C-130E Pilot Conversion Notes

References
Flight Manual: T.O. 1C-130E(H)-1
Performance Manual: T.O. 1C-130E(H)-1-1

General
The C-130E model aircraft were in production from 1961 until 1965, with a second production run in 1972. The 1972 model aircraft were equipped with -15 engines and use T.O. 1C-130H-1-1 performance manual, and are sometimes called “Super-És.” The C-130E is an earlier generation aircraft lacking a centralized warning and caution system, requiring the crew to constantly monitor and scan the aircraft systems for problems.
Engines
The engines installed on the 1961 through 1965 model aircraft are T56-A-7 Engines. The -7 engine has the same maximum torque limit of 19,600 inch-pounds, but lower TIT limits than the -15. As a result, the -7 engine will put out less torque than the -15 under most conditions.

The oil temperature, pressure, RPM, and torque limitations are identical to the -15. The following are the TIT limits:

- Cross over TIT: 740-780 °C
- Maximum Continuous: 932 °C
- Military (30 minutes): 977 °C
- Takeoff (5 minutes): 961-977 °C
The engines do not have oil cooler augmentation, so the oil temperature must be closely monitored for overheating when using reverse thrust during taxi.

Engine Low Oil Quality Indicator
On the left side of the engine stack is an ENG LOW QUANTITY warning light. Each engine power section and reduction gear box share a common oil system, feed by a 12 gallon tank. Each engine has an individual oil quantity indicator. If any engine’s quantity drops below 4 gallons, the ENG LOW QUANTITY light on the left of the engine stack will illuminate. The engine gages must be consulted to determine which engine has the low quantity.
**Propellers**

Propeller Low Quantity Master Warning Light

Each propeller valve housing has a self-contained, dedicated supply of hydraulic fluid used to control the propeller blade angle. If the propeller quantity is low, the Propeller Low Quantity Master Warning Light on the right side of the engine stack will illuminate. The copilot will need to look on the right side shelf to determine which propeller has the low quantity:

If the propeller low oil light illuminates on the ground, shut down the engine by placing the condition lever to ground stop. In flight, reference the flight manual. Depending on the situation, it may be permissible to run the propeller with low oil quantity. In all cases, it is recommended the engine be shut down prior to landing.

Propeller Governing

The propeller governing system maintains a constant engine RPM. Normally, the propellers are governed electronically through the synchrophaser. Electronic governing provides:

- Speed stabilization (rate feedback)
- Throttle anticipation
- Synchrophasing

There is a backup, purely mechanical governing mode. The MECH mode is selected via four guarded switches on the copilot’s side shelf:
The propellers on the C-130 are not counterweighted, and the blade angle will flatten from centrifugal force if hydraulic pressure is not maintained on the blade change mechanism. The propellers must be driven towards feather via valve housing hydraulic pressure. An electrically powered auxiliary feather motor is used to feather the propeller. When the propeller is signaled to feather, either via the condition lever or fire handle, the auxiliary feather motor operates. Operation of the auxiliary feather motor is indicated to the aircrew via solenoid-actuated feather buttons. When the auxiliary feather motor is operating, the feather override button is pulled down and a light illuminates. The crew can pull the feather motor override button out to shut off the feather motor, or push the button in to complete the feather cycle.

Limitations on use of the auxiliary feather motor:

- Must be operative for flight
- Duty cycle: 1 minute on, 1 minute OFF, not to exceed 2 minutes on in 30 minutes
- Reverse to feather static feather cycle must be completed in 25 seconds.
- Must pop out within 6 seconds of completing the feather cycle
The feather valve and NTS test switch is used to verify operation of the feather valve (VALVE position) and NTS circuits (NTS position). The NTS position is used during engine shutdown to check the operation of the NTS.
Gas Turbine Compressor
In lieu of an APU, the E-model has a gas turbine compressor, a two-stage, centrifugal compressor that supplies bleed air. This bleed air may be used for engine start or to operate the air turbine motor (ATM), a turbine connected to an AC generator. Controls for the GTC are located on the overhead panel. The GTC is normally operated by the FE. The GTC is operable on the ground only.

