to fuel pressurization/ignition for bowed rotor protection, (2) weakened Wf/Pb fuel scheduling for all ground starts to reduce the risk of HPC stall, (3) automatic fuel depulse for HPC stall recovery with attendant 30 second increase in allowed autostart starter duty cycle (4) increase the on-ground starter cutout speed back to the pre-SCN 10 level of 6372 RPM N2 and (5) revise the HPC handling bleed valve scheduling below idle for all starts to reduce the risk of HPC stall.

2 1.2 MANUAL START LOGIC ENHANCEMENTS: Modify the EEC logic to initiate a manual start based on the ON state of the Manual Start Push Button, rather that the transition from OFF to ON. In addition, the same automatic starter crash re-engagement protection currently provided for automatic starts is incorporated for manual starts to cover Master Lever resets or A/C 28 VDC electrical transients when the Manual Start Push Button discrete is set to ON.

3 1.3 IGNITION TIMER LOGIC FOR STARTER DISCRETE FAULTS: Modify the current logic to initiate the ignition timer using starter valve command instead of starter valve discrete feedback, if the feedback is invalid.

(b) 2.0 RATINGS AND SCHEDULES

1 2.1 GROWTH ENGINE AND A319 ENTRY INTO SERVICE RATINGS: Incorporate revised EPR ratings and revised breakpoint temperature schedules which satisfy revised aircraft/engine takeoff thrust requirements.

2 2.2 ENGINE RATING VS A/C TYPE DISAGREE INDICATION: Modify the EEC logic to output on ARINC to the aircraft the calculated aircraft type based on the engine DEP selected engine rating. The aircraft Flight Warning Computer will compare its aircraft type based on its pin programming with that provided by the EEC and display an ECAM warning in case of disagreement.

3 2.3 INTENTIONALLY OMITTED

4 2.4 UNRATED N1 MODE ALTITUDE LAPSE RESET: Modify the EEC logic to reset the previously calculated N1 takeoff reset on landing to cover the case where the engine is not shutdown between flights.

5 2.5 EPR-N1C2 SYNTHESIS REVISION: Incorporate a revised EPR-N1C2 synthesis curve which is more representative of V2500-A5 gas generator characteristics at high EPR levels.

(c) 3.0 OVERBOOST PROTECTION LOGIC FOR THE A319: V2500-A5 engines installed on the A319 aircraft will have the FMU's with a reduced maximum fuel flow stop, relative to those installed on the A320/A321, which will reduce the potential thrust overboost that can occur in a failure situation. In addition, special logic is incorporated into the EEC for detection of thrust overboost on the A319 aircraft within the takeoff envelope, which will command various engine stability bleeds open based on ambient conditions in order to maintain engine thrust within acceptable limits.

(d) 4.0 EGT BIASING FOR 22K, 24K, 24EK 7 33K RATINGS: Incorporate appropriate biasing of the EEC's ARINC EGT output for the V2533-A5 and the A319 ratings to ensure compatibility with the current 635 C A319/320 and 650 C A321 cockpit display limit.

(e) 5.0 THROTTLE RESOLVER ANGLE FAULT ACCOMMODATION: Modify the EEC Throttle Resolver Angle fault logic to allow a detected fault to heal a limited number of times (3), if the input is validated again for a specified period of time (5 seconds). Utilize additional aircraft inputs (slats) to set the most appropriate fail-safe value to idle when the aircraft is in APPROACH, thus precluding the need to shut down the engine at landing.

(f) 6.0 THRUST REVERSER LOGIC

1 6.1 THRUST REVERSER THIRD LINE OF DEFENSE SHUT OFF VALVE MONITORING: Modify the existing EEC Thrust Reverser control logic, Menu Mode Thrust Reverser Test logic and existing Hydraulic Control Unit pressure switch processing logic to provide the potential to: (1) verify Shut Off Valve functioning during the normal Thrust Reverser deploy/stow cycle on landing, (2) verify Shut Off Valve functioning during the Thrust Reverser Menu Mode Test, (3) provide functional and dispatch status of the total Thrust Reverser system, including the additional aircraft controlled Shut Off Valve when installed as noted by digital discrete from the aircraft Engine Interface Unit and (4) provide auto restow capability for the Shut Off Valve Installed configuration.

2 6.2 THRUST REVERSER STOW TIME MONITORING: Modify the EEC logic to latch the ENG 1(2) REVERSER FAULT ECAM warning which is triggered for Thrust Reverser stow time exceedances to insure that this NO DISPATCH condition is reported to the maintenance crew for appropriate maintenance action prior to the next dispatch of the aircraft.

3 6.3 THRUST REVERSER MENU MODE NUISANCE FAULT: Modify the logic to transmit Throttle Lever Angle anytime the EEC is running the reverser test regardless of whether or not the reverser is being commanded.

(g) 7.0 VARIABLE STATOR VANE SYSTEM LOGIC

1 7.1 STATOR VANE ACTUATOR (SVA) TRACK CHECK DE-LATCHING: Modify the EEC logic to allow the SVA track check faults which set this message to clear if the SVA system returns to within the required tolerance for five seconds. The SVA track check fault is allowed to clear up to three times after which it will be latched until the next EEC reset. Additionally, the occurrence of any SVA track check fault in flight will be recalled on landing to provide a NO DISPATCH message to ensure appropriate maintenance action.

2 7.2 GROWTH ENGINE VARIABLE STATOR VANE SCHEDULE CHANGE: Revise the N2 biased stator vane schedule for all models to reflect +3 degree opening versus current schedule to allow recovery of the current N2 Redline margin at the higher thrust level of the A321-200 (V2533-A5).

(h) 8.0 TRANSIENT CONTROL LOGIC

1 8.1 EPR COMPENSATION ENHANCEMENT: Modify the EPR loop compensation to enhance the engine stability in the EPR loop at high power.

2 8.2 TRANSIENT TOPPING LOOP LOGIC FOR ALL RATINGS: Incorporate enhanced N1 topping logic for all V2500-A5 takeoff ratings, consistent with logic already employed for the A321 33K rating.

(i) 9.0 AIR DATA COMPUTER ASSOCIATED LOGIC

1 9.1 ENGINE P2 PROBE MEASUREMENT CORRECTION LOGIC: Incorporate a feedback EPR modifier in the EEC logic which adjusts engine power based on the difference between engine and aircraft Air Data Computer P2 measurements, thus restoring takeoff thrust to the required level without exposing the engine to potential overboost. Implementation as a feedback loop modifier allows EPR command for takeoff ratings to be maintained at current levels, thus eliminating any changes in cockpit display.

2 9.2 INTENTIONALLY OMITTED

3 9.3 ARINC TRANSMISSION OF SELECTED PARAMETER SOURCES FOR RATINGS: Modify the EEC logic to provide the selected source of P2, T2 and PAMB used by the EEC in calculating the engine rating to aid in rating verification.

(j) 10.0 WEIGHT ON WHEELS ACCOMMODATION LOGIC: Additional logic was added to prevent this toggling of Weight On Wheels to AIR while the 1/2 second confirmation timer elapses.

(4) Substantiation

The flight simulation and flight testing of the SCN11 software logic was accomplished at Airbus in Toulouse, France.

(5) Effects of Bulletin on Workshop Procedures:

Removal/Installation	Not affected
Disassembly/Assembly	Not affected
Cleaning	Not affected
Inspection/Check	Not affected
Repair	Not affected
Testing	Not affected

(6) Supplemental Information

None.

C. Description

(1) To provide a new Electronic Engine Control (EEC) with SCN11 software logic with version 032/032 trims. This software version provides changes to starting.

Part I - If the Electronic Engine Control is sent to one of the addresses listed in Paragraph 2. B., Accomplishment Instructions

A new EEC can be obtained from the supplier referenced in Part I of this Service Bulletin. The removed part is returned, programmed, identified with the new part number and installed again.

Part II - If IAE is requested to assist or coordinate the reprogramming of the Electronic Engine Control

(b) The EEC can be programmed on the engine, by the procedure given in Part II of this Service Bulletin, and identified with the new part number.

D. Approval

The Part Number Changes and/or part modifications described in Section 2 and 3 of this Service Bulletin have been shown to comply with the applicable Federal Aviation Regulations and are FAA-APPROVED for the Engine Model listed.

E. Compliance

Category Code 4.

Accomplish at the first visit of an engine or module to a maintenance base capable of compliance with the accomplishment instructions regardless of the planned maintenance action or the reason for engine removal.

F. Manpower

Estimated Manhours to incorporate the full intent of Part I of this Bulletin:

Venue	Estimated Manhours
(1) In Service	TOTAL: 1 hour 16 minutes
(a) To gain access	
(i) Install warning notices ..	5 minutes
(ii) Open the fan cowls	7 minutes
(iii) Remove the EEC	23 minutes
TOTAL	35 minutes
(b) To return to flyable status	
(i) Install the EEC	28 minutes
(ii) Close the fan cowls ..	8 minutes
(iii) Remove the warning notices	5 minutes
TOTAL	41 minutes
(2) At overhaul	Not Applicable

Estimated Manhours to incorporate the full intent of Part II of this Bulletin:

Venue	Estimated Manhours
(1) In Service	TOTAL: 1 hour 25 minutes
(a) To gain access	
(i) Install warning notices ..	5 minutes
(ii) Open the fan cowls	7 minutes
(iii) Program the EEC	1 hour
TOTAL	1 hour 12 minutes
(2) At overhaul	TOTAL: 1 hour
(a) Program the EEC	1 hour

G. Material - Price and Availability

(1) Modification Kit not required.

