ENGINE – FUEL AND CONTROL – PROVIDE A NEW ELECTRONIC ENGINE CONTROL (EEC) WITH THE SCN12C SOFTWARE CONFIGURATION – CATEGORY CODE 4 – MOD.ENG-73-0069

1. Planning Information

A. Effectivity

(1) Aircraft: Airbus A320

(2) Engine: V2500-A1 Engines through Serial No.V0361

For the engines specified which incorporate this Service Bulletin the Bump configurations which follow are applicable.

BUMP 00 (No thrust bump)

BUMP 04 (No Thrust Bump)

BUMP 07 (Improved Consolidated Thrust Bump)*

*The Flight Operations Manual will have specific instructions for Aircraft which have Engines with these Thrust Bump Configurations.

This Service Bulletin may be intermixed with A1SCN12B/A on either of the engines on the aircraft.

If Reference (1) is incorporated on the engine(s) when you do this bulletin, it must be removed when this Service Bulletin is incorporated.

You must contact your IAE Representative when you incorporate this Service Bulletin. You must obey the contractual obligations when you change a no thrust bump configuration (00 or 04) to a thrust bump configuration (other than 00 or 04).

B. Reason

(1) Condition

(a) 1.0 IDLE EGT SPIKING: Short duration EGT spikes which can result in EGT Redline exceedance indications in the cockpit have been observed during initial accels off-idle.

(b) 2.0 STATOR VANE TRACK CHECKS: Stator Vane track faults have been experienced during accels on the A1 engine in Revenue Service. The transient tolerance is too tight for stator vane system operation during thses maneuvers. No engine operability effects have been encountered during these maneuvers.

(c) 3.0 BIASING OF EGT FOR COCKPIT DISPLAY: Lack of EGT margin is resulting in increased number of redline exceedance events for -A1 revenue service engines, particularly under hot day conditions.

(d) 4.0 ALTERNATOR CIRCUIT NUISANCE FAULT: Annuciations of "ALTERNATOR CIRCUIT FAILED" on ECAM have been seen during in-flight shutdowns on N2 synthesis. This fault is non-dispatchable.

(e) 5.0 WEIGHT-ON-WHEELS (WOW) VALIDATION/ACCOMODATION LOGIC: Thrust reversr operation is not inhibited if both WOW discretes are failed closed and the aircraft is in the air.

(f) 6.0 THRUST REVERSER CHANGES:

1 6.1 A/C PERMISSION SWITCH TEST: The Thrust Reverser A/C permission switch verification test is not performed in both channels on each flight.

2 6.2 REVERSER STOW & LOCK (S&L) AND ARMING VALVE CROSS CHECK FAULTS: Dispatch for 10 days is currently allowed with S&L and Arming Valve cross check faults. Thrust Reverser system status indication is degraded for subsequent Thrust Reverser system failures in this configuration.

3 6.3 REVERSER PRESURIZED ECAM WARNING: Cross check failures of the Thrust Reverser S&L sensor to the EEC can inhibit the setting of the "REVERSER PRESSURIZED" ECAM warning.

(g) 7.0 FLEX TEMPERATURE MODE CHANGES:

1 7.1 FLEX TEMPERATURE MODE SELECTION: Flex Temperature Mode engagement requires that the Flex Temperature input from the pilot be greater than the ambient temperature. Variations in the absolute and transient characteristics of the EEC selected T2, relative to the Flex Temperature input by the pilot as the A/C proceeds down the runway during takeoff, can result in unintended changes in the engagement of Flex T/O. This is most likely to occur for minor derated T/O's where the Flex Temperature is set purposely close to the actual ambient temperature obtained from the tower by the pilot.

2 7.2 FLEX TEMPERATURE ARINC LABEL 214: The value of Flex Temperature received by the EEC from the Flight Management computer is echoed back to the A/C on ARINC Label 214. The Flight Management Computer, however, sets its Flex Temperature SSM to No Computed Data (NCD) above 1500 feet, even if the EEC is still operating in Flex T/O Mode. This results in the loss of Flex Temperature indication in the cockpit during T/O.

(h) 8.0 HEAT MANAGEMENT CHANGES:

1 8.1 AIR COOLED OIL COOLER (ACOC) SPRING VALVE NUISANCE FAULT: The air valve spring failed detection logic has been inappropriately flagging the spring failed.

2 8.2 HEAT MANAGEMENT FLIP MODE FAULT RECORDING: The nuisance Flip Mode fault, "HMS-IDG OVTMP W/RECIRC/" can be set after engine shutdown. This fault is recorded in EEROM and is a Class II fault which is intended to indicate a heat management system malfunction.

3 8.3 FUEL AND ENGINE OIL T/C FAILSAFE CLOSES AIR VALVE: The following discussion applies to both the engine oil and fuel thermocouples. If the fuel thermocouple is failed in both channels, the failsafe valve for the input causes the logic to think the fuel is too cold. The logic responds by closing the air valve.

(i) 9.0 WING ANTI-ICE (WAI) MINIMUM PB SCHEDULES: a/c ground handling characteristics with WAI selected has been criticized due to the resulting raised engine idle.

(j) 10.0 MAINTENANCE LOGIC IMPROVEMENTS:

1 10.1 CLEAR LANGUAGE MESSAGE (CLM) CORRELATION TO ECAM WARNINGS: Determination of the required maintenance actions for faults identified in the Post Flight Report (PFR) can be less than straight forward.

2 10.2 A/C DATA & EEC P/N MENU REVISION: The Data Entry Plug (DEP) configuration is not presently available to the maintainer through Menu Mode.

3 10.3 INTERNAL FAULT FLAG: Bit 18 in the first status word of a Clear Language Message (CLM) is currently not always set properly. This bit is used by the CFDS to determine the source of the detected fault. When the bit is erroneously set to zero, identification of the correct source may not be posasible, thus complicating the troubleshooting process.

4 10.4 "ENG 1(2) REVERSER UNLOCKED" MESSAGE IN MENU MODE: Spurious setting of the "ENG 1(2) REVERSER UNLOCKED" ECAM warning have been experienced during operation of the Thrust Reverser Menu Mode test with the latest Flight Warning Computer (FWC) Standard D1E.

(k) 11.0 OVERSPEED NUISANCE FAULTS

1 11.1: Overspeed nuisance faults have been experienced in the field on A1 engines.

2 11.2: Presently the EEC will record a nuisance FMU overspeed system fault following a real overspeed system activation event.

(l) 12.0 START ABORT DUE TO LOSS OF AIRCRAFT 28 VDC: Temporary failures of the aircraft 28 VDC input have resulted in autostarts being aborted in revenue service without an accompanying ECAM message.

(m) 13.0 DISPATCH LOGIC: A number of faults which are approved at the engine level for Long Term Dispatch are currently conservatively treated as Short Term Dispatch items.

(n) 14.0 AUTOSTART LOCKED ROTOR DETECTION: Starts have occured in production where the low rotor initially began to rotate but later bound-up prior to attaining idle. The software did not detect the locked rotor. The intent of the autostart locked low rotor abort logic is to prevent engine starting to idle with the low rotor not turning.

(o) 15.0 MIN LIMITS FOR DADC TAT ALT INPUTS: The current minimum limits for both DADC T2 (-60) and Altitude (-1000 FT) do not cover the full range originally specified in the engine specification.

(p) 16.0 MEMORY SAVING ITEMS: There is very little memory and timing Margin left in the A1 software when it is loaded into the EEC 150-1 control.

(q) 17.0 OVERSPEED EVENT RECORDING: None.

18.0 AUTO-START ENHANCEMENT FOR BOWED ROTOR: Field experience with the A1 engine has identified the potential for engine clearance degradation between rotating and static parts following engine restart of a previously shut-down hot engine.

(s) EEC FUEL DRAINAGE: The EEC150-1 upper shock mounts have the potential of retaining 3.5 to 11.5 cubic centimeters (CC) of fluid.

(2) Background

(a) OFF IDLE EGT SPIKING: EGT spikes are caused by initial fuel addition to accelerate the engine off-idle, where the LPT initially extracts little to no work, thus resulting in a momentarily high gas temperature spike passing the EGT sensors. This is not harmful to engine hardware based on service experience.

(b) 2.0 STATOR VANE TRACK CHECKS: The overall stator vane system transient response capability was not taken into account in the present design; only the stator vane actuator characteristics were considered when the logic was designed.

(c) 3.0 BIASING OF EGT FOR COCKPIT DISPLAY: Greater than expected deterioration rates in conjunction with EGT limits which are currently set below the maximum certified levels.

(d) 4.0 ALTERNATOR CIRCUIT NUISANCE FAULT: The fault logic associated with the alternator circuit is enabled using N2 synthesis which is intentionally biased for starting and thus is inaccurate during engine windmilling. This results in the logic determining that the high rotor is turning fast enough for the alternator to meet its minimum output requirement, when it is not.

(e) 5.0 WEIGHT-ON-WHEELS (WOW) VALIDATION/ACCOMODATION LOGIC: If both WOW discretes indicate ground, no verification is done with Mn.

(f) 6.0 THRUST REVERSER CHANGES:

1 6.1 A/C PERMISSION SWITCH TEST:The verifcation that the switch is not stuck closed is incorporated as part of the normal Thrust Reverser command logic, This results in the verification of the switch integrity at the end of the flight during normal reverser operation and only in the channel "In Control."

2 6.2 REVERSER STOW & LOCK (S&L) AND ARMING VALVE CROSS CHECK FAULTS: S&L and Arming Valve cross check faults currently set only class II faults.

3 6.3 REVERSER PRESSURIZED ECAM WARNING: The EEC failsafe the ARINC output of the S&L sensor to "UNLOCKED" if the S&L feedback differs between channels. However, the logic in the Flight Warning Computer (FWC) requires the S&L feedback to indicate "LOCKED" before providing a "REVERSER PRESSURIZED" indication on ECAM.

(g) 7.0 FLEX TEMPERATURE MODE CHANGES:

1 7.1 FLEX TEMPERATURE MODE SELECTION: The selection of Flex T/O Mode is currently not frozen until Mn is greater than 0.15.

2 7.2 FLEX TEMPERTURE ARINC LABEL 214: The EEC echoes back the Flex Temperature it receives from the A/C with the as received SSM.

(h) 8.0 HEAT MANAGEMENT CHANGES:

1 8.1 AIR COOLED OIL COOLER (ACOC) SPRING VALVE NUISANCE FAULT: The current design does not properly distinguish between normal and failed operation effectively.

2 8.2 HEAT MANAGEMENT FLIP MODE FAULT RECORDING: On engine shutdown during soakback, it may be possible for the IDG oil temperature to rise over and stay above the maintenance limit long enough to set the fault flag. At shutdown, there is no fuel to use as a cooling medium for the IDG oil.

3 8.3 FUEL AND ENGINE OIL T/C FAILSAFE CLOSES AIR VALVE: The current heat management design does not completely accomodate failure of the fuel and engine oil thermocouples.

(i) 9.0 WING ANTI-ICE (WAI) MINIMUM PB SCHEDULES: Pilot selection of WAI causes the EEC to raise the minimum PB schedule to meet the increased bleed requirements.

(j) 10.0 MAINTENANCE LOGIC IMPROVEMENTS:

1 10.1 CLEAR LANGUAGE MESSAGE (CLM) CORRELATION TO ECAM WARNINGS: Troubleshooting faults is complicated by the lack of correlation between ECAM warnings and CLM's transmitted from the EEC as summarized in the PFR.

2 10.2 A/C DATA & EEC P/N MENU REVISION: New requirement.

3 10.3 INTERNAL FAULT FLAG: Some internal fault flags were incorrectly specified and some were handled incorrectly in the software.

4 10.4 "ENG 1(2) REVERSER UNLOCKED" MESSAGE IN MENU MODE: FWC Standard D1E no longer inhibits the setting of this ECAM warning in Phase 1 & 10 when the TRA is not in the reverser area. Since the EEC does not presently transmit TRA to the A/C during Menu Mode operation, execution of the T/R Menu Mode test can now set this warning.

(k) 11.0 OVERSPEED NUISANCE FAULTS

1 11.1: The specific cause of the test failures has not been deteremined.

2 11.2: Current EEC logic does not recognise that the overspeed valve in the FMU is hydrulically latched in the overspeed position following system activation, Once the engine spools down in response to the resulting fuel flow reduction, the EEC stops commanding the overspeed valve. Since the valve does not return to the normal position, as commanded by the EEC, the EEC sets the nuisance FMU overspeed system fault.

(l) 12.0 START ABORT DUE TO LOSS OF AIRCRAFT 28 VDC: The current design does not adequately address temporary losses of aircraft 28 VDC.

(m) 13.0 DISPATCH LOGIC: Revenue Service experience was desired before downgrading these from Short Term to Long Term Dispatch.

(n) 14.0 AUTOSTART LOCKED ROTOR DETECTION: The present logic design only considered the case where the low rotor never turns at all from the beginning of the autostart sequence. The possibility of binding-up later in the start sequence was not anticipated.

(o) 15.0 MIN LIMIT FOR DADC TAT AND ALT INPUTS: The software was designed to the ICD requirements but the ICD was not in compliance with the original requirements in the engine specification.

(p) 16.0 MEMORY SAVING ITEMS: The software requirements for the A1 engine have caught up with the memory and processing capability of the original design of the EEC 150-1.

(q) 17.0 OVERSPEED EVENT RECORDING: New requirement.

(r) 18.0 AUTO-START ENHANCEMENT FOR BOWED ROTOR: Thermal differentials developing after shut-down of a hot engine can produce significant "bowing" of the rotor spool, couples with resulting amplication of the natural spool whirl on the subsequent engine start, can result in rubbing leading to clearance degradation and a corresponding loss in engine performance.

(s) EEC FUEL DRAINAGE: During the nacelle drainage certification testing on the A321/V2500-A5, the EEC150-20 upper shock mounts retined fluid in excess of the 3 CC maximum allowed. The cause of the fluid retention is a result of the position of the EEC as mounted on the fan case. Since the EEC150-1 has a similar housing design, retention of fluid will also occur.

(3) Objective

(a) OFF IDLE EGT SPIKING: New logic has been implemented to override the Engine 7A Bleed closed during on ground opertions to provide additional EGT Redline margin.