The GTC fuel supply is directly from the fuel cross feed manifold, so there is no minimum main fuel tank quantity for a self contained start. The fuel to the GTC is shut off by moving either the GTC control switch to OFF or pulling the GTC fire handle. The crossfeed manifold must be pressurized for the GTC to run for more than 1-2 minutes, usually the No 2 boost pump is used because it is powered by the ESS AC buss (powered by ATM).

GTC starter duty cycle is 1 minute ON, 4 minutes OFF

The GTC must be operated for 1 minute prior to applying a load (4 minutes during cold weather operations [OAT < 32º F]).

Minimum operating bleed pressure from the GTC is 35 psi.

The GTC does not put out enough volume of bleed air to run the air turbine motor and air conditioning packs simultaneously. Therefore, before engine shutdown, the FE should shut off the air conditioning prior to engine shutdown to ensure the ATM is able to power the ESS AC bus.

CAUTION

As soon as the GTC starter disengages, the starter light will go out. If the light does not go out within 1 minute, move the control switch to OFF and wait 4 minutes before making another start attempt. The starter duty cycle is 1 minute ON, 4 minutes OFF.

CAUTION

During ground operation, monitor the leading edge temperature indicators. A rise in temperature indicates that an anti-icing valve is open. GTC bleed air must be shut off to prevent damage to heated surface.
Fire/Overheat/Turbine Overheat

When a FIRE is detected in an engine nacelle or with the GTC, the appropriate two bottom lights in the respective fire handle will illuminate STEADY.

If there is a TURBINE overheat (over temperature in hot section) detected in the nacelle aft of the fire wall, the top two red lights in the fire handle will FLASH.

**CAUTION**

Operation of the turbine overheat test switch should not exceed 30 seconds. Do not test again for a period of 1 minute. Long, continuous testing may result in failure of the system.

**Note**

The test switch will only check circuit continuity and that the switch is functioning properly. Even though all indicator lights illuminate, this does not indicate the detectors are properly set or even operating.

There is a FIRE cue light on the pilot’s instrument panel above the Flight Director Mode Select Switch panel that illuminates STEADY for engine FIRES and FLASHES for TURBINE overheat:
Nacelle overheat: Dedicated lights above co-pilot’s airspeed indicator.

Note
The test switch will only check circuit continuity and that the switch is functioning properly. Even though all indicator lights illuminate, this does not indicate the detectors are properly set or even operating.
Bleed Air

The engine bleed air switches are ON/OFF (no override position). The engineer confirms opening/closing of the bleed valves by watching for torque decrease (opening)/increase (closing).

Bleed air sources:
- Engines (4) 14th stage compressor, minimum pressure is 70 psi.
- GTC (1) minimum pressure is 35 psi.

Bleed Loads:
- Engine starters
- Pressurization/air-conditioning (2 packs, one for flight deck, one for cargo area)
- Wing and empennage anti-icing
- Engine Anti-icing (inlet air ducts, oil cooler scoops, inlet guide vanes)
- Air turbine motor (ATM)
- Urinal ejectors

The aircraft is equipped with wing bleed air isolation valves. These valves are normally open, and may be closed electrically. Once closed, they must be manually reopened from the inside the cargo compartment.

Bleed air to operate the ATM, GTC, air conditioning, and under floor heat comes from the section of the bleed air system between the wing isolation valves.

The bleed air manifold gage is located on the back wall of the navigator’s station:
Preflight Bleed air check using GTC to pressurize:

- Minimum system pressure: \textbf{35 psi}
- Minimum time to drop from 30 to 15 psi once the GTC bleed air valve switch is closed: \textbf{8.5 seconds}. 
The electrical system is broken down into three sub-systems:

- AC powered system
- Secondary AC system
- DC system

AC Electrical Sources

- (4) 40 KVA engine driven generators
- 20/30 KVA Air Turbine Motor (ATM) The ATM must be on line prior to putting all four engines in low speed ground idle.

ATM Characteristics:

Load:

- In flight or on the ground with OAT ≤ 40°C (104°F) and cooling fan is operational: 30 KVA (1.0 reading on loadmeter). The ATM cooling fan operation can be verified by noticing a momentary load on the ATM generator loadmeter after the ATM control switch is placed ON.