(2) This Service Bulletin will be done at no cost to the operator.

H. Tooling - Price and Availability

The tools and equipment that follow are necessary to do the procedure given in Part II of this Service Bulletin.

(1) A dedicted (recommendation) IBM compatible computer, with the following minimum requirements:

(a) 80286 processor

(b) 512 Kbytes RAM

(c) 1.44 Mbyte, 3.5" floppy disk drive

(d) Dual channel RS-422 asynchronous communication board (HS recommends Model DS202 by Qua Tech Incorporated) with the following setup:

Channel A EEC - COM3 (Base address 2E8, IRQ level 5)
Channel B EEC - COM4 (Base address 3E8, IRQ level 5)

(e) MSDOS operating system (version 3.0 or higher)

NOTE: The IBM computer date/time must be current prior to performing this procedure.

(f) Virus scan program such as "VI-SPY" is recommended.

(2) Hamilton Standard diskette called out in Reference (4). This diskette contains the EEC150-20: application code, trims, memory clear utilities, and software loader.

(3) EEC150-20 communication cables as defined in Table 1.

(4) EEC150-20 Nameplate PN 751333-1.

(5) 28 VDC +/- 0.5A power supply and associated power cables as defined in Table 2.

NOTE: The IBM computer date/time must be current prior to performing this procedure.

(f) Virus scan program such as "VI-SPY" is recommended.

(2) Hamilton Standard diskette called out in Reference (4). This diskette contains the EEC150-20: application code, trims, memory clear utilities, and software loader.

(3) EEC150-20 communication cables as defined in Table 1.

(4) EEC150-20 Nameplate PN 751333-1.

EEC SIGNAL NAME	EEC CONNECTOR	QUA-TECH CONNECTOR	QUA-TECH SIGNAL NAME
UART IN LINE B CHA	P1-b	PA-2	TXD+
UART IN LINE A CHA	P1-H	PA-7	TXD-
UART OUT LINE A CHA	P1-c	PA-4	RXD+
UART OUT LINE B CHA	P1-J	PA-8	RXD-
BOOT DISC CHA	P1-D	N/A	N/A
BITE DISC CHA	P1-Z	N/A	N/A
BOOT/BITE RTN CHA	P1-m	N/A	N/A
UART IN LINE B CHB	P7-b	PB-2	TXD+
UART IN LINE A CHB	P7-H	PB-7	TXD-
UART OUT LINE A CHB	P7-c	PB-4	RXD+
UART OUT LINE B CHB	P7-J	PB-8	RXD-
BOOT DISC CHB	P7-D	N/A	N/A
BITE DISC CHB	P7-Z	N/A	N/A
BOOT/BITE RTN CHB	P7-m	N/A	N/A

Table 1
Communication Connections

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Communication Connections
Table 1

EEC SIGNAL NAME	EEC CONNECTOR	POWER SUPPLY
GTP CHA	P3-m	+28VDC
GTP RTN CHA	P3-r	RTN
GTP CHB	P9-m	+28VDC
GTP RTN CHB	P9-r	RTN

Table 2
Power Supply Connections

E7704

I. Weight and Balance

(1) Weight change .. .. .. None

(2) Moment arm .. .. .. No effect

(3) Datum .. .. .. Engine front mount Centerline (Powerplant station P.P.S.100)

J. Electrical Load Data

This Service Bulletin has no effect on the aircraft electrical load.

K. Reference

(1) V2500-ENG-73-0052 (Engine - Fuel and Control - To Provide a New Electronic Engine Control (EEC) With the SCN9A Version 021/121 Software Configuration and Hardware Changes to Address Nacelle Drainage Requirements)

(2) V2500-ENG-73-0080 (Engine - Fuel and Control - To Provide a New Electronic Engine Control (EEC) With the SCN10A Software Configuration Version 026/026 Trims)

(3) V2500-ENG-73-0083 (Engine - Fuel and Control - To Provide a New Electronic Engine Control (EEC) With the SCN10B Software Configuration Version 027/027 Trims)

(4) Hamilton Standard Service Bulletin EEC150-20-73-14

(5) Airbus Service Bulletin A320-73-1053

(6) V2500 Aircraft Maintenance Manual

(7) V2500 Engine Illustrated Parts Catalog (S-V2500-2IA)

L. Other Publications Affected

(1) The V2500-A5 Engine Illustrated Parts Catalog (S-V2500-2IA), Chapter/Section 73-22-34, Figure 1, to add the new parts.

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Power Supply Connections
Table 2

I. Weight and Balance

(1) Weight change .. .. .. None

(2) Moment arm .. .. .. No effect

(3) Datum .. .. .. Engine front mount Centerline (Powerplant station P.P.S.100)

J. Electrical Load Data

This Service Bulletin has no effect on the aircraft electrical load.

K. Reference

(1) Internal Reference No.

96VZ005

(2) Other References

V2500-ENG-73-0052 (Engine - Fuel and Control - To Provide a New Electronic Engine Control (EEC) With the SCN9A Version 021/121 Software Configuration and Hardware Changes to Address Nacelle Drainage Requirements)

V2500-ENG-73-0080 (Engine - Fuel and Control - To Provide a New Electronic Engine Control (EEC) With the SCN10A Software Configuration Version 026/026 Trims)

V2500-ENG-73-0083 (Engine - Fuel and Control - To Provide a New Electronic Engine Control (EEC) With the SCN10B Software Configuration Version 027/027 Trims)

Hamilton Standard Service Bulletin EEC150-20-73-14

Airbus Service Bulletin A320-73-1053

V2500 Aircraft Maintenance Manual

V2500 Engine Illustrated Parts Catalog (S-V2500-2IA)

L. Other Publications Affected

(1) The V2500-A5 Engine Illustrated parts Catalog (S-V2500-2IA), Chapter/Section 73-22-34, Figure 1, to add the new parts.

2. Accomplishment Instructions

Part I - If the Electronic Engine Control is sent to one of the addresses listed in Paragraph 2. B., Accomplishment Instructions

A. The Source Demonstration requirements of this rework means that any facility not authorized to accomplish this rework either utilize the Authorized Vendors listed below or contact IAE Technical Services to determine if a qualification program can be initiated at their facility.

IAE-INTERNATIONAL AERO ENGINES AG
Corporate Center II
628 Hebron Ave.
Glastonbury, CT 06033-2595 USA
ATTN: Director Technical Services

B. The Authorized Rework Vendor for this bulletin is listed below:

Hamilton Standard
97 Newberry Road
East Windsor, CT 06088 USA

C. The designation by IAE of an authorized rework vendor indicates that the vendor has demonstrated the necessary capability to enable it to carry out the rework. However, IAE makes no warranties or representations concerning the qualifications or quality standards of the vendors to carry out the rework, and accepts no responsibility whatsoever for any work that may be carried out by a rework vendor, other than when IAE is listed as the vendor. Authorized rework vendors do not act as agents or representatives of IAE.

D. Removal Instructions

(1) Remove the 808050-4-026 (2A3223) Electronic Engine Control by the approved procedure given in Reference (6), Chapter/Section 73-22-34, Removal/Installation. Refer to Figure 1.

E. Rework Instructions

(1) Do a modification of the 808050-4-026 (2A3223) Electronic Engine Control (See Reference (7), Chapter/Section 73-22-34, Fig/Item No.01-280) and reidentify by the procedures given in Reference (2).

	Procedure	Supplementary Information
(a)	Send the Electronic Engine Control to the approved vendor to be modified.	See Figure 1 and Reference (4).

F. Installation Instructions

(1) Install the 808050-4-028 (2A3250) Electronic Engine Control (1 off) by the approved procedure given in Reference (6), Chapter/Section 73-22-34, Removal/Installation. See Figure 1.

G. Recording Instructions

(1) A record of accomplishment is necessary.

Part II - If IAE is requested to assist or coordinate the reprogramming of the Electronic Engine Control

NOTE: This procedure can only be accomplished by maintenance personnel that have been trained by an IAE representative.

A. Isolate aircraft electrical system and gain access to the EEC by doing the pre-requisite procedures given in steps 2A., B., C. and D. in Reference (6), Chapter/Section 73-22-34, Removal/Installation, (the removal procedure).

NOTE: Only turn back-on aircraft 28VDC when instructed to in the following procedure.

B. General

(1) Hamilton Standard Electronic Engine Control, Model EEC150-20, software is programmed into the EEC using an IBM compatible computer and Hamilton Standard supplied software.

(a) Disassembly of the EEC is not required.