(b) 2.0 STATOR VANE TRACK CHECKS: Modify the track check rate limit in the accel direction to be a function of N2 and Altitude so that the overall system transient operation will be accounted for within appropriate engine operability constraints.

(c) 3.0 BIASING OF EGT FOR COCKPIT DISPLAY: Increase EGT redline limits for max takeoff and max continuous ratings to reflect the max certified levels. Bias the ARINC EGT transmitted to the cockpit to maintain the A320 cockpit display limits at 635 C and 610 C for takeoff and max continuous rating, respectively. Eliminate the additional DEP selectable EGT biasing provision.

(d) 4.0 ALTERNATOR CIRCUIT NUISANCE FAULT: Modify the logic to enable the fault detection on the alternator circuit only when the required sensor input signals are available so tha nuisance faults will not be inappropriately set.

(e) 5.0 WEIGHT-ON-WHEELS (WOW) VALIDATION/ACCOMODATION LOGIC: If both WOW discretes indicate ground, do a comparison with Mn. If Mn is greater than 0.5, inhibit reverser operation and record a maintenance fault.

(f) 6.0 THRUST REVERSER CHANGES:

1 6.1 A/C PERMISSION SWITCH TEST: Modify the logic to incorporate the A/C permission switch test into the existing engine spool-up test so that the verifiction is performed on each flight in both channels of the control.

2 6.2 REVERSER STOW & LOCK (S&L) AND ARMING VALVE CROSS CHECK FAULTS: Upgrade cross check faults of the S&L of Arming Valve from Class II Class I by modifying the logic to set the Class I (NO DISPATCH) "REVERSER SYSTEM FAULT" (270/19) for cross check faults of the S&L or Arming Valve.

3 6.3 REVERSER PRESSURIZED ECAM WARNING: Modify the logic to output on ARINC the local S&L feedback , instead of the failsafe value, to prevent inhibiting of the "REVERSER PRESSURIZED" ECAM warning in the presence of S&L cross check faults.

(g) 7.0 FLEX TEMPERATURE MODE CHANGES:

1 7.1 FLEX TEMPERATURE MODE SELECTION: Modify the logic to freeze the Flex T/O Mode selection when TLA is greater than Max Climb (MCL).

2 7.2 FLEX TEMPERATURE ARINC LABEL 214: Modify the logic to output on Label 214 the Flex Temperature used and frozen in the power management and not the one received from the A/C.

(h) 8.0 HEAT MANAGEMENT CHANGES:

1 8.1 AIR COOLED OIL COOLER (ACOC) SPRING VALVE NUISANCE FAULT: Remove the air valve spring failed detection logic. The logic has been a source of nuisance faults without providing much benefit and is redundant to the test of the ACOC valve done during engine spoolup.

2 8.2 HEAT MANAGEMENT FLIP MODE FAULT RECORDING: Modify the logic such that the Flip Mode nuisance fault will not set after the engine is shutdown.

3 8.3 FUEL AND ENGINE OIL T/C FAILSAFE CLOSES AIR VALVE: Modify the design to failsafe the fuel temperature to the proper failsafe value so that the fuel will not be inappropriately declared too cold and the air valve inappropriately closed.

(i) 9.0 WING ANTI-ICE (WAI) MINIMUM PB SCHEDULES: WAI selection on ground causes the A/C Bleed Zone Controller to command the WAI valve open for 30 seconds to verify operation of the valve. Therefore, the logic in the EEC is modified to invoke the higher PB shedule for only 40 seconds following WAI selection on the ground.

(j) 10.0 MAINTENANCE LOGIC IMPROVEMENTS:

1 10.1 CLEAR LANGUAGE MESSAGE (CLM) CORRELATION TO ECAM WARNINGS: The following CLM's have been added to cover ECAM warnings which are listed in the PFR which currently do not have associated CLM's transmitted from the EEC: (1) "78-31-42 HC/PROX SW/T/R UP ACT" for "REVERSER UNLOCKED IN FLIGHT", (2) "78-31-51 HCU/T/R UP ACT/PROX SW" for "REVERSER PRESSURIZED" and (3) "74-00-00 IGN/115vac/EEC" for ENG 1(2) Ignition A (B).

2 10.2 A/C DATA & EEC P/N MENU REVISION: The DEP configuration, as it is marked on the plug itself, has been added to the existing A/C Data & EEC P/N menu screen to aid in maintenance.

3 10.3 INTERNAL FAULT FLAG: Update the internal fault flag list and modify the logic to provide the correct LRU identification at the A/C level.

4 10.4 "ENG 1(2) REVERSER UNLOCKED" MESSAGE IN MENU MODE: Modify the logic so that the EEC will transmit the TRA position to the A/C during the T/R Menu Mode test to prevent spurious setting of the "ENG 1(2) REVERSER UNLOCKED" ECAM warning.

(k) 11.0 OVERSPEED NUISANCE FAULTS

1 11.1: Continuing review of the ovverspeed test criteria has identified the following changes aimed at addressing the field events: (1) Modify the logic to eliminate the potential for single pass failures setting an overspeed fault; (2) delete the overspeed test done on engine spool-up as it is redundant to the test done on engine spool-down and (3) record additional fault information associated with a detected overspeed fault to aid in identifying the specific test that is setting the overspeed fault.

2 11.2: Modify the EEC logic to account for the hydraulic latching of the overspeed valve following a real overspeed event to avoid the setting of the nuisance FMU overspeed system fault.

(1) 12.0 START ABORT DUE TO LOSS OF AIRCRAFT 28 VDC: Change the logic so that a temporary loss of aircraft 28 VDC will not permanently inhibit the starting logic.

(m) 13.0 DISPATCH LOGIC: Modify the logic to downgrade the following faults to Long Term Dispatch: (1) Cross check faults between channels for the following signals... Pb, P5, Pamb, P2; Starter Air Valve & Fuel On/Off discrete feedbacks and Air Cooled Oil Cooler and Spill Valve LVDT feedbacks; (2) wraparound faults for Tenth Stage Makeup solenoid and Pb Heater relay discrete outputs and Air Cooled Oil Cooler and Spill Valve torque motor outputs; and (3) track checks on the Air Cooled Oil Cooler and Spill Valve torque motor loops. Additionally, the "Class III Menu Mode Report", has been renamed the "Scheduled Maintenance Report", the number of fault cells allocated to this fault class was increased from 9 to 12 and the fault recording design was modified to record the last occurrence of a fault, rather than the first occurrence, to aid in the confirmation of the performed maintenance actions.

(n) 14.0 AUTOSTART LOCKED ROTOR DETECTION: Change the autostart locked low rotor logic to abort any start where the low rotor does not rotate, or stops rotating during the start sequence prior to attaining idle.

(o) 15.0 MIN LIMITS FOR DADEC TAT AND ALT INPUTS: Modify the input processing logic to account for the originally intended required input range for T2 (-80C) and Altitude (-2000 FT).

(p) 16.0 MEMORY SAVING ITEMS: In order to make room for the A1 SCN 12C requirements to be implemented in the EEC 150-1, the following memory and timing savings actions were executed: (1) Delete the trim range check done in the application software as it is redundant to that done in the Super Monitor used to download experimental trims, (2) eliminate unused provisions for T2 and hot engine biasing of the Wf/Pb start schedules, (3) eliminate unused provisions for biasing of the Stator Valve scheduling for accel, decal, or reverse operation, (4) consolidate the 4-7th and 10th stage bleed logic since they are scheduled identically, (5) simplify the powersetting logic where excess capability is no longer needed, (6) convert the min Pb schedules to polynomials from tables for ECS and WAI requirements and (7) delete the processing of Flight Number from the A/C.

(q) 17.0 OVERSPEED EVENT RECORDING: Provide a CLM, "71-00-00 PROPULSION SYSTEM", and add the capability to record appropriate parametric data in EEROM at the time of an overspeed event to aid in the troubleshooting of such an event.

(r) 18.0 AUTO-START ENHANCEMENT FOR BOWED ROTOR: Modify the logic to provide an additional 30 seconds of sry motoring of the engine on the starter before initiating fuel pressurization for all Auto-Starts on the ground. This additional motoring will reduce thermals on the rotor spool and provide priming of the Number 3 bearing which is designed to control rotor spool whirl, thus minimizing the potential for rotor rub.

(s) EEC FLUID DRAINAGE: Drill 0.125 Inch (3.175 mm) holes in each side of the upper shock mount supports, to allow proper drainage of fluids.

(4) Substantiation

The flight simulation and flight testing of the SCN12C software logic was accompanied 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 SCN12C software logic that adds many improvements.

D. Approval

Incorporation of this Service Bulletin on A320 aircraft is authorized by Reference (4), Airbus Service Bulletin A320-73-1035.

The Part Changes and/or part modification described in Section 2 and 3 of this Service Bulletin have been shown to comply with the applicable Federal Aviation Regulations ans 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 this Bulletin:

Venue		Estimated Manhours
(1) In Service		TOTAL: 1 hour 21 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 remove the ACC Front Duct Cover Assembly, if required, Reference (1)		5 minutes
	TOTAL	5 minutes
(c) 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

G. Material - Price and Availability

(1) Modification Kit not required.

(2) This Service Bulletin will be done at no cost to the operator if the Electronic Engine Control is sent to one of the addresses listed in Paragraph 2, Accomplishment Instructions.

H. Tooling - Price and Availability

None.

I. Weight and Balance

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

(2) Momemt 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.

94VZ034

(2) Other References

V2500-ENG-75-0025 (Engine - HP/LP Active Clearance Control Ducts - To Provide a Front Duct Cover Assembly for Controlled Service Use).

Hamilton Standard Service Bulletin EEC150-1-73-29.

Hamilton Standard Service Bulletin EEC150-20-73-9.

Airbus Service Bulletin A320-73-1035.

V2500 Aircraft Maintenance Manual.

V2500 Engine Illustrted Parts Catalog (S-V2500-1IA).

V2500 Engine Manual (E-V2500-1IA).

L. Other Publications Affected

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

2. Accomplishment Instructions

A. The Source Demonstration requirements of this rework means that any facility not authorized to accomplish this rework either utilize the Authorised 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 Hedron Ave.
Glastonbury, CT 06033-2595 USA
ATTN: Director Technical Services

B. Authorized Rework Vendors for this bulletin are listed below.

Hamilton Support Systems
Customer Service Center
97 Newberry Road
East Windsor, CT 06088 USA

or

Pratt & Whitney Overhaul/Repair Center Europe (PWORCE)
Maastricht Airport
P.O. Box 269
6190 AG BEEK
The Netherlands

C. The designation by IAE of an authorized rework 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. Pre-Requisite Instructions

(1) On the aircraft panel 1125VU, put a warning notice to tell the persons not to start the engine.

(2) On the aircraft panel 50VU, make sure that the ON legend on the EDG FADEC GND PWR push button switch is OFF and install a warning notice.

(3) Open the Fan Cowls by the use of the approved procedure in Reference (5), Chapter/Section 71-13-00, (TASK 71-13-00-010-010).

E. Removal Instructions

(1) Remove the 2A2990, 2A2991, 2A2992 or 2A2993 Electronic Engine Control by the approved procedure given in Reference (5), Chapter/Section 73-22-34, Removal/Installation. Refer to Figure 1.

F. Rework Instructions

(1) Do a modification of the 2A2990, 2A2991, 2A2992 or 2A2993 Electronic Engine Control (See Reference (6), Chapter/Section 73-22-34, Fig/Item No.01-280) and reidentify by the procedures given in Reference (2) or (3), as applicable.

Procedure	Supplementary Information
(a) Send the Electronic Engine Control to the approved vendor to be modified. See paragraph 2.B.	See Figure 1.

(2) Remove the Active Clearance Control (ACC) Front Duct Cover Assembly. Refer to Reference (1) and Figure 2.

(a) Locate the Front ACC Duct.

(b) Remove the two 4W0102 Bolts from the Front Duct Cover Assembly.

(c) Remove the 2A3637 Front Duct Cover Assembly.

NOTE: When you incorporate this Service Bulletin with the new SCN12C software logic, the Front Duct Cover Assemble given in Reference (1) must be removed.

G. Installation Instructions

(1) Install the 2A3149, 2A3150, 2A3151, or 2A3153 Electronic Engine Control (1 off) by the approved procedure given in Reference (5), Chapter/Section 73-22-34, Removal/Installation. See Figure 1.

CAUTION: MAKE SURE THAT THE DATA RECORD ON THE DEP BACKSHELL AGREES WITH THE DATA RECORD ON THE ENGINE INDENTIFICATION PLATE.

(2) Install the Data Entry Plug (with the applicable wire combination). See Reference (5), Chapter/Section 73-22-35, Removal/Installation.

NOTE: Before you incorporte this Service Bulletin do a check of the Data Entry Plug configurations in use. Make sure you have one of the permitted Bump configurations given in this Service Bulletin.

NOTE: If you have a Bump configuration in use that is not one of the permitted Bump configurations given, you must change the wire configuration to one of the approved Bump configurations specified. Use the procedure specified in Reference (7), Chapter/Section 71-00-00 testing-11. You must change the engine records to include this modification.

When you change the wire configuration of the Data Entry Plug assembly you must do a check to make sure the new configuration is correct. Use the electrical tester specified. See Reference (7), Chapter/Section 71-00-00, Testing-11.

(a) Install a Data Entry Plug with the 00/04 Bump configuration for engine that will not use the Thrust Bump.

(b) Install the Data Entry Plug with the 07 Bump configuration for engines that will use the improved Consolidated Thrust Bump).

NOTE: When you either change or replace the Data Entry Plug Assembly to incorporate a Bump configuration you must install a new Engine Identification plate. Contact your IAE representative to get a new Engine Identification Plate.

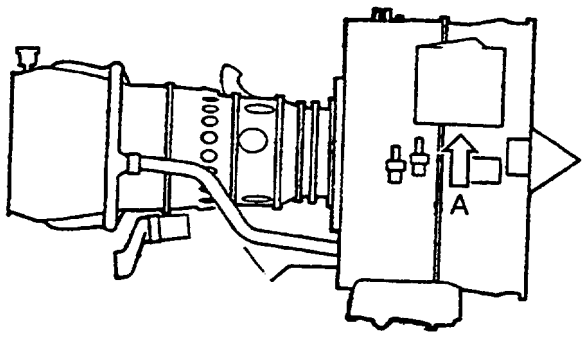
H. Post-Requisite Instructions

(1) Close the Fan Cowls by the use of the approved procedure in Reference (5), Chapter/Section 71-13-00 (TASK 71-13-00-410-010).

