

AIRPLANE  
SIMULATION COMPANY

DCS

# C-130J

## USER MANUAL

Version 0.8.1, 11/21/2025

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Welcome to DCS: C-130J, the Airplane Simulation Company's debut full-fidelity module. After four years of intensive development and testing, we are proud to present what we believe (and hope you'll agree) is the most accurate and comprehensive simulation of the C-130J ever created for a desktop flight simulator. Built upon a comprehensive library of reference material, multiple data-gathering trips, and extensive Subject Matter Expert (SME) input, we have left no stone unturned in our relentless pursuit of delivering a compelling and immersive simulation of this incredible aircraft.

The C-130 first flew in 1954 as a rugged, versatile transport designed for the U.S. Air Force during the Cold War. Its Short Takeoff and Landing (STOL) capability, four turboprop engines, and ability to operate from unprepared runways made it ideal for tactical airlift.

Over the decades, the C-130 has been adapted into numerous specialized roles, including gunship (AC-130), electronic attack and psychological operations (EC-130), search and rescue (HC-130), weather reconnaissance (WC-130), and aerial refueling (KC-130).



The most modern production version, the C-130J, was introduced in the 1990s and features new AE2100 engines, 6-bladed composite propellers, digital avionics, and extended range and payload capabilities.

Now in continuous production for more than 70 years, the C-130 remains one of the longest-running military aircraft programs in history. Having served in over 70 countries worldwide, the C-130 has proved itself as a workhorse in tactical airlift, combat, humanitarian aid, and disaster relief missions.

DCS: C-130J is a representation of a Block 6.5 C-130J-30 as flown by the U.S. Air Force's Air Mobility Command. Other variants, such as the short-fuselage C-130J and special operations MC-130J, are planned for release at a later date.

**Disclaimer: DCS: C-130J is to be used for entertainment purposes only. Its accompanying documentation and educational content are intended for flight simulation use only.**





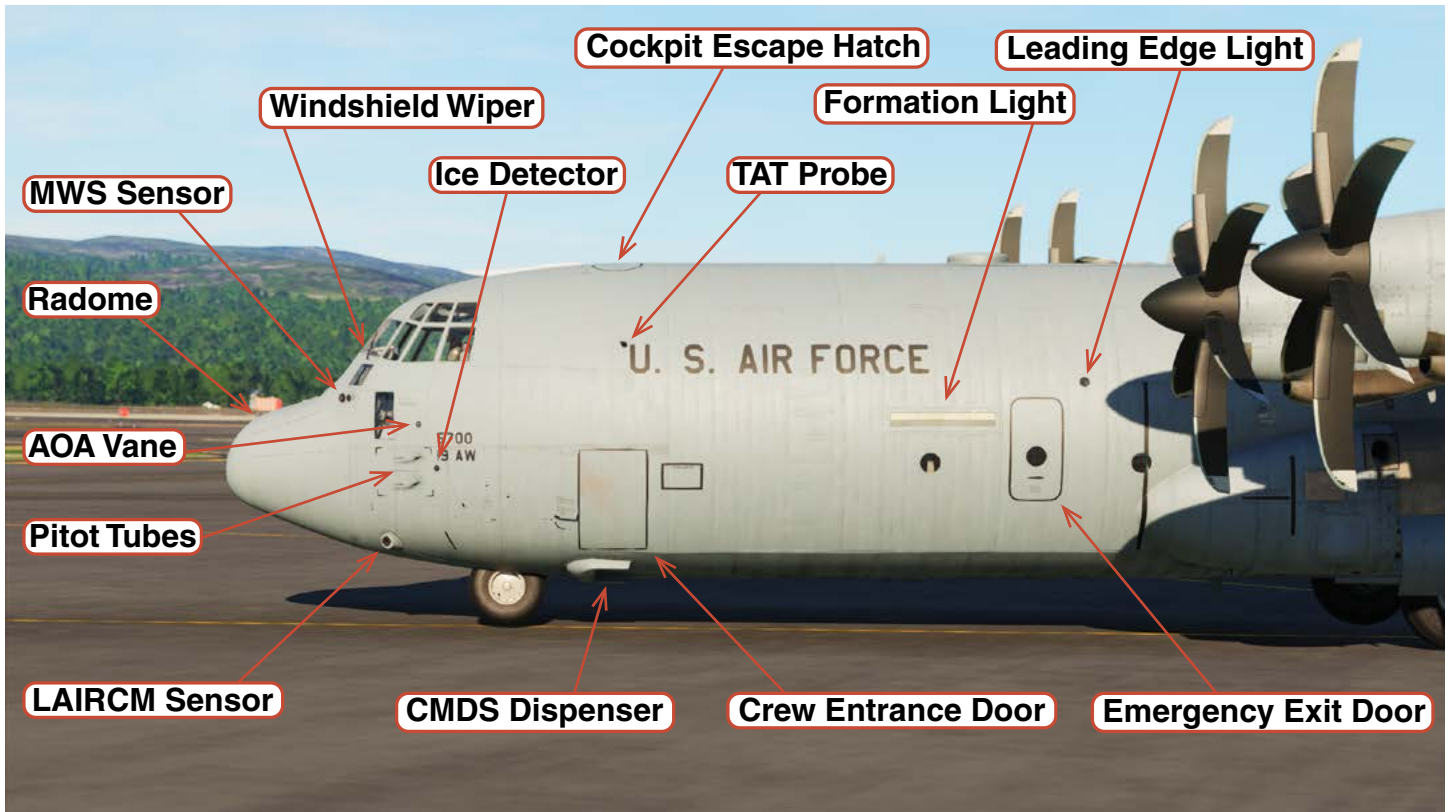
The C-130J is typically crewed by a pilot, copilot, and loadmaster. The pilot occupies the left seat while the copilot sits in the right seat. A third seat is provided aft of the center console for an augmented crew member to occupy. Bench seating, located on the back wall of the cockpit, provides seating and restraint harnesses for three additional passengers. A bunk bed above the bench seat facilitates crew rest on long-range missions.

Both pilot stations feature a control yoke and rudder pedals: the pilot and copilot's flight controls are interlinked so that if one pilot moves their yoke, the other pilot's controls will move correspondingly. A throttle quadrant is centrally located for use by both pilots. A nosewheel steering wheel is located to the left of the pilot's seat to maneuver the aircraft while on the ground. A Heads Up Display (HUD) is mounted above the pilot and copilot's seats to facilitate operation of the aircraft without having to look inside the cockpit.

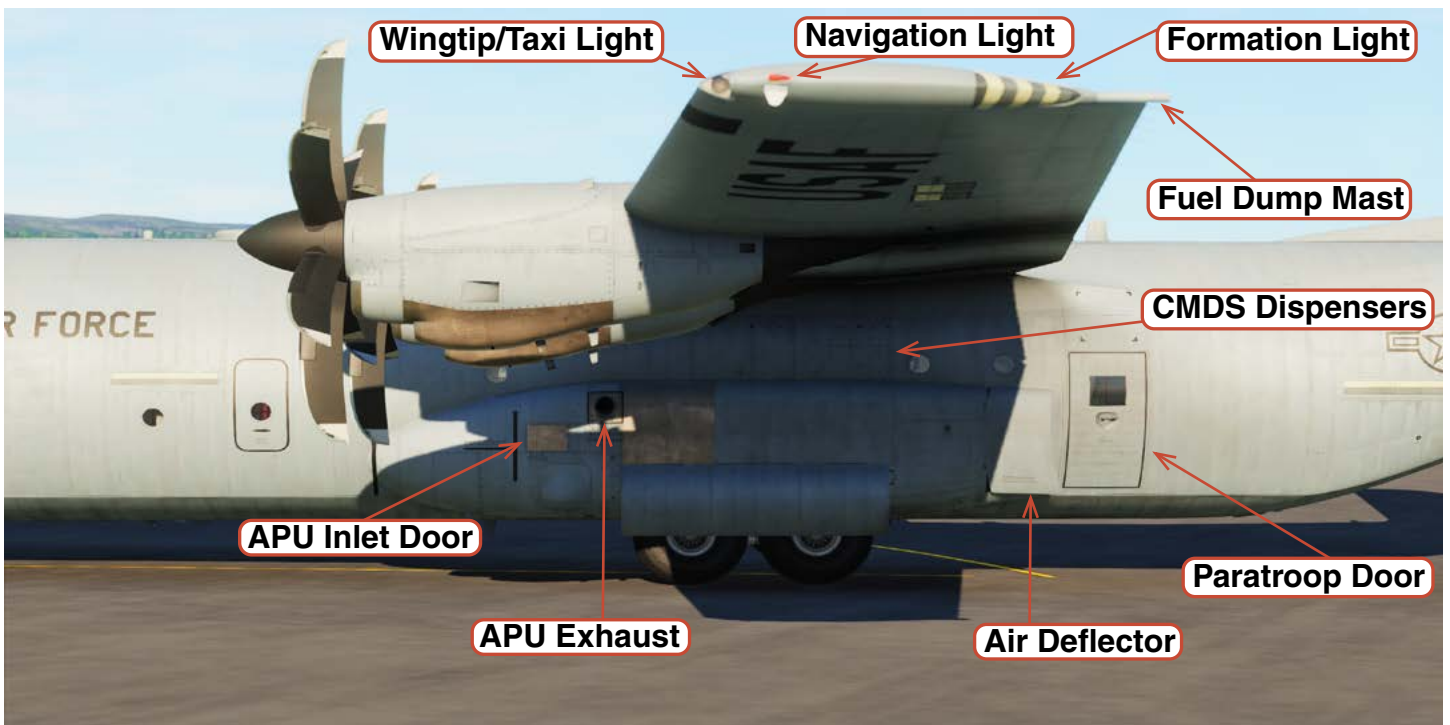
Four large, rectangular screens known as Heads Down Displays (HDD) are mounted to the main instrument panel. The HDDs are controlled by two Avionics Management Units (AMU) located on either side of the Communication Navigation Breaker Panel (CNBP). Three Communication/Navigation/Identification-Management Units (CNI-MU) are located on the center console that control a wide variety of mission functions and aircraft systems including flight planning, airdrop, and countermeasures.