(b) Data integrity of the Hamilton Standard supplied software is performed as part of the reprogramming procedure.

(c) A bit-for-bit memory verification test is included as part of the reprogramming procedure.

(d) No functional, thermal cycle, or vibration testing is required for units reprogrammed in accordance with this Service instruction.

(e) The EEC can be reprogrammed at room ambient conditions or while it is installed on the engine.

(2) The tools specified in Paragraph 1. H. are necessary to accomplish this procedure.

C. Do the steps that follow to reprogram the Electronic Engine Control (EEC) without removing it from the engine.

(1) Verify that the model number on the identification plate of the unit is "EEC150-20".

(2) Record the current unit part number and the unit serial number from the nameplate. This information will be input into your computer.

(3) Connect commercial power to all necessary reprogramming equipment.

(4) Remove the harness connector from the EEC connector marked J1 and connect the programming harness connector marked P1 to the EEC connector marked J1. Ensure that the red engagement stripe on the EEC connector J1 is fully covered.

(5) Remove the harness connector from the EEC connector marked J7 and connect the programming harness connector marked P7 to the EEC connector marked J7.

(a) Make sure that the red engagment stripe on the EEC connector J7 is fully covered.

(6) If the computer and power supply connections to the cables are permanent, skip to step C.(9).

(7) Connect the programming harness connector marked "ch. a uart" to the IBM compatible computer UART board connectors for the channel A RS-422 Port (COM3). Make sure that these connectors are properly mated.

(8) Connect the programming harness marked "ch. b uart" to the IBM compatible computer UART board connectors for the channel B RS-422 Port (COM4). Make sure that the connectors are properly mated.

NOTE: UART connections can differ for different IBM Compatible Computers.

NOTE: It is important to verify that the connectors are correctly installed for correct loader operation. Hamilton Standard recommends labeling the RS-422 COM3 port as "ch. a uart" and COM4 port as "ch. b uart"on the computer to reduce errors.

(9) If the EEC is powered by aircraft 28VDC power supply, skip to step C.(13).

(10) If the computer and power supply connections to the cables are not permanent, connect the opposite end of P3 and P9 cables to the 28VDC supply.

(11) Remove the harness connector from the EEC connector marked J3 and connect the power supply harness connector marked P3 to the EEC connector marked J3. Ensure that the red engagement stripes on EEC connector J3 are fully covered.

(12) Remove the harness connector from the EEC connector marked J9 and connect the power supply harness connector marked P9 to the EEC connector marked J9. Ensure that the red engagement stripes on EEC connector are fully covered.

(13) Locate the BOOT/BITE switches for channel A and channel B. Set the BOOT/BITE switches to the ON (closed) position.

(14) Turn on the 28VDC power supply to the EEC.

(15) Turn on the power to the IBM compatible computer.

NOTE: Please make sure that the Disk Drive "A" has no disks present, prior to power on of the computer.

(16) Wait for the MSDOS prompt "C:\> to appear to the IBM compatible computer.

NOTE: The procedure uses disk drive "A" to identify the location of the floppy drive in the computer system. If your computer is configured with the 3.5 inch floppy drive at a different designation, substitute that designation into the procedure.

(17) Obtain the Hamilton Standard reprogramming diskette which is given in Reference (4).

(a) Make sure that the write protection tab of the diskette is covering the "hole".

NOTE: If necessary, you can remove the stickers from the corner of the disk and move the protecting device to close the hole.

(b) Insert the diskette into the floppy drive designated as "A" on the IBM compatible computer.

(18) The display will show the "C:\>". Type a: then press the RETURN key.

NOTE: Some computers have the RETURN key designated ENTER.

(19) The display will show the "A:\>" prompt.

(a) Type LDR150 then press the RETURN key. This starts the UART programming utility.

1 Several messages will appear including the program identification, version number, time and the UTC/P&W document property rights notice.

2 If there is a configuration error on the diskette, the program will display the appropriate error message and abort the programming process. Refer to Table 3 for a summary of error code description and troubleshooting suggestions.

(20) The UART programming utility LDR150, will display the following message: "Enter operator's name performing download:[ ]>"

(a) The field between the brackets will always be empty the first time the program is executed on the diskette.

(b) Subsequent execution of the program will display the last name entered.

1 If the operator is the same, press the RETURN key to continue.

2 If a different name is present than the operator or no name is present, the operator should enter his/her name and press the RETURN key.

(21) The LDR150 program will display the following message:

WARNING - EEC Fault Memory Will Be Cleared By This Program. If an EEC Fault Dump Is Required Prior to Programming, enter Q to Quit or C to Continue [Q/C]:

(a) If a fault dump has already been accomplished or is not required, type C, then press the RETURN key.

(b) If a fault dump is required or the operator wishes to terminate the programming procedure, type Q then press the RETURN key.

(c) If the operator selects the quit option, turn off the 28VDC power to the EEC and go to step C. (37).

(22) The LDR150 program will now prompt with the following message: "Enter the 9 character EEC Serial Number : [XXXX-XXXX]>". From the Hamilton Standard nameplate, enter the nine character EEC serial number and press the RETURN key.

NOTE: For steps (23) and (24), if the EEC150-20 part number on the nameplate between the dashes is a single digit, enter a zero immediately preceeding this digit.

Example: P/N 808050-4-026 would be entered as 808050-04-026.

(23) The LDR150 program will now prompt with the following message: "Enter the 13 character Current EEC HW Part No.: [XXXXXX-XX-XXX]>". From the Hamilton Standard nameplate, enter the 13 character EEC Hardware Part Number and press the RETURN key.

(24) The LDR150 program will now prompt with the following message: "Enter the 13 character EEC HW Part No.: [XXXXXX-XX-XXX]>". From Reference (4), the Service Bulletin, enter the 13 character EEC Hardware Part Number and press the RETURN key.

(25) The LDR150 program will now prompt with the following message: "Enter Trim Checksum Value for "xxxxxx.xxx:>". The xxxxxx.xxx designation is the name of the Trim File bein loaded to the EEC. From Reference (4), the Service Bulletin, enter the trim checksum value and press the RETURN key.

(26) The LDR program will now prompt with the following message: "Do you wish to reenter the above entries [Y/N/Q]:".

(a) To proceed with programming process, type N, then press the RETURN key. Continue with step C. (27).

(b) To correct any errors in the data entered, type Y, then press RETURN. Continue with step C. (20).

(c) To quit the programming process, type Q, then press RETURN. Turn off the 28 VDC power to the EEC and continue with step C. (37).

(27) At this point the screen will be initialized to display the activity of the programming process.

(a) Status messages will scroll across the screen.

(b) If an error occurs, see Table 3 for a summary of error code description and troubleshooting suggestions.

(28) The LRD150 program will prompt with the following message:

Turn Off the BITE and BOOT switches to the EEC
then
Turn Off POWER to the EEC and wait at least 5 seconds
then
Turn On POWER to the EEC

Press the RETURN Key When Ready to Continue

Locate the BOOT/BITE switches on your test equipment, and set the BOOT/BITE switches to the OFF (open) position.

(29) Switch off the 28 VDC supply to the EEC, wait 5 seconds, then switch on the 28 VDC power supply to the EEC.

(30) On the IBM compatible computer, press the RETURN key.

(31) Wait until the LDR150 program prompts with the following message:

```
    Turn ON the BITE and BOOT switches to the EEC
                then
    Turn Off POWER to the EEC and wait at least 5 seconds
                then
    Turn ON POWER to the EEC
    ...Press the RETURN Key When Ready to Continue
```

Locate the BOOT/BITE switches on your test equipment, and set the BOOT/BITE switches to the ON (closed position.

(32) Switch off the 28VDC supply power to the EEC, wait 5 seconds, then switch on the 28VDC supply to the EEC.

(33) On the IBM compatible computer, press the RETURN key.

(34) Wait until the LDR150 program prompts with the following message:

```
    Turn Off POWER to the EEC

    ...Press the RETURN Key When Ready to Continue
```

Switch off the 28VDC supply to the EEC.

(35) On the IBM compatible computer, press the RETURN key.

(36) The LDR150 program will now display the status of the programming process. Record the name of the log file for hard copy report of the process.

(a) If successful programming occurred, the following message will be displayed:

```
****EEC REPROGRAMMING SUCCESSFULLY COMPLETED***
Record the log file name "VLXXXX.LOG" for later printout.
```

If desired, record the log file name "VLXXXX.LOG" for later printout."

(b) If the programming was unsuccessful, the following message will be displayed:

```
****DOWNLOAD PROCESS ABORTED - ERROR CODE "X" ****Record the log file
name "VLXXXX.LOG" for later printout.
```

If desired, record the log file name "VLXXXX.LOG" for later printout.

The "X" refers to the type of error that caused the process to abort. Table 3 describes the error codes and action to be taken.

(37) Press the RETURN key to terminate the program and return to the MSDOS prompt "A:\>".

(38) A paper copy of the log file can be made by the IBM compatible computer if a printer is available. You can do this as follows:

NOTE: You can remove the diskette, write protect the diskette, and move to a system with a printer if no printer is connected to the original system. Complete the commands listed below to make a paper copy.