(2) Remove the warning notices.

I. Recording Instructions

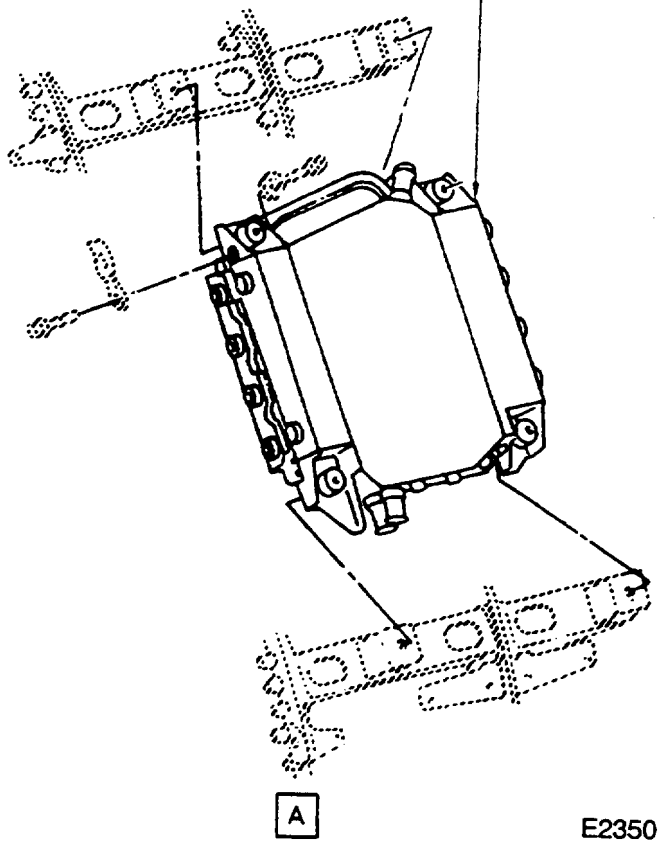
(1) A record of accomplishment is necessary.



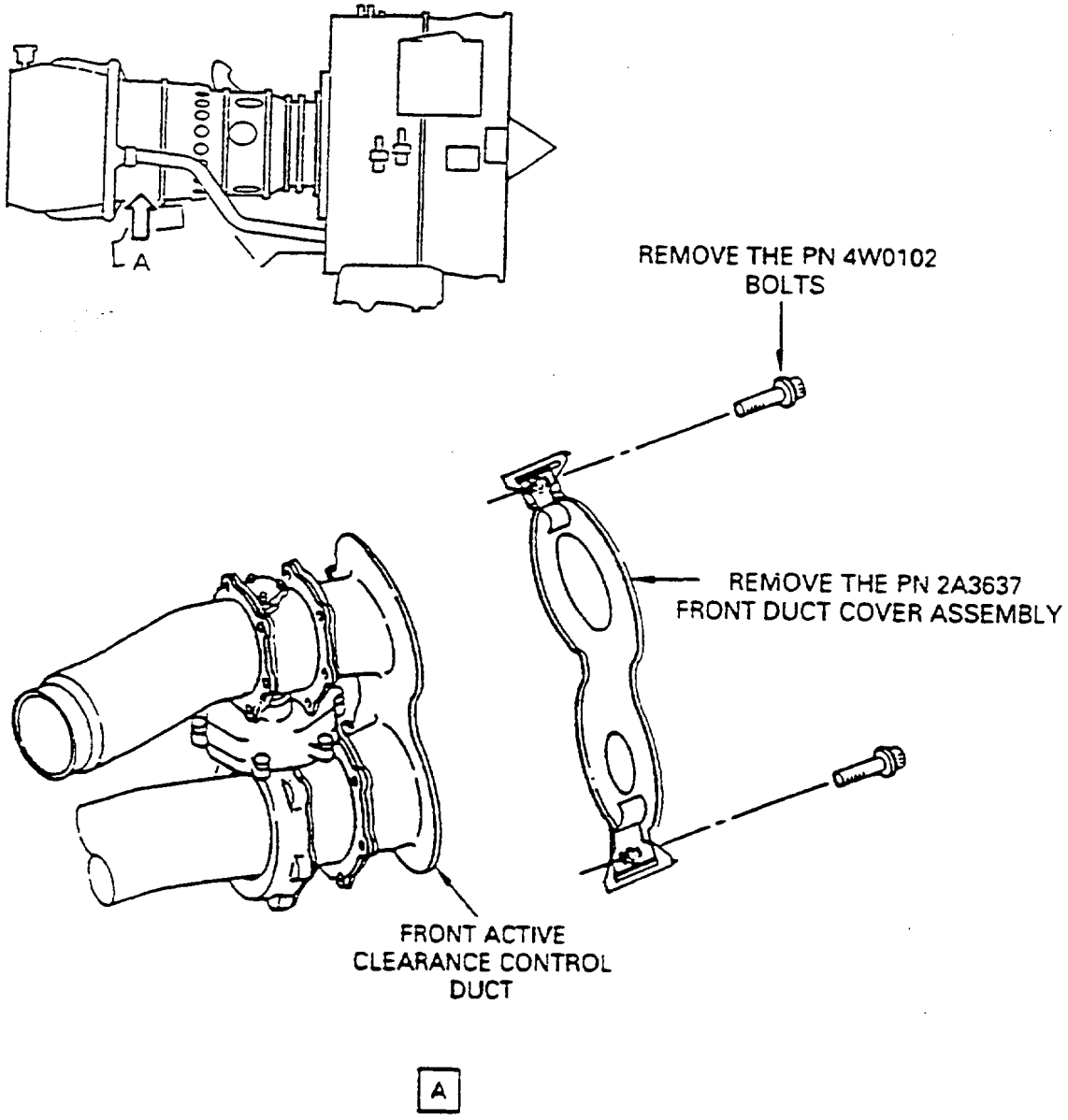
REMOVE THE APPLICABLE PART NUMBER* ELECTRONIC ENGINE CONTROL, DO A MODIFICATION, IDENTIFY AND INSTALL THE APPLICABLE PART NUMBER*
(1 off)

*ELECTRONIC ENGINE CONTROL PART NUMBERS

REMOVE	INSTALL
2A3105	2A3148
2A2993	2A3153
2A2990	2A3149
2A2991	2A3150
2A2992	2A3151



Location of Electronic Engine Control (EEC)
Fig.1



Location of ACC Front Duct Cover Assembly
Fig.2

3. Material Information

A. Kits associated with this Bulletin:

None.

B. Parts affected by this Bulletin:

New Part No. (ATA No.)	Qty	Est'd Unit Price ($)	Keyword	Old Part No. (IPC No.)	Instructions/ Disposition
Applicability: For each V2500 Engine that incorporates V2500-ENG-73-0007, V2500-ENG-73-0015, V2500-ENG-73-0024, V2500-ENG-70-0056, V2500-ENG-73-0027, V2500-ENG-73-0032, V2500-ENG-73-0037, V2500-ENG-73-0044 and V2500-ENG-70-0336 to incorporate this Service Bulletin.					
2A3148 (73-22-34)	1		Control, Electronic Engine	2A3105 (01-280)	(1D) (A) (B)
Applicability: For each V2500 Engine that incorporates V2500-ENG-73-0007, V2500-ENG-73-0015, V2500-ENG-73-0024, V2500-ENG-70-0056, V2500-ENG-73-0027, V2500-ENG-73-0032, V2500-ENG-73-0037 and V2500-ENG-73-0044 but not incorporating V2500-ENG-70-0336 to incorporate this Service Bulletin.					
2A3153 (73-22-34)	1		Control, Electronic Engine	2A2993 (01-280)	(1D) (A) (C)
Applicability: For each V2500 Engine that incorporates V2500-ENG-73-0007, V2500-ENG-73-0015, V2500-ENG-73-0027, V2500-ENG-70-0032, V2500-ENG-73-0037, and V2500-ENG-73-0044, but not incorporating V2500-ENG-73-0024, V2500-ENG-70-0056 and V2500-ENG-70-0336, to incorporate this Service Bulletin.					
2A3149 (73-22-34)	1		Control, Electronic Engine	2A2990 (01-280)	(1D) (A) (E)
Applicability: For each V2500 Engine that incorporates V2500-ENG-73-0007, V2500-ENG-73-0015, V2500-ENG-73-0024, V2500-ENG-73-0027, V2500-ENG-73-0032, V2500-ENG-73-0037 and V2500-ENG-73-0044, but not incorporating V2500-ENG-70-0056 and V2500-ENG-70-0336, to incorporate this Service Bulletin.					
2A3150 (73-22-34)	1		Control, Electronic Engine	2A2991 (01-280)	(1D) (A) (F)
Applicability: For each V2500 Engine that incorporates V2500-ENG-73-0007, V2500-ENG-73-0015, V2500-ENG-70-0056, V2500-ENG-73-0027, V2500-ENG-73-0032, V2500-ENG-73-0037 and V2500-ENG-73-0044, but not incorporating V2500-ENG-73-0024 and V2500-ENG-70-0336, to incorporate this Service Bulletin.					

2A3151 (73-22-34)	1	Control, Electronic Engine	2A2992 (01-280)	(1D) (A) (G)

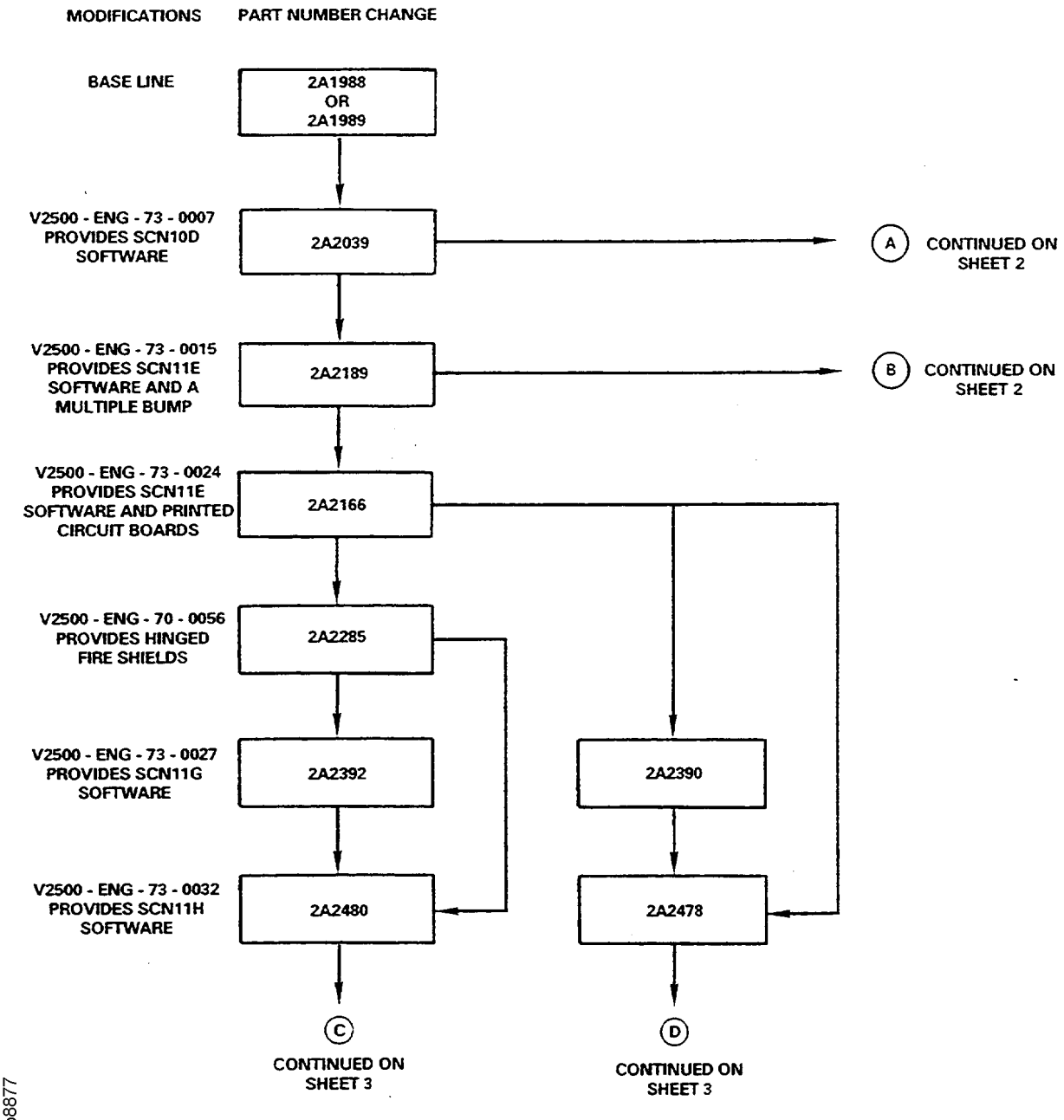
C. Instruction/Disposition Code Statements:

(1D) The New part can be obtained through modification by the approved procedure in Reference (2). Purchase the New parts from or return the Old parts for modification to the approved vendor given in the Accomplishment Instructions.

Notes (C), (E), and (G) give the new Hamilton Standard part numbers.