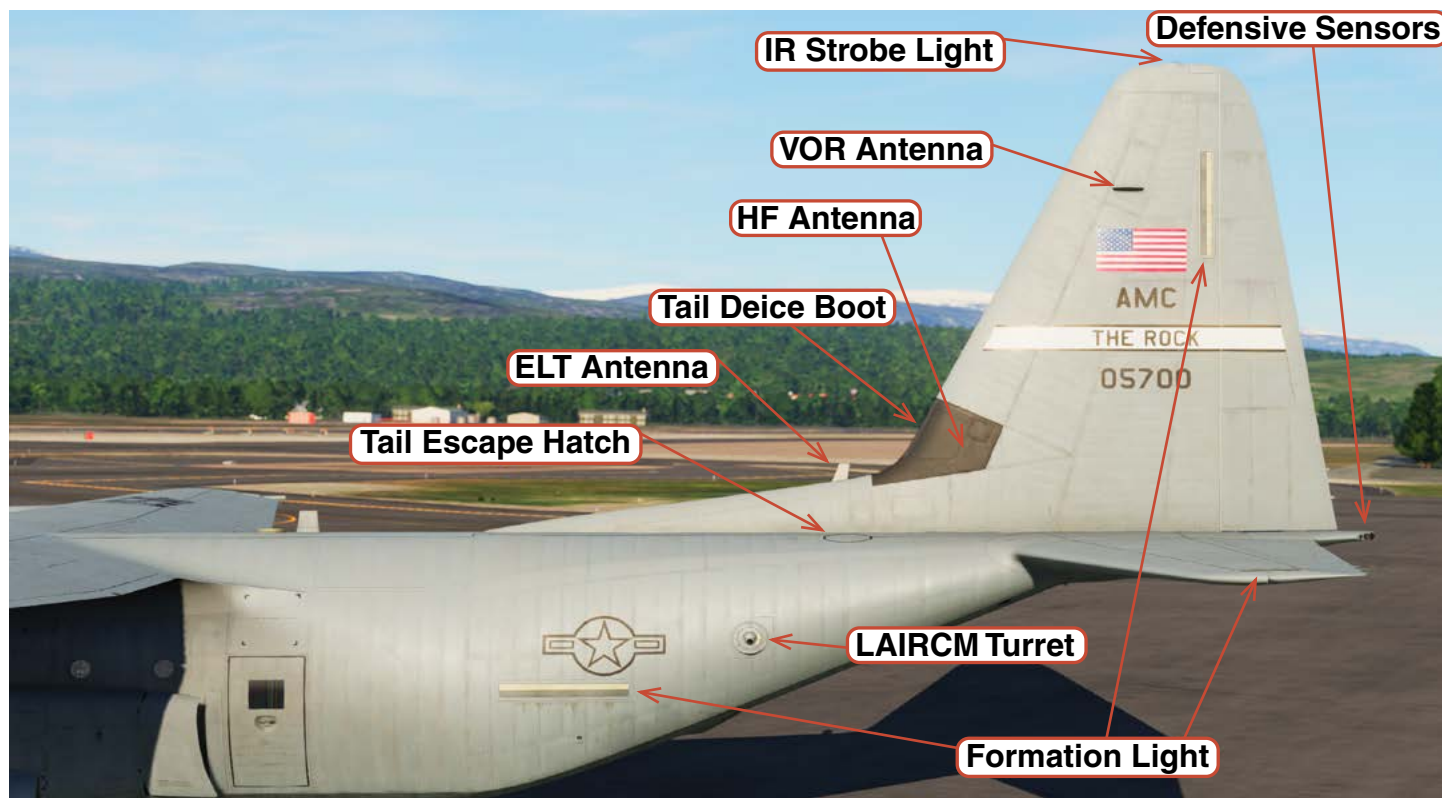
## Forward Sensors and Equipment



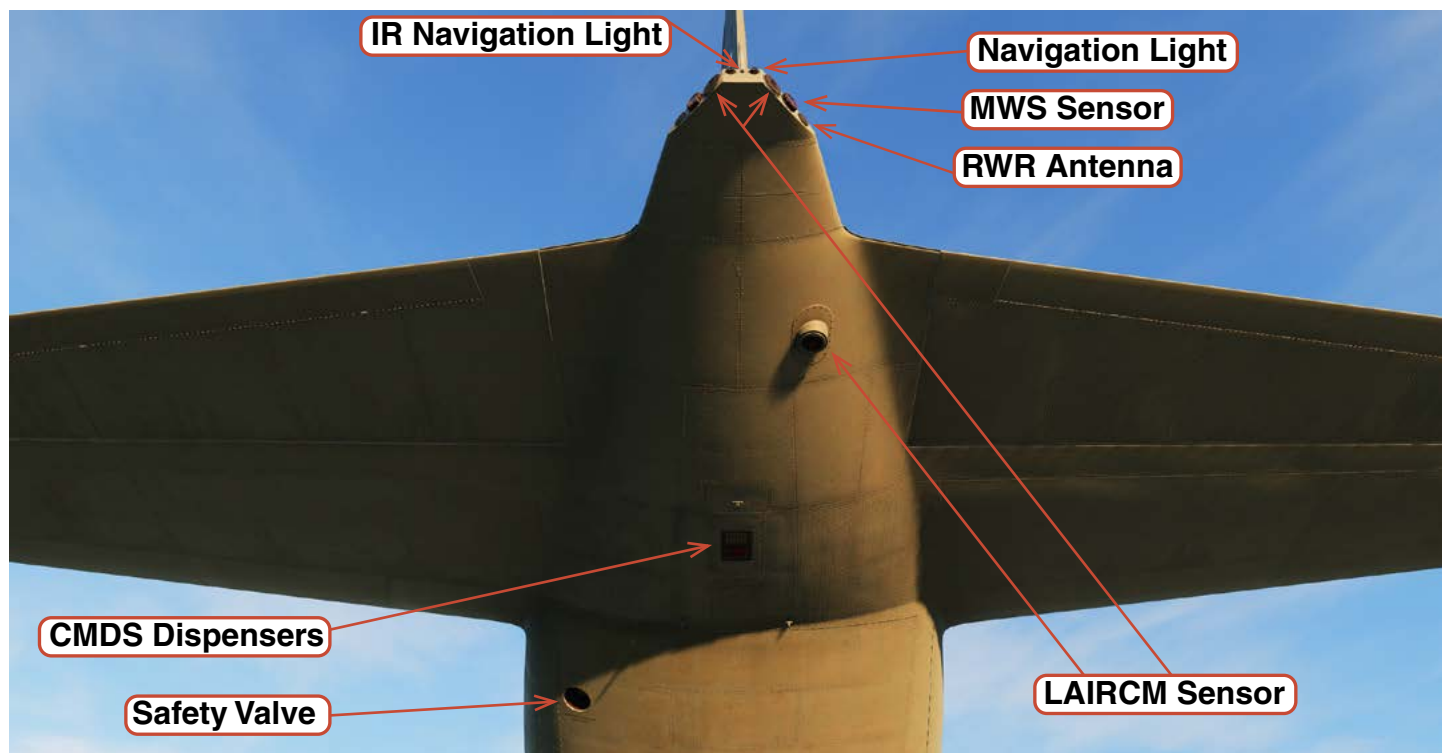
## Fuselage and Wing Equipment



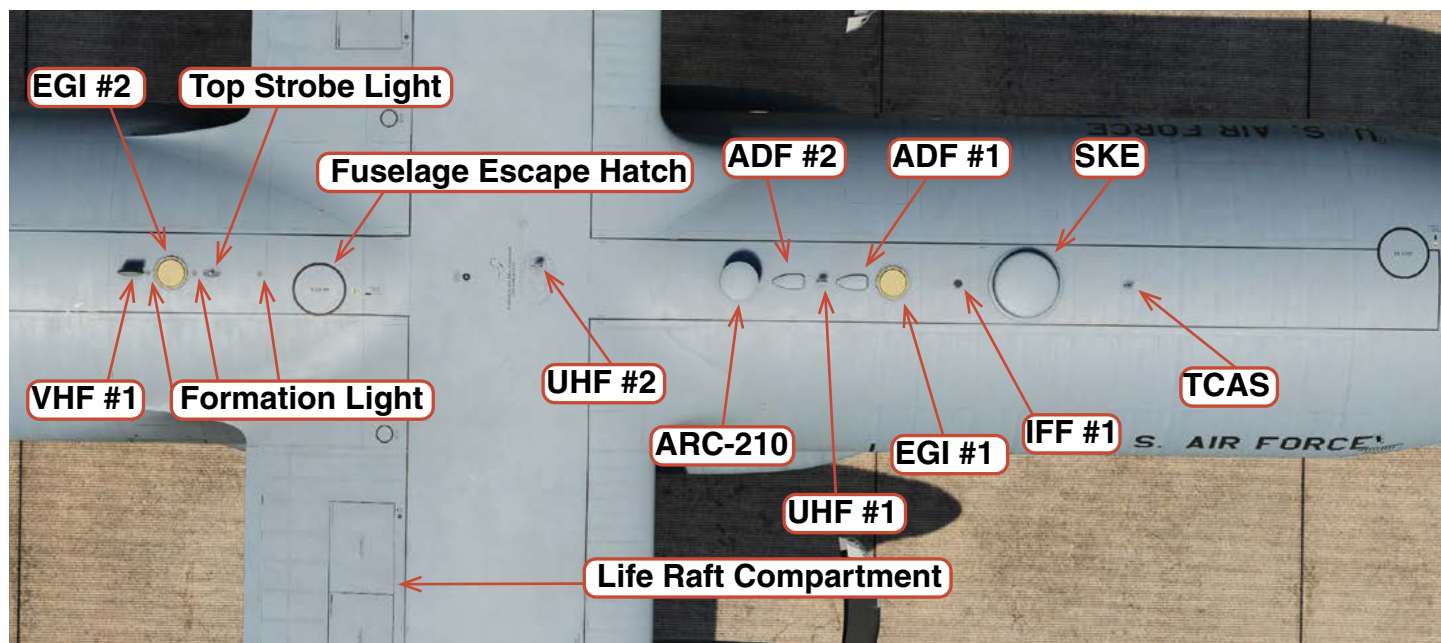
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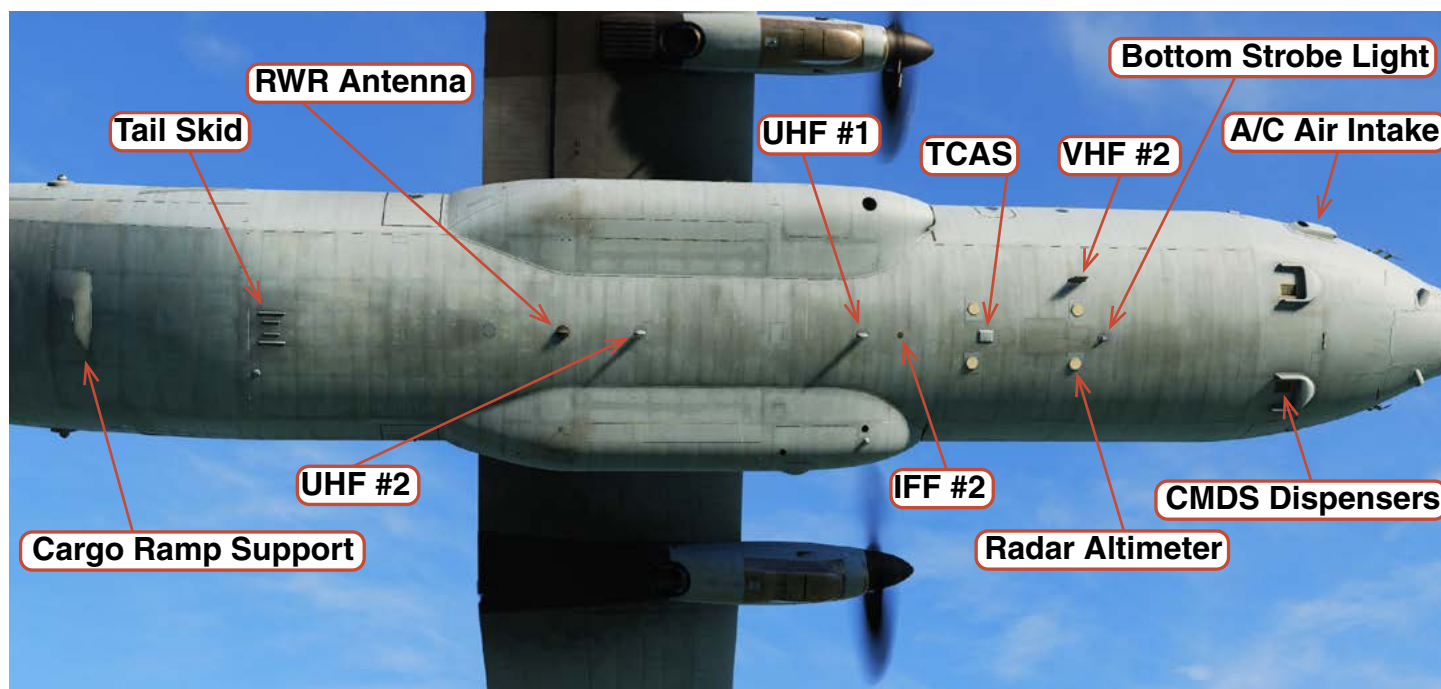
## Aft Sensors and Equipment



## Top Antennas and Equipment



## Bottom Antennas and Equipment





- |   |  |
|---|--|
| 1. Standby Magnetic Compass               | 11. Standby Flight Instruments               |
| 2. Pilot HUD                              | 12. HDD #2                                   |
| 3. Copilot HUD                            | 13. HDD #3                                   |
| 4. Pilot REF/MODE Panel                   | 14. HDD #4                                   |
| 5. Pilot AMU                              | 15. Copilot Autopilot Mode Annunciator Panel |
| 6. CNBP                                   | 16. Parking Brake Handle                     |
| 7. Copilot AMU                            | 17. Trim Indicator Panel                     |
| 8. Copilot REF/MODE Panel                 | 18. Landing Gear Control Panel               |
| 9. Pilot Autopilot Mode Annunciator Panel | 19. Hydraulic Control Panel                  |
| 10. HDD #1                                |  |



# Upper Center Console



1. Pilot Lighting Control Panel
2. Radar Control Panel
3. Copilot Lighting Control Panel
4. Pilot ICS Control Panel
5. Copilot ICS Control Panel
6. Pilot CNI-MU
7. Engine Power Levers
8. Copilot CNI-MU
9. Pilot Heading and Course Select Panel
10. LSGI Select Switches
11. Copilot Heading and Course Select Panel
12. AFCS Control Panel



# Lower Center Console



1. Aerial Delivery Panel
2. Trim Control Panel
3. Cursor Control Panel
4. Defensive Systems Control Panel
5. Flap Control Panel
6. ARC-210 Radio
7. Aug Crew Audio Monitoring Panel
8. Aug Crew CNI-MU
9. Aug Crew ICS Control Panel
10. Aug Crew Interphone Connection Port





1. Pilot Interphone Connection Port
2. Aug Crew Reading Light
3. Cockpit Temperature Probe
4. Center Console Flood Lights
5. Copilot Interphone Connection Port
6. Control Boost Panel
7. Oil Cooler Flap Panel

8. Electrical Panel
9. Pilot Reading Light
10. Ice Protection Panel
11. Bleed Air Panel
12. Pressurization Panel
13. Copilot Reading Light

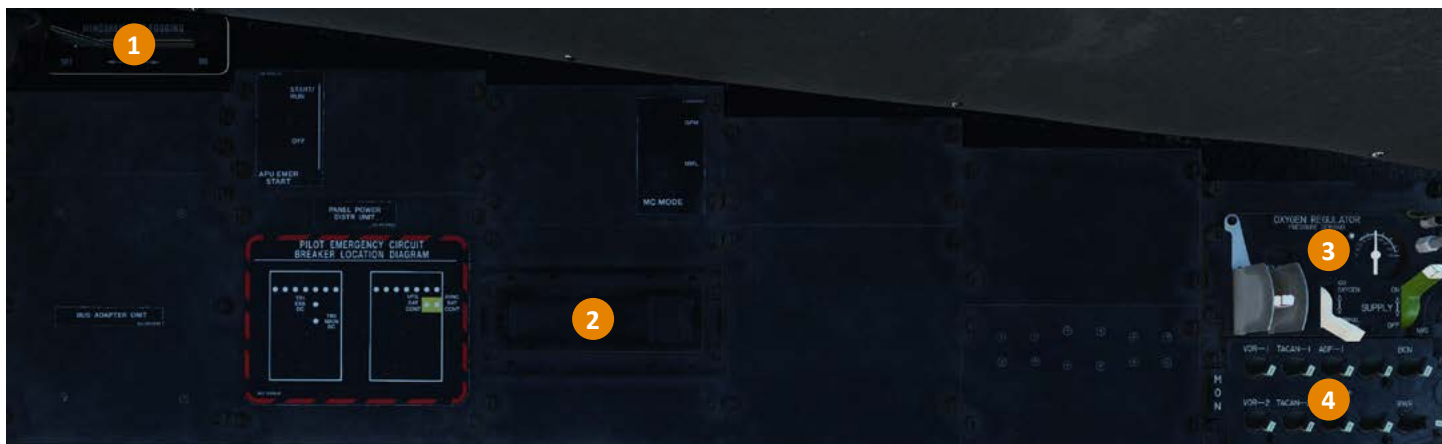




1. Cockpit Voice Recorder Microphone
2. Fuel Control Panel
3. Air Conditioning Control Panel
4. Exterior Lighting Control Panel
5. FADEC Control Panel
6. Fire Control Panel
7. APU Control Panel
8. Pilot HUD Control Panel
9. Propeller Control Panel
10. ATCS and Propeller Sync Switches
11. Engine Start Panel
12. Miscellaneous Switches Panel
13. Copilot HUD Control Panel



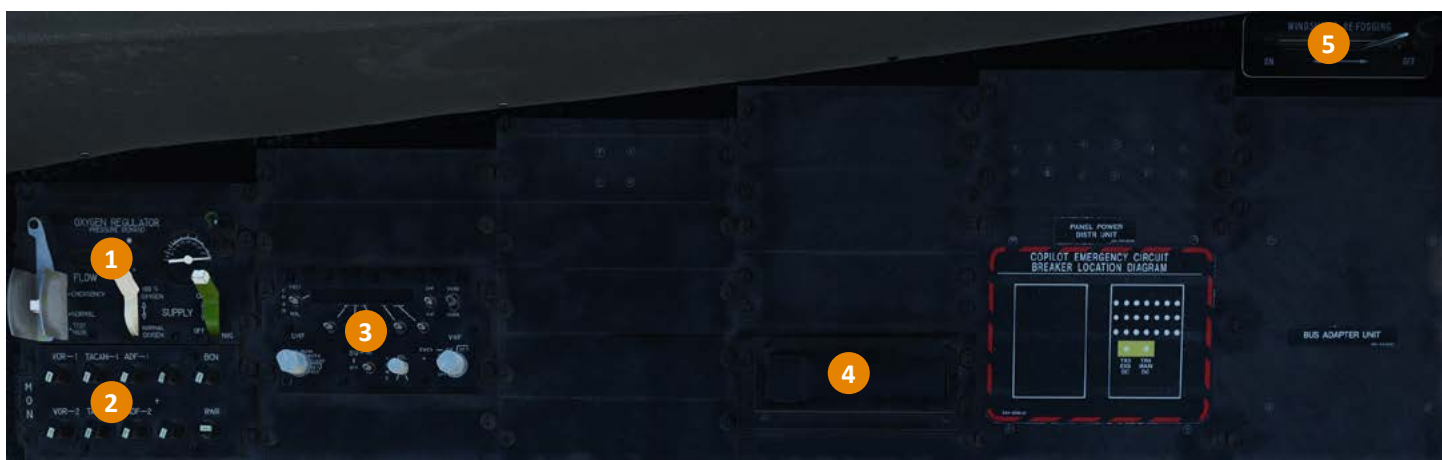
## Pilot Side Console



1. Pilot Windshield Defog Lever
2. DSDTS

3. Pilot Oxygen Regulator
4. Pilot Audio Monitoring Panel

## Copilot Side Console



1. Copilot Oxygen Regulator
2. Copilot Audio Monitoring Panel
3. Get Home Control Radio

4. DSDTS
5. Copilot Windshield Defog Lever



## Autoflight System

The C-130J is equipped with a 3-axis autopilot that follows lateral and vertical commands generated by the flight director without pilot input. Electric servo motors are attached to the elevator, rudder, and aileron booster assemblies to manipulate the associated flight controls according to inputs from the Automatic Flight Control Processor (AFCP).