(a) At the MSDOS prompt, type PRINT VLXXX.LOG.

(b) Press the RETURN key.

(c) Wait until the printer is finished before proceeding to the next step.

(d) Remove the diskette, write protect the diskette.

(39) Disconnect the EEC reprogramming electrical connectors from J1 and J7, and J3/J9, if applicable.

(40) Reconnect the aircraft electrical harness connectors to J1 and J7, and J3/J9, if applicable.

(41) Identify the Electronic Engine Control by the procedure specified in Reference (3).

(42) Close-up the engine and remove the remaining notices by doing the post-requisite procedures given in the steps 6, 7 and 8 in Reference (6), Chapter/Section 73-22-34 Removal/Installation,(the installation procedure) and the Recording Instructions given in Part I, Paragraph G.

(43) Do the post-installation test specified in Reference (6), Chapter/Section 71-00-00, as required for removal/installation of an Electronic Engine Control.

NOTE: You can remove the diskette, write protect the diskette, and move to a system with a printer if no printer is connected to the original system. Complete the commands listed below to make a paper copy.

(a) At the MSDOS prompt, type **PRINT VLXXX.LOG**.

(b) Press the **RETURN** key.

(c) Wait until the printer is finished before proceeding to the next step.

(d) Remove the diskette, write protect the diskette.

(39) Disconnect the EEC reprogramming electrical connectors from J1 and J7, and J3/J9, if applicable.

(40) Reconnect the aircraft electrical harness connectors to J1 and J7, and J3/J9, if applicable.

(41) Identify the Electronic Engine Control by the procedure specified in Reference (3).

(42) Close-up the engine and remove the remaining notices by doing the post-requisite procedures given in the steps 6, 7 and 8 in Reference (6), Chapter/Section 73-22-34 Removal/Installation,(the installation procedure) and the Recording Instructions given in Part I, Paragraph G.

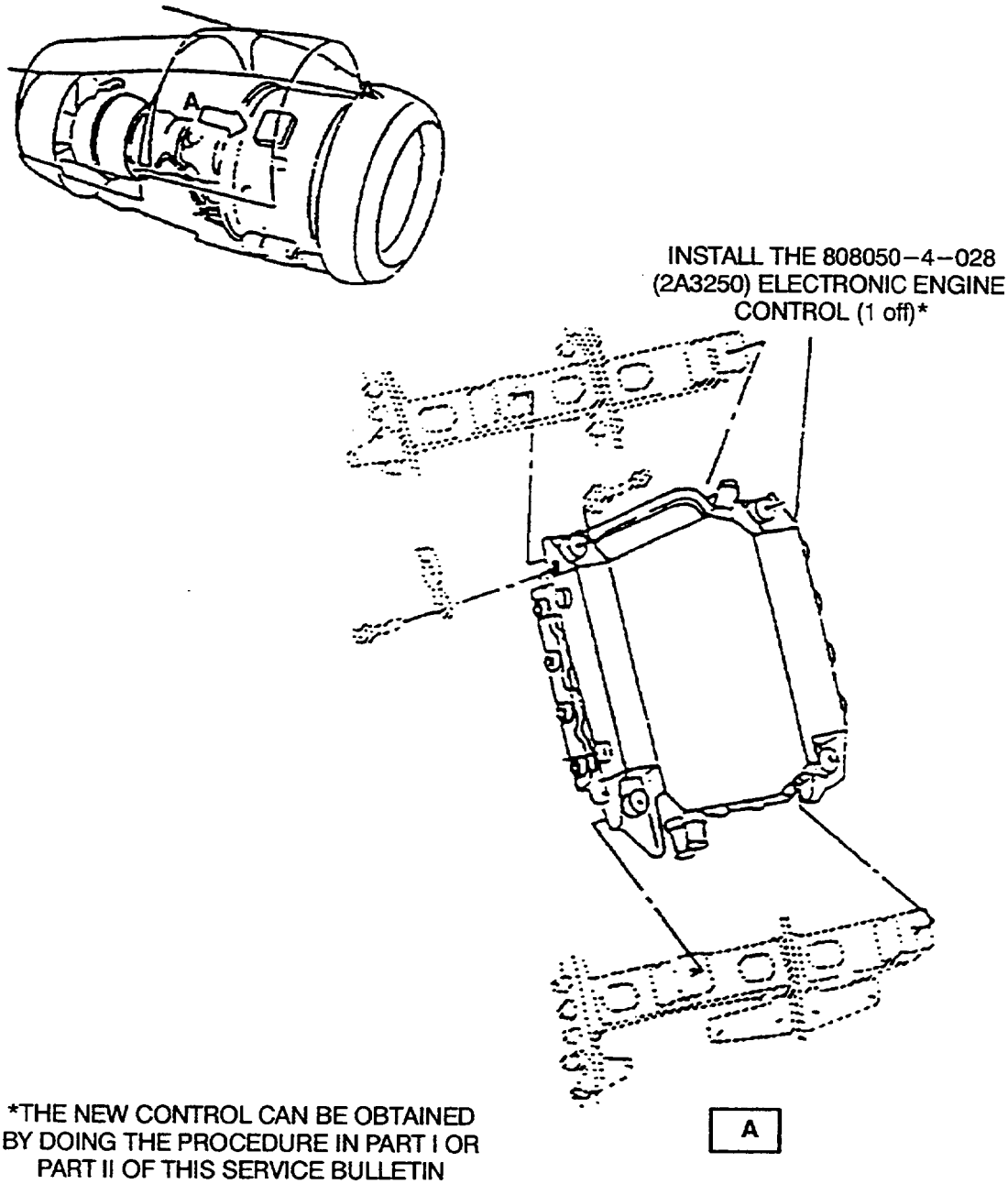
(43) Do the post-installation test specified in Reference (6), Chapter/Section 71-00-00, as required for removal/installation of an Electronic Engine Control.

ERROR CODE	ERROR TYPE	ACTION
E1	EEC VERIFY ERROR - Data verify error in EEC - Compare failed or location could not be programmed	Try procedure 3 times, if still bad return EEC unit
E2	COMMUNICATION ERROR - Communication problem between EEC and IBM compatible computer	Check BITE, cables, power supply. UART board, and EEC. Retry 3 times.
E3	CONFIGURATION ERROR - Configuration data comparison failed. (Possible Hardware P/N mismatch, EEC compatibility mismatch, Trim Checksum mismatch)	Operator data entered incorrect or incorrect data on existing nameplate. Check data - retry with the correct information.
E4	SYSTEM PROBLEM - Poor operating environment, bad disk, or program aborted by operator.	If the process was not terminated by the operator, check that the disk id not write protected, or replace disk and retry.

Table 3
Error Code Definitions

ded0001065

Error Code Definitions
Table 3



Location of Electronic Engine Control (EEC)
Fig 1

3. Material Information

Applicability: For each V2500 Engine to incorporate this Bulletin.

A. Kits associated with this Bulletin:

None.