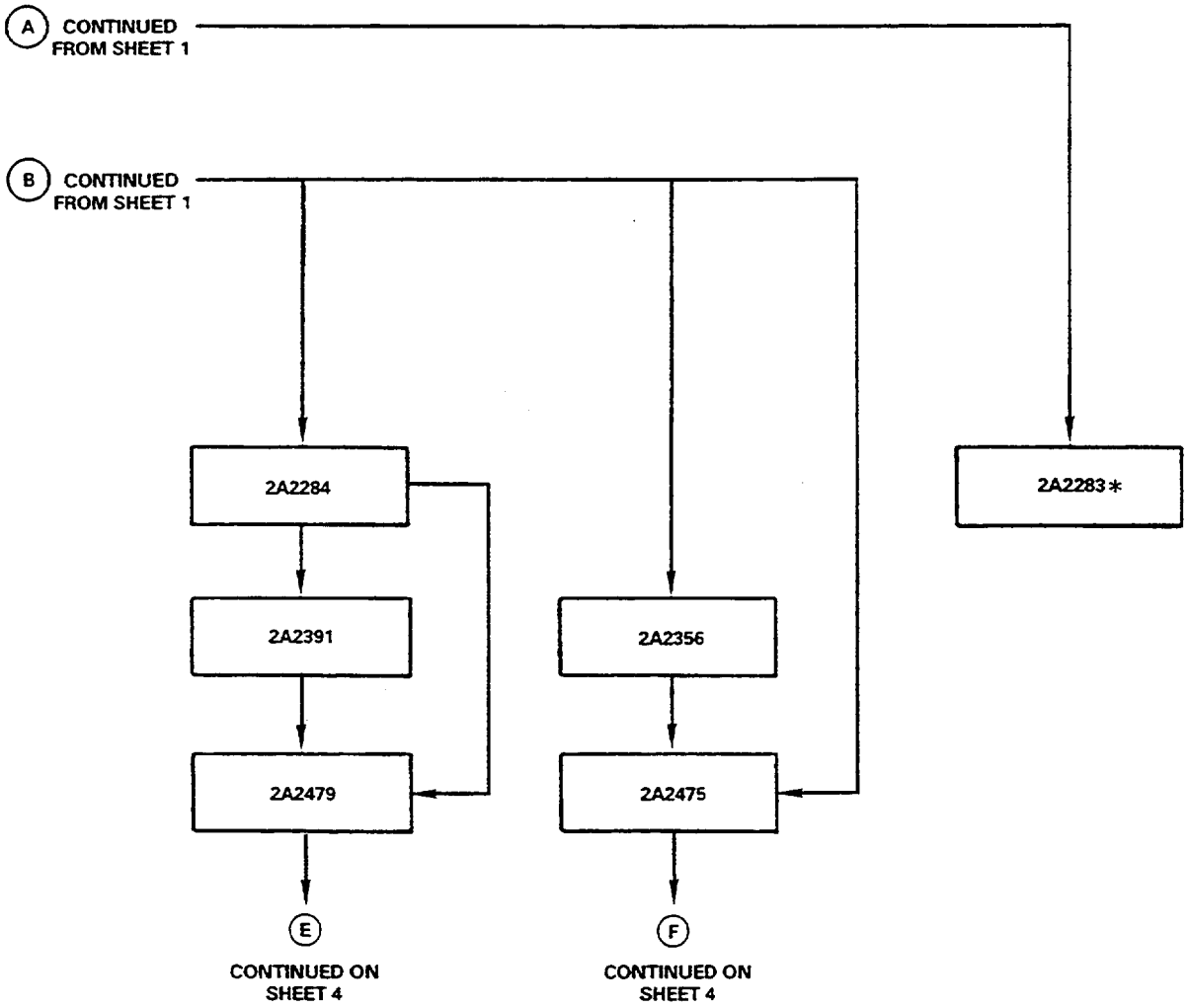
(A) New part is currently available.
(B) HSD P/L 808050-04-046
(C) HSD P/L 798300-18-046
(E) HSD P/L 798300-15-046
(F) HSD P/L 798300-16-046
(G) HSD P/L 798300-17-046

NOTE: The estimated 1995 unit prices shown are provided for planning purposes and do not constitute firm quotation. Consult the IAE Price Catalog or contact IAE's Spare Parts Sales Department for information concerning firm prices.



de000b8877

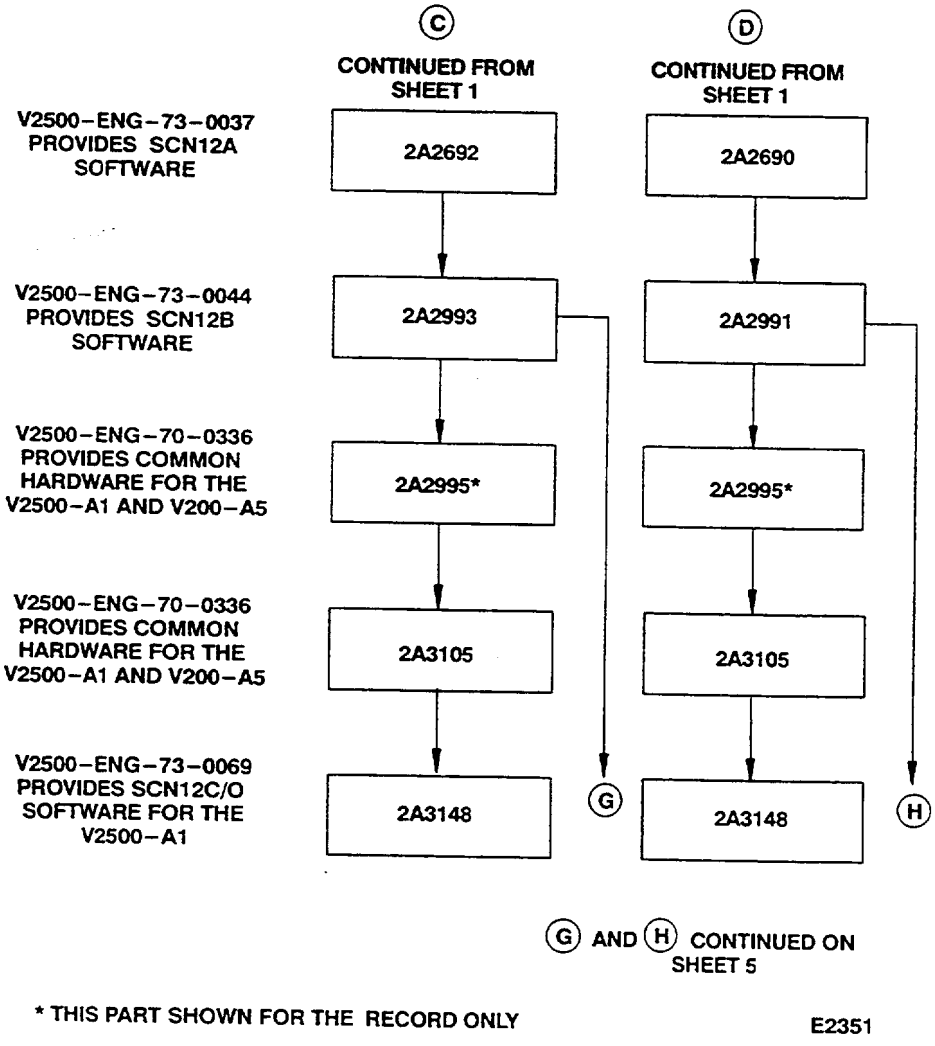
Family Tree - Electronic Engine Control (EEC) Catalog Sequence No. 73-22-34, Fig 01, Item 280
Fig.3 (Sheet 1)



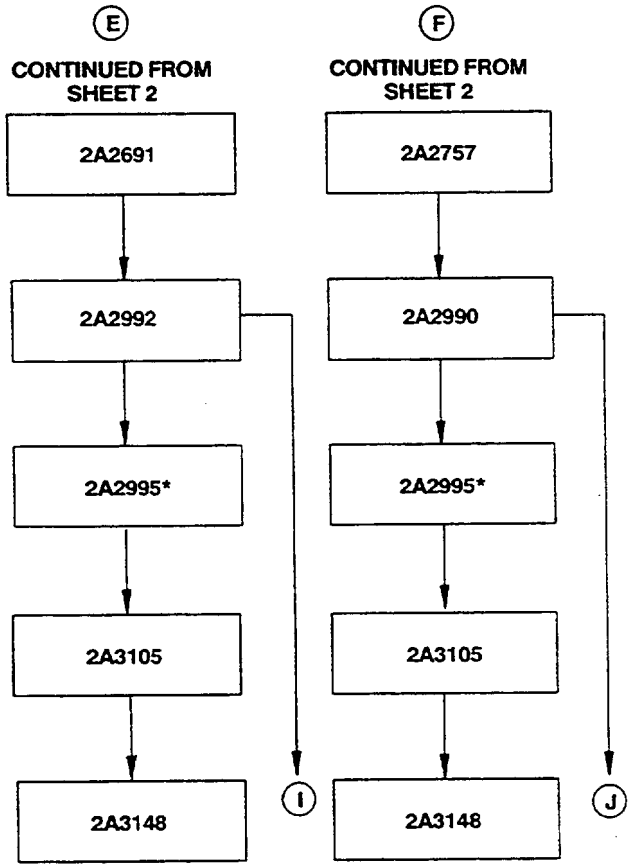
*THERE IS NO PROCEDURE TO
ADVANCE THIS CONFIGURATION

de000b8878

- Family Tree Electronic Engine Control (EEC) Catalog Sequence No. 73-22-34, Fig 01, Item 280
Fig.3 (Sheet 2)

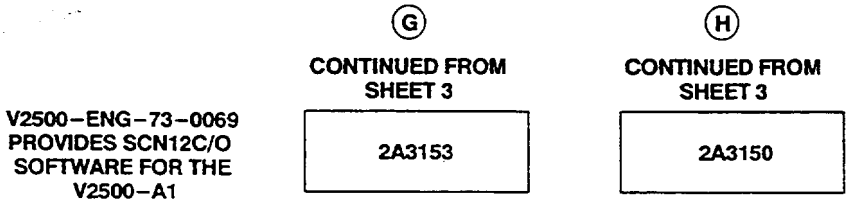


- Family Tree Electronic Engine Control (EEC) Catalog Sequence No. 73-22-34, Fig 01, Item 280
Fig.3 (Sheet 3)

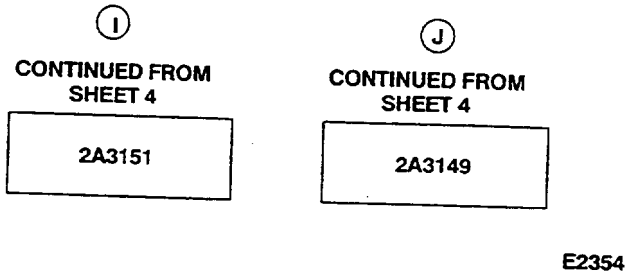


* THIS PART SHOWN FOR THE RECORD ONLY

- Family Tree Electronic Engine Control (EEC) Catalog Sequence No. 73-22-34, Fig 01, Item 280
Fig.3 (Sheet 4)



- Family Tree Electronic Engine Control (EEC) Catalog Sequence No. 73-22-34, Fig 01, Item 280
Fig.3 (Sheet 5)



- Family Tree Electronic Engine Control (EEC) Catalog Sequence No. 73-22-34, Fig 01, Item 280
Fig.3 (Sheet 6)

Printed in Great Britain

UNITED TECHNOLOGIES HAMILTON STANDARD

SERVICE BULLETIN

Engine Fuel and Control – EEC150–1 Electronic Engine Control – Incorporation of New Software Configuration

1. Planning Information

A. Effectivity

Hamilton Standard EEC150–1 Electronic Engine Controls

798300–8–XXX
798300–10–XXX
798300–12–XXX
798300–14–XXX

NOTE: The EEC150–1 is used on Airbus A320 aircraft that use the IAE V2500–A1 engine. XXX – Identifies all available software configurations.

B. Reason

The purpose of this Service Bulletin is to allow the V2500–A1 operators install SCN12C software and modify the upper shock mounts on EEC150–1 Electronic Engine Controls.

(1) Problem.

(a) OFF IDLE EGT SPIKING: Short duration EGT spikes which can result in EGT Redline exceedance indications in the cockpit have been observed during initial accels off–idle.

(b) STATOR VANE TRACK CHECKS: Stator vane track check faults have been experienced during accels on the A1 engine in Revenue Service. The transient tolerance is too tight for stator vane system operation during these maneuvers. No engine operability effects have been encountered during these maneuvers.

(c) BIASING OF EGT FOR COCKPIT DISPLAY: Lack of EGT margin is resulting in increased number of redline exceedance events for A1 revenue service engines, particularly under hot day conditions.

(d) ALTERNATOR CIRCUIT NUISANCE FAULT: Annunciations of "ALTERNATOR CIRCUIT FAILED" on ECAM have been seen during in–flight shutdowns on N2 synthesis. This fault is non–dispatchable.

(e) WEIGHT–ON–WHEELS (WOW) VALIDATION/ACCOMMODATION LOGIC: Thrust reverser operation is not inhibited if both WOW discretes are failed closed and the aircraft is in the air.

(f) THRUST REVERSER CHANGES:

1 A/C PERMISSION SWITCH TEST: The Thrust Reverser A/C permission switch verification test is not performed in both channels on each flight.

2 REVERSER STOW & LOCK (S&L) AND ARMING VALVE CROSS CHECK FAULTS: Dispatch for 10 days is currently allowed with S&L and Arming Valve cross check faults. Thrust Reverser system status indication is degraded for subsequent Thrust Reverser system failures in this configuration.

3 REVERSER PRESSURIZED ECAM WARNING: Cross check failures of the Thrust Reverser S&L sensor to the EEC can inhibit the setting of the "REVERSER PRESSURIZED" ECAM warning.

(g) FLEX TEMPERATURE MODE CHANGES:

1 FLEX TEMPERATURE MODE SELECTION: Flex Temperature Mode engagement requires that the Flex Temperature input from the pilot be greater than the ambient temperature. Variations in the absolute and transient characteristics of the EEC selected T2, relative to the Flex Temperature input by the pilot as the A/C proceeds down the runway during takeoff, can result in unintended changes in the engagement of Flex T/O. This is most likely to occur for minor derated T/O's where the Flex Temperature is set purposely close to the actual ambient temperature obtained from the tower by the pilot.

2 FLEX TEMPERATURE ARINC LABEL 214: The value of Flex Temperature received by the EEC from the Flight Management computer is echoed back to the A/C on ARINC Label 214. The Flight Management Computer, however, sets its Flex Temperature SSM to No Computed Data (NCD) above 1500 feet, even if the EEC is still operating in Flex T/O Mode. This results in the loss of Flex Temperature indication in the cockpit during T/O.