- OAT > 40°C (104°F) or any temperature with cooling fan inoperative: 20 KVA (0.66 loadmeter reading)

The external AC power switch automatically goes to OFF when the ATM generator switch is placed to ON, regardless of generator operation.
DC Electrical Sources
- Main battery (24 Volt)
- INS battery (24 Volt)

The AC powered system is three phase, 115/200 volt used for large loads such as fuel boost pumps and window heat. A system of “K-relays” prioritizes AC electrical power as follows:
- ATM supplies ESS AC bus only
- First AC generator on line powers ESS and MAIN AC
- If second generator is brought on line, the entire AC will be powered:
  - If on the same wing as first, each generator powers the opposite, symmetric AC bus
  - If the second generator is on the opposite wing, each generator powers its side.

Important AC Bus loads:

<table>
<thead>
<tr>
<th>LH AC Bus</th>
<th>ESS AC Bus</th>
<th>Main AC Bus</th>
<th>RH AC Bus</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Crew Comfort bus”</td>
<td>#2 fuel boost pump</td>
<td>“Pump Bus”</td>
<td>“Anti/De-ice bus”</td>
</tr>
<tr>
<td>#1 fuel boost pump</td>
<td>Feather motors</td>
<td>#3 fuel boost pump</td>
<td>#4 fuel boost pump</td>
</tr>
<tr>
<td>LH Ext tank boost pump</td>
<td>Aux hydraulic pump</td>
<td>Ext tank rear pumps</td>
<td>RH Ext boost pump</td>
</tr>
<tr>
<td>Galley Ovens</td>
<td>Hyd suction boost pumps</td>
<td>Aux tank pumps</td>
<td>Prop/Eng ice control</td>
</tr>
<tr>
<td>Coffee Jugs</td>
<td>Synchrophaser</td>
<td>Dump pumps</td>
<td>Spinner anti-ice</td>
</tr>
<tr>
<td>Windsheild anti-ice</td>
<td>TD System</td>
<td>APN-59 radar</td>
<td>Bus off indications</td>
</tr>
<tr>
<td>Cargo compt fan</td>
<td>Trim tabs</td>
<td>SKE</td>
<td>MLS</td>
</tr>
<tr>
<td></td>
<td>Pilot’s VVI</td>
<td></td>
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</tbody>
</table>
The Secondary AC system is used to power low-load instrument loads where there is sensitivity to variations in the AC power quality. There are two secondary AC buses, each with two sources of power:

- Copilots AC Instrument bus
  Powered via inverter from ISO DC bus, or from ESS AC bus
- AC Instrument and Fuel Control bus
  Powered via inverter from ESS DC bus, or from ESS AC bus

### Important Secondary AC bus loads

<table>
<thead>
<tr>
<th>Copilot AC Instrument Bus</th>
<th>AC Instrument and Fuel Control Bus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot and copilot attitude spheres</td>
<td>Torque</td>
</tr>
<tr>
<td>Flight directors</td>
<td>TIT</td>
</tr>
<tr>
<td></td>
<td>Fuel flow</td>
</tr>
<tr>
<td></td>
<td>Fuel quantity</td>
</tr>
<tr>
<td></td>
<td>LOX quantity</td>
</tr>
<tr>
<td>#1 Single Phase Bus</td>
<td>#2 Single Phase Bus</td>
</tr>
<tr>
<td>Fuel pressure gages</td>
<td>#1 Engine/Gearbox oil press</td>
</tr>
<tr>
<td>#3 Engine/Gearbox oil press</td>
<td>#2 Engine/Gearbox oil press</td>
</tr>
<tr>
<td>#4 Engine/Gearbox oil press</td>
<td>Hydraulic gages:</td>
</tr>
<tr>
<td></td>
<td>Emergency brake gage</td>
</tr>
<tr>
<td></td>
<td>Booster system pressure</td>
</tr>
<tr>
<td></td>
<td>#1 Engine/Gearbox oil press</td>
</tr>
<tr>
<td></td>
<td>#2 Engine/Gearbox oil press</td>
</tr>
<tr>
<td></td>
<td>Utility system gage</td>
</tr>
<tr>
<td></td>
<td>Normal brake gage</td>
</tr>
<tr>
<td></td>
<td>Auxiliary system pressure</td>
</tr>
<tr>
<td></td>
<td>Utility system rudder boost</td>
</tr>
<tr>
<td></td>
<td>Booster sys rudder boost</td>
</tr>
</tbody>
</table>