B. Part affected by this Bulletin:

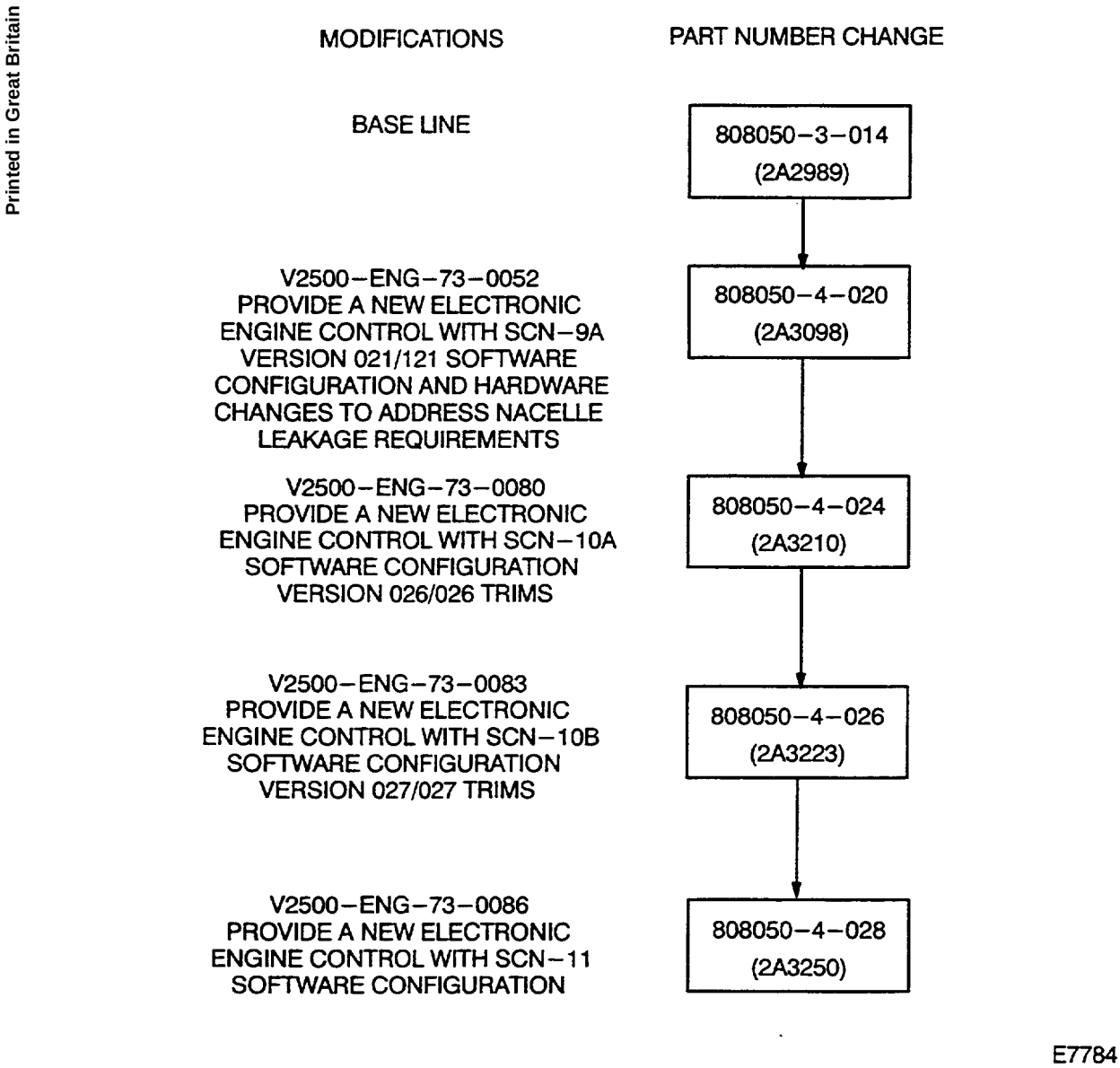
New Part No. (ATA No.)	Qty.	Est'd Unit Price ($)	Keyword	Old Part No. (IPC No.)	Instructions/ Disposition
808050-4-028 2A3250 (73-22-34)	1		Control, Electronic Engine	808050-4-026 2A3223 (01-280)	(1D) (A)

C. Instruction/Disposition Code Statements:

(1D) The New part can be obtained through modification by the approved procedure in Reference (4). Purchase the New parts from or return the Old parts for modification to the approved vendor given in the Accomplishment Instructions.

(A) New part is currently available.

NOTE: The estimated 1996 unit prices shown are provided for planning purposes only and do not constitute a firm quotation. Consult the IAE Price Catalog or contact IAE's Spare Parts Sales Department for information concerning firm prices.



Family Tree - Electronic Engine Control (EEC) Catalog Sequence No. 73-22-34, Fig 01, Item 280
Fig.2

Hamilton Standard
A United Technologies Company

SERVICE BULLETIN

ENGINE FUEL AND CONTROL - EEC150-20 - ELECTRONIC ENGINE CONTROL - INCORPORATION OF NEW SOFTWARE: A5 SCN11

1. Planning Information

A. Effectivity

Hamilton Standard EEC150-20 Electronic Engine Controls

808050-4-YYY

B. Reason

The purpose of this service bulletin is to allow the V2500-A5 operators to install new software in the EEC150-20.

(1) Problem

(a) Starting Enhancements

1 Enhanced Autostart Logic

V2500-A5 engines have experienced failed ground autostarts during flight test as well as during revenue service operation. The problem has been most apparent during operation at high altitude airports or for operation with quick turnaround times.

2 Manual Start Logic Enhancements

Manual starts in the field have not always been successful due to premature closure of the Starter Air Valve.

3 Ignition Timer Logic for Starter Discrete Faults

A starter valve discrete feedback fault will inhibit the commanding of fuel on for an autostart on the ground. Manual ground starts and in-flight starts are unaffected.

(b) Ratings and Schedules

1 Growth Engine and A319 Entry into Service Ratings

Revised EPR ratings are required for the V2533-A5, V2522-A5, and V2524-A5.

2 Engine Rating vs A/C Type Disagree Indication

A positive means is required to confirm that the selected engine rating on both engines is appropriate for the aircraft model on which it is installed.

3 Unrated N1 Mode Altitude Lapse Reset

If the engine is not shut down between flights and/or the EEC is not reset after landing, and the EEC were to revert to the N1 Unrated mode during the subsequent takeoff, a potential thrust discrepancy up to ± 3% relative to the desired rating could result on the affected engine. Any discrepancy is washed out by throttle movement and therefore does not affect flight regimes other than takeoff.

4 EPR-N1C2 Synthesis Revision

The V2533-A5 flight test illustrated that engine power in the N1 mode was overboosted relative to that of the EPR mode for operation at the 33K takeoff rating.

(c) Overboost Protection Logic for the A319

For V2500-A5 installation on the A319 aircraft, Airbus Industries has requested to put in place additional features to limit excessive overthrust due to fuel system or other possible failures.

(d) EGT Biasing for 22K, 24K, 24EK and 33K Ratings

To preclude the need for changes to the aircraft cockpit display computers, biasing of the EEC's ARINC EGT output must be implemented for the V2533-A5 and the A319 ratings.

(e) Throttle Resolver Angle Fault Accommodation

Current aircraft procedures require that the engine be shutdown before landing in response to an ENG THR LEVER FAULT or ENG THR LEVER DISAGREE warning if autoland is not used.

(f) Thrust Reverser Logic

1 Thrust Reverser Third Line of Defense Shut Off Valve Monitoring

Potential incorporation of an additional aircraft controlled Shut Off Valve to the Thrust Reverser system, upstream of the existing Hydraulic Control Unit, will rely on the EEC for functional verification and fault annunciation.

2 Thrust Reverser Stow Time Monitoring

A clear NO DISPATCH indication is required for Thrust Reverser system faults which result in Thrust Reverser stow time exceedances.

3 Thrust Reverser Menu Mode Nuisance Fault

If the maintainer deploys the reverser during the Thrust Reverser Menu Mode test, and does not do anything more for 60 seconds, the EEC will abort the test automatically. When this happens, a REV UNLOCKED message appears in the cockpit.

(g) Variable Stator Vane System Logic

1 Stator Vane Actuator (SVA) Track Check Delatching

The ECAM warning ENG 1(2) COMPRESSOR VANE remains displayed even though the conditions that originally drove the message no longer exist.

2 Growth Engine Variable Stator Vane Schedule Change

The current variable stator vane schedule does not provide adequate N2 Redline margin at low altitude, high power operation for the growth (V2533-A5) engine.

(h) Transient Control Logic

1 EPR Compensation Enhancement

Flight test indicates that the EPR loop stability can be enhanced at the higher power conditions required for the growth (V2533-A5) engine.

2 Transient Topping Loop Logic for All Ratings

At critical high altitude takeoff conditions, N1 transient overshoots can result in N1 redline exceedance during engine acceleration to takeoff power.

(i) Air Data Computer Associated Logic

1 Engine P2 Probe Measurement Correction Logic

Flight test data for the V2533-A5 and V2527E-A5 ratings indicated that aircraft takeoff performance was deficient relative to expectations based on runway acceleration characteristics.

2 ARINC Transmission of Selected Parameter Sources for Ratings

Verification of correct rating calculation in the EEC currently requires external calculations which may not always be fully representative of EEC internal logic.

(j) Weight on Wheels (WOW) Accommodation Logic

When the aircraft is on the ground, an intermittent Engine Interface Unit Label 31 can result in Weight on Wheels toggling between ground and air.

(2) Cause

(a) Starting Enhancements

1 Enhanced Autostart Logic

Diagnostic tests conducted on both development and production standard engines have identified HPC stall during or immediately after light up as the primary cause of failed start attempts. The HPC stall line was found to be particularly sensitive to residual engine temperatures such that an engine which has been shut down for a relatively short time (approximately 2 hours or less) is more susceptible to failure during subsequent start attempts. Rotor bow is identified as a potential concern during start attempts with warm engines.

2 Manual Start Logic Enhancements

Current EEC logic requires detection of the transition of the Manual Start Push Button discrete from OFF to ON in order to initiate a manual start. A/C 28 VDC electrical transients, or a "quick" selection of the Manual Start Push Button after IGN selection, can result in one or both channels of the EEC missing this transition. This results in no command, or loss of command, to the Starter Air Valve and thus termination of the manual start sequence.

3 Ignition Timer Logic for Starter Discrete Faults

Implementation of the extended crank for bowed rotor concerns was accomplished using the existing timer that is triggered off the start valve discrete feedback. If there is a fault associated with the starter valve discrete feedback, the timer never times out and fuel is never commanded ON. Previous auto start logic commanded fuel ON based on N2.

(b) Ratings and Schedules

1 Growth Engine and A319 Entry Into Service Ratings

Aircraft performance analysis from A321 and A319 flight test identified the need to modify the associated ratings to achieve the desired aircraft performance.

2 Engine Rating vs A/C Type Disagree Indication

Introduction of multiple engine ratings within the EEC in support of the A320/ 321/319 aircraft models introduces the potential for inappropriate installation on the aircraft.