(h) HEAT MANAGEMENT CHANGES:

1 AIR COOLED OIL COOLER (ACOC) SPRING VALVE NUISANCE FAULT: The air valve spring failed detection logic has been inappropriately flagging the spring failed.

2 HEAT MANAGEMENT FLIP MODE FAULT RECORDING: The nuisance Flip Mode fault, "HMS–IDG OVTMP W/RECIRC/@" can be set after engine shutdown. This fault is recorded in EEROM and is a Class II fault which is intended to indicate a heat management system malfunction.

3 FUEL AND ENGINE OIL T/C FAILSAFE CLOSES AIR VALVE: The following discussion applies to both the engine oil and fuel thermocouples. If the fuel thermocouple is failed in both channels, the failsafe value for the input causes the logic to think the fuel is too cold. The logic responds by closing the air valve.

(i) WING ANTI–ICE (WAI) MINIMUM PB SCHEDULES: A/C ground handling characteristics with WAI selected has been criticized due to the resulting raised engine idle.

(j) MAINTENANCE LOGIC IMPROVEMENTS:

1 CLEAR LANGUAGE MESSAGE (CLM) CORRELATION TO ECAM WARNINGS: Determination of the required maintenance actions for faults identified in the Post Flight Report (PFR) can be less than straight forward.

2 A/C DATA & EEC P/N MENU REVISION: The Data Entry Plug (DEP) configuration is not presently available to the maintainer through Menu Mode.

3 INTERNAL FAULT FLAG: Bit 18 in the first status word of a Clear Language Message (CLM) is currently not always set properly. This bit is used by the CFDS to determine the source of the detected fault. When the bit is erroneously set to zero, identification of the correct source may not be possible, thus complicating the troubleshooting process.

4 "ENG 1(2) REVERSER UNLOCKED" MESSAGE IN MENU MODE: Spurious setting of the "ENG 1(2) REVERSER UNLOCKED" ECAM warning have been experienced during operation of the Thrust Reverser Menu Mode test with the latest Flight Warning Computer (FWC) Standard D1E.

(k) OVERSPEED NUISANCE FAULTS

1 Overspeed nuisance faults have been experienced in the field on A1 engines.

2 Presently the EEC will record a nuisance FMU overspeed system fault after a real overspeed system activation event.

(l) START ABORT DUE TO LOSS OF AIRCRAFT 28 VDC: Temporary failures of the aircraft 28 VDC input have resulted in autostarts being aborted in revenue service without an accompanying ECAM message.

(m) DISPATCH LOGIC: A number of faults which are approved at the engine level for Long Term Dispatch are currently conservatively treated as Short Term Dispatch items.

(n) AUTOSTART LOCKED ROTOR DETECTION: Starts have occurred in production where the low rotor initially began to rotate but later bound–up prior to attaining idle. The software did not detect the locked rotor. The intent of the autostart locked low rotor abort logic is to prevent engine starting to idle with the low rotor not turning.

(o) MIN LIMITS FOR DADC TAT AND ALT INPUTS: The current minimum limits for both DADC T2 (–60) and Altitude (–1000 FT) do not cover the full range originally specified in the engine specification.

(p) MEMORY SAVING ITEMS: There is very little memory and timing margin left in the A1 software when it is loaded into the EEC150–1 control.

(q) OVERSPEED EVENT RECORDING: None.

(r) AUTO–START ENHANCEMENT FOR BOWED ROTOR: Field experience with the A1 engine has identified the potential for engine clearance degradation between rotating and static parts following engine restart of a previously shut–down hot engine.

(s) EEC FLUID DRAINAGE: The EEC150–1 upper shock mounts have the potential of retaining 3.5 to 11.5 cubic centimeters (cc) of fluid.

(2) Cause.

(a) OFF IDLE EGT SPIKING: EGT spikes are caused by initial fuel addition to accelerate the engine off–idle, where the LPT initially extracts little to no work, this results in a momentary high gas temperature spike passing the EGT sensors. This is not harmful to engine hardware based on service experience.

(b) STATOR VANE TRACK CHECKS: The overall stator vane system transient response capability was not taken into account in the present design; only the stator vane actuator characteristics were considered when the logic was designed.

(c) BIASING OF EGT FOR COCKPIT DISPLAY: Greater than expected deterioration rates in conjunction with EGT limits which are currently set below the maximum certified levels.

(d) ALTERNATOR CIRCUIT NUISANCE FAULT: The fault logic associated with the alternator circuit is enabled using N2 synthesis which is intentionally biased for starting and thus is inaccurate during engine windmilling. This results in the logic determining that the high rotor is turning fast enough for the alternator to meet its minimum output requirement, when it is not.

(e) WEIGHT–ON–WHEELS (WOW) VALIDATION/ACCOMMODATION LOGIC: If both WOW discretes indicate ground, no verification is done with Mn.

(f) THRUST REVERSER CHANGES:

1 A/C PERMISSION SWITCH TEST: The verification that the switch is not stuck closed is incorporated as part of the normal Thrust Reverser command logic. This results in the verification of the switch integrity at the end of the flight during normal reverser operation and only in the channel "In Control."

2 REVERSER STOW & LOCK (S&L) AND ARMING VALVE CROSS CHECK FAULTS: S&L and Arming Valve cross check faults currently set only Class II faults.

3 REVERSER PRESSURIZED ECAM WARNING: The EEC failsafes the ARINC output of the S&L sensor to "UNLOCKED" if the S&L feedback differs between channels. However, the logic in the Flight Warning Computer (FWC) requires the S&L feedback to indicate "LOCKED" before providing a "REVERSER PRESSURIZED" indication on ECAM.

(g) FLEX TEMPERATURE MODE CHANGES:

1 FLEX TEMPERATURE MODE SELECTION: The selection of Flex T/O Mode is currently not frozen until Mn is greater than 0.15.

2 FLEX TEMPERATURE ARINC LABEL 214: The EEC echoes back the Flex Temperature it receives from the A/C with the as–received SSM.

(h) HEAT MANAGEMENT CHANGES:

1 AIR COOLED OIL COOLER (ACOC) SPRING VALVE NUISANCE FAULT: The current design does not properly distinguish between normal and failed operation effectively.

2 HEAT MANAGEMENT FLIP MODE FAULT RECORDING: On engine shutdown during soakback, it may be possible for the IDG oil temperature to rise over and stay above the maintenance limit long enough to set the fault flag. At shutdown, there is no fuel flow to use as a cooling medium for the IDG oil.

3 FUEL AND ENGINE OIL T/C FAILSAFE CLOSES AIR VALVE: The current heat management design does not completely accommodate failures of the fuel and engine oil thermocouples.

(i) WING ANTI–ICE (WAI) MINIMUM PB SCHEDULES: Pilot selection of WAI causes the EEC to raise the minimum PB schedule to meet the increased bleed requirements.

(j) MAINTENANCE LOGIC IMPROVEMENTS:

1 CLEAR LANGUAGE MESSAGE (CLM) CORRELATION TO ECAM WARNINGS: Troubleshooting faults is complicated by the lack of correlation between ECAM warnings and CLM's transmitted from the EEC as summarized in the PFR.

2 A/C DATA & EEC P/N MENU REVISION: New requirement.

3 INTERNAL FAULT FLAG: Some internal fault flags were incorrectly specified and some were handled incorrectly in the software.

4 "ENG 1(2) REVERSER UNLOCKED" MESSAGE IN MENU MODE: FWC Standard D1E no longer inhibits the setting of this ECAM warning in Phase 1 & 10 when the TRA is not in the reverser area. Since the EEC does not presently transmit TRA to the A/C during Menu Mode operation, execution of the T/R Menu Mode test can now set this warning.

(k) OVERSPEED NUISANCE FAULTS

1 The specific cause of the test failures has not been determined.

2 Current EEC logic does not recognize that the overspeed valve in the FMU is hydraulically latched in the overspeed position following system activation. Once the engine spools down in response to the resulting fuel flow reduction, the EEC stops commanding the overspeed valve. Since the valve does not return to the normal position, as commanded by the EEC, the EEC sets the nuisance FMU overspeed system fault.

(l) START ABORT DUE TO LOSS OF AIRCRAFT 28 VDC: The current design does not adequately address temporary losses of aircraft 28 VDC.

(m) DISPATCH LOGIC: Revenue Service experience was desired before downgrading these faults from Short Term to Long Term Dispatch.

(n) AUTOSTART LOCKED ROTOR DETECTION: The present logic design only considered the case where the low rotor never turns at all from the beginning of the autostart sequence. The possibility of binding–up later in the start sequence was not anticipated.

(o) MIN LIMITS FOR DADC TAT AND ALT INPUTS: The software was designed to the ICD requirements but the ICD was not in compliance with the original requirements in the engine specification.

(p) MEMORY SAVING ITEMS: The software requirements for the A1 engine have caught up with the memory and processing capability of the original design of the EEC150–1.

(q) OVERSPEED EVENT RECORDING: New requirement.

(r) AUTO–START ENHANCEMENT FOR BOWED ROTOR: Thermal differentials developing after shut–down of a hot engine can produce significant "bowing" of the rotor spool which, coupled with resulting amplification of the natural spool whirl on the subsequent engine start, can result in contact which leads to clearance degradation and a corresponding loss in engine performance.

(s) EEC FLUID DRAINAGE: During the nacelle drainage certification testing on the A321/V2500–A5, the EEC150–20 upper shock mounts retained fluid in excess of the 3 cc maximum allowed. The cause of the fluid retention is a result of the position the EEC is mounted on the fan case. Since the EEC150–1 has a similar housing design, retention of fluid will also occur.

(3) Solution.

(a) OFF IDLE EGT SPIKING: New logic has been implemented to override the Engine 7A Bleed closed during on ground operations to provide additional EGT Redline margin.

(b) STATOR VANE TRACK CHECKS: Modify the track check rate limit in the accel direction to be a function of N2 and Altitude so that the overall system transient operation will be accounted for within appropriate engine operability constraints.

(c) BIASING OF EGT FOR COCKPIT DISPLAY: Increase EGT redline limits for max takeoff and max continuous ratings to reflect the max certified levels. Bias the ARINC EGT transmitted to the cockpit to maintain the A320 cockpit display limits at 635°C and 610°C for takeoff and max continuous ratings, respectively. Eliminate the additional DEP selectable EGT biasing provision.

(d) ALTERNATOR CIRCUIT NUISANCE FAULT: Modify the logic to enable the fault detection on the alternator circuit only when the required sensor input signals are available so that nuisance faults will not be inappropriately set.

(e) WEIGHT–ON–WHEELS (WOW) VALIDATION/ACCOMMODATION LOGIC: If both WOW discretes indicate ground, do a comparison with Mn. If Mn is greater than 0.5, inhibit reverser operation and record a maintenance fault.

(f) THRUST REVERSER CHANGES:

1 A/C PERMISSION SWITCH TEST: Modify the logic to incorporate the A/C permission switch test into the existing engine spool–up test so that the verification is performed on each flight in both channels of the control.

2 REVERSER STOW & LOCK (S&L) AND ARMING VALVE CROSS CHECK FAULTS: Upgrade cross check faults of the S&L or Arming Valve from Class II to Class I by modifying the logic to set the Class I (NO DISPATCH) "REVERSER SYSTEM FAULT" (270/19) for cross check faults of the S&L or Arming Valve.

3 REVERSER PRESSURIZED ECAM WARNING: Modify the logic to output on ARINC the local S&L feedback, instead of the failsafe value, to prevent inhibiting of the "REVERSER PRESSURIZED" ECAM warning in the presence of S&L cross check faults.

(g) FLEX TEMPERATURE MODE CHANGES:

1 FLEX TEMPERATURE MODE SELECTION: Modify the logic to freeze the Flex T/O Mode selection when TLA is greater than Max Climb (MCL).

2 FLEX TEMPERATURE ARINC LABEL 214: Modify the logic to output on Label 214 the Flex Temperature used and frozen in the power management and not the one received from the A/C.

(h) HEAT MANAGEMENT CHANGES:

1 AIR COOLED OIL COOLER (ACOC) SPRING VALVE NUISANCE FAULT: Remove the air valve spring failed detection logic. The logic has been a source of nuisance faults without providing much benefit and is redundant to the test of the ACOC valve done during engine spoolup.

2 HEAT MANAGEMENT FLIP MODE FAULT RECORDING: Modify the logic such that the Flip Mode nuisance fault will not set after the engine is shutdown.

3 FUEL AND ENGINE OIL T/C FAILSAFE CLOSES AIR VALVE: Modify the design to failsafe the fuel temperature to the proper failsafe value so that the fuel will not be inappropriately declared too cold and the air valve inappropriately closed.

(i) WING ANTI–ICE (WAI) MINIMUM PB SCHEDULES: WAI selection on ground causes the A/C Bleed Zone Controller to command the WAI valve open for 30 seconds to verify operation of the valve. Therefore, the logic in the EEC is modified to invoke the higher PB schedule for only 40 seconds following WAI selection on the ground.

(j) MAINTENANCE LOGIC IMPROVEMENTS:

1 CLEAR LANGUAGE MESSAGE (CLM) CORRELATION TO ECAM WARNINGS: The following CLM's have been added to cover ECAM warnings which are listed in the PFR and currently do not have associated CLM's transmitted from the EEC: (1) "78–31–42 HC/PROX SW/T/R UP ACT@" for "REVERSER UNLOCKED IN FLIGHT", (2) "78–31–51 HCU/T/R UP ACT/PROX SW@" for "REVERSER PRESSURIZED" and (3) "74–00–00 IGN@/115VAC/EEC@" for ENG 1(2) Ignition A (B).

2 A/C DATA & EEC P/N MENU REVISION: The DEP configuration, as it is marked on the plug itself, has been added to the existing A/C Data & EEC P/N menu screen to aid in maintenance.

3 INTERNAL FAULT FLAG: Update the internal fault flag list and modify the logic to provide the correct LRU identification at the A/C level.

4 "ENG 1(2) REVERSER UNLOCKED" MESSAGE IN MENU MODE: Modify the logic so that the EEC will transmit the TRA position to the A/C during the T/R Menu Mode test to prevent spurious setting of the "ENG 1(2) REVERSER UNLOCKED" ECAM warning.