In addition to utilizing the primary flight controls, the autopilot has control over the elevator trim tab system to alleviate control loads when engaged. This results in the aircraft always being in a trimmed state and allows for the pilot to take manual control of the aircraft without large-scale elevator movements.

Yaw damper functionality is also provided that commands rudder deflection to automatically coordinate turns and eliminate yawing moments caused by changes in power and aileron deflection.

## Flight Director

The flight director is represented in the PFD and HUD as a circular donut when both the pitch and roll axis are enabled via the autopilot control panel. When the autopilot is engaged, the AFCP generates commands to servos mounted on the flight controls to maneuver the aircraft so that the CDM is superimposed on the flight director donut.

The system has two distinct categories of steering, lateral and vertical, that can be selected and changed via the autopilot mode control panel. Only one submode of each category can be active at a time, with a second mode able to be in an armed state.

## Lateral Modes

1. **Navigation (NAV):** The aircraft turns according to CDI course needle displacement.
2. **Heading Select (HDG):** The aircraft turns to match the magnetic heading selected via the heading select knob.
3. **Roll:** The aircraft holds a specific bank angle. This can either be wings-level as in the case of the CNI sequencing past the last waypoint in the active flight plan, or a bank angle up to 35 degrees when using the autopilot TURN knob.
4. **CAPS:** The aircraft rolls to follow commands generated by the CAPS SKE system.

## Vertical Modes

1. **Indicated Air Speed (IAS):** The aircraft pitches to maintain the selected indicated airspeed.
2. **Vertical Speed (VS):** The aircraft pitches to maintain the selected vertical speed.
3. **Pitch:** The aircraft holds a specific pitch attitude selected by either the autopilot pitch control wheel or the pitch synchronization function.
4. **Altitude Hold (ALT):** The aircraft pitches to maintain the captured, preselected altitude.
5. **Altitude Select (ALT SEL):** The aircraft captures the preselected altitude when climbing or descending.

**WARNING: IAS is the ONLY vertical mode of the flight director that protects against inadvertent stall entry.**



## Pitch Sync Function

Pitch sync is a non-annunciated vertical mode that is activated by the yoke pitch sync switch. When the switch is pressed and held, the vertical axis autopilot servo is momentarily disconnected to allow the pilot to position the aircraft's pitch manually. The flight director is also synced to the CDM's vertical position. When the switch is released, the autopilot will hold the aircraft's new pitch attitude.

## Autopilot Engagement

The autopilot can be engaged by actuating either the PILOT or COPILOT switch on the autopilot control panel to the ENGAGE position.

For the autopilot to be engaged, the following criteria must be met:

1. The autopilot disconnect switch on either yoke is not pressed.
2. The go-around switch on either yoke is not pressed.
3. The elevator trim switch on either yoke is not actuated.
4. The autopilot TURN ring is in the center detent.
5. The elevator trim tab switch is in the NORM position.
6. The pitch and lateral switches on the AFCS panel are not in the OFF position.

## Autopilot Automatic Disengagement

Several criteria will cause the autopilot to automatically disengage. When this occurs, the associated autopilot engage/disengage switch will be released to the DISENGAGE position, the autopilot aural alert will sound, and "AP DSNG" will flash on the PFD, HUD, and on-side autopilot mode annunciator panel until acknowledged.

Any of the following conditions will trigger an autopilot disengagement:

- The go-around switch on either yoke is pressed.
- The elevator trim tab switch is moved out of the NORM position.
- The elevator trim switch on either yoke is actuated.
- The aircraft is decelerated to the stall warning speed.

## Autothrottle System

An automatic throttle system allows for hands-off management of engine power settings to maintain a desired airspeed. When engaged, the system commands servos that manipulate the power levers to maintain the reference airspeed set via the REF/MODE panel. The system has authority to command power settings between flight idle and maximum continuous power and will not advance the power levers into the takeoff range.

Disengagement of the system is accomplished via the two throttle-mounted autothrottle disengage switches and annunciated by the aural alert "THROTTLE THROTTLE" along with indications in the PFD and HUD.

Note: The autothrottle system is disabled with weight-on-wheels.



## AFCS Control Panel

The Automatic Flight Control System (AFCS) panel allows for control over the autopilot system.



### 1. Turn Knob

The TURN knob functions by sending a bank angle command to the lateral axis of the autopilot. The commanded bank angle varies based on the rotation of the knob: at the knob's travel limit, a 35-degree bank will be held. When the knob is positioned to the center detent, the autopilot will follow flight director bank commands.

### 2. Pitch Wheel

The PITCH wheel functions in the same fashion as the TURN knob but, instead, specifies a pitch angle to the autopilot. The pitch wheel's authority is limited to plus or minus 10 degrees of pitch.

### 3. Autopilot Engagement Switches

Two autopilot engagement switches are provided, one for the pilot's autopilot and another for the co-pilot's. When a switch is positioned to ENGAGE, the respective autopilot will be activated and coupled to the on-side flight director; only one autopilot may be engaged at a time. The switches are held to the ENGAGE position by magnets that automatically release when an autopilot disengagement condition is met.

### 4. Pitch and Lateral Axis Disengage Switches

The PITCH and LAT disengage switches allow the flight crew to manually disengage a specific axis of the autopilot. When an axis is disengaged, the associated flight control servos will not respond to flight director commands. This allows the crew to manually maneuver the aircraft with the autopilot still engaged.

Note: Disengaging both axes with the autopilot engaged will cause the autopilot to function only as a yaw damper.



## Heading and Course Select Panel

Two heading and course select knobs are used to adjust the reference heading bug position and CDI course.



### 1. Heading Knob

The heading knob adjusts the position of the reference heading bug; pressing the knob will sync the bug to the aircraft's current heading.

### 2. Course Knob

The course knob adjusts the course of the onside CDI. Pressing the knob will sync the course to the aircraft's current heading.



## REF/MODE Panel

Two identical REF/MODE panels are located on the forward glareshield. The panels are divided into two separate subpanels: the REF side controls the various reference bugs on the PFD, HUD, and engine display, while the MODE side controls the lateral and vertical modes of the autopilot. A digital display is located above the REF SET knob that displays the value selected by the pilot.

### REF Subpanel



#### 1. Reference Select Switch

The reference select switch is a 6-position selector knob that selects which field the REF SET knob adjusts. The following positions are selectable:

**HP:** Adjusts the engine horsepower reference value shown on the engine status display. The reference horsepower is set in increments of 50 horsepower from 0 to 5000 horsepower.

**RAD ALT:** Adjusts the Radio Altimeter reference value shown on the PFD. The reference altitude is set in 1 foot increments from 0 to 300 feet, 10 foot increments from 300 to 1000 feet, and 50 foot increments above 1000 feet.

**IAS:** Adjusts the Indicated Airspeed reference value displayed on the PFD and HUD. The reference airspeed is set in increments of 1 knot from 30 to 350 knots.

**Note:** The reference airspeed cannot be set below  $1.2 V_S$  with weight off wheels. With weight on wheels, the reference airspeed is fixed to  $V_{OBS}$  until 400 AGL.

**FPA:** Adjusts the reference Flight Path Angle reference value displayed on the PFD and HUD. The reference FPA is set in increments of 0.1 degree from -32.0 degrees to +32.0 degrees.

**MINS:** Adjusts either the decision height or minimum descent altitude reference value, depending on the configuration. The reference value is set in increments of 10 feet.

**Unlabeled:** No function. Setting the switch to this position will cause the digital display to go blank.



## 2. Reference Set Knob

The REF SET knob is a continuous-turn knob with a press-to-clear function. It is used in conjunction with the Reference Select Switch to set the value for the various reference bugs. When pressed, the symbology associated with the selected reference value is removed from the on-side PFD and HUD. The symbology returns after the knob is pressed for a second time.

Note: The horsepower reference symbology can be cleared from either side.

## 3. Altitude Select Knob

The ALT SEL knob is a continuous-turn knob with a press-to-sync function. The knob is used to set the reference barometric altitude for the altitude alert function. The reference altitude is set in increments of 100 feet from 0 to 50,000 feet. When pressed, the reference altitude is set to the aircraft's current altitude.

## 4. Barometer Set Knob

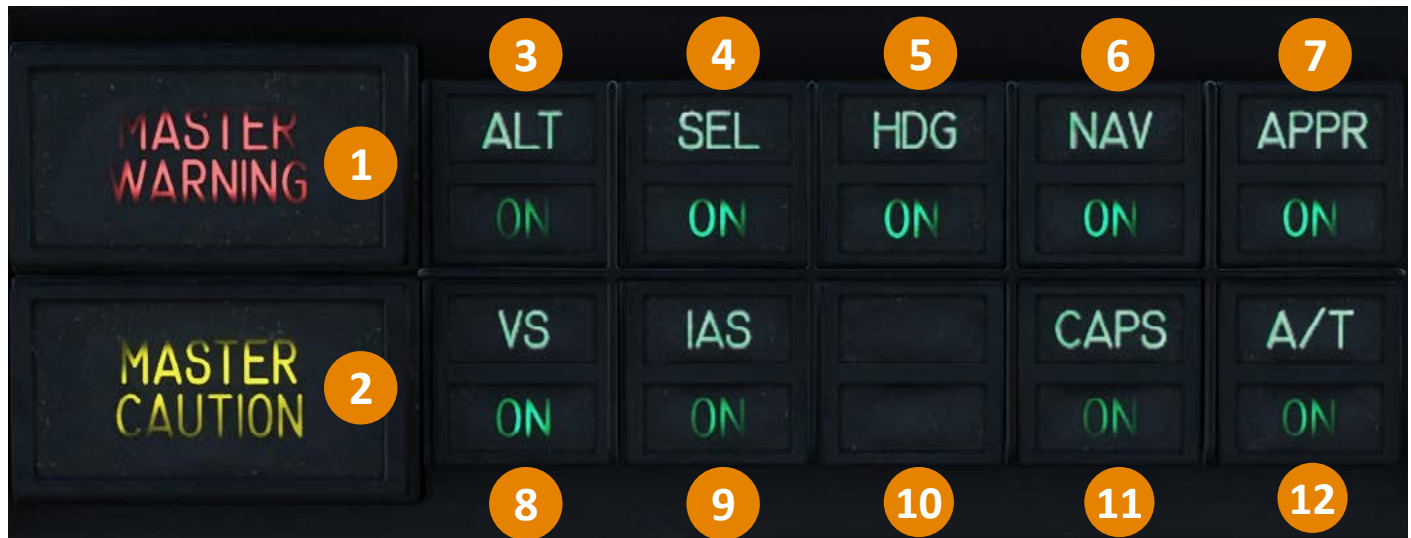
The BARO SET knob is a continuous-turn knob with a press-to-reset function. The knob is used to set the altimeter to the local barometric pressure. The pilot's BARO SET knob changes the baro setting on HDD 1, HDD 2, and the pilot's HUD; likewise, the copilot's knob changes the baro setting on HDD 3, HDD 4, and the copilot's HUD.

Altimeter values are set in increments of 0.01 inHg from 28.10 to 31.00 inHg, or in 1 millibar increments from 951 to 1050 millibars, depending on the selected baro scale.

When pressed, the altimeter is reset to either 29.92 inHg, or 1013 millibars, depending on the selected baro scale.



## MODE Subpanel



### 1. Master Warning Pushlight

The MASTER WARNING pushlight, in conjunction with the master warning aural tone, alerts the crew to a new ACAWS warning message. When activated, “MASTER WARNING” flashes in red at 3 Hz and the aural tone loops until silenced. Pressing the button while illuminated will acknowledge the warning, which extinguishes the light and silences the tone.

### 2. Master Caution Pushlight

The MASTER CAUTION pushlight, in conjunction with the master caution aural tone, alerts the crew to a new ACAWS caution message. When activated, “MASTER CAUTION” flashes in amber at 3 Hz and the aural tone loops until silenced. Pressing the button while illuminated will acknowledge the caution, which extinguishes the light and silences the tone.

## Autopilot Mode Switches

Autopilot mode switches are used to select lateral and vertical modes for the flight director. In addition to the green “ON” legends on each switchface, the armed and engaged autopilot modes will be announced on the PFD and HUD.



## 3. Altitude Hold Switch

Pressing the ALT switch engages the altitude hold mode of the flight director. When the switch is pressed, the aircraft is commanded to level off at the aircraft's current altitude. Altitude hold will not engage if vertical speed is greater than 2,000 FPM. The green "ON" legend will annunciate upon successful, manual engagement of altitude hold via the switch, or after completion of an altitude capture with the altitude select mode active and when the aircraft is within 10 feet of the preselected altitude.

Altitude hold will be disengaged automatically if any of the following conditions are true:

- Pitch synchronization is activated via the yoke SYN switch.
- The autopilot pitch control wheel is used to command a pitch change.
- Glideslope capture.
- Engagement of IAS mode.
- Engagement of VS mode.

## 4. Altitude Select Switch

Pressing the SEL switch engages the altitude select mode of the flight director. When the aircraft is approaching the preselected altitude while climbing or descending, the flight director mode will automatically switch to ALT HOLD to level off and capture the selected altitude. After this occurs, the PFD and HUD will annunciate ALT HOLD as the active vertical mode. The switchface's green "ON" legend will remain illuminated to indicate that altitude select mode is still active for the next altitude change.

## 5. Heading Select Switch

Pressing the HDG button engages the heading mode of the flight director, which is annunciated by the green "ON" legend illuminating. Heading mode will automatically disengage upon capture of a navigation or localizer source.

## 6. Navigation Switch

Pressing the NAV switch engages the navigation mode of the flight director, which is annunciated by the green "ON" legend illuminating. In this mode, the flight director tracks the CDI source that has been selected on the NAV-SELECT AMU page.

## 7. Approach Mode Switch

Pressing the APPR switch engages the approach mode of the flight director, which is annunciated by the green "ON" legend illuminating. Approach mode allows for the flight director to generate guidance commands to track a ground-based localizer and glideslope signal.

When selected, NAV mode is armed to allow for localizer capture, and glideslope mode is armed to allow for glideslope capture. Once the aircraft is within the localizer capture window, the flight director will intercept and track the localizer course. When the glideslope indicator becomes centered, the flight director will follow the glideslope down to the runway.