3 Unrated N1 Mode Altitude Lapse Reset

Current EEC logic assumes the engine will be shutdown and the EEC reset between flights to re-initialize the N1 Unrated mode takeoff reset designed to emulate the EPR mode lapse rate for the subsequent takeoff.

4 EPR-N1C2 Synthesis Revision

The EPR-N1C2 synthesis curve used in defining the N1 mode power settings was determined to be inaccurate at high EPR levels representative of 33K maximum takeoff. This resulted in target N1 power settings which exceeded N1 speeds typical of EPR mode operation at the 33K takeoff rating.

(c) Overboost Protection Logic for the A319

The V2500-A5 engine and fuel system are designed to satisfy the maximum takeoff requirements of the A321 and A320 aircraft. For installation on the smaller A319 aircraft, the potential overboost which can occur as a result of an EEC or other fuel system failure reflects a much greater thrust relative to the normal takeoff rating.

(d) EGT Biasing for 22K, 24K 24EK and 33K Ratings

The V2533-A5 growth engine has a higher certified EGT redline limit (670 C) relative to the current standard V2500-A5 production engine (650 C certified limit). In addition, increased thrust requirements for the A319 V2522-A5, V2524-A5, and V2524E-A5 takeoff ratings have resulted in the need for higher EGT limits for those ratings as well.

(e) Throttle Resolver Angle Fault Accommodation

Current EEC Throttle Lever Angle fault detection and accommodation logic results in permanent latching of a Throttle Resolver Angle fault and a Throttle Resolver Angle accommodation at certain flight conditions that can result in the engine being set to a level of thrust that cannot be accommodated at landing.

(f) Thrust Reverser Logic

1 Thrust Reverser Third Line of Defense Shut Off Valve Monitoring

Third Line of Defense system design and potential retrofit considerations dictate use of the existing Hydraulic Control Unit pressure switch processing by the EEC to provide aircraft Shut Off Valve functional verification and fault annunciation.

2 Thrust Reverser Stow Time Monitoring

The current ENG 1(2) REVERSER FAULT ECAM warning which is triggered for Thrust Reverser stow time exceedances is not latched and will be displayed only until the Thrust Reverser completes its stow cycle.

3 Thrust Reverser Menu Mode Nuisance Fault

Current EEC logic stops transmitting Throttle Lever Angle over ARINC when the Thrust Reverser Menu Mode test times out. The Flight Warning Computer assumes the throttle is not in reverse if it does not receive a valid indication that it is in reverse. Therefore, when the test is aborted, the Flight Warning Computer senses that the reverser is deployed with the throttle not in reverse and sets the associated warning.

(g) Variable Stator Vane System Logic

1 Stator Vane Actuator (SVA) Track Check De-Latching

SVA track check faults which set this message are latched faults which can only be cleared by an EEC reset.

2 Growth Engine Variable Stator Vane Schedule Change

The increased thrust required for the growth engine cannot be achieved with the current variable stator vane schedule without a resulting increase in N2 at low altitude, high power.

(h) Transient Control Logic

1 EPR Compensation Enhancement

The EPR loop compensation was not designed to accommodate the engine dynamics at the higher growth engine rating.

2 Transient Topping Loop Logic for all Ratings

Although adequate N1 margin exists for steady state operation, the potential exists for N1 redline exceedance during acceleration to takeoff power when operating at critical ambient temperature conditions.

(i) Air Data Computer Associated Logic

1 Engine P2 Probe Measurement Correction Logic

Analysis of V2533-A5 and V2527E-A5 takeoff data indicated an erroneous engine P2 measurement at low Mach number, high airflow conditions due to apparent inlet boundary effects associated with the engine inlet P2 probe. The discrepancy in engine P2 measurement resulted in a shift in the thrust vs. indicated EPR relationship, producing a loss of takeoff thrust at rated EPR.

2 ARINC Transmission of Selected Parameter Sources for Ratings

The selected source of the P2, T2 and PAMB used by the EEC to calculate the engine rating is not currently available on the EEC ARINC output bus.

(j) Weight on Wheels (WOW) Accommodation Logic

When the A/C is on the ground, if the Engine Interface Unit Label 031 becomes invalid, Mach Number is immediately used to set Weight on Wheels. When Label 031 is received again, Mach Number is no longer used, but use of the Engine Interface Unit Weight on Wheels is delayed by 1/2 second during which the default of AIR is set.

(3) Solution

(a) Enhanced Autostart

Incorporate the following starting enhancements: (1) addition of a 50-second dry crank prior to fuel pressurization/ignition for bowed rotor protection, (2) weakened Wf/Pb fuel scheduling for all ground starts to reduce the risk of HPC stall, (3) automatic fuel depulse for HPC stall recovery with attendant 30-second increase in allowed autostart starter duty cycle, (4) increase the on-ground starter cutout speed back to the pre-SCN10 level of 6372RPM N2 and (5) revise the HPC handling bleed valve scheduling below idle for all starts to reduce the risk of HPC stall.

(b) Manual Start Logic Enhancements

Modify the EEC logic to initiate a manual start based on the ON state of the Manual Start push button, rather than the transition from OFF to ON. In addition, the same automatic starter crash re-engagement protection currently provided for automatic starts is incorporated for manual starts to cover Master Lever resets or A/C 28 VDC electrical transients when the Manual Start push button discrete is set to ON.

(c) Ignition Timer Logic for Starter Discrete Faults

Modify the current logic to initiate the ignition timer using starter valve command instead of starter valve discrete feedback if the feedback is invalid.

(4) Ratings and Schedules

(a) Growth Engine and A319 Entry into Service Ratings

Incorporate revised EPR ratings and revised breakpoint temperature schedules which satisfy revised aircraft/engine takeoff thrust requirements.

(b) Engine Rating vs A/C Type Disagree Indication

Modify the EEC logic to output the calculated aircraft type, on ARINC, to the aircraft based on the engine DEP selected engine rating. The aircraft Flight Warning Computer compares its aircraft type, based on its pin programming, to that provided by the EEC and displays an ECAM warning in case of disagreement.

(c) Unrated N1 Mode Altitude Lapse Reset

Modify the EEC logic to reset the previously calculated N1 takeoff reset on landing when the engine is not shutdown between flights.

(d) EPR-N1C2 Synthesis Revision

Incorporate a revised EPR-N1C2 synthesis curve which is more representative of V2500-A5 gas generator characteristics at high EPR levels.

(5) Overboost Protection Logic for the A319

V2500-A5 engines installed on the A319 aircraft will have FMU's with a reduced maximum fuel flow stop, relative to those installed on the A320/A321, which will reduce the potential thrust overboost that can occur during a failure. In addition, special logic is incorporated into the EEC for detection of thrust overboost on the A319 aircraft within the takeoff envelope, which will logic command various engine stability bleeds open, based on ambient conditions, in order to maintain engine thrust within acceptable limits.

(6) EGT Biasing for 22K, 24K, 24EK, and 33K Ratings

Incorporate appropriate biasing of the EEC's ARINC EGT output for the V2533-A5, as well as the appropriate A319 ratings, to ensure compatibility with the current 635 C A319/320 and 650 C A321 cockpit display limits.

(7) Throttle Resolver Angle Fault Accommodation

Modify the EEC Throttle Resolver Angle fault logic to allow a detected fault to heal a limited number of times (3), if the input is validated again for a specified period of time (5 seconds). Utilize additional aircraft inputs (slats) to set the most appropriate fail-safe value of Throttle Resolver Angle at the time of the failure and allow transition of this value to idle when the aircraft is in APPROACH, thus precluding the need to shut down the engine at landing.

(8) Thrust Reverser Logic

(a) Thrust Reverser Third Line of Defense Shut Off Valve Monitoring

Modify the existing EEC Thrust Reverser control logic, Menu Mode Thrust Reverser Test logic and Hydraulic Control Unit pressure switch processing logic to provide the potential to (1) verify Shut Off Valve functioning during the normal Thrust Reverser deploy/stow cycle on landing, (2) verify Shut Off Valve functioning during the Thrust Reverser Menu Mode Test, (3) provide functional and dispatch status of the total Thrust Reverser system, including the additional aircraft controlled Shut Off Valve when installed as noted by digital discrete from the aircraft Engine Interface Unit, and (4) provide auto restow capability for the Shut Off Valve Installed configuration.

(b) Thrust Reverser Stow Time Monitoring

Modify the EEC logic to latch the ENG 1(2) REVERSER FAULT ECAM warning, which is triggered for Thrust Reverser stow time exceedances, to insure that this NO DISPATCH condition is reported to the maintenance crew for appropriate maintenance action before the next dispatch of the aircraft.

(c) Thrust Reverser Menu Mode Nuisance Fault

Modify the logic to transmit Throttle Lever Angle anytime the EEC is running the reverser test regardless if whether or not the reverser is commanded.