The secondary AC system is set as follows for engine start:

- Copilot’s AC instrument switch – ESS AC bus (horizontal position)
- AC Inst and Fuel Control Bus – ESS DC bus (vertical position)

This results in the “Dash One” configuration, as the switches look like “ – 1”

For takeoff, the position of the AC Inst and Fuel Control Bus switch depends on whether a solid state inverter is installed:
• No solid state inverter: AC Inst and Fuel Control Bus – ESS AC bus (horizontal position)
• Solid state inverter: AC Inst and Fuel Control Bus – ESS DC bus (vertical position)

Aircraft 62-1824 has a solid state inverter, so the AC Inst and Fuel Control bus is normally powered via the ESS DC bus through the inverter

**WARNING**

The autopilot will disengage when the copilot’s instrument power switch is placed to the DC or OFF position.

**CAUTION**

Placing the copilot’s inverter switch in the DC position with the VERF REF switches in the INS position will cause the ADI to become unstable and tumble.

**CAUTION**

Prior to placing the copilot’s AC INSTR switch to the DC BUS position, select VG and HDG mode on both flight director systems.

The DC system is normally powered by four transformer-rectifiers if the AC system is powered.

### Important DC Bus Loads

<table>
<thead>
<tr>
<th>ESS DC Bus</th>
<th>Main DC Bus</th>
<th>ISO DC Bus</th>
<th>Battery Bus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire detection</td>
<td>Interphone</td>
<td>Fire extinguisher</td>
<td>Fire extinguisher</td>
</tr>
<tr>
<td>Overheat detectors</td>
<td>UHF 1</td>
<td>AC internal power solenoid</td>
<td></td>
</tr>
<tr>
<td>AC Inst and Fuel Control inverter</td>
<td>GTC start control</td>
<td>Alarm bell</td>
<td></td>
</tr>
<tr>
<td>Bleed air isolation valves</td>
<td>ATM generator control</td>
<td>Jump lights</td>
<td></td>
</tr>
<tr>
<td>Cabin press and aux vent</td>
<td>Engine generator control</td>
<td>ISO DC ON BATT light</td>
<td></td>
</tr>
<tr>
<td>Emergency elevator trim</td>
<td>Bus tie switch</td>
<td>Voltmeter (DC in BATT position)</td>
<td></td>
</tr>
<tr>
<td>Emergency brake valves</td>
<td>CP pitot heat</td>
<td>Emergency depressurization</td>
<td></td>
</tr>
<tr>
<td>Oil quantity indicators</td>
<td></td>
<td>Emergency exit light extinguishing button</td>
<td></td>
</tr>
<tr>
<td>Oil temperature indicators</td>
<td></td>
<td>Emergency locator transmitter</td>
<td></td>
</tr>
<tr>
<td>Antiskid Flap control valve</td>
<td></td>
<td>SKE battery</td>
<td></td>
</tr>
</tbody>
</table>
Flight Instruments
Both pilot’s and copilot’s ADI are powered by the copilot’s instrument bus

Both pilots will have an independent attitude reference selected while flying in IMC.

WARNING
Placing the copilot’s inverter switch in the DC position with the VERF REF switches in the INS position will cause the ADI to become unstable and tumble.

CAUTION
Prior to placing the copilot’s AC INSTR switch to the DC BUS position, select VG and HDG mode on both flight director systems.
Flight director
The pilot and copilot have independent flight directors, operated via Flight Director Mode Select Panels:

Flight Director NORMAL/MANUAL switch

<table>
<thead>
<tr>
<th>FD Mode Select Control Panel selection:</th>
<th>NORMAL</th>
<th>MANUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDG</td>
<td>No flight director</td>
<td>Flight director bank steering bar provide guidance to heading bug</td>
</tr>
<tr>
<td>TAC</td>
<td>Flight director bank steering to intercept/maintain TACAN course.</td>
<td>Flight director bank steering bar provide guidance to heading bug.</td>
</tr>
<tr>
<td>VOR/ILS, tuned to VOR frequency</td>
<td>Flight director bank steering to intercept/maintain VOR course.</td>
<td>Flight director bank steering bar provide guidance to heading bug.</td>
</tr>
<tr>
<td>VOR/ILS, tuned to ILS frequency</td>
<td>Flight director steering to intercept/maintain ILS course and glideslope.</td>
<td>Manual ILS mode, also used for back course localizers</td>
</tr>
<tr>
<td>SCNS/GPS/I-INS/I-DOP</td>
<td>Flight director bank steering to intercept/maintain SCNS/GPS/I-INS/I-DOP.</td>
<td>Flight director bank steering bar provide guidance to heading bug</td>
</tr>
</tbody>
</table>