(k) OVERSPEED NUISANCE FAULTS

1 Continuing review of the overspeed test criteria has identified the following changes aimed at addressing the field events: (1) Modify the logic to eliminate the potential for single pass failures setting an overspeed fault; (2) delete the overspeed test done on engine spool–up as it is redundant to the test done on engine spool–down and (3) record additional fault information associated with a detected overspeed fault to aid in identifying the specific test that is setting the overspeed fault.

2 Modify the EEC logic to account for the hydraulic latching of the overspeed valve following a real overspeed event to avoid the setting of the nuisance FMU overspeed system fault.

(l) START ABORT DUE TO LOSS OF AIRCRAFT 28 VDC: Change the logic so that a temporary loss of aircraft 28 VDC will not permanently inhibit the starting logic.

(m) DISPATCH LOGIC: Modify the logic to downgrade the following faults to Long Term Dispatch: (1) Cross check faults between channels for the following signals . . . Pb, P5, Pamb, P2; Starter Air Valve & Fuel On/Off discrete feedbacks and Air Cooled Oil Cooler and Spill Valve LVDT feedbacks; (2) wraparound faults for Tenth Stage Makeup solenoid and Pb Heater relay discrete outputs and Air Cooled Oil Cooler and Spill Valve torque motor outputs; and (3) track checks on the Air Cooled Oil Cooler and Spill Valve torque motor loops. Additionally, the "Class III Menu Mode Report" has been renamed the "Scheduled Maintenance Report," the number of fault cells allocated to this fault class was increased from 9 to 12 and the fault recording design was modified to record the last occurrence of a fault, rather than the first occurrence, to aid in the confirmation of the performed maintenance actions.

(n) AUTOSTART LOCKED ROTOR DETECTION: Change the autostart locked low rotor logic to abort any start where the low rotor does not rotate, or stops rotating during the start sequence prior to attaining idle.

(o) MIN LIMITS FOR DADC TAT AND ALT INPUTS: Modify the input processing logic to account for the originally intended required input range for T2 (–80C) and Altitude (–2000 FT).

(p) MEMORY SAVING ITEMS: In order to make room for the A1 SCN 12C requirements to be implemented in the EEC150–1, the following memory and timing savings actions were executed: (1) Delete the trim range check done in the application software as it is redundant to that done in the Super Monitor used to download experimental trims, (2) eliminate unused provisions for T2 and hot engine biasing of the Wf/Pb start schedules, (3) eliminate unused provisions for biasing of the Stator Valve scheduling for accel, decel, or reverse operation, (4) consolidate the #4–7th and 10th stage bleed logic since they are scheduled identically, (5) simplify the powersetting logic where excess capability is no longer needed, (6) convert the min Pb schedules to polynomials from tables for ECS and WAI requirements and (7) delete the processing of Flight Number from the A/C.

(q) OVERSPEED EVENT RECORDING: Provide a CLM, "71–00–00 PROPULSION SYSTEM@", and add the capability to record appropriate parametric data in EEROM at the time of an overspeed event to aid in the troubleshooting of such an event.

(r) AUTO–START ENHANCEMENT FOR BOWED ROTOR: Modify the logic to provide an additional 30 seconds of dry motoring of the engine on the starter before initiating fuel pressurization for all Auto–Starts on the ground. This additional motoring will reduce thermals on the rotor spool and provide priming of the Number 3 bearing which is designed to control rotor spool whirl, thus minimizing the potential for rotor rub.

(s) EEC FLUID DRAINAGE: Drill 0.125 inch (3.175 mm) holes in each side of the upper shock mount supports to allow proper drainage of fluids.

C. Description

The EEC150–1 flameshields are removed. The two vibration isolators on the handle side of the housing are removed. Two drainage holes are drilled in each of the two isolator supports on the handle side. The EEC150–1 is then disassembled to remove the processor/input module from channel A and B. Both processor/input modules are reprogrammed. The EEC150–1 is then reassembled and tested. The EEC150–1 is then re–identified with the new part number.

D. Compliance

Category 4 – Accomplish on a planned basis when an installed EEC150–1 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 given in Paragraphs 2 and 3 of this service bulletin obey the applicable Federal Aviation Regulations and are FAA–approved for the EEC150–1 Electronic Engine Control.

F. Manpower

Approximately 4 man–hours are necessary to do these Service Bulletin procedures when you do component maintenance (or overhaul). This estimate does not include any time necessary to do functional tests.

G. Material – Cost and Availability

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

(a) United Technologies Corporation
Hamilton Standard Division
Attention: Hamilton Support Systems
Electronics Service Center
97 Newberrry Road
East Windsor, CT 06088
U.S.A.

(b) Pratt & Whitney
Overhaul and Repair Center – Europe (PWORCE)
Maastricht Airport
P.O. 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 EEC150–1–73–29 and the IAE Service Bulletin Number V2500–ENG–73–0069.

(3) The new parts required to accomplish this Service Bulletin are listed in Section 3, 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 the HS Service Bulletin Number EEC150–1–73–29, IAE Service Bulletin Number IAE Service Bulletin Number V2500–ENG–73–0069, and be addressed to:

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

Facsimile: 803–325–2849

H. Tooling

None

I. Weight and Balance

None

J. Electrical Load Data

Not Affected

K. References

E9137 Standard Electronic Practices Manual
Components Maintenance Manual CMM 73–22–34
IAE Service Bulletin Number V2500–ENG–73–0069
Hamilton Standard Service Bulletin EEC150–20–73–9

L. Other Publications Affected

Illustrated Parts Catalog 73–22–34

2. 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 EEC150–1.

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

A. Remove the flame shields as necessary to get access to the two vibration isolators adjacent to the EEC housing handle. To remove the flame shields, refer to DISASSEMBLY in CMM 73–22–34.

B. Remove the two vibration isolators adjacent to the handle on the EEC housing. To remove the vibration isolators, refer to DISASSEMBLY in CMM 73–22–34.

C. Refer to Figure 1 to establish X and Y planes.

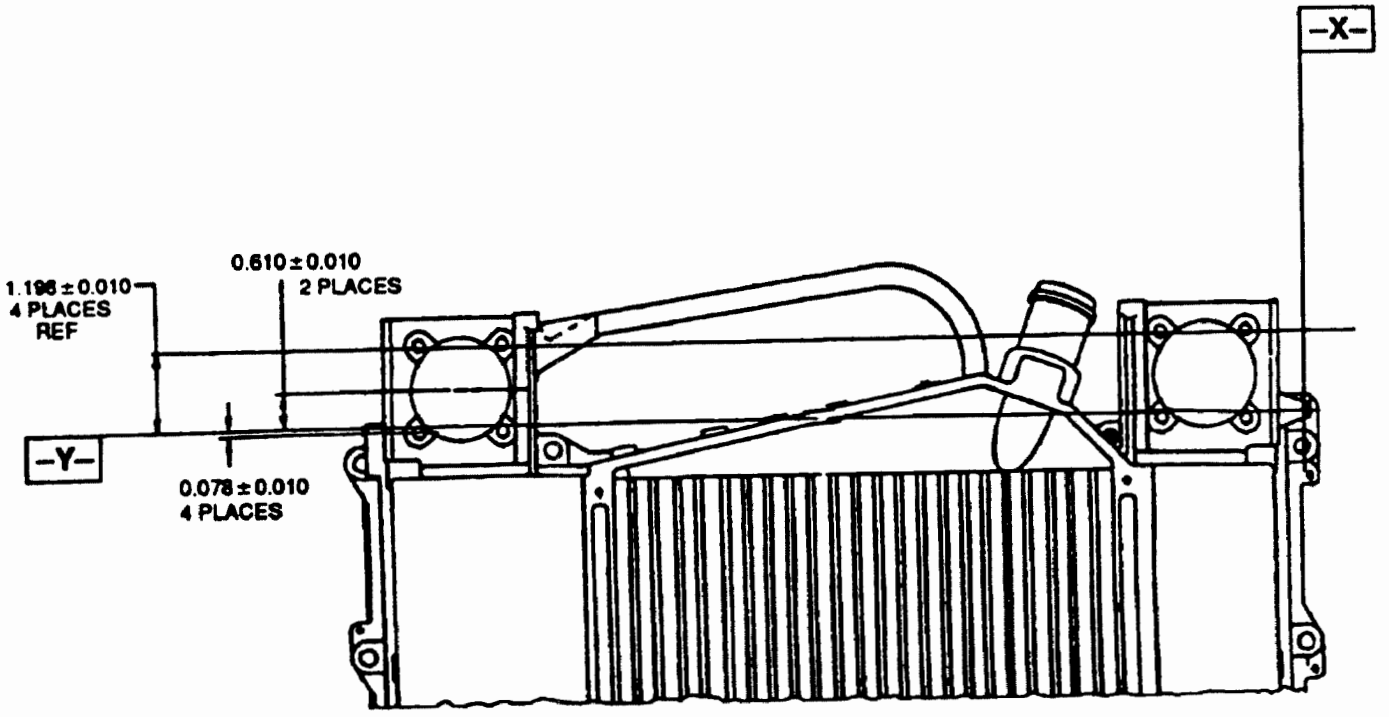


FIGURE 1 LOCATION OF X AND Y PLANES

D. Drill two 0.125 ± 0.004 inch holes in the housing at the locations shown in Figure 2.

NOTE: Use a drill bit long enough to drill both holes at once.

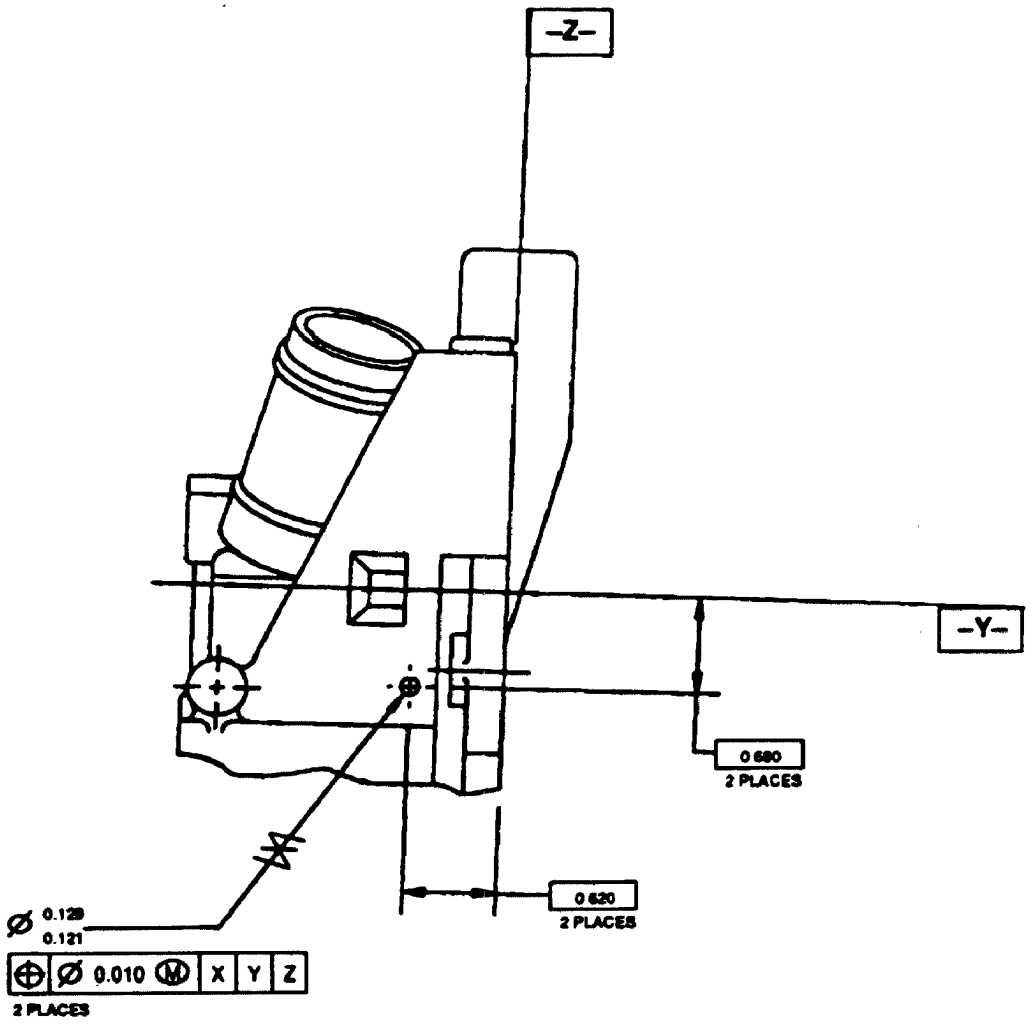


FIGURE 2 LOCATION OF DRILL HOLES

E. Drill two 0.125 ± 0.004 inch holes in the housing at the locations shown in Figure 3.

NOTE: Use a drill bit long enough to drill both holes at once.