(9) Variable Stator Vane System Logic

(a) Stator Vane Actuator (SVA) Track Check De-Latching

Modify the EEC logic to allow the SVA track check faults which set this message to clear if the SVA system returns to within the required tolerance for 5 seconds. The SVA track check fault is allowed to clear up to three times after which it is latched until the next EEC reset. Additionally, the occurrence of any SVA track check fault in flight will be recalled on landing to provide a NO DISPATCH message to ensure appropriate maintenance action.

(b) Growth Engine Variable Stator Vane Schedule Change

Revise the N2 biased stator vane schedule for all models to reflect +3 degree opening versus current schedule to allow recovery of the current N2 Redline margin at the higher thrust level of the growth engine.

(10) Transient Control Logic

(a) EPR Compensation Enhancement

Modify EPR loop compensation to enhance the engine stability in the EPR loop at high power.

(b) Transient Topping Loop Logic for all Ratings

Incorporate enhanced N1 topping logic for all V2500-A5 takeoff ratings, consistent with logic already employed for the A321 33K rating.

(11) Air Data Computer Associated Logic

(a) Engine P2 Probe Measurement Correction Logic

Incorporate a feedback EPR modifier in the EEC logic which adjusts engine power based on the difference between engine and aircraft Air Data Computer P2 measurements thus restoring takeoff thrust to the required level without exposing the engine to potential overboost. Implementation as a feedback loop modifier allows EPR command for takeoff ratings to be maintained at current levels, thus eliminating any changes in cockpit display.

(b) ARINC Transmission of Selected Parameter Sources for Ratings

Modify the EEC logic to provide the selected source of P2, T2 and PAMB used by the EEC to calculate the engine rating to aid in rating verification.

NOTE: Weight On Wheels (WOW) Accommodation Logic

Additional logic was added to prevent toggling the Weight On Wheels to AIR while the 1/2 second confirmation timer elapses.

C. Description

You do not open the EEC150-20 to install the released software. The EEC150-20 is reprogrammed with Airbus (A5)/SCN11 software and reidentified with the new part number. A functional test of the EEC150-20 is not required.

D. Compliance

Category 4 - Accomplish on a planned basis when an installed EEC150-20 is at a maintenance base capable of compliance with the Accomplishment Instructions, regardless of other planned maintenance.

E. Approval

The part number changes and/or part modifications are given in Paragraphs 2 and 3 of this service bulletin. They obey the applicable Federal Aviation Regulations and are FAA-approved for the EEC150-20 Electronic Engine Control.

F. Manpower

Approximately 1 man-hour is necessary to do these service bulletin procedures.

G. Material - Cost and Availability

(1) This service bulletin will be done at no charge to the operator if the EEC150-20 is sent to one of these addresses:

(a) United Technologies Corporation
Hamilton Standard Division
Attention: Hamilton Support Systems
Electronics Service Center
97 Newberry Road
East Windsor, CT 06088
USA

(b) Pratt & Whitney
Overhaul and Repair Center - Europe (PWORCE)
Maastricht Airport
PO Box 269
6190 AG BEEK
Maastricht Airport
The Netherlands

(2) IAE funds this program. The hard copy, no-charge purchase order to perform this service bulletin must refer to the HS Service Bulletin number EEC150-0-73-14 and the IAE Service Bulletin Number V2500-ENG-73-0086

(3) The new parts required to accomplish this Service Bulletin are listed in Section 2, Material Information. These parts are available at no cost to the operator. Lead times can be obtained from Hamilton Standard by issuing a hard copy, no-charge purchase order for the quantity requested. Purchase orders for parts must refer to HS Service Bulletin number EEC150-20-73-14, the IAE Service Bulletin number V2500-ENG-73-0086 and be addressed to:

Mail:Hamilton Standard Customer
Support Service Center
47 Lakeshore Parkway
Rock Hill, SC 29730
Attn: Spare Parts Sales

Facsimile: 803-325-2849

H. Tooling

None

I. Weight and Balance

No affect.

J. Electrical Load Data

No affect.

K. References

E9137 Standard Electronic Practices Manual
Component Maintenance Manual CMM 73-28-01
IAE Service Bulletin Number V2500-ENG-73-0086
Hamilton Standard Service Bulletin EEC150-20-73-16
Hamilton Standard Service Bulletin EEC150-20-73-8

L. Other Publications Affected

Illustrated Parts Catalog 73-28-01

M. Additional Data

HS Service Bulletin EEC150-20-73-8 must be incorporated prior to incorporation of Service Bulletin EEC150-20-73-14.

HS records as of September 17, 1996 show the EEC150-20 units with the following serial numbers have not been updated to Service Bulletin EEC150-20-73-8:

2520-0039
2520-0052
2520-0059
2520-0061
2520-0062
2520-0090
2520-0093
2520-0115
2520--128

2. Material Information

A. This service bulletin change uses the parts in the list for each EEC150-20 that incorporates this service bulletin.

B. Any parts that usually are discarded when you disassemble the EEC150-20 are not in the list.

C. In the list of parts for this change, MSQ is the Minimum Sales Quantity. The parts that have an entry in this area of the list are supplied only in this quantity, or a multiple of this quantity.

D. In the list of parts for this change, the Key Word is a one-word name for the part.

E. In the list of parts for this change, the Instruction Codes tell you what to do with the parts. A short list under the list of parts tells you about the instruction codes that are used in the list.

F. New Parts Required

Table 1. New Parts

New PN	Qty	MSQ	Estimated Price	Key Word	PN Before this SB	Instruction Code
751333-1	1	20	1.80	Plate	751333-1	A
819191-10	1	1	0.00	Diskette	819191-8	A, B, C

Instruction Code A: The service bulletin change adds the New PN to the EEC150-20.

Instruction Code B: One reprogramming diskette can modify approximately 40 EEC150-20 units. You should order the proper quantity of diskettes to modify your fleet of EEC150-20 units.

Instruction Code C: The reprogramming diskette is provided to you at no charge by IAE. See your local IAE service representative for ordering information.

3. Accomplishment Instructions

CAUTION: REFER TO THE E9137 STANDARD ELECTRONIC PRACTICES MANUAL FOR SPECIAL PRECAUTIONS. ELECTROSTATIC DISCHARGE (ESD) CAN CAUSE DAMAGE TO THE ELECTRONIC COMPONENTS IN THE EEC150-20.

NOTE: The Alternate Reprogramming Method procedures may be used whenever the EEC electrical connectors are disconnected from the aircraft. If the EEC is reprogrammed using 28 VDC power from the aircraft, refer to the engine service bulletin.

NOTE: Refer to the E9137 Standard Electronic Practices Manual to do the procedure unless otherwise noted.

A. If you use the Alternate Reprogramming Method, skip to step 3.B. Otherwise refer to CMM 73-28-01, section 200 (ATLAS) to reprogram the EEC150-20. Use the program and version number shown below:

Replace Y811183-027 with Y811183-032
Replace Y811184-027 with Y811184-032
Replace Y811185-027 with Y811185-032

If you do not use the Alternate Reprogramming Method of programming, skip to step 3.AO.

B. If you use the Alternate Reprogramming Method, verify that the model number on the identification plate of the unit is EEC150-20.

C. Record the current unit part number and the unit serial number from the nameplate. You will enter this information into the computer.

D. Plug in all necessary equipment, but do not turn the equipment on.

E. Connect the programming harness connector marked P1 to the EEC connector marked J1. Ensure that the red engagement stripe on the EEC connector J1 is fully covered. Connections are given in Table 2.

F. Connect the programming harness connector marked P7 (Table 2) to the EEC connector marked J7. Ensure the red engagement stripe on the EEC connector J7 is fully covered. If the computer and power supply connections to the cables are permanent, skip to step 3.J.

G. Connect the programming harness connector marked CH A UART to the IBM compatible computer UART board connectors for the channel A RS-422 port (COM3). Ensure that these connectors are properly mated.

H. Connect the programming harness connector marked CH B UART to the IBM compatible computer UART board connectors for the channel A RS-422 port (COM4). Ensure that these connectors are properly mated.

NOTE: UART connections can differ for different IBM compatible computers.

NOTE: It is important to verify that the connectors are correctly installed for correct loader operation. HS recommends labeling the RS-422 COM3 port as CH A UART and COM4 port as CH B UART on the computer to reduce errors.

I. Connect the opposite end of P3 and P9 (Table 3) cables to the 28 VDC supply.

J. Connect the power supply harness connector marked P3 to the EEC connector marked J3. Ensure that the red engagement stripes on EEC connector J3 are fully covered.

K. Connect the power supply harness connector marked P9 to the EEC connector marked J9. Ensure that the red engagement stripes on EEC connector J9 are fully covered.

L. Locate the BOOT/BITE switches for Channel A and Channel B. Set the BOOT/BITE switches ON (closed).

M. Turn on the 28 VDC power supply to the EEC.

N. Turn on power to the IBM compatible computer.

O. Wait for the MSDOS prompt C:\> to appear on the IBM compatible computer.

NOTE: The procedure assumes the floppy disk is in drive A. If the floppy drive in your computer has another designation, substitute that designation in the procedure.