## 8. Vertical Speed Switch

Pressing the VS switch engages the Vertical Speed hold mode of the flight director, which is annunciated by the green "ON" legend illuminating. When pressed, the flight director commands the aircraft to maintain the vertical speed that existed at the time of engagement by using pitch. Other vertical modes such as IAS and altitude select are incompatible with VS mode, and selection of these will automatically disengage VS mode.

**WARNING: There is no airspeed protection in VS mode. The aircraft can, and will, decelerate to a stall condition if left unmonitored.**

## 9. Indicated Air Speed Switch

Pressing the IAS switch engages the Indicated Airspeed hold mode of the flight director, which is annunciated by the green "ON" legend illuminating. When pressed, the flight director commands the aircraft to maintain the indicated airspeed that existed at the time of engagement by using pitch. Other vertical modes such as VS and altitude select are incompatible with IAS mode, and selection of these will automatically disengage IAS mode.

## 10. Unused

## 11. Coordinated Aircraft Positioning System Switch

Pressing the CAPS switch engages the coordinated aircraft positioning system mode of the flight director, which is annunciated by the green "ON" legend illuminating. When pressed, the flight director commands the aircraft to follow lateral guidance commands generated by the SKE system.

## 12. Autothrottle Engage Switch

Pressing the A/T switch engages the autothrottle system, which is annunciated by the green "ON" legend illuminating. When the system is engaged, servos will drive the power levers to maintain the selected airspeed automatically.

Due to the difference in speed management philosophies between the autothrottle system and the IAS HOLD vertical mode, simultaneous engagement of these modes is not possible. This is because the autothrottles use engine power to maintain airspeed while the IAS HOLD mode uses pitch to maintain airspeed. If A/T is selected with IAS HOLD engaged, IAS HOLD will be automatically disengaged. The opposite is not true, however: selection of IAS HOLD with A/T active will have no effect.



## Autopilot Mode Annunciator Panel

Two identical autopilot mode annunciator panels are provided for the pilot and copilot. Each panel contains various green lights that illuminate to show, at a glance, which autopilot modes are currently active.

Annunciator	Meaning		
AP ON	The onside autopilot is engaged.	AP ON	AP DSGN
AP DSNG	Flashes at a rate of 3Hz when the autopilot has been disengaged and not acknowledged by the crew.	PTCH OFF	LAT OFF
PTCH OFF	The onside autopilot is engaged and the pitch axis has been deselected.	NAV ARM	NAV CAPT
LAT OFF	The onside autopilot is engaged and the lateral axis has been deselected.	GS ARM	GS CAPT
NAV ARM	Navigation mode has been armed.	GO ARND	BACK LOC
NAV CAPT	Navigation mode is active.	CAT2 ARM	CAT2
GS ARM	Glideslope capture is armed.		
GO ARND	Go around mode is active.		
BACK LOC	Localizer backcourse mode is active.		
CAT2 ARM	Monitoring for a CAT2 approach has been armed.		
CAT2	Monitoring for a CAT2 approach is active.		



## Communication/Navigation/Breaker Panel

The CNBP allows for tuning of the communication and navigation radios, alteration of the transponder code, and control over the Electronic Circuit Breakers (ECBs). The CNBP is interacted with via a keypad, mode keys and a set of LSKs. For a detailed description of the CNBP pages, see the CNBP section.



### 1. Line Select Key

The LSKs allow for navigation through the CNBP interface. LSKs on the left side of each screen are labeled L1-L4, while the right LSKs are R1-R4.

### 2. Mode Keys

The mode keys select which page is displayed on the CNBP.

### 3. Keypad

The keypad is used to enter data into the CNBP scratchpad. The CLR key is used to remove data from the scratchpad and is dual-purpose: pressing the key once will remove one character from the scratchpad while holding the key for more than one second will clear all characters.

### 4. Brightness Control Rocker

The brightness rocker adjusts the backlighting intensity for the CNBP screen.



## CNBP Operation

The CNBP operates by taking a pilot input made via the keypad and placing it into a scratchpad along the bottom of the display. The LSKs are then used to select which datafield the input will be sent to. A validity check is performed when a field is selected: if the scratchpad input contains invalid data for the given field, the input will be rejected and no action will occur. These rejections are annunciated via system messages displayed in the scratchpad.

## Scratchpad

The scratchpad is 14 characters wide and located on the bottom row of the display. When a frequency is entered and successfully tuned into a radio, the tuned frequency will remain in the scratchpad for 3 seconds before being cleared. This allows for multiple radios to be tuned to the same frequency without having to re-enter it into the scratchpad. In the event of an invalid tuning operation that results in a scratchpad message, the scratchpad will not be cleared and the invalid data will remain.

Note: If the scratchpad is cleared using the CLR key within 3 seconds of tuning a radio, any additional inputs will be cleared once the 3 second timer expires.

## Scratchpad Messages

Scratchpad messages are formatted as right-justified and highlighted in inverse video. The following messages can be displayed based on operator input:

**INVALID ENTRY:** An entry operation has been attempted with invalid scratchpad data.

**INVALID FREQUENCY:** A frequency tuning operation has been attempted on a radio and the entry data is invalid. Either of the following scenarios will trigger the message:

- The entered frequency was in an invalid format and/or was lacking a decimal.
- The entered frequency was out of range for the selected radio.

**INVALID HDD:** An HDD assignment has been attempted for the ECB HDD page, and the entered number is not a valid HDD identifier. Valid HDD identifiers range from 1 to 4.

**INVALID ECB #XXX:** An ECB operation has been attempted and the ECB identifier is invalid. This message will also be generated if multiple ECBs are entered, an operation is attempted, and an identifier in the list is invalid.

**VERIFY PULL:** "PULL" was selected on the ECB page with multiple, valid ECB identifiers in the scratchpad. A second selection of "PULL" is required within 10 seconds to carry out the operation. If this does not occur, no operation will occur.

**VERIFY RESET:** "RESET" was selected on the ECB page with multiple, valid ECB identifiers in the scratchpad. A second selection of "RESET" is required within 10 seconds to carry out the operation. If this does not occur, no operation will occur.



## Frequency Recall

The six communication radios (UHF, VHF, and HF) have a frequency recall function associated with them. After a frequency for these radios has been changed, the previous frequency is stored in memory; provided a frequency is not already present in the CNBP scratchpad, the stored frequency may be recalled into the radio's active frequency by pressing the LSK adjacent to the desired radio.

## Transponder Field

A transponder field is displayed adjacent to R4 on the COMM and NAV CNBP pages. The field displays the IFF Mode 3 code, as well as IFF status identifiers.

The Mode 3 code tuned into the IFF system is displayed to the left of the status identifiers. The transponder code can be changed either via the CNBP keypad or the IFF CNI page; entries made on the CNBP will propagate to the CNI, and vice versa. Valid Mode 3 codes range from 0000 to 7777. When power has been removed from the IFF, an "OFF" label will be shown in the Mode 3 code field.

Note: If the IFF is turned on and set to STBY in the IFF CNI page, pressing R4 will set the IFF to transmit on transponder #1.

The IFF status identifiers provide a quick way to verify which transponder modes are operating. The individual fields are blank when the display criteria are not met. Three different identifiers are available for display:

Status Identifier	Display Criteria
T	The IFF is not in standby and set to transmit.
3	IFF Mode 3 is set to ON.
C	IFF Mode C is set to ON.



## COMM Page

The COMM page is accessed by selecting the COMM mode key. From this page, the aircraft's various communications radios can be tuned. These radios include Ultra High Frequency (UHF), Very High Frequency (VHF) and High Frequency (HF). Two separate radios are available for each type, denoted by the identifier Ux for UHF, Vx for VHF, and Hx for HF. The tuned frequency for each radio is displayed adjacent to the respective radio's identifier.

When a radio is not powered, "OFF" is displayed in the frequency field for the associated radio. Tuning a radio that is powered off will automatically turn it on.



## Radio Frequency Ranges

The following ranges are used by the CNBP when determining the validity of an entered communication frequency. If a tuning operation is attempted on a radio with a frequency outside of its valid range, the "INVALID FREQUENCY" CNBP message will be displayed.

Radio	Frequency Range
UHF	225.000 to 399.975 in 0.025 MHz steps
VHF, Low Band	30.000 to 87.975 in 0.025 MHz steps
VHF, High Band	116.000 to 173.975 in 0.025 MHz steps
HF	2.0000 to 29.0000 in 0.001 MHz steps



## NAV Page

The NAV page is accessed by selecting the NAV mode key. From this page, the aircraft's various navigation radios can be tuned. These radios include Very High Frequency Omni-Directional Range (VOR), Tactical Air Navigation (TACAN), and Automatic Direction Finding (ADF). Two separate radios are available for each type, denoted by the identifier Vx for VOR, Tx for TACAN, and Ax for ADF. The tuned frequency for each radio is displayed adjacent to the respective radio's identifier.

When a radio is not powered, "OFF" is displayed in the frequency field for the associated radio. Tuning a radio that is powered off will automatically turn it on.



## Radio Frequency Ranges

The following ranges are used by the CNBP when determining the validity of an entered navigation frequency. If a tuning operation is attempted on a radio with a frequency outside of its valid range, the "INVALID FREQUENCY" CNBP message will be displayed.

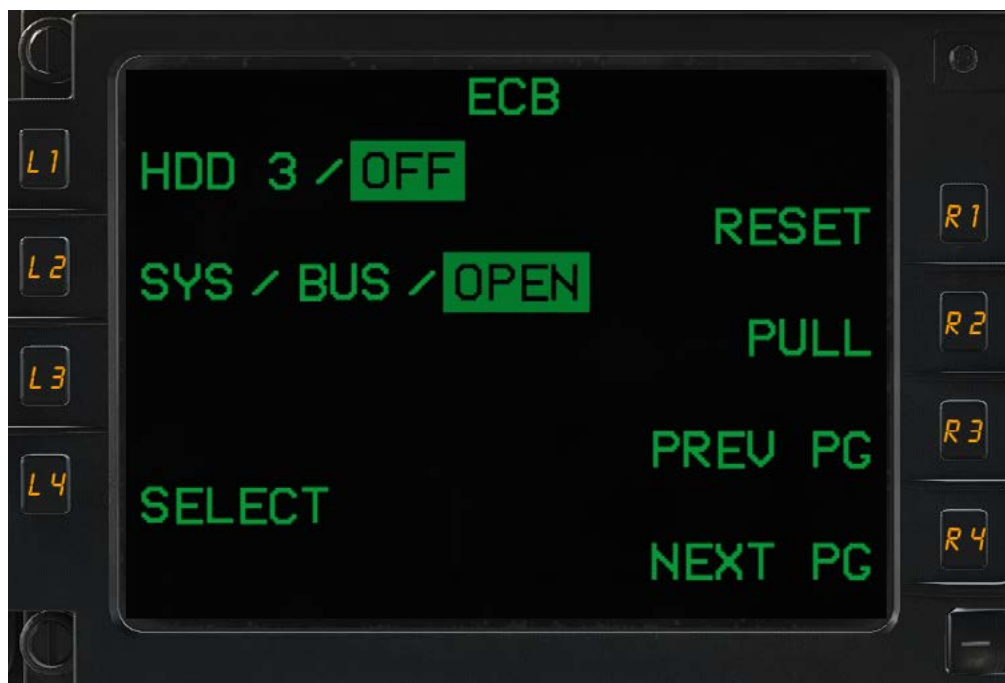
Radio	Frequency Range
VOR	108.0 to 117.95 MHz in 0.05 MHz steps
TACAN	1X/Y to 126X/Y
ADF	100.0 to 2199.5 in 0.5 kHz steps

Note: The CNBP assumes all TACAN channels are in the X band unless otherwise specified. To tune a Y band, a decimal must be entered in the scratchpad following the channel.



## ECB Page

The ECB page is accessed by selecting the ECB mode key. From this page, the aircraft's Electronic Circuit Breakers can be manipulated.



**L1:** Controls which HDD the ECB HDD page will appear on.

On a hot start, HDD 3 is the designated HDD that the ECB page will be displayed on; this can be changed by entering an HDD identifier in the CNBP scratchpad and pressing L1. Pressing L1 with the CNBP scratchpad blank will toggle the ECB HDD page on and off.

Note: On initial power up, the HDD field will be blank: an HDD identifier must be entered using the scratchpad for the LSK to function. If the aircraft loses AC power, this field will also be reset to blank.

**L2:** Controls which ECB page is shown on the designated HDD. Pressing L2 will cycle through the 3 different page options. "OPEN" is the default selection.

- **SYS:** The ECB BY SYSTEM page will be displayed. The ECB list is sorted by what system they belong to.
- **BUS:** The ECB BY BUS page will be displayed. The ECB list is sorted by what electrical bus they belong to.
- **OPEN:** The ECB BY SYSTEM – OPEN ONLY page will be displayed. Only open ECBs are displayed and are sorted by which system they belong to.



**L3:** Blank.

**L4:** When ECB identifier(s) are present in the scratchpad, using L4 will select the ECBs from the list and display them in inverse video on the ECB HDD page. Further actions such as pull and reset can then be performed.

**R1:** When ECB identifier(s) are present in the scratchpad, using R1 will reset the entered ECBs. If more than one ECB was present in the scratchpad, the message "VERIFY RESET" will be displayed and R1 must be pressed a second time to carry out the operation.

**R2:** When ECB identifier(s) are present in the scratchpad, using R2 will pull the entered ECBs. If more than one ECB was present in the scratchpad, the message "VERIFY PULL" will be displayed and R2 must be pressed a second time to carry out the operation.

**R3:** Cycles to the previous page of the ECB page structure. If the current page is the first page of the structure, pressing PREV PAGE will cycle to the last page.

**R4:** Cycles to the next page of the ECB page structure. If the current page is the last page of the structure, pressing NEXT PAGE will cycle to the first page.



## Standby Flight Instruments

Analog backup instruments for attitude, airspeed, altitude, and heading are provided in the event of an electrical system or Air Data Computer (ADC) failure. These instruments include an attitude indicator, a combined altimeter/airspeed indicator, and a magnetic compass.



### Standby Attitude Indicator

The standby attitude indicator uses an electronically driven gyroscope to provide a means of pitch and bank information that is independent of the aircraft's ADCs. In the event of a total AC electrical failure, the aircraft's utility battery will supply a minimum of 30 minutes' worth of power to the attitude indicator. When power to the instrument is lost, a minimum of 9 minutes of usable attitude information is still available.

Pitch indications are provided in increments of 5 degrees, with the blue section indicating nose-up (positive) pitch, and the brown nose-down (negative) pitch. Roll indications are provided via a triangular roll pointer in increments of 10 and 30 degrees, depending on the bank angle.

#### 1. Adjustable Waterline Symbol

The adjustable waterline symbol moves up and down according to the PULL TO CAGE knob's position. The vertical adjustment allows for inaccurate pitch biases to be corrected. The waterline can be moved -10 degrees and +15 degrees from the center position.



## 2. PULL TO CAGE Knob

The PULL TO CAGE knob is used to adjust the position of waterline symbol, reset the gyroscope to a new level position, and cage the gyroscope. The knob rotates and pulls outwards, depending on the action being performed.