For instrument takeoffs, the flight director NORMAL/MANUAL switch should be in the MANUAL position.
The pilot navigation selector has priority, preventing the copilot from selecting the same radio navaid. If the copilot selects the same radio as selected by the pilot, the amber “SELECTED NAV SYSTEM OFF” under the HSI will illuminate, and the copilot will be disconnected from any navigation information:

The SELECTED NAV SYSTEM OFF does not apply if both the pilot and copilot simultaneously select:

- HDG
- SCNS
- I-INS
- I-DOP

The copilot has an ADI selector switch (NORMAL, PILOT REPEAT). When the ADI selector switch is placed in the PILOT REPEAT position during an ILS approach, the copilot’s ADI repeats the ILS information from the pilot’s ADI. The green COPILOT ADI REPEAT light will illuminate under the copilot’s HSI, provided the pilot has selected VOR/ILS-1 or VOR/ILS-2 with the MODE SEL switch and an ILS frequency has been selected.

Air data instruments
The E-model has a significant position error correction. There is a 5-10 knot airspeed difference (average 8 knot) between E-model aircraft and C-130s equipped with the Rosemount system. The Rosemount system indicated HIGHER airspeeds.
Fuel
The fuel indicators are analog and there is no direct indication when they are powered. The fuel indicators are powered from the AC INST & ENGINE FUEL CONTROL bus. As a technique, to ensure the AC INST & ENGINE FUEL CONTROL is powered before reading the fuel quantity, ensure the TIT gage OFF flags are removed from view.

If analog gages are installed, before using the totalizer, add up the individual tank quantities and ensure the totalizer is accurate.

The fuel dumping system in some E-models consist of a dump manifold without dump valves, so that any dump pump operation will dump fuel overboard without requiring a second switch action. This makes the dump pumps unusable for tank-to-tank fuel trimming.

If any fuel quantity indicator is off scale high, off scale low, fluctuates erratically, or is inoperative, pull the associated fuel quantity indicator circuit breaker. The circuit breaker will not be reset until proper inspection and repairs have been made.
Hydraulics

The E-model has a hand operated forward cargo door hydraulic system, which is used exclusively as an alternate source of hydraulic power to lower the nose gear, operate the cargo ramp and door, and for emergency brakes.

**CAUTION**

Wait at least 10 seconds after the auxiliary hydraulic pump is turned OFF, to allow the accumulator to discharge, before turning the pump switch back on. Failure to do this will overload the motor and open the pump circuit breakers.
Navigation
The aircraft has two identical N-1 compasses. The No 1 N1 compass is associated with the pilot; the No 2 N1 compass is associated with the copilot. The N1 compass is normally operated in the magnetic-slaved mode (latitude-correction knob full counterclockwise). When operating correctly, the annunciator pointer should be approximately centered. Erratic movement or oscillation of the heading pointer indicates a malfunction, and the compass shouldn’t be relied upon. The two compasses should indicate within 2° when free of other aircraft and ground equipment, or in flight in straight and level flight.

Note: VOR 1 / 2 pointer selection is made via the POINTER SEL switch on the Flight Director Mode Select Panel.
For magnetic-slaved operation:
The N1 compasses should be synchronized before use as a magnetic-slave compass, since airplane movement on the ground without power applied may cause the system to get out of synchronization. The system will self-synchronize, but it is slow and manual synchronization is much faster.

1. Rotate the latitude correction knob to OFF

2. Synchronize the master indicator by pushing in to engage then rotating the synchronizing knob until the annunciator pointer is on the center index.

3. Check the heading pointers against the standby compass, as it is possible to synchronize the compasses 180 degrees from the correct heading.