P. Obtain the Hamilton Standard reprogramming diskette PN 819191-10. Ensure that the write protection tab of the diskette is covering the "hole."

Q. Insert the diskette into the floppy drive designated A on the IBM compatible computer. The display shows C:\>.

R. Type **a:**, then press the RETURN key (ENTER key on some computers). The display shows A:\>.

S. Type **LDR150**, then press RETURN. This starts the UART programming utility. Several messages appear, including the program identification, version number, time, and the UTC/P&W document property rights notice.

NOTE: If there is a configuration error on the diskette, the program displays the appropriate error message and aborts the programming process. See Table 4 for a summary of error code descriptions and troubleshooting suggestions.

T. The UART programming utility LDR150 displays the following message: Enter operator's name performing download: [ ]>. The field between the brackets is always empty the first time the program is executed. Subsequent execution displays the last name entered.

(1) If this is not the first execution of the program, and the displayed name is unchanged, press RETURN and go to step V.

(2) If this is the first program execution (no name is displayed), or if the operator's name changes, enter the new name and press RETURN.

U. The LDR150 program displays this message:

WARNING - EEC Fault Memory Will Be Cleared By This Program. If an EEC Fault Dump is Required Prior to Programming, Enter Q to Quit or C to Continue [Q/C]:

(1) If a fault dump is already accomplished, or is not required, type C, then press RETURN, and go to step V.

(2) If a fault dump is required, or if you want to stop the programming procedure, type Q, then press RETURN. If the programming procedure is stopped, turn off 28 VDC power to the EEC and go to step 3.AK.

V. The LDR150 program displays this message: ENTER THE 9 CHARACTER EEC SERIAL NUMBER: [xxxx-xxxx].

W. Enter the nine character EEC serial number, from the nameplate, and press RETURN.

NOTE: For steps 3.X and Y, precede the middle part number digit with a zero. For example, enter 808050-4-026 as 808050-04-026.

X. The LDR150 program display shows: ENTER THE 13 CHARACTER CURRENT EEC HW PART NO.: [XXXXXX-XX-XXX]. Enter the part number and press RETURN.

Y. The LDR150 program display shows: ENTER THE 13 CHARACTER SB EEC HW PART NO.: [XXXXXX-XX-XXX]. Enter the new part number given in this service bulletin and press RETURN.

Z. The LDR150 program display shows: ENTER TRIM CHECKSUM VALUE FOR XXXXXX.XXX:>. The XXXXXX.XXX designation is the name of the Trim File being loaded into the EEC. Enter the trim checksum value 26739 and press RETURN.

AA. The LDR150 program display shows: DO YOU WISH TO ENTER THE ABOVE ENTRIES [Y/N/Q]:

(1) To proceed with the programming process, type N, then press RETURN. Go to step 3. AB.

(2) To correct any errors in the data entered, type Y, then press RETURN. Go to step 3. T.

(3) To quit the programming process, type Q, then press RETURN. Turn off the 28 VDC power to the EEC and continue with step 3. AL.

AB. At this point, the screen is initialized to display the activity of the programming process. Status messages scroll across the screen. If an error occurs, see Table 4 for a summary of error code descriptions and troubleshooting suggestions.

AC. The LDR150 program display shows:

Turn off the BITE and BOOT switches to the EEC
then
Turn Off POWER to the EEC and wait at least 5 seconds
then
Turn On Power to the EEC

Press the RETURN Key When Ready to Continue

(1) Locate the BOOT/BITE switches on your test equipment, and set them to OFF (open).

AD. Switch off the 28 VDC power to the EEC wait 5 seconds, then switch power on.

AE. On the IBM compatible computer, press RETURN.

AF. Wait until the LDR150 program display shows:

Turn ON the BITE and BOOT switches to the EEC
then
Turn Off POWER to the EEC and wait at least 5 seconds
then
...Press the RETURN Key When Ready to Continue

(1) Locate the BOOT/BITE switches on your test equipment, and set the BOOT/BITE switches to OFF (open).

AG. Switch off the 28 VDC power supply to the EEC, wait 5 seconds, then switch power on.

AH. On the IBM compatible computer, press RETURN.

AI. Wait until the LDR150 display shows:

Turn Off POWER to the EEC
... Press the RETURN Key When Ready to Continue

(1) Switch off the 28 VDC power supply to the EEC.

AJ. On the IBM compatible computer, press the RETURN key.

AK. The LDR150 program displays the status of the programming process. Record the name of the log file for hard copy report of the process.

(1) If programming is successful, the following message is displayed:

EEC REPROGRAMMING SUCCESSFULLY COMPLETED
Record the log file name VLXXXX.LOG for later printout

If desired, record the log file name VLXXXX.LOG for later printout.

(2) If the programming is unsuccessful, the following message is displayed:

DOWNLOAD PROCESS ABORTED - ERROR CODE X
Record the log file name VLXXXX.LOG for later printout.

If desired, record the log file name VLXXXX.LOG for later printout.

The X refers to the type of error that caused the process to abort. Table 4 describes the error codes and action to be taken.

AL. Press RETURN to stop the program and return to the MSDOS prompt: A:\>.

AM. If a printer is available, a paper copy of the log file can be generated by the IBM computer:

NOTE: If no printer is available, you can move the diskette to a system with a printer and do the next three steps.

At the MSDOS prompt, type PRINT VLXXXX.LOG.

(1) Press RETURN.

(2) Do not proceed to the next step until the file is printed.

AN. Disconnect the EEC electrical connectors from the J1, J3, J7, and J9 connectors.

AO. Put the information shown below on a new identification plate.

NOTE: EEC150-20 assemblies reprogrammed at one of the addresses given in 1.G.1 are returned with their assemblies reidentified.

NOTE: If HS Service Bulletin EEC150-20-73-16 (reference K.) is incorporated, ignore items (1) and (2) and go to (3).

(1) Put the new end assembly part number in the PART NO. area of the of the new identification plate.

PART NUMBER BEFORE THIS SERVICE BULLETIN	PART NUMBER AFTER THIS SERVICE BULLETIN
808050-4-YYY	808050-4-028

(2) Put the new IAE part number in the CI NO. area of the new identification plate.

EEC150-20 END ASSEMBLY	NEW IAE PART NUMBER
808050-4-028	2A3250

(3) Put the date and last three digits of the new part number (3.AO. (1)) on the identification plate per HS Service Bulletin EEC150-20-73-16, using a ballpoint pen or equivalent tool.

Table 2. Communication Connections

EEC SIGNAL NAME	EEC CONNECTOR	QUA-TECH CONNECTOR	QUA-TECH SIGNAL NAME
UART IN LINE B CHA	P1-b	PA-2	TXD+
UART IN LINE A CHA	P1-H	PA-7	TXD-
UART OUT LINE A CHA	P1-c	PA-4	RXD+
UART OUT LINE B CHA	P1-J	PA-8	RXD-
BOOT DISC CHA	P1-D	N/A	N/A
BITE DISC CHA	P1-Z	N/A	N/A
BOOT/BITE RTN CHA	P1-m	N/A	N/A
UART IN LINE B CHB	P7-b	PB-2	TXD+
UART IN LINE A CHB	P7-H	PB-7	TXD-
UART OUT LINE A CHB	P7-c	PB-4	RXD+
UART OUT LINE B CHB	P7-J	PB-8	RXD-
BOOT DISC CHB	P7-D	N/A	N/A
BITE DISC CHB	P7-Z	N/A	N/A
BOOT/BITE RTN CHB	P7-m	N/A	N/A

Table 3. Power Supply Connections

EEC SIGNAL NAME	EEC CONNECTOR	POWER SUPPLY
GTP CHA	P3-m	+28 VDC
GTP RTN CHA	P3-r	+28 VDC RTN

Table 3. Power Supply Connections

EEC SIGNAL NAME	EEC CONNECTOR	POWER SUPPLY
GTP CHB	P9-m	+28 VDC
GTP RTN CHB	P9-r	+28 VDC RTN

Table 4. Error Code Definitions

ERROR CODE	ERROR TYPE	ACTION
E1	EEC VERIFY ERROR - Data verify error in EEC - Compare failed or location could not be programmed.	Try procedure three times; if still bad return EEC unit.
E2	COMMUNICATION ERROR - Communication problem between EEC and IBM compatible computer.	Check BITE, cables, power supply, UART board, and EEC. Retry three times.
E3	CONFIGURATION ERROR - Configuration data comparison failed. (Possible hardware PN mismatch, EEC compatibility mismatch, trim checksum mismatch)	Operator data entered incorrectly or incorrect data on existing nameplate. Check data - retry with the correct information.
E4	SYSTEM PROBLEM - Poor operating environment, bad disk, or program aborted by the operator	If the process was not terminated by the operator, check that the disk is not write protected, or replace disk and retry.

Hamilton Standard Service Bulletin EEC150-20-73-14
Hamilton Standard Internal Reference Number EC240604, 240606
Hamilton Standard Reference A320, IAE V2500-A5
IAE Engineering Change Number 96VZ005
IAE Service Bulletin Number V2500-ENG-73-0086
IAE Part Number 2A3250