Rotation of the knob when it hasn't been pulled will result in movement of the adjustable waterline symbol. If the knob is pulled, the gyroscope will realign its level position to match the aircraft's attitude. If the knob is pulled and rotated, the gyroscope's position will be locked in place and not provide any attitude information.

## 3. OFF Flag

The OFF flag is displayed in the pitch window when accurate attitude information is not available, such as during a power loss to the unit, or the gyroscope being caged.

## Standby Altimeter/Airspeed Indicator

A combined altimeter/airspeed indicator uses static pressure from an exterior static port and dynamic pressure from a pitot tube to provide an independent source of altitude and airspeed information.

The aircraft's altitude is shown via a revolving pointer and a set of rotating indicator drums. The pointer indicates the 100s value of the altitude, while the drums display the 1,000s value. The far left drum has a white checkerboard indicator that shows whenever aircraft altitude is below 10,000 feet. A white "NEG" flag is displayed on the same drum when altitude is below 0.

Indicated airspeed is presented via a revolving drum indicator below the altimeter. The airspeed scale ranges from 0 to 350 knots.

## 4. BARO SET Knob

The BARO SET knob is used to adjust the barometric pressure used by the altimeter. The selected pressure is displayed both in millibars (MB) and inches of mercury (inHg) on either side of the altimeter. The barometer settings range from 745mb/28.00 inHg to 1050mb/30.99 inHg.

## Magnetic Compass

Inside the compass housing, a compass card is suspended in fluid and rotates freely to align itself with magnetic north. A white lubber line is used to read the heading from the card. An inset floodlight provides illumination at night.



## Landing Gear System Overview

The landing gear system on the C-130J is a tricycle type, featuring a dual-wheel steerable nose gear and two tandem-wheel main landing gear. The nose gear retracts forward into the nose gear bay located in the forward fuselage, while both main gears retract vertically into the wheel wells on the side of the fuselage. Each gear assembly is fitted with a position sensor that provides feedback to the cockpit whether the gear is down and locked, in transit, or retracted. Under normal operation, retraction and extension of the gear occurs in 19 seconds or less.

## Main Landing Gear

The main landing gear system consists of two gear assemblies mounted on each side of the fuselage, each with two wheels. Both wheels on the gear assemblies are equipped with carbon brakes. The gear normally extends and retracts via hydraulic fluid supplied by the utility system, which flows through a landing gear selector valve to each of the two landing gear motors.

Each gear assembly is raised and lowered vertically along a track by ball screws. The screws are driven by torque shafts that are connected to a hydraulic motor through a gearbox. The gear is held in the UP position by hydraulic pressure; when the gear is extended, friction washers on the ball screw assemblies serve as downlocks. Pivoting doors seal the landing gear bays when the gear is retracted and are linked to their respective gear strut through a mechanical linkage. Small windows on each of the wheel wells in the cargo bay allow for visual confirmation of the gear's positioning while in flight.

## Weight-on-Wheels Switches

Weight-on-wheels switches are located on the lower aft side of each main landing gear leg. When weight is applied to the aft wheels of each gear leg, the respective switch closes, providing a signal to the mission computers that the aircraft is on the ground, which inhibits some systems from operating.

## Nose Landing Gear

The nose landing gear is actuated by a hydraulic cylinder and held in the up and down position by hydraulic up and downlocks. Like the main gear, the nose gear is normally supplied with hydraulic fluid by the utility system. Hydraulic fluid flows from the landing gear selector valve to the nose gear uplock and downlock cylinders, and to the nose gear actuating cylinder. The gear is held in the up position via hydraulic pressure. In the event of a utility system failure, a shuttle valve connects the system to the auxiliary hydraulic system, allowing auxiliary system pressure to extend the nose gear.

## Nosewheel Steering

The nose landing gear steering system is hydraulically actuated by pressure from the utility system and controlled by a steering wheel in the cockpit. The steering system is mechanically prevented from exceeding 60 degrees of travel left or right of center and damped by steering cylinders to prevent nose gear oscillations and shimmy. Centering cams on the nose gear return the nose to a centered position whenever the weight is removed from the nose gear.



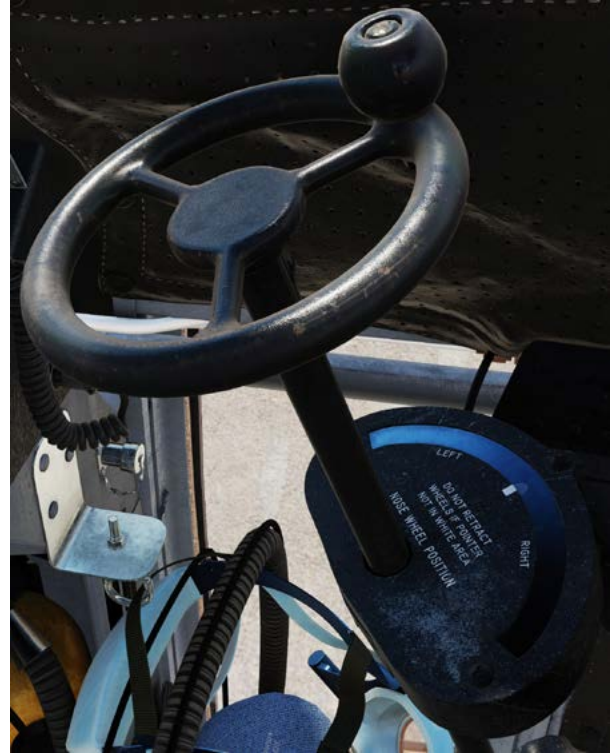
## Nosewheel Steering Control

Also referred to as ‘the tiller’, the nose gear steering wheel is located to the left of the pilot’s side yoke. The steering wheel is connected via a cable to the steering control valve. Counterclockwise movement of the wheel rotates the nose gear to the left, and vice versa to the right.

A white indicator, visible through a curved window forward of the wheel column, shows the current deflection of the nosewheel. The center/neutral position is denoted by a white rectangular mark, with yellow indices marking 20 degrees either side of center. The wheel is limited to 1.5 rotations left and right of center.

## Brake System

Each main landing gear wheel is equipped with a disk-type, hydraulically actuated brake. The nose gear wheels are not equipped with brakes.



The brakes are controlled from the cockpit by applying toe pressure at the top of the rudder pedals at both flight crew stations. When the pedals are pressed during normal operation, hydraulic fluid from the utility hydraulic system is sent through the normal brake selector valve to the brake control valves. Once the fluid leaves the brake control valves, it flows through anti-skid valves, brake fuses, and shuttle valves to the brake cylinders.

In emergency operation, the brake system receives hydraulic fluid from the auxiliary system through the emergency brake selector valve. When the emergency brake system is activated via the EMER BRAKE SEL switch, fluid is directed to the brake control valves, then through the hydraulic fuses and shuttle valves to the brakes. The anti-skid valves, and by association the anti-skid system, are bypassed in this mode of operation.

## Brake Accumulators

Air-charged accumulators are utilized in the normal and emergency brake systems to provide a reserve source of hydraulic pressure in the event of system failure and to mitigate pressure surges.

In the normal brake system, the accumulator stores pressure for about two brake applications if the anti-skid switch is in the OFF position. If the switch is in the ON position, only one brake application will be available.

In the emergency brake system, the accumulator is half the size and supplies only enough pressure for one application.



## Anti-Skid System

The anti-skid system protects the main gear tires from damage caused by brake lockup and wheel skidding when excessive brake pressure is applied. Each main landing gear axle contains a wheel speed transducer unit which monitors when the landing gear wheel begins to approach an anti-skid condition.

If the wheel speed decreases rapidly, indicating an impending tire lockup or skid, an impulse is sent to the anti-skid valve which reduces brake pressure to the affected wheel. Each wheel has independent skid detection and control. The system also provides protection against locked wheels by comparing the deceleration of wheel pairs. If the deceleration tolerance is exceeded, the system reduces brake pressure to the slower wheel until it spins up again.

## Parking Brake Handle

The parking brake handle sets the aircraft's parking brake when pulled. Pulling the handle out with the brakes depressed closes the parking brake shutoff valve and blocks the return of brake pressure to the system, which holds the brakes applied. When the system is properly engaged, all four rudder pedals should be depressed and the parking brake handle extended.

For the parking brake to be set, the toe brakes must be depressed at least 80% of their travel. The brakes can be released by momentarily depressing the brake pedals, which will cause the handle to snap inward and release the trapped brake pressure.



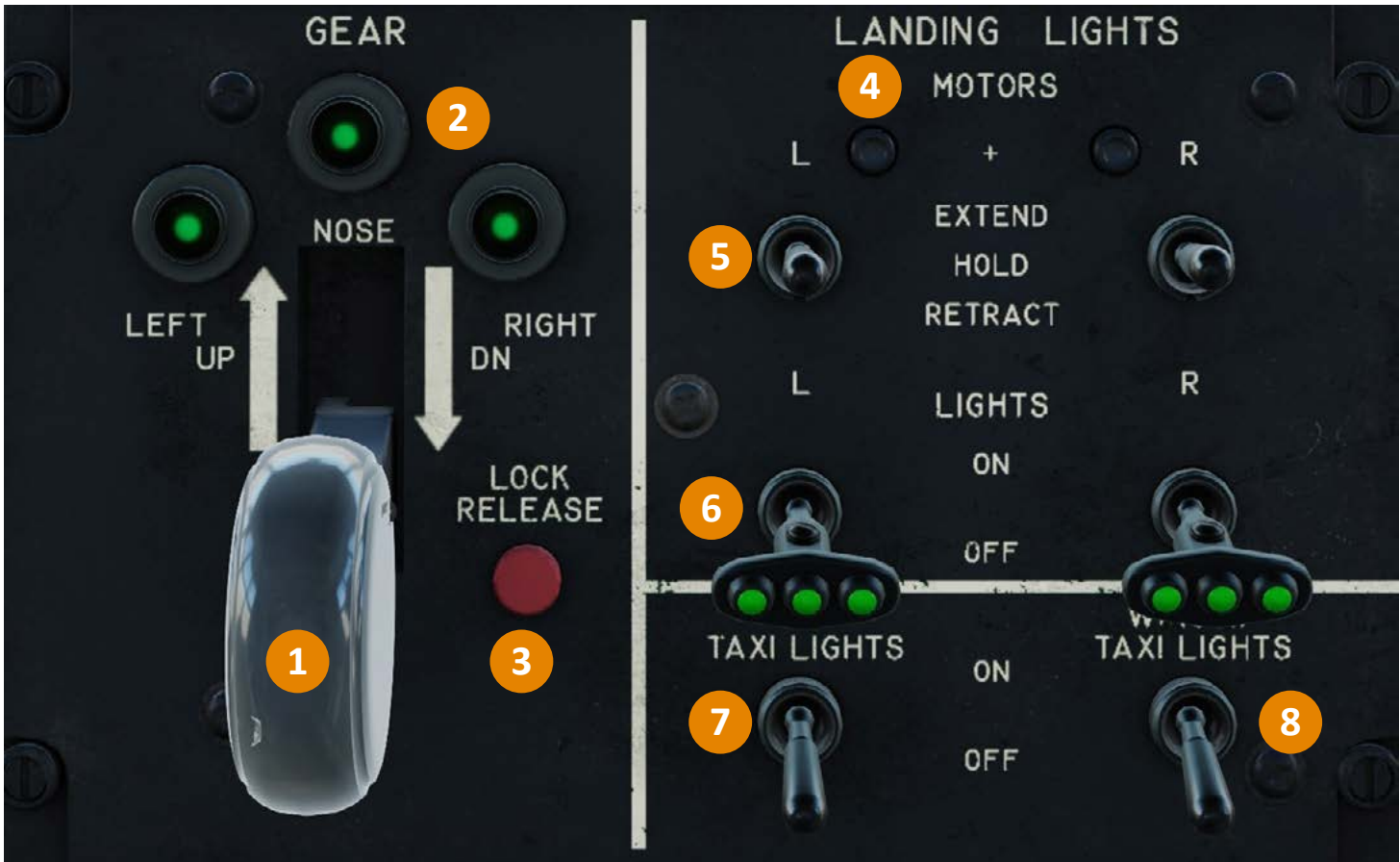
## Brake Pedals

Toe brakes are provided at the top of each rudder pedal that apply brake pressure to the brake assemblies on the main landing gear wheels. Pressure on the left toe brake causes the brakes on the left gear to engage, and vice versa.



## Landing Gear Control Panel

The landing gear control panel is used to manipulate the landing gear and forward-facing exterior lights. A clickspot is provided between the switch pairs to allow both of them to move with one mouse action.



### 1. Landing Gear Lever

The landing gear lever directs an actuating mechanism to raise or lower the landing gear.

When the lever is moved to the UP position, a selector valve directs utility hydraulic system pressure to release the nose gear downlock and supply fluid to both main landing gear hydraulic motors, which causes the gear assemblies to retract. When the lever is moved to the DN position, the nose gear uplock is released and the hydraulic motors are reversed, which causes the gear to extend.

The lever is mechanically locked to the DN position when either of the following conditions are true:

- Weight on wheels signal indicates the aircraft is not in the air.
- Loss of isolated DC power.



## Landing Gear Lever Warning Lights

Red warning lights are installed inside the translucent landing gear lever. These lights illuminate to warn the crew of a potentially unsafe gear configuration under any of the following conditions:

1. A landing gear position does not match the gear lever selection.
2. Any power lever is reduced below 38 degrees PLA, or within 5 degrees PLA of the FLT IDLE position, and the landing gear is not down.
3. The landing gear is not down, and flaps are extended greater than 70%.

## 2. Gear Position Indicator Lights

A green light is provided for the nose and two main landing gear assemblies to indicate the position of each landing gear. When a gear assembly is locked in the down position, the green light will illuminate; if an assembly is not locked in the down position, the light will extinguish.

## 3. Downlock Release Button

The downlock release button is spring-loaded and used to release the landing gear lever's mechanical lock.

## 4. Landing Light Motor Lights

Green lights are provided for the electric motors that extend and retract the two landing lights. The lights illuminate whenever their respective landing lights are not fully retracted.

## 5. Landing Light Motor Switches

Electric motors are used to extend and retract the two landing lights. Each motor has a control switch with three positions:

EXTEND: The motor is energized to drive its landing light to the fully-extended position.

HOLD: The motor is de-energized to stop the light in its current position.

RETRACT: The motor is energized to drive its landing light to the fully-retracted position.

## 6. Landing Light Switches

Two switches control the illumination of the left and right landing lights.

## 7. Taxi Light Switch

The taxi light switch controls the illumination of the left and right taxi lights.

## 8. Wingtip Taxi Light Switch

The taxi light switch controls the illumination of the left and right wingtip taxi lights.



## Hydraulic System Overview

Three independent hydraulic systems power the flight controls, landing gear, brakes, and cargo ramp/door. The three systems, known as the utility, booster, and auxiliary, are pressurized to 3000 PSI and provide redundancy in case of a failure of one or multiple systems.