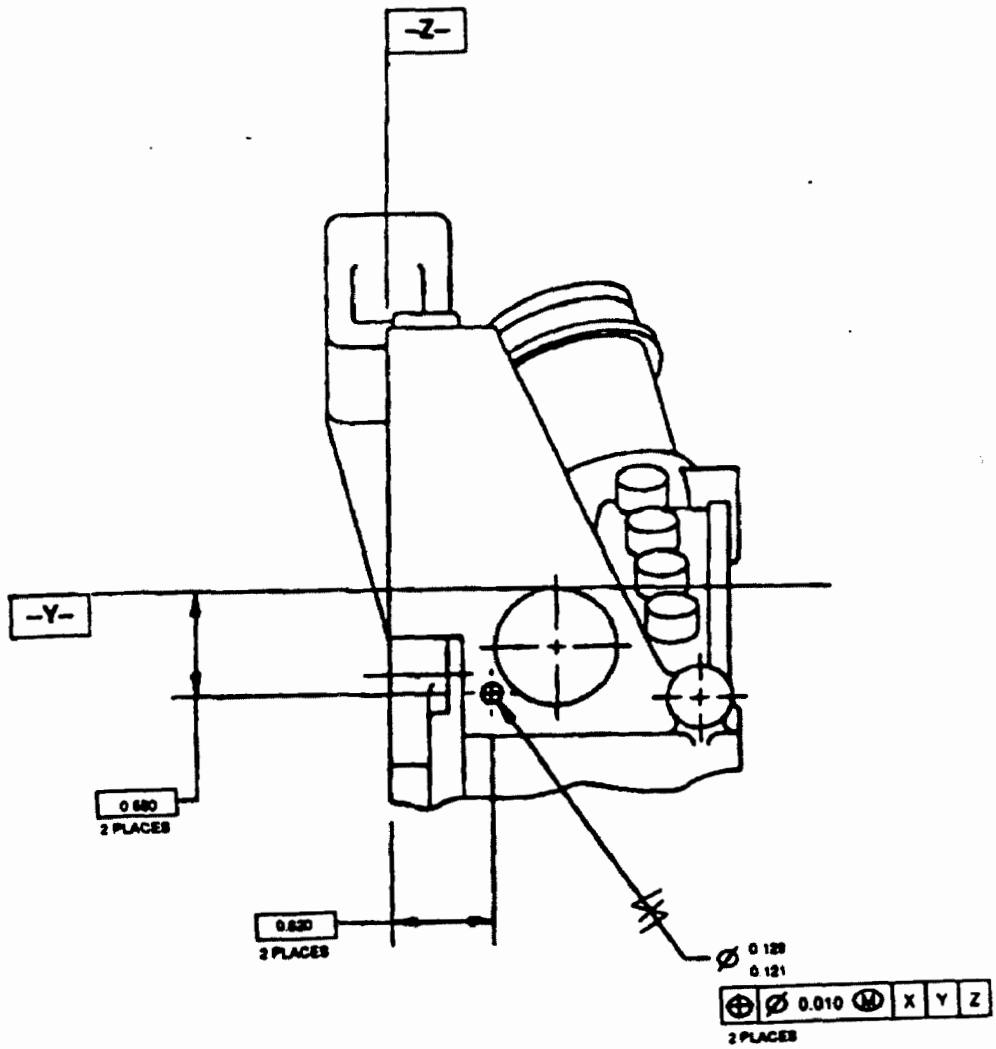


FIGURE 3 LOCATION OF DRILL HOLES

F. Mix and apply a solution of Alodine 600 to the reworked areas.

G. Install the vibration isolators on the EEC adjacent to the housing handle. Refer to ASSEMBLY in CMM 73–22–34 for assembly procedure.

H. Refer to the REPAIR RSS–HS004 section of CMM 73–22–34 to reprogram the EEC150–1. Use the program, version number, and engine trims shown below.

	Channel A	Channel B
Application Program:	Y805881	Y805882
Application Version Number:	078	078
Engine Trim Program:	Y805886	Y805886
Engine Trim Version Number:	078	078

I. Re–identify the Processor/Input Modules. Change the part numbers as shown below:

Assembly	Old Part Number	New Part Number
Processor/Input Module – Channel A	793610–14–XXX 793610–40–XXX	793610–14–046 793610–40–046
Processor/Input Module – Channel B	793612–14–XXX 793612–40–XXX	793612–14–046 793612–40–046

NOTE: XXX – Identifies all available software configurations.

J. Refer to the ASSEMBLY section of CMM 73–22–34 to reassemble the EEC150–1.

K. Change the Hamilton Standard Part Number to show that this Service Bulletin is included into the end–assembly configuration. Put the information shown below on a new unit identification plate. EEC150–1 units reprogrammed at one of the addresses shown in paragraph 1.G will be sent back with their assemblies re–identified as shown.

(a) Put the new end–assembly part number in the "PART NO." area of the new identification plate:

PART NUMBER BEFORE THIS SERVICE BULLETIN	PART NUMBER AFTER THIS SERVICE BULLETIN
798300–8–XXX	798300–15–046
798300–10–XXX	798300–16–046
798300–12–XXX	798300–17–046
798300–14–XXX	798300–18–046

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

EEC150–1 END–ASSEMBLY	NEW IAE PART NUMBER
798300–15–046	2A3149
798300–16–046	2A3150
798300–17–046	2A3151
798300–18–046	2A3153

L. Refer to the TESTING AND TROUBLESHOOTING section of the CMM 73–22–34 to test the EEC150–1. Environmental Stress Screening (ESS) is not required.

3. Material Information

A. This Service Bulletin change will use the parts in the list for each EEC150–1 that incorporates this service bulletin.

B. Any parts that usually are discarded when you disassemble the EEC150–1 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 multiplication 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

New PN	Qty	MSQ	Estimated Price	Key Word	PN Before this SB	Instruc–tion Code
751333–1	1	20	1.80	Plate	751333–1	A, B
777613–1	10	100	0.43	Cover	777613–1	A, B

Instruction Code A. The Service Bulletin change adds the "New PN" to the EEC150–1.

Instruction Code B. The Service Bulletin change removes the "PN before the SB" from the EEC150–1. Discard the part or use it in other equipment.

Hamilton Standard Service Bulletin EEC150–20–73–9
Hamilton Standard Internal Reference Number EC225332, EC236224
Hamilton Standard Reference A320, IAE V2500–A1
IAE Engineering Change Number 94VZ034
IAE Service Bulletin Number V2500–ENG–73–0069

UNITED TECHNOLOGIES HAMILTON STANDARD

SERVICE BULLETIN

Engine Fuel and Control – EEC150–20 Electronic Engine Control – Incorporation of New Software Configuration

1. Planning Information

A. Effectivity

Hamilton Standard EEC150–20 Electronic Engine Controls

808050–4–XXX

NOTE: Following incorporation of this service bulletin, the EEC150–20 can be installed on Airbus A320 aircraft that use the IAE V2500–A1 engine. XXX – Identifies all available software configurations.

B. Reason

The purpose of this Service Bulletin is to allow the V2500–A1 operators install SCN12C software in the EEC150–20.

(1) Problem.

(a) OFF IDLE EGT SPIKING: Short duration EGT spikes which can result in EGT Redline exceedance indications in the cockpit have been observed during initial accels off–idle.

(b) STATOR VANE TRACK CHECKS: Stator vane track check faults have been experienced during accels on the A1 engine in Revenue Service. The transient tolerance is too tight for stator vane system operation during these maneuvers. No engine operability effects have been encountered during these maneuvers.

(c) BIASING OF EGT FOR COCKPIT DISPLAY: Lack of EGT margin is resulting in increased number of redline exceedance events for A1 revenue service engines, particularly under hot day conditions.

(d) ALTERNATOR CIRCUIT NUISANCE FAULT: Annunciations of "ALTERNATOR CIRCUIT FAILED" on ECAM have been seen during in–flight shutdowns on N2 synthesis. This fault is non–dispatchable.

(e) WEIGHT–ON–WHEELS (WOW) VALIDATION/ACCOMMODATION LOGIC: Thrust reverser operation is not inhibited if both WOW discretes are failed closed and the aircraft is in the air.

(f) THRUST REVERSER CHANGES:

1 A/C PERMISSION SWITCH TEST: The Thrust Reverser A/C permission switch verification test is not performed in both channels on each flight.

2 REVERSER STOW & LOCK (S&L) AND ARMING VALVE CROSS CHECK FAULTS: Dispatch for 10 days is currently allowed with S&L and Arming Valve cross check faults. Thrust Reverser system status indication is degraded for subsequent Thrust Reverser system failures in this configuration.

3 REVERSER PRESSURIZED ECAM WARNING: Cross check failures of the Thrust Reverser S&L sensor to the EEC can inhibit the setting of the "REVERSER PRESSURIZED" ECAM warning.

(g) FLEX TEMPERATURE MODE CHANGES:

1 FLEX TEMPERATURE MODE SELECTION: Flex Temperature Mode engagement requires that the Flex Temperature input from the pilot be greater than the ambient temperature. Variations in the absolute and transient characteristics of the EEC selected T2, relative to the Flex Temperature input by the pilot as the A/C proceeds down the runway during takeoff, can result in unintended changes in the engagement of Flex T/O. This is most likely to occur for minor derated T/O's where the Flex Temperature is set purposely close to the actual ambient temperature obtained from the tower by the pilot.

2 FLEX TEMPERATURE ARINC LABEL 214: The value of Flex Temperature received by the EEC from the Flight Management computer is echoed back to the A/C on ARINC Label 214. The Flight Management Computer, however, sets its Flex Temperature SSM to No Computed Data (NCD) above 1500 feet, even if the EEC is still operating in Flex T/O Mode. This results in the loss of Flex Temperature indication in the cockpit during T/O.

(h) HEAT MANAGEMENT CHANGES:

1 AIR COOLED OIL COOLER (ACOC) SPRING VALVE NUISANCE FAULT: The air valve spring failed detection logic has been inappropriately flagging the spring failed.

2 HEAT MANAGEMENT FLIP MODE FAULT RECORDING: The nuisance Flip Mode fault, "HMS–IDG OVTMP W/RECIRC/@" can be set after engine shutdown. This fault is recorded in EEROM and is a Class II fault which is intended to indicate a heat management system malfunction.

3 FUEL AND ENGINE OIL T/C FAILSAFE CLOSES AIR VALVE: The following discussion applies to both the engine oil and fuel thermocouples. If the fuel thermocouple is failed in both channels, the failsafe value for the input causes the logic to think the fuel is too cold. The logic responds by closing the air valve.

(i) WING ANTI–ICE (WAI) MINIMUM PB SCHEDULES: A/C ground handling characteristics with WAI selected has been criticized due to the resulting raised engine idle.

(j) MAINTENANCE LOGIC IMPROVEMENTS:

1 CLEAR LANGUAGE MESSAGE (CLM) CORRELATION TO ECAM WARNINGS: Determination of the required maintenance actions for faults identified in the Post Flight Report (PFR) can be less than straight forward.

2 A/C DATA & EEC P/N MENU REVISION: The Data Entry Plug (DEP) configuration is not presently available to the maintainer through Menu Mode.

3 INTERNAL FAULT FLAG: Bit 18 in the first status word of a Clear Language Message (CLM) is currently not always set properly. This bit is used by the CFDS to determine the source of the detected fault. When the bit is erroneously set to zero, identification of the correct source may not be possible, thus complicating the troubleshooting process.

4 "ENG 1(2) REVERSER UNLOCKED" MESSAGE IN MENU MODE: Spurious setting of the "ENG 1(2) REVERSER UNLOCKED" ECAM warning have been experienced during operation of the Thrust Reverser Menu Mode test with the latest Flight Warning Computer (FWC) Standard D1E.

(k) OVERSPEED NUISANCE FAULTS

1 Overspeed nuisance faults have been experienced in the field on A1 engines.

2 Presently the EEC will record a nuisance FMU overspeed system fault after a real overspeed system activation event.

(l) START ABORT DUE TO LOSS OF AIRCRAFT 28 VDC: Temporary failures of the aircraft 28 VDC input have resulted in autostarts being aborted in revenue service without an accompanying ECAM message.

(m) DISPATCH LOGIC: A number of faults which are approved at the engine level for Long Term Dispatch are currently conservatively treated as Short Term Dispatch items.

(n) AUTOSTART LOCKED ROTOR DETECTION: Starts have occurred in production where the low rotor initially began to rotate but later bound–up prior to attaining idle. The software did not detect the locked rotor. The intent of the autostart locked low rotor abort logic is to prevent engine starting to idle with the low rotor not turning.

(o) MIN LIMITS FOR DADC TAT AND ALT INPUTS: The current minimum limits for both DADC T2 (–60) and Altitude (–1000 FT) do not cover the full range originally specified in the engine specification.

(p) MEMORY SAVING ITEMS: There is very little memory and timing margin left in the A1 software when it is loaded into the EEC150–1 control.

(q) OVERSPEED EVENT RECORDING: None.

(r) AUTO–START ENHANCEMENT FOR BOWED ROTOR: Field experience with the A1 engine has identified the potential for engine clearance degradation between rotating and static parts following engine restart of a previously shut–down hot engine.

(2) Cause.

(a) OFF IDLE EGT SPIKING: EGT spikes are caused by initial fuel addition to accelerate the engine off–idle, where the LPT initially extracts little to no work, this results in a momentary high gas temperature spike passing the EGT sensors. This is not harmful to engine hardware based on service experience.

(b) STATOR VANE TRACK CHECKS: The overall stator vane system transient response capability was not taken into account in the present design; only the stator vane actuator characteristics were considered when the logic was designed.

(c) BIASING OF EGT FOR COCKPIT DISPLAY: Greater than expected deterioration rates in conjunction with EGT limits which are currently set below the maximum certified levels.

(d) ALTERNATOR CIRCUIT NUISANCE FAULT: The fault logic associated with the alternator circuit is enabled using N2 synthesis which is intentionally biased for starting and thus is inaccurate during engine windmilling. This results in the logic determining that the high rotor is turning fast enough for the alternator to meet its minimum output requirement, when it is not.

(e) WEIGHT–ON–WHEELS (WOW) VALIDATION/ACCOMMODATION LOGIC: If both WOW discretes indicate ground, no verification is done with Mn.

(f) THRUST REVERSER CHANGES:

1 A/C PERMISSION SWITCH TEST: The verification that the switch is not stuck closed is incorporated as part of the normal Thrust Reverser command logic. This results in the verification of the switch integrity at the end of the flight during normal reverser operation and only in the channel "In Control."

2 REVERSER STOW & LOCK (S&L) AND ARMING VALVE CROSS CHECK FAULTS: S&L and Arming Valve cross check faults currently set only Class II faults.

3 REVERSER PRESSURIZED ECAM WARNING: The EEC failsafes the ARINC output of the S&L sensor to "UNLOCKED" if the S&L feedback differs between channels. However, the logic in the Flight Warning Computer (FWC) requires the S&L feedback to indicate "LOCKED" before providing a "REVERSER PRESSURIZED" indication on ECAM.

(g) FLEX TEMPERATURE MODE CHANGES:

1 FLEX TEMPERATURE MODE SELECTION: The selection of Flex T/O Mode is currently not frozen until Mn is greater than 0.15.

2 FLEX TEMPERATURE ARINC LABEL 214: The EEC echoes back the Flex Temperature it receives from the A/C with the as–received SSM.