The E-model is equipped with 2 AN/ARN-6 Automatic direction finding receivers.
Tuning the ADF
1. Function switch – CONT momentarily, then ANT
   Allow 5 minute warm up
2. Function switch – LOOP, verify control via L-R control moving pointer to wingtip (3:00/9:00 o’clock position) for best reception. If appropriate bearing pointer does not move, momentarily move the function switch to CONT to transfer control.
3. Function switch – ANT
4. Intercom – ON, listen for ident
5. CW/VOICE switch – CW, tune for null (low pitch)
6. CW/VOICE switch –VOICE, monitor ident
7. Function Switch – ADF, ensure bearing pointer points to station
8. Volume – adjust

Autopilot
The E-model is equipped with the AN/AYW-1 Automatic Flight Control System (AFCS, sometimes called the All Weather Flight Control System (AWFCS)).

There are two autopilot flight control systems (AFCS), labeled AP1 and AP2. AP1 is associated with the pilot and uses the INS for an attitude reference, AP2 with the copilot and uses the pilot's VG for an attitude reference. The autopilot can be engaged by pressing the AP1 or AP2 push button on the flight control panel, located on the pedestal behind the throttle quadrant. The following conditions must be met to engage the autopilot:

- Turn ring – centered
- Elevator trim – NORM
- PITCH and LAT switches – ON
- No 1 compass system must be operable to engage AP1
- No 2 compass system must be operable to engage AP2
Autopilot modes are indicated on the glare shield mounted flight progress-warning panel (FPWP). The lights on the FPWP can only be checked by running an autopilot BIT:

The only way to check the FPWP lights is to run the autopilot BIT on the ground. Autopilot engagement is indicated by illumination of the green annunciator bar above the push button and on the flight progress-warning panel.

The autopilot engages in basic modes:
- Roll: heading hold (wings level) or roll attitude hold (if coupled in a bank)
- Pitch: pitch attitude hold

**WARNING**

The autopilot will disengage when the copilot’s instrument power switch is placed to the DC or OFF position.
The autopilot will respond to pitch and roll inputs made via the integrated pitch and roll controller (pitch wheel and turn knob).

**WARNING**

During high speed operation, the airplane responds quickly to large movements of the pitch wheel (up to ± 30° of pitch) that could result in injury or structural damage.

The pitch and lateral axis of the autopilot may be independently disconnected using the LAT and PITCH switches on the Flight Control Panel.

Altitude hold may be engaged by pressing the ALT HOLD button on the Flight Control Panel. The autopilot will maintain the altitude at the time the button was pressed. If speed-on-pitch mode was active, selecting ALT HOLD will disengage speed-on-pitch mode (described below).
FLT DIR: Couples the autopilot to the onside (AP1 engaged→Pilot, AP2→Copilot) flight director. The flight director steering bars must be displayed in the ADI for the autopilot to couple. The autopilot will couple to both the lateral or pitch axis of the flight director, if present. If either PITCH or LAT off is selected, the other axis will remain engaged.

When flying an approach with FLT DIR selected, the autopilot may not correct for a deviation from the glideslope, which may result in remaining above or below the glideslope. If the airplane remains off glideslope, disengage the autopilot and complete the approach manually.

SPEED ON PITCH
The speed-on-pitch hold mode may be engaged by pressing the SPEED-ON-PITCH button Mode Select Panel. The autopilot will maintain the indicated airspeed at the time the button was pressed, and is designed for climbs and descents. In the speed on pitch mode, the autopilot system uses the elevator to maintain a target indicated airspeed. While in speed on pitch mode, the pilot is responsible for establishing the desired vertical rate with the throttles; climb power for climbs and flight idle for descents. If altitude hold was active, selecting SPEED-ON-PITCH will disengage ALT HOLD.

Speed on pitch mode should not be engaged during flight in greater than light turbulence. If speed on pitch is engaged in turbulence, the autopilot will aggressively change pitch attitude, attempting to follow airspeed fluctuations. This may result in personnel and/or objects being tossed about in the cabin.
When the HDG mode is engaged, the aircraft will turn in the shortest direction to the onside (AP1→Pilot, AP2→Copilot) HSI heading bug. To avoid an unanticipated turn, the heading bug should be on the desired heading before engaging:

If the heading bug is moved through 180 degrees, the autopilot will reverse the direction of the turn.
LNAV-LOC
Pressing the LNAV-LOC button arms the autopilot to capture and track the onside (AP1→Pilot, AP2→Copilot) lateral guidance (LOC, SNCS, TAC, VOR)
APPR (Approach)
Pressing the APPR button arms the autopilot to capture and track the onside (AP1→Pilot, AP2→Copilot) localizer and glide slope. The heading mode may be engaged prior to APPR, which allows the heading bug to be used to follow vectors until the localizer is captured.