### Utility Hydraulic System

The utility system is pressurized by engine-driven pumps attached to engines 1 and 2. Hydraulic fluid is supplied to the two engine pumps by an electrically powered suction pump that transfers fluid from a reservoir located on the left side of the cargo bay. The electric suction pump is powered by the essential AC bus. The utility system provides hydraulic pressure to the flaps, landing gear, brakes, half of the flight control booster assemblies, and nosewheel steering systems.

### Booster Hydraulic System

The booster system functions in the same way as the utility system, with the differences being that its engine-driven pumps are attached to engines 3 and 4, and the reservoir is located on the right side of the cargo bay. The booster system provides hydraulic pressure to the aileron, elevator, and rudder boost systems.

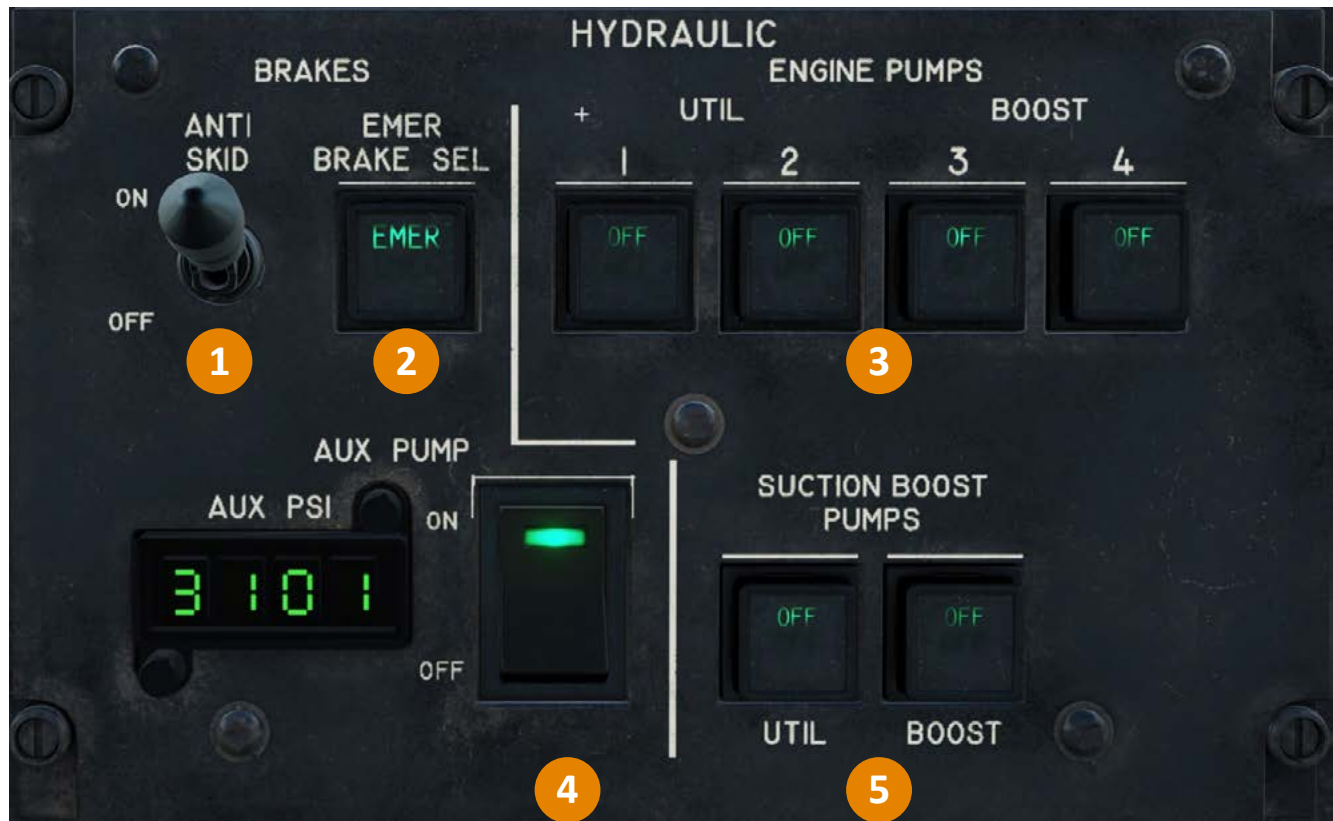
### Auxiliary Hydraulic System

The auxiliary system is powered by an electric hydraulic pump located on the right side of the aft cargo bay. The pump is powered by the main AC bus and provides hydraulic pressure to the cargo door and ramp, emergency brakes, and emergency landing gear extension systems.



## Hydraulic Control Panel

The hydraulic control panel contains controls for the hydraulic pumps, anti-skid system, and auxiliary hydraulic pump.



### 1. Anti-Skid Switch

The anti-skid switch controls whether the anti-skid system is operating.

**OFF:** The system is inoperative.

**ON:** The system is enabled and modulates brake pressure to eliminate wheel skidding.

### 2. Emergency Brake Select Switch

The emergency brake selector switch controls the position of the normal and emergency brake selector valves. When the switchface is dark, the normal brake valve is open and the emergency valve is closed; this configuration allows for utility system pressure to reach the brake system.

When the button is pressed, the emergency brake valve opens and the normal brake valve closes. When this occurs, the auxiliary hydraulic system supplies pressure to the brakes. The emergency brake valve being open is annunciated by a green “EMER” label appearing on the switchface.

Note: When the EMER BRAKE SEL button is pressed, a thumping sound will be heard from the nose gear bay. This sound comes from the selector valves as they change positions.



### 3. Engine Pump Switches

Four switches, one for each engine, control the engine-driven hydraulic pumps for the utility and booster systems. When the switches are in the ON position, the switch face is dark and the pumps are active. In the OFF position, a green “OFF” label appears on the switch face and the pumps are deactivated.

### 4. Auxiliary Hydraulic Pump Switch

The aux pump switch controls the auxiliary hydraulic pump in the cargo bay. In the ON position, a green light on the switch illuminates and the pump is energized to supply pressure to the auxiliary hydraulic system. In the OFF position, the pump is de-energized. A digital display to the left of the switch indicates the pressure in the aux hydraulic system.

### 5. Suction Boost Pump Switches

Two switches control the electric suction pumps for the utility and booster systems. When the switches are in the ON position, the switch face is dark and the pumps are active. In the OFF position, a green “OFF” label appears on the switchface and the pumps are deactivated.



## Pilot Lighting Control Panel

Brightness control rheostats are provided for lighting on the pilot's side of the cockpit. Controls are also provided for overriding the brightness settings of the entire cockpit's lighting.



### 1. Master Lighting Mode Switch

The three-position switch selects the operating mode for all cockpit lighting.

**NVIS:** Lighting incompatible with night vision goggles is deactivated.

**NORM:** The brightness rheostats on the pilot and copilot lighting panels are in full control over the cockpit lighting.

**TSTORM:** The brightness settings of individual lighting groups and displays are overridden and set to full brightness.

### 2. Annunciator Brightness Switch

The annunciator brightness switch is used to change the brightness of the various annunciator and indicator lights around the cockpit. The switch is spring-loaded to the center from DIM and BRT.

**DIM:** The annunciator and indicator lights are set to illuminate at a reduced brightness.

**BRT:** The annunciator and indicator lights are set to illuminate at full brightness.



### 3. Dome Light Rheostat

Controls the intensity of the cockpit dome lights.

### 4. Circuit Breaker Light Rheostat

Controls the intensity of the pilot side circuit breaker panel's flood lighting.

### 5. Display Master Rheostat

Controls the brightness of HDD #1 and #2, the pilot's AMU, and the CNBP.

### 6. Side and Instrument Panel Backlighting Rheostat

Controls the intensity of the side console and instrument panel's backlighting.

### 7. Side and Instrument Panel Flood Rheostat

Controls the intensity of the side console and instrument panel's flood lighting.

### 8. Floor Light Rheostat

Controls the intensity of the floor lighting around the cockpit.

### Copilot Lighting Control Panel

Brightness control rheostats are provided for lighting on the copilot's side of the cockpit. Counterclockwise rotation reduces lighting intensity while clockwise rotation increases it.



## 1. Circuit Breaker Light Rheostat

Controls the intensity of the copilot side circuit breaker panel's flood lighting.

## 2. Overhead Panel Flood Light Rheostat

Controls the intensity of the overhead panel flood lighting.

## 3. Overhead Panel Backlighting Rheostat

Controls the intensity of the overhead panel's backlighting.

## 4. Center Console Backlighting Rheostat

Controls the intensity of the center console's backlighting.

## 5. Display/Lamp Test Switch

The display/lamp test switch is used to test the various cockpit annunciator lighting and 8-segment digital displays.

**LAMP:** Illuminates all of the annunciator and indicator lights.

**DISPL:** Displays 8s on all of the 8-segment digital displays around the cockpit, except for the battery voltage display.

## 6. Side and Instrument Panel Flood Light Rheostat

Controls the intensity of the copilot side console and instrument panel's flood lighting.

## 7. Side and Instrument Panel Backlighting Rheostat

Controls the intensity of the copilot side console and instrument panel's backlighting.

## 8. Display Master Rheostat

Controls the brightness of HDD #3 and #4 and the copilot's AMU.



## Aerial Delivery Panel

The Aerial Delivery Panel allows airdrop-related systems such as the cargo ramp/door, jump lights, and air deflectors to be interacted with.



### 1. RAMP/DOOR Light

A green “FULL” light illuminates when the cargo door is locked in the open position, and the cargo ramp is level with the cargo bay floor.

### 2. RAMP/DOOR Switch

The RAMP/DOOR switch allows for the cargo ramp and cargo door to be opened and closed simultaneously. The switch is spring-loaded to OFF from OPEN.

**OPEN:** The cargo ramp and cargo door are commanded open.

**OFF:** Cargo ramp and door movement is halted.

**CLOSE:** The cargo ramp and door are commanded closed.

Because mission computer permission is needed to open the cargo ramp and door, the switch will only function when the following criteria have been met:

1. The Weight on Wheels switch is in the air position. Selecting the RAMP/DOOR WOW OVRD to ON via the PREFLIGHT AMU page will override this condition.
2. The airplane is not pressurized above 0.2 inHg. Holding the switch to OPEN for more than 8 seconds will override this condition.



### 3. CAUTION Light Switch

The caution light switch controls the illumination of the red jump status lights in the cargo bay. When the button is pressed, a yellow light on the switchface illuminates and the red lights are turned on.

### 4. JUMP Light Switch

The jump light switch controls the illumination of the green jump status lights in the cargo bay. When the button is pressed, a green light on the switchface illuminates and the green lights are turned on.

Note: As a safety precaution, the JUMP light will not function unless the CAUTION light is already selected.

### 5. CHUTE RELEASE Button

The chute release switch releases the extraction parachute(s), if configured. When the cargo ramp and door are in the Aerial Delivery System (ADS) position without weight on wheels, pressing the CHUTE RELEASE button energizes the extraction parachute release in the cargo bay. A cover on top of the button prevents inadvertent selection.

### 6. AIR DEFLECTOR Switch

The air deflector switch controls the position of both paratroop door air deflectors.

**OPEN:** The air deflectors are extended into the air stream.

**CLOSE:** The air deflectors are retracted into the fuselage.

### 7. COMPUTER DROP Switch

The computer drop switch selects the level of control the CNI-MU has over the airdrop sequence.

**AUTO:** The CNI-MU automatically selects the JUMP lights and energizes the extraction release upon reaching the computed GREEN LIGHT point. No operator input is required.

**AD-MAN TJ-AUTO:** The CNI-MU automatically selects the JUMP lights upon reaching the computed GREEN LIGHT point, but the extraction release must be operated manually via the CHUTE RELEASE button.

**MAN:** The CNI-MU has no control over the sequence; the JUMP lights and extraction chute release must be operated manually via their respective switchlights.

### 8. ALARM Switch

The guarded ALARM switch controls four mechanical alarm bells in the cargo bay. When the switch is moved to the ON position, the bells activate.



## Overview

The C-130J is outfitted with several defensive systems that enhance the survivability of the aircraft in hostile environments and protect against a variety of threat types that include infrared-guided, radar-guided, and laser-guided. The defensive suite consists of the AN/AAR-47 Missile Warning System (MWS), the AN/ALR-56M Radar Warning Receiver (RWR), and the AN/ALE-47 Countermeasure Dispensing System (CMDS).

### AAR-47 MWS

The MWS utilizes four combined optical and laser sensors, two on the nose of the aircraft and two on the tail, to passively detect missile launches via the infrared signature of their booster exhaust plume. A separate part of the sensor can detect the beam of a laser associated with weapon guidance. Sensor placement, combined with the sensors' Field of View (FOV), allows for 360-degree detection around the aircraft.

When the system detects a threat, the MWS warning tone is played for three seconds in the cockpit. Additionally, directional arrows appear on the HUD and NAV-RADAR RWR overlay; in the case of a laser warning, additional symbols are displayed on the RWR overlay to distinguish between different laser categories.

### ALR-56M RWR

The RWR receives and processes a wide range of radio frequency signals using sensors located on the nose and tail. The received signals are processed for direction finding and analyzed to determine if they are from radar emitters; if the signal is categorized as a radar, further analysis is conducted to determine whether the radar represents a threat. If the radar is recognized as a threat, symbology appears on the NAV-RADAR RWR overlay, along with associated audio alerts.

### ALE-47 CMDS

The CMDS consists of 14 countermeasure dispensers located around the aircraft: four on the nose, four on each side of the fuselage, and another two on the tail. The nose dispensers are reserved for flares only, but the other ten can be configured with mixed chaff and flare depending on mission requirements. Each dispenser can hold up to 30 expendable countermeasures.

When the RWR or MWS detect a threat, a dispense command is sent to the CMDS to dispense the appropriate countermeasure. If the system is enabled via the defensive systems control panel and the DEF SYS CONTROL page, countermeasures will be automatically dispensed depending on the CMDS mode selection.



## Defensive Systems Control Panel

The defensive systems control panel allows for the defensive systems to be armed and disarmed, as well as configured to the threat environment.



### 1. Master Switch

The defensive systems master switch allows for the entire defensive system to be quickly armed and disarmed.

**OPR:** All components of the defensive systems are activated unless a component has been manually deactivated on the DEF SYS CONTROL CNI page.

**STBY:** All components of the defensive systems are inhibited from radiating or dispensing.

### 2. CMDS Jettison Switch

The guarded switch is spring-loaded to OFF and allows for the entire flare inventory to be rapidly jettisoned from the aircraft. When the switch is held to ON with weight-off-wheels, the CMDS dispenses all loaded flares in quick succession. Chaff is unable to be jettisoned via this switch.



## 3. CMDS Mode Selector

The CMDS mode selector is used to choose the operating mode for the CMDS.

**STBY:** Power is applied to the CMDS to allow the system to run a BIT. No power is applied to the squibs and dispensing is inhibited, except for flare jettison via the JETTISON switch.

**MAN:** Chaff, flares, and other payloads may be dispensed manually via the yoke chaff/flare eject button according to the countermeasure program selected by the MAN PRGMS switch.