(h) HEAT MANAGEMENT CHANGES:

1 AIR COOLED OIL COOLER (ACOC) SPRING VALVE NUISANCE FAULT: The current design does not properly distinguish between normal and failed operation effectively.

2 HEAT MANAGEMENT FLIP MODE FAULT RECORDING: On engine shutdown during soakback, it may be possible for the IDG oil temperature to rise over and stay above the maintenance limit long enough to set the fault flag. At shutdown, there is no fuel flow to use as a cooling medium for the IDG oil.

3 FUEL AND ENGINE OIL T/C FAILSAFE CLOSES AIR VALVE: The current heat management design does not completely accommodate failures of the fuel and engine oil thermocouples.

(i) WING ANTI–ICE (WAI) MINIMUM PB SCHEDULES: Pilot selection of WAI causes the EEC to raise the minimum PB schedule to meet the increased bleed requirements.

(j) MAINTENANCE LOGIC IMPROVEMENTS:

1 CLEAR LANGUAGE MESSAGE (CLM) CORRELATION TO ECAM WARNINGS: Troubleshooting faults is complicated by the lack of correlation between ECAM warnings and CLM's transmitted from the EEC as summarized in the PFR.

2 A/C DATA & EEC P/N MENU REVISION: New requirement.

3 INTERNAL FAULT FLAG: Some internal fault flags were incorrectly specified and some were handled incorrectly in the software.

4 "ENG 1(2) REVERSER UNLOCKED" MESSAGE IN MENU MODE: FWC Standard D1E no longer inhibits the setting of this ECAM warning in Phase 1 & 10 when the TRA is not in the reverser area. Since the EEC does not presently transmit TRA to the A/C during Menu Mode operation, execution of the T/R Menu Mode test can now set this warning.

(k) OVERSPEED NUISANCE FAULTS

1 The specific cause of the test failures has not been determined.

2 Current EEC logic does not recognize that the overspeed valve in the FMU is hydraulically latched in the overspeed position following system activation. Once the engine spools down in response to the resulting fuel flow reduction, the EEC stops commanding the overspeed valve. Since the valve does not return to the normal position, as commanded by the EEC, the EEC sets the nuisance FMU overspeed system fault.

(l) START ABORT DUE TO LOSS OF AIRCRAFT 28 VDC: The current design does not adequately address temporary losses of aircraft 28 VDC.

(m) DISPATCH LOGIC: Revenue Service experience was desired before downgrading these faults from Short Term to Long Term Dispatch.

(n) AUTOSTART LOCKED ROTOR DETECTION: The present logic design only considered the case where the low rotor never turns at all from the beginning of the autostart sequence. The possibility of binding–up later in the start sequence was not anticipated.

(o) MIN LIMITS FOR DADC TAT AND ALT INPUTS: The software was designed to the ICD requirements but the ICD was not in compliance with the original requirements in the engine specification.

(p) MEMORY SAVING ITEMS: The software requirements for the A1 engine have caught up with the memory and processing capability of the original design of the EEC150–1.

(q) OVERSPEED EVENT RECORDING: New requirement.

(r) AUTO–START ENHANCEMENT FOR BOWED ROTOR: Thermal differentials developing after shut–down of a hot engine can produce significant "bowing" of the rotor spool which, coupled with resulting amplification of the natural spool whirl on the subsequent engine start, can result in contact which leads to clearance degradation and a corresponding loss in engine performance.

(3) Solution.

(a) OFF IDLE EGT SPIKING: New logic has been implemented to override the Engine 7A Bleed closed during on ground operations to provide additional EGT Redline margin.

(b) STATOR VANE TRACK CHECKS: Modify the track check rate limit in the accel direction to be a function of N2 and Altitude so that the overall system transient operation will be accounted for within appropriate engine operability constraints.

(c) BIASING OF EGT FOR COCKPIT DISPLAY: Increase EGT redline limits for max takeoff and max continuous ratings to reflect the max certified levels. Bias the ARINC EGT transmitted to the cockpit to maintain the A320 cockpit display limits at 635°C and 610°C for takeoff and max continuous ratings, respectively. Eliminate the additional DEP selectable EGT biasing provision.

(d) ALTERNATOR CIRCUIT NUISANCE FAULT: Modify the logic to enable the fault detection on the alternator circuit only when the required sensor input signals are available so that nuisance faults will not be inappropriately set.

(e) WEIGHT–ON–WHEELS (WOW) VALIDATION/ACCOMMODATION LOGIC: If both WOW discretes indicate ground, do a comparison with Mn. If Mn is greater than 0.5, inhibit reverser operation and record a maintenance fault.

(f) THRUST REVERSER CHANGES:

1 A/C PERMISSION SWITCH TEST: Modify the logic to incorporate the A/C permission switch test into the existing engine spool–up test so that the verification is performed on each flight in both channels of the control.

2 REVERSER STOW & LOCK (S&L) AND ARMING VALVE CROSS CHECK FAULTS: Upgrade cross check faults of the S&L or Arming Valve from Class II to Class I by modifying the logic to set the Class I (NO DISPATCH) "REVERSER SYSTEM FAULT" (270/19) for cross check faults of the S&L or Arming Valve.

3 REVERSER PRESSURIZED ECAM WARNING: Modify the logic to output on ARINC the local S&L feedback, instead of the failsafe value, to prevent inhibiting of the "REVERSER PRESSURIZED" ECAM warning in the presence of S&L cross check faults.

(g) FLEX TEMPERATURE MODE CHANGES:

1 FLEX TEMPERATURE MODE SELECTION: Modify the logic to freeze the Flex T/O Mode selection when TLA is greater than Max Climb (MCL).

2 FLEX TEMPERATURE ARINC LABEL 214: Modify the logic to output on Label 214 the Flex Temperature used and frozen in the power management and not the one received from the A/C.

(h) HEAT MANAGEMENT CHANGES:

1 AIR COOLED OIL COOLER (ACOC) SPRING VALVE NUISANCE FAULT: Remove the air valve spring failed detection logic. The logic has been a source of nuisance faults without providing much benefit and is redundant to the test of the ACOC valve done during engine spoolup.

2 HEAT MANAGEMENT FLIP MODE FAULT RECORDING: Modify the logic such that the Flip Mode nuisance fault will not set after the engine is shutdown.

3 FUEL AND ENGINE OIL T/C FAILSAFE CLOSES AIR VALVE: Modify the design to failsafe the fuel temperature to the proper failsafe value so that the fuel will not be inappropriately declared too cold and the air valve inappropriately closed.

(i) WING ANTI–ICE (WAI) MINIMUM PB SCHEDULES: WAI selection on ground causes the A/C Bleed Zone Controller to command the WAI valve open for 30 seconds to verify operation of the valve. Therefore, the logic in the EEC is modified to invoke the higher PB schedule for only 40 seconds following WAI selection on the ground.

(j) MAINTENANCE LOGIC IMPROVEMENTS:

1 CLEAR LANGUAGE MESSAGE (CLM) CORRELATION TO ECAM WARNINGS: The following CLM's have been added to cover ECAM warnings which are listed in the PFR and currently do not have associated CLM's transmitted from the EEC: (1) "78–31–42 HC/PROX SW/T/R UP ACT@" for "REVERSER UNLOCKED IN FLIGHT", (2) "78–31–51 HCU/T/R UP ACT/PROX SW@" for "REVERSER PRESSURIZED" and (3) "74–00–00 IGN@/115VAC/EEC@" for ENG 1(2) Ignition A (B).

2 A/C DATA & EEC P/N MENU REVISION: The DEP configuration, as it is marked on the plug itself, has been added to the existing A/C Data & EEC P/N menu screen to aid in maintenance.

3 INTERNAL FAULT FLAG: Update the internal fault flag list and modify the logic to provide the correct LRU identification at the A/C level.

4 "ENG 1(2) REVERSER UNLOCKED" MESSAGE IN MENU MODE: Modify the logic so that the EEC will transmit the TRA position to the A/C during the T/R Menu Mode test to prevent spurious setting of the "ENG 1(2) REVERSER UNLOCKED" ECAM warning.

(k) OVERSPEED NUISANCE FAULTS

1 Continuing review of the overspeed test criteria has identified the following changes aimed at addressing the field events: (1) Modify the logic to eliminate the potential for single pass failures setting an overspeed fault; (2) delete the overspeed test done on engine spool–up as it is redundant to the test done on engine spool–down and (3) record additional fault information associated with a detected overspeed fault to aid in identifying the specific test that is setting the overspeed fault.

2 Modify the EEC logic to account for the hydraulic latching of the overspeed valve following a real overspeed event to avoid the setting of the nuisance FMU overspeed system fault.

(l) START ABORT DUE TO LOSS OF AIRCRAFT 28 VDC: Change the logic so that a temporary loss of aircraft 28 VDC will not permanently inhibit the starting logic.

(m) DISPATCH LOGIC: Modify the logic to downgrade the following faults to Long Term Dispatch: (1) Cross check faults between channels for the following signals . . . Pb, P5, Pamb, P2; Starter Air Valve & Fuel On/Off discrete feedbacks and Air Cooled Oil Cooler and Spill Valve LVDT feedbacks; (2) wraparound faults for Tenth Stage Makeup solenoid and Pb Heater relay discrete outputs and Air Cooled Oil Cooler and Spill Valve torque motor outputs; and (3) track checks on the Air Cooled Oil Cooler and Spill Valve torque motor loops. Additionally, the "Class III Menu Mode Report" has been renamed the "Scheduled Maintenance Report," the number of fault cells allocated to this fault class was increased from 9 to 12 and the fault recording design was modified to record the last occurrence of a fault, rather than the first occurrence, to aid in the confirmation of the performed maintenance actions.

(n) AUTOSTART LOCKED ROTOR DETECTION: Change the autostart locked low rotor logic to abort any start where the low rotor does not rotate, or stops rotating during the start sequence prior to attaining idle.

(o) MIN LIMITS FOR DADC TAT AND ALT INPUTS: Modify the input processing logic to account for the originally intended required input range for T2 (–80C) and Altitude (–2000 FT).

(p) MEMORY SAVING ITEMS: In order to make room for the A1 SCN 12C requirements to be implemented in the EEC150–1, the following memory and timing savings actions were executed: (1) Delete the trim range check done in the application software as it is redundant to that done in the Super Monitor used to download experimental trims, (2) eliminate unused provisions for T2 and hot engine biasing of the Wf/Pb start schedules, (3) eliminate unused provisions for biasing of the Stator Valve scheduling for accel, decel, or reverse operation, (4) consolidate the #4–7th and 10th stage bleed logic since they are scheduled identically, (5) simplify the power setting logic where excess capability is no longer needed, (6) convert the min Pb schedules to polynomials from tables for ECS and WAI requirements and (7) delete the processing of Flight Number from the A/C.

(q) OVERSPEED EVENT RECORDING: Provide a CLM, "71–00–00 PROPULSION SYSTEM@", and add the capability to record appropriate parametric data in EEROM at the time of an overspeed event to aid in the troubleshooting of such an event.

(r) AUTO–START ENHANCEMENT FOR BOWED ROTOR: Modify the logic to provide an additional 30 seconds of dry motoring of the engine on the starter before initiating fuel pressurization for all Auto–Starts on the ground. This additional motoring will reduce thermals on the rotor spool and provide priming of the Number 3 bearing which is designed to control rotor spool whirl, thus minimizing the potential for rotor rub.

C. Description

The EEC150–20 is reprogrammed and re–identified with the new part number.

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 given in Paragraphs 2 and 3 of this service bulletin 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 Newberrry Road
East Windsor, CT 06088
U.S.A.

(b) Pratt & Whitney
Overhaul and Repair Center – Europe (PWORCE)
Maastricht Airport
P.O. 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 EEC150–20–73–9 and the IAE Service Bulletin Number V2500–ENG–73–0069.

(3) The new parts required to accomplish this Service Bulletin are listed in Section 3, 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 the HS Service Bulletin Number EEC150–20–73–9, the IAE Service Bulletin Number V2500–ENG–73–0069, and be addressed to:

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

Facsimile: 803–325–2849

H. Tooling

None

I. Weight and Balance

None

J. Electrical Load Data

Not Affected

K. References

E9137 Standard Electronic Practices Manual
Components Maintenance Manual CMM 73–28–01
IAE Service Bulletin Number V2500–ENG–73–0069

L. Other Publications Affected

Illustrated Parts Catalog 73–28–01

2. 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: Refer to the E9137 Standard Practices Manual to do the procedures unless otherwise noted.

A. Refer to the REPAIR RSS–HS004 section of CMM 73–28–01 to reprogram the EEC150–20. Use the program, version number, and engine trims shown below.

	Channel A	Channel B
Application Program:	Y805881	Y805882
Application Version Number:	078	078
Engine Trim Program:	Y805886	Y805886
Engine Trim Version Number:	078	078

B. Change the Hamilton Standard Part Number to show that this Service Bulletin is included into the end–assembly configuration. Put the information shown below on a new unit identification plate. EEC150–20 units reprogrammed at one of the addresses shown in paragraph 1.G will be sent back with their assemblies re–identified as shown.

(a) Put the new end–assembly part number in the "PART NO." area of the new identification plate:

PART NUMBER BEFORE THIS SERVICE BULLETIN	PART NUMBER AFTER THIS SERVICE BULLETIN
808050–4–XXX	808050–4–046

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

EEC150–20 END–ASSEMBLY	NEW IAE PART NUMBER
808050–4–046	2A3148

C. A functional test is not required.

3. Material Information

A. This Service Bulletin change will use 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 multiplication 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

New PN	Qty	MSQ	Estimated Price	Key Word	PN Before this SB	Instruc-tion Code
751333–1	1	20	1.80	Plate	751333–1	A, B

Instruction Code A. The Service Bulletin change adds the "New PN" to the EEC150–20.

Instruction Code B. The Service Bulletin change removes the "PN before the SB" from the EEC150–20. Discard the part or use it in other equipment.

Hamilton Standard Service Bulletin EEC150–1–73–29
Hamilton Standard Internal Reference Number EC225332, EC231759, EC231760
Hamilton Standard Reference A320, IAE V2500–A1
IAE Engineering Change Number 94VZ034
IAE Service Bulletin Number V2500–ENG–73–0069