The autopilot may capture glideslope before capturing the localizer. If this occurs, the autopilot will fly the glideslope, which may result in a descent prior to the cleared zone.

Placing the ADI selector switch to the SKE position while the autopilot is engaged in the APPR mode will cause the autopilot to disconnect.

When the LATERAL axis of the autopilot is engaged, the autopilot makes parallel inputs for turn coordination and yaw damping. Parallel means the autopilot rudder inputs are in parallel with the pilot's inputs, so if the pilot makes a rudder input that the autopilot is not commanding, the autopilot will attempt to counter the pilot input. This is different than other autopilots such as the KC-135 or B737-B777 where the autopilot yaw damping/turn coordination are made in series with the pilot inputs, allowing the pilot to make rudder trim changes without fighting the autopilot.
If the pilot attempts to put in rudder trim with the LATERAL axis engaged, the autopilot will end up putting in an additional correction. So in order to trim the aircraft for an engine out situation, either disconnect the autopilot or disengage the LATERAL axis. Input rudder trim as required, then reconnect the autopilot/reengage the LATERAL axis. The rudder trim will then be correct for a single airspeed/power setting combination. If the aircraft is maneuvered away from the trimmed condition, the autopilot will fly the aircraft in side slip. It is possible and acceptable to trim the aircraft with an intermediate amount of rudder trim, then fly an engine-out approach with the autopilot engaged. The pilot should be aware that the aircraft will be in side slip as the airspeed and power are changed from the trim condition.

Autopilot disconnect
The autopilot may be disconnected by:

- Pressing the autopilot release on either control wheel
- Pressing the AP1 button, with AP1 engaged
- Pressing the AP2 button, with AP2 engaged
- Positioning the elevator tab power selector to OFF or EMER
- Using the elevator trim
- Placing both LAT and PITCH switches OFF

The normal means of disconnecting the autopilot is to use the autopilot release switch. The AUTO PILOT DISC warning will flash, and can be extinguished by pressing the release switch a second time:

Autopilot failures:

**Trim command failure**
**AP1 engaged and INS attitude reference bad**
**AP2 engaged and pilot’s attitude gyro bad**

Radar
The E-model is equipped with the APN-59 ground mapping radar. The APN-59 is a real beam only, with a raw video plan position indicator (PPI). Radar controls are located at the navigator’s station, with a removable repeater scope for the pilots. The pilot’s repeater scope is washed out in sunlight. This, coupled with the controls being at the navigator’s station, means that the radar is not operable by the pilots. The radar hazard area to personnel extends 40 feet from the nose of the aircraft, while the explosives/fuel ignition hazard area extends 300 feet from the nose of the aircraft. Get clearance from the pilots prior to operating the radar.
**Brakes:**
The E-model has 2030 psi brakes.

**Communications**
Most E-model aircraft are equipped with 2 UHF radios and 1 VHF radio. The radios are normally controlled through the SCNS control head, although UHF #1 may be controlled through the manual control head by turning it on.
Normal Procedures

Engine Start

<table>
<thead>
<tr>
<th>Condition</th>
<th>Stop Start Criteria</th>
</tr>
</thead>
</table>
| Within 5 seconds of start switch actuation | • START VALVE OPEN light does not illuminate  
• No rotation |
| 35% RPM | • No Fuel Flow  
• No Ignition  
• No Engine or Gearbox oil pressure indication |
| Peak TIT < 720 | • Low TIT |
| Peak TIT > 850 | • Hot start |
| 60 seconds | • On speed (70 seconds in high temperatures)  
• Hydraulic Pressure indication |
| On Speed + 30 seconds | • Full hydraulic pump pressure |