**SEMI:** Chaff and other payloads can be dispensed on command if the CMDS is authorized by pressing the chaff/flare eject button on the pilot control wheel. The message "CMDS READY" is displayed on the HUD and PFD, indicating the system has been alerted to an RWR threat and is ready to dispense a countermeasure upon authorization. In the event the system is alerted to an MWS threat, flares are dispensed automatically without the need for pilot authorization.

**AUTO:** Chaff and flares are automatically dispensed, according to the threat type.

**BYP:** Chaff and flares may be manually dispensed upon actuation of the CMDS dispense switch; flares are automatically dispensed according to MWS inputs. This is a mission-critical function to ensure CMDS operation in the event of a programmer failure.

## 4. ECM Switch. No function in the real C-130J.

## 5. IRCM Switch. No function in the real C-130J.

## 6. MAN PRGMS Selector

The manual programs switch is used to select which countermeasure program is used during manual dispensing.

**1-4:** The program selected on the CMDS CONTROL CNI page is utilized.

**5:** Program #5 is utilized.

**6:** Program #6 is utilized.

## 7. RWR SRCH Switch

The RWR search (SRCH) mode switch toggles the search mode of the RWR. When the switch is pressed, a green "ON" light is displayed and the RWR will display any detected search or acquisition radars.

When the SRCH mode is active, a magenta "S" will appear in the center of the NAV-RADAR RWR overlay. If SRCH mode is OFF and a search radar is detected, "SRCH RADAR" will be displayed in the HDD message window for 5 seconds.



## 8. RWR Mode Switch

The RWR mode switch selects whether the RWR's priority mode is active. When the switch is pressed, a green "PRI" light is displayed and the RWR will only display the five highest priority threats. When priority mode is OFF, the RWR will display the 12 highest priority threats. Up to 16 threats can be displayed if the RWR SRCH or SHOW UNK options are enabled.

## 9. RWR Handoff Switch. No function

## 10. RWR ALT Switch

The RWR altitude switch selects whether the RWR will display low-altitude threats or high-altitude threats. When the switch is pressed, a green "HIGH" light is displayed and the RWR will only display high-altitude threats; if the switch face is blank, low-altitude threats are displayed. A magenta "L" will appear in the center of the NAV-RADAR RWR overlay when low mode is active.

## 11. RWR TGT SEP Switch

The target separation switch will separate RWR symbology along their line of bearing to eliminate overlapping symbols when multiple threats exist in close proximity. When target separation mode is active, a green "TGT" light will appear on the switch face. Deselection of target separation will cause all symbology to return to its original location.



## Overview

A conventional arrangement of primary and secondary flight controls is used to control the aircraft while airborne. Primary flight controls include the elevators, ailerons, and rudder while flaps and trim tabs encompass the secondary flight controls. The primary flight controls are mechanically linked to the cockpit controls via a system of cables attached to hydraulic booster assemblies; the secondary controls have no mechanical linkage.

A Stall Warning System (SWS) and Sideslip Warning System are installed that monitor flight parameters and provide alerts when approaching a stall or excessive sideslip condition.

## Elevators

Two separate elevator control surfaces are attached to the aft portion of horizontal stabilizer, one on either side of the vertical stabilizer. These two surfaces move together to control the aircraft's pitch by using forward and aft inputs from the cockpit control yokes. A forward yoke input deflects the elevator surfaces downward, pitching the aircraft down. An aft input deflects the surfaces upward, pitching the aircraft up.

## Elevator Trim System

Each elevator surface has an adjustable trim tab mounted to the trailing edge that is driven by an AC motor during normal operation, and a DC motor during emergency operation. The tabs deflect based on pilot input from the yoke-mounted pitch trim switches, or via the emergency elevator trim switch on the center console, to reduce the forward or aft yoke pressure needed to maintain the desired pitch attitude. When the autopilot is engaged, the trim tabs are automatically adjusted to eliminate elevator control pressure.

Note: Any manual elevator trim actuation with autopilot engaged will cause the autopilot to immediately disconnect.

## Ailerons

Two separate aileron control surfaces are located on the trailing edge of the wingtips, one on each wing. The left and right ailerons deflect in opposite directions to roll the aircraft according to left and right inputs from the control yokes. A left yoke input raises the left aileron and lowers the right aileron, which changes the lift characteristics of the wings, causing a rolling moment. A right input raises the right aileron and lowers the left aileron.

## Aileron Trim System

While both ailerons have trim tabs, only the left aileron's tab can be controlled by the flight crew: the right tab is only adjustable by maintenance personnel while on the ground. The left trim tab is operated by an AC motor in response to aileron trim inputs made on the trim control panel.

Note: The autopilot is unable to make aileron trim inputs.



## Rudder

The rudder is located on the trailing edge of the vertical stabilizer and deflects based on rudder pedal input to yaw the aircraft. Pushing the left pedal deflects the rudder to the left, which causes the nose to yaw left; a right pedal input deflects the rudder to the right, yawing the nose to the right.

## Rudder Trim System

A trim tab is mounted on the trailing edge of the rudder and deflects via an AC motor in response to rudder trim inputs made on the trim control panel.

Note: The autopilot is unable to make rudder trim inputs.

## Flight Control Boost System

Control cables from the cockpit yokes are connected to a dual-cylinder, hydraulic booster assembly via a connector on the end of the cables. The booster assembly takes input from the control cables and deflects the elevators, ailerons, and rudder using the hydraulic cylinders, which greatly reduces the yoke force needed to maneuver the aircraft. To provide redundancy in the event of a partial hydraulic failure, one cylinder is powered by the utility hydraulic system, with the other cylinder powered by the booster system. Fluid is supplied to the cylinders through shutoff valves that allow them to be isolated from the wider hydraulic system in the event of a leak or malfunction.

The aileron and rudder boosters use reduction valves to reduce their strength under certain scenarios. The elevator booster does not, however, and always operates at full strength.

## Aileron Boost States

The aileron booster assembly can operate in two states: low boost and high boost. The low boost state uses hydraulic fluid at 2,050 psi, while the high boost state operates at 3,000 psi.

In the low boost state, fluid from the two hydraulic systems is sent through a pressure reduction valve before it reaches the booster assembly. This reduced pressure prevents excess stress from being applied to the fuselage wing boxes when the aircraft is rolled at high speeds. The low boost state is active when either of the following conditions are met:

- The autopilot is engaged.
- Indicated airspeed is above 270 knots.

When the high boost state is activated, the pressure reducing valve is bypassed and fluid is supplied to the booster assembly at the full 3,000 psi of the hydraulic systems. For the high boost state to be active, both of the following conditions must be met:

1. The autopilot is disengaged, or the autopilot is engaged with the lateral axis deselected.
2. Indicated airspeed is below 270 knots.



## Rudder Boost States

The rudder booster assembly can operate in two states: low boost and high boost. The low boost state uses hydraulic fluid at 1,300 psi, while the high boost state operates at 3,000 psi.

In the low boost state, fluid from the two hydraulic systems is sent through a pressure reduction valve before it reaches the booster assembly. This reduced pressure reduces rudder sensitivity, allowing for more precise inputs to be made and reducing excessive rudder loads at high speed.

When the high boost state is activated, the pressure reducing valve is bypassed and fluid is supplied to the booster assembly at the full 3,000 psi of the hydraulic systems. The high boost state is activated when the wing flaps are extended beyond 15% and provides increased rudder authority for managing asymmetrical power at low airspeeds. The high boost state is automatically deactivated when the flaps are retracted past 15%.

## Wing Flaps

Four Fowler-type flaps extend from the wings: each wing has an inboard and an outboard flap. The flaps are powered by hydraulic motors supplied by the utility hydraulic system and move based on input from the flap selector handle. A spring-loaded flap brake holds the flaps in their selected position and prevents inadvertent movement.

Asymmetric flap deployment is prevented by position sensors that constantly compare the positions of the four flap sections. If a section becomes jammed during extension or retraction, the flap motors for the opposite wing are deactivated.

## Flap Automatic Pitch Trim

An automatic pitch trim system reduces the nose-up tendency experienced during flap retraction by applying a nose-down trim input. The system is armed whenever the wing flaps are extended to 75% or greater. When the flaps are retracted, the elevator trim tab motor is actuated to trim the elevators nose-down; the motor will run until any of the following conditions are met, whichever comes first:

- The elevator trim tabs have been moving for 2.8 seconds (approximately 7 degrees of deflection).
- Flap movement has stopped.
- The flap position is between 50 and 55%.

## Stall Warning System

The SWS monitors the airplane's Angle of Attack (AOA) and provides stall warning indications when it detects an aerodynamic stall is imminent. The SWS takes input from the nose-mounted AOA vanes to continuously compute stall warning and stick pusher activation speeds. If stall warnings are ignored and AOA continues to increase, a stick pusher automatically activates to force the nose down.



## Stall and Stick Pusher Speeds

The Stall Warning Speed ( $V_s$ ) is the calculated airspeed that results in the visual and aural aspects of the stall warning system being activated.  $V_s$  is dynamically calculated and varies based on gross weight, AOA, load factor, bank angle, engine power setting, and wing flap position.  $V_s$  is displayed in the HUD as a reference airspeed, and the PFD as the low-speed awareness cue.

The stick pusher speed is 8% less than  $V_s$  and is the calculated airspeed at which the elevator stick pusher activates.

## Stall Warning Characteristics

The stall warning system uses aural and visual alerts to alert the crew of the condition. When the aircraft's airspeed reaches  $V_s$ , an aural "STALL" voice alert is played, and "STALL" is presented in the special alert areas of the HUD and PFD.

## Stick Pusher System

A hydraulically powered stick pusher assembly is attached to the elevator control cables and mechanically forces the elevator downwards at the stick pusher speed to reduce AOA. It is possible to override the pusher by holding the yoke-mounted autopilot disconnect switches, or by removing pusher power on the STALL AND SIDESLIP AMU page.

## Sideslip Warning System

The sideslip warning system uses the pressure difference between the left and right pitot-static tubes to compute a sideslip angle. A sideslip limit is computed based on engine power, landing gear position, and potential ice accumulation and is represented by a limit fence in the HUD. If the sideslip angle is close to exceeding, or exceeds the sideslip limit, aural and visual warnings will be presented to the crew.

## Sideslip Warning Characteristics

The stall warning system uses aural and visual alerts to alert the crew of the condition. The specific alert generated depends on if engine power is symmetric or asymmetric, and whether the sideslip limit has been exceeded. Symmetric power is defined as less than a 2,000 hp difference between the left and right wing's engines.

When the aircraft is operating under symmetric power and the sideslip angle is approaching the limit, a flashing "SIDESLIP....." or ".....SIDESLIP" is presented in the special alert areas of the HUD and PFD, depending on the direction of the slip. The dots will point to the right when left rudder is needed to eliminate the sideslip, and to the left when right rudder is needed. The alerts change to "LEFT RUD....." or ".....RIGHT RUD" when sideslip exceeds the limit. An aural "LEFT RUDDER" or "RIGHT RUDDER" voice alert will also be played.

When the aircraft is operating under asymmetric power, the "SIDESLIP" special alerts change to "RUDDER".



## Front Yoke Controls

Switches and buttons are provided on the front of both yokes that allow for the flight director, elevator trim, cursor, and countermeasures to be interacted with.

### 1. Elevator Trim Switches

Two thumb switches are used to activate the elevator trim system. Both switches must move at the same time for the trim system to activate. Forward movement trims the elevator nose down, while aft movement trims nose up.

### 2. PFD Reset Switch

The reset switch is used to quickly display the PFD on HDD 1. When the switch is pressed for a second time, the last-displayed HDD page will return to HDD 1.

### 3. Autopilot Disconnect Switch

The disconnect switch is used to manually disconnect the autopilot and acknowledge the autopilot disconnect alert.

### 4. Cursor Control Switch

The cursor switch is used to slew the position of the common cursor.

### 5. Pitch Sync Switch

The pitch sync switch is used to synchronize the flight director to the CDM's current pitch position.

### 6. Countermeasure Dispense Switch

The dispense switch is used to manually dispense chaff and flares according to the selected countermeasure program. When the "CMDS READY" special alert is displayed, using the switch grants consent to the CMDS to dispense countermeasures in response to the threat.

### 7. Go-Around Switch

The go-around switch is used to activate the go-around mode of the flight director.



## Side Yoke Controls

Switches and buttons are provided on the sides of both yokes that allow for the HUD, interphone, and stopwatch to be interacted with.

### 1. HUD Declutter Switch

The declutter switch is used to step through the HUD's declutter modes. When no declutter mode is active, the first press of the switch will select declutter level 1, a second press will select level 2, and a third press will reset the HUD no declutter.

### 2. Interphone/Radio Switch

The interphone/radio switch is used to select which audio channel the crewmember's microphone will be transmitted on. Aft movement transmits on the internal interphone, while forward movement transmits on the selected radio.

### 3. Hush/Stopwatch Switch

The dual-purpose rocker switch is used to activate the hush function, and toggle the stopwatch. When the left side of the switch is pressed, the next mode of the stopwatch will activate. When the right side is pressed, the hush function of the aural alert system is activated and hush-able aural alerts will be silenced.



## Trim Control Panel

The trim control panel is used to make aileron and rudder trim inputs, and elevator trim inputs in the emergency mode.

### 1. Elevator Trim Tab Power Switch

The source of electrical power for the elevator trim tab motor is selected via the trim tab power switch. The positioning of the switch will also determine which cockpit control is used to make elevator trim inputs.

**NORM:** The motor is powered via AC power. The yoke-mounted elevator trim switches, as well as the autopilot, can make trim inputs.

**OFF:** Power is disconnected from the motor, rendering it inoperative. Setting the switch to OFF with the autopilot engaged will cause it to automatically disconnect.

**EMER:** The motor is powered via DC power. Trim inputs must be made via the emergency elevator trim tab switch as the yoke-mounted switches will be rendered inoperative.

### 2. Aileron/Emergency Elevator Trim Tab Switch

Aileron trim and emergency elevator trim inputs are made via a momentary switch. The switch is spring-loaded to center from all four positions. Moving the switch left and right will deflect the aileron trim tabs, while forward and aft moment will move the elevator tabs when the ELEV TRIM TAB switch is set to EMER.

### 3. Rudder Trim Tab Switch

The rudder trim tab is controlled via a three-position switch. The switch is spring-loaded to center from both positions.



## Trim Indicator Panel

The trim indicator panel displays the position of the aileron, rudder, and elevator trim tabs. A flap position indicator displays the position of the wing flaps



### 1. Aileron Trim Gauge

Two pointers represent the position of the left and right aileron trim tabs in degrees of deflection. Because the right aileron's trim tab does not move in response to pilot input, the right pointer simply mirrors the position of the left pointer. Aileron trim tab travel is limited to 20 degrees from neutral in either direction.

### 2. Rudder Trim Gauge

The gauge's pointer represents the deflection of the rudder trim tab in degrees left or right of center. Rudder trim tab travel is limited to 25 degrees from neutral in either direction.

### 3. Elevator Trim Gauge

The gauge's pointer represents the deflection of the elevator trim tabs in degrees of deflection. A white band spanning from 5 degrees down to 5 degrees up represents the takeoff position for the elevator trim. Elevator trim tab travel is limited to 25 degrees up and 6 degrees nose down.