Temperature limits

<table>
<thead>
<tr>
<th>Condition</th>
<th>Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 720°C</td>
<td>Maintenance action required prior to flight. Record in 781.</td>
</tr>
<tr>
<td>720-749°C</td>
<td>Continue and perform temperature controlling check prior to flight. Record starting and crossover TIT. If TIT malfunction exists, place condition lever to GND STOP</td>
</tr>
<tr>
<td>750-830°C</td>
<td>Normal</td>
</tr>
<tr>
<td>831-850°C</td>
<td>Leave running. Record peak TIT in 781 and continue mission</td>
</tr>
<tr>
<td>851-965°C</td>
<td>Discontinue the start, record in 781. One restart is permitted after cooling below 200°C TIT. If TIT exceeds 850°C on 2nd start, discontinue and record. Restart not recommended</td>
</tr>
<tr>
<td>&gt;965°C</td>
<td>Discontinue and record peak TIT in 781. Over temperature inspection required.</td>
</tr>
</tbody>
</table>
Engine Starter limits:

1 minute ON  
1 minute OFF  
1 minute ON  
5 minute OFF  
1 minute ON  
30 minute OFF

**CAUTION**

When the ATM and ATM generator are shut down for low density conditions during a self-contained start, a fire hazard may exist if the battery relay opens or the GTC stops at a low engine RPM after light off. Should this occur, immediately position the engine condition lever to FEATHER to mechanically shut off fuel flow to the engine. This may be an indication of a failed battery relay.

**NOTE**

The ATM must be on for low speed ground idle operation. If the ATM generator fails, the low speed ground idle buttons must be manually disengaged to prevent a drain on the aircraft battery.

**Taxi**

**CAUTION**

With the ATM turned OFF, do not attempt to low speed all four engines since electrical equipment may be damaged.

Managing oil temperatures.
Without oil cooler augmentation, the oil temperature must be closely monitored during taxi. Optimum cooling occurs when the engine is operated at LSGI, with the throttle advanced 1 to 1-1/2 knob widths above the ground idle detent. Conditions permitting, attempt to taxi with all four engines in LSGI. Some engineers use the technique of closing the oil cooler flaps slightly, with the belief this causes an air burble that aids cooling. Use of reverse thrust will quickly overheat the oil.

**Descent**
During descent below 15,000 feet MSL, manually open the oil cooler flaps and place the switches to the FIXED position. Monitor oil temperature and manually control the oil cooler flaps to keep the oil temperature close to 60ºC.

**Engine Shutdown**
Turn off air conditioning before shutting down engines.
Emergency Procedures

Engine Shutdown Procedure

**CAUTION**

[E-H1 only]: Do not hold agent discharge switch to the No 1 or No2 position for more than 1 to 2 seconds. To do so may cause the FIRE EXT circuit breaker to open.

Gas Turbine Compressor Emergency Shutdown (Ground/In flight)

1. Fire Handle - “Pulled” (E)
2. Agent – “Discharged” (for fire) (E)

**WARNING**

If the condition persists, a break in the bleed air manifold may exist. Isolate by closing both wing isolation valves and place the GTC bleed air switch to closed. If the fire continues, discharge the remaining bottle.

**CAUTION**

[E-H1 only]: Do not hold agent discharge switch to the No 1 or No2 position for more than 1 to 2 seconds. To do so may cause the FIRE EXT circuit breaker to open.

Bleed Air Leak

**CAUTION**

If an engine bleed air valve cannot be closed (valve closure is determined by observing torque increase on the affected engine) and the bleed air system is leaking, it may be necessary to shut down the engine.

**CAUTION**

Do not operate the GTC after landing with a bleed air leak. If the uncontrolled loss of bleed air cannot be isolated, operation of the GTC may repressurize the area(s) where the failure occurred.
Multiple Engine Power Loss/Stall/Flameout

**CAUTION**

In the event the ATM generator is powering the essential AC bus, shutting off all the engine bleed air will eliminate the pneumatic air source for the ATM. The resulting under speed condition and generator disconnect may cause essential AC bus power loss.

**Performance Data**

A rotation speed chart (Figure 3-21) is provided. The charted rotation speed allows for the aircraft to be rotated and achieve takeoff speed, and is set so that takeoff speed will be greater than or equal to one-engine inoperative \(V_{MCA}\).

David Fedors/25 March 11/5-7037