### 4. Flap Position Indicator

The flap position indicator displays the position of the wing flaps as a percentage of maximum extension.

## Trim Panel Pointer Behavior

The various pointers on the trim panel are powered by the essential AC bus. When essential AC power is not available, the pointers are parked in a position that does not correspond to their components. When AC power becomes available, the pointers will swing to their correct positions.



## Flap Control Panel

The flap control panel is used to extend and retract the wing flaps.

### 1. Flap Control Lever

The flap control lever can be moved in increments of 1% via the mouse wheel to set the position of the wing flaps. In the forward position, the flaps are set to 0% extension and fully retracted; in the aft position, the flaps are set to 100% and fully extended. The selected flap position can be read by an indicator mounted at the front edge of the control lever, which lines up with the white position markings on the panel face.

An indentation on the right sidewall of the panel denotes the 50% position. A mechanical latch above the flap lever engages when the flap lever is set to 0% to prevent inadvertent movement of the lever.



### 2. Flap Lever Friction Adjust Knob. No function

## Control Boost Panel

The control boost panel allows the flight control booster assemblies to be isolated from their respective hydraulic systems in the event of a leak or malfunction.



## Control Boost Switches

The guarded control boost switches select the position of hydraulic shutoff valves for the boost and utility supply lines of the elevator, rudder, and aileron booster assemblies.

**ON:** The shutoff valve is open and fluid from the respective hydraulic system is able to reach the booster cylinder.

**OFF:** The shutoff valve is closed and the booster cylinder is isolated from the hydraulic system.



## Oxygen System

A 300 psi Liquid Oxygen (LOX) system provides oxygen to regulators located around the aircraft for use by crew members. Oxygen is sent to the regulators through two heat exchangers that are supplied via a 25-liter LOX converter located in the aircraft's nose.

## Oxygen Regulators

Ten diluter-demand, pressure-breathing regulators are installed throughout the aircraft; six are located in the flight deck, with another four in the cargo compartment. Each regulator incorporates a flow indicator, a pressure gauge, and three toggle switches to control valve positions. An oxygen mask with combined smoke goggles is provided for each crewmember that can attach to an outlet port on the regulator.



### 1. Emergency Toggle Lever

The emergency toggle lever controls the oxygen flow rate to the mask. The lever is spring-loaded to NORMAL from TEST MASK.

**EMERGENCY:** Oxygen is continuously supplied to the mask to force smoke and fumes out of the mouthpiece.

**NORMAL:** Oxygen is supplied to the mask when the user inhales.

**TEST MASK:** Oxygen is momentarily supplied to the mask to verify the mask is receiving oxygen from the system.



## 2. Flow Indicator

A white and black sliding indicator is provided to indicate whether oxygen is flowing. Oxygen flow is indicated by the white portion of the slider being shown in the FLOW window.

## 3. Diluter Lever

In other aircraft, the diluter lever is used to control the mix of oxygen supplied to the mask. In the C-130J, the diluter function is inoperative and both switch positions supply 100% oxygen to the mask.

## 4. Oxygen Pressure Gauge

The oxygen pressure gauge indicates, in psi, the oxygen supply system pressure that is reaching the regulator.

## 5. Supply Lever

The supply lever controls whether oxygen is supplied to the mask.

**OFF:** Oxygen to the mask is shut off.

**ON:** Oxygen is available from the mask.



## Overview

The electrical system consists of two DC batteries, four engine-driven AC generators, an APU-driven AC generator, and four transformer-rectifier units. The various components of the electrical system are connected via a network of AC and DC buses. Mechanical and Electronic Circuit Breakers (ECBs) protect electrical components from overcurrent conditions and power surges.

## DC Batteries

Two 24-volt, 35-amp DC batteries are located in the nose; these are known as the avionics and utility batteries. Each battery is connected to the electrical system via a battery relay that positions itself according to the battery switch position. A hot bus is also connected to each battery which allows components to be powered with the battery relays open.

The utility battery supplies power to the utility battery bus through a current limiter, and to the isolated DC bus via a battery relay. The utility battery bus is a hot bus, while the isolated DC bus receives power when the utility battery relay is closed.

The avionics battery supplies power to the avionics battery bus through a current limiter, and to the avionics DC bus via a battery relay. The avionics battery bus is a hot bus, while the avionics DC bus receives power when the avionics battery relay is closed.

The two batteries are charged when an AC power source is available, such as an engine/APU generator or an external power cart. If the voltage on either battery is allowed to drop below 18 volts, the respective relay will automatically open to protect the battery from fully discharging.

## AC Generators

Five oil-cooled, three-phase, 115-volt AC generators are installed in the aircraft. The four engines each have a generator mounted in their accessory gearboxes, while the APU generator is powered via a driveshaft from the APU core.

The generators are managed by a Generator Control Unit (GCU) which monitors generator frequency and voltage to regulate power output to the buses. If an out-of-tolerance condition is detected, the GCU opens a contactor to disconnect the offending generator from the electrical system. The contactor is also opened whenever the generator control switch on the overhead panel is positioned to OFF/RESET.



## Transformer-Rectifiers

Four Transformer-Rectifier (TR) units are installed in the aircraft that convert 115-volt AC power to 28-volt DC power. The TRs work by sending 115V AC input current through a transformer, which reduces the voltage down to 28V. The 28-volt AC power is then sent through a rectifier that uses diodes to convert the two-way AC current to one-way DC current. The result is an electrical current that the DC electrical system can utilize.

TRs 1 and 2 receive power from the essential AC bus, with TRs 3 and 4 taking power from the main AC bus. The output from TRs 1 and 3 is sent to the essential DC bus, while TRs 2 and 4 power the main DC bus.

## Circuit Breakers

Circuit breakers are provided for every piece of electrical equipment installed on the aircraft. These breakers not only protect the individual components from power surges, but they also protect the wider electrical system from excessive power draw or overcurrent caused by a malfunctioning device. Two different types of circuit breakers are utilized: mechanical circuit breakers, and electronic circuit breakers.

Mechanical breakers are installed in the cockpit, loadmaster station, and cargo bay that must be manually pulled and reset. The electronic breakers function in the same fashion as the mechanical breakers, except that they can be manipulated remotely via the CNBP.

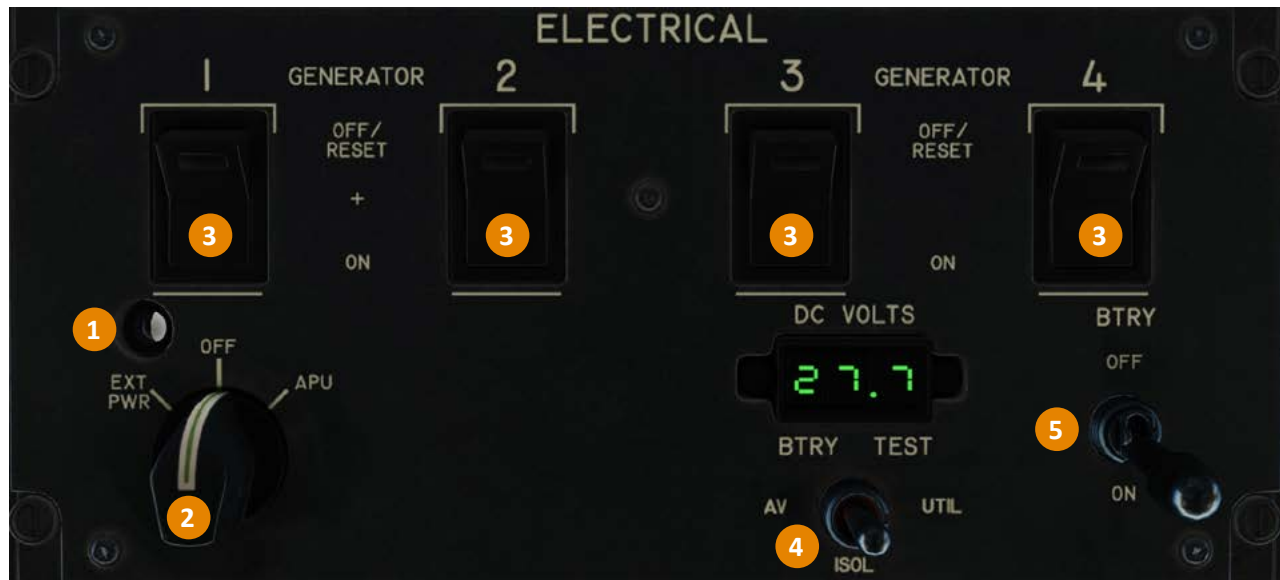
## External Power

A Ground Power Unit (GPU) can be enabled via the “Ground Electric Power” option in the communications menu to supply AC power to the aircraft when the engines and APU are not running.



## Electrical Control Panel

The electrical control panel allows for control over the AC and DC power sources on the aircraft.



### 1. External Power Indicator

A white and black, circular indicator indicates the availability of external power. When the indicator is black, no external power is connected; when the indicator is white, external power is available for use.

### 2. External Power/APU Switch

The external power switch selects which alternative electrical source is powering the aircraft. A two-second holding relay prevents power interruption when switching between external/APU power and the engine generators.

**EXT PWR:** AC power from an external GPU is supplied to the left and right-hand AC, essential AC, and main AC buses.

**OFF:** APU and external power is disconnected.

**APU:** If the APU generator is the only source of AC power, the APU generator supplies power to the essential and AC buses. If another generator is online, the APU will power the essential AC bus only.

### 3. Generator Switches

A generator control switch is provided for each generator that controls the position of the GCU contactor. An inset, green light illuminates when the switch is set to OFF/RESET.

**OFF/RESET:** The GCU contactor is open, which de-energizes the generator and disconnects it from the electrical system.

**OPEN:** The GCU contactor is closed and the generator is connected to the electrical system.



## 4. Battery Test Switch

The battery test switch allows for the voltage of the two DC batteries to be checked individually without power applied to the aircraft. The switch is spring-loaded to the center position from AV and UTIL. Battery voltage for the selected battery is displayed on the DC VOLTS indicator.

**AV:** The avionics battery voltage is displayed.

**ISOL:** The isolated DC bus voltage is displayed.

**UTIL:** The utility battery voltage is displayed.

Note: Because the DC VOLTS indicator is not connected to the display test circuit, it will not display 8s when the display test is being run.

## 5. Battery Switch

The battery switch controls the utility and avionics battery relays.

**OFF:** The relays for both batteries are open, which disconnects the batteries from the electrical system.

**ON:** The relays for both batteries are closed, and the batteries are connected to their respective buses.



## Engine Fundamentals

The C-130J is outfitted with four FADEC-controlled AE2100D3 turboprop engines that are each connected to a 6-bladed composite propeller via a reduction gearbox. An accessory drive box is mounted to the propeller gearbox which powers engine-driven components such as hydraulic pumps and electric generators.

The AE2100D3 is fundamentally similar to a jet engine found on a commercial airliner, except that the engine core drives a propeller rather than a large inlet fan. While most airliner engines have the inlet fan connected directly to the engine core, turboprop engines use a reduction gearbox to decouple the propeller from the engine and allow its RPM to be controlled independently from the engine compressor. This configuration is known as a free-spinning turbine. Because of this, there are two separate sections of the engine that work together to produce power: these are the Gas Generator (NG), and Power Turbine (NP).

### Gas Generator (NG)

The gas generator's function is to take ambient air and, via a compressor and combustion section, produce a large volume of compressed, hot air for the power turbine. To do this, air enters the engine intake and flows through 14 concentric rings of compressor blades, with each ring having less space between the blades. These rings of blades are known as compressor stages, and they greatly compress the air as it moves aft through the engine core.

The compressed air then reaches the combustion chamber, where fuel is introduced and the mixture is ignited. As the combustion occurs, the volume of gas expands drastically, which increases its temperature and velocity dramatically. After the gas has expanded and accelerated, it flows through a two-stage gas generator turbine: this turbine extracts a minimal amount of energy from the airflow and uses it to maintain the rotation of the compressor section at the desired speed.

### Power Turbine (NP)

The Power Turbine is located downstream of the gas generator and has two stages of rotating blades that capture the energy of the airflow supplied by the gas generator. The airflow spins the turbine, which is connected to the reduction gearbox via the power turbine shaft.

### Reduction Gearbox

The reduction gearbox, also referred to as the propeller gearbox, is mounted at the front of the engine and takes rotational energy from the power turbine shaft and transmits it to the propeller shaft via a set of reduction gears. The reduction gears slow the speed of the power turbine to one that a propeller can utilize, which greatly increases efficiency and reduces noise. The reduction gearbox powers the following components on each engine:

- AC generator.
- Propeller gearbox oil supply pump.
- Propeller gearbox scavenge pump.
- Propeller overspeed governor.
- Propeller Pitch Control Unit (PCU).



## Power Section Accessory Gearbox

The power section accessory gear box is mounted at the bottom of the engine and is powered by the compressor stage of gas generator. The gearbox powers the following components on each engine:

- Engine driven fuel pump metering unit.
- Permanent magnetic alternator.
- Engine oil supply pump.
- Engine oil scavenge pump.
- Air Turbine Starter (ATS).

## Propellers

Six-bladed, variable-pitch, composite propellers are attached to the propeller shaft of the propeller gear box. The inner section of each blade's leading edge is covered with a heated deicing boot, while the outer section is reinforced with nickel to protect against erosion. The respective engine's FADEC controls the Pitch Control Unit (PCU) for each propeller to adjust blade angle scheduling to maintain 100% NP when the power levers are in the flight range. An overspeed governor automatically activates to increase blade pitch and reduce RPM when NP exceeds 104%.

An auxiliary feather pump can be used to manually feather or unfeather the propellers under the following conditions:

1. The respective engine's control switch is set to STOP.
2. The respective engine is operating in LSGI with the power lever in the GND IDLE position.

## FADEC

Each engine is equipped with two single-channel Full Authority Digital Electronic Control (FADEC) units. FADEC interfaces with other aircraft systems and the Distributed Air Data System (DADS) to provide automatic monitoring and control of the engines and their propellers. A gearbox-mounted PMA ensures the FADEC receives power whenever the engine is running, regardless of whether the rest of the airplane has electrical power.

One FADEC is in control at a time while the other monitors: the controlling unit is known as the FADEC in Control (FIC). If the monitoring unit determines the FIC is defective, it automatically assumes control. In addition to fault detection, the FIC switches to the monitoring unit when the FADEC switch on the overhead panel is positioned to ALT.

FADEC takes pilot input in the form of Power Lever Angle (PLA) to modulate fuel flow to the engine and schedule propeller blade angle to achieve the commanded power setting. It's important to understand that PLA is simply sending a request for power to the FADEC: the FADEC will prioritize the engine's health over the pilot's request.



While FADEC continuously manages the engine and propellers, it has additional functions. These functions include the following:

- Ground idle propeller blade angle scheduling.
- Propeller autofeather.
- Auto ignition and relight.
- Propeller synchrophasing.
- Propeller underspeed/overspeed protection.
- Gas generator overspeed protection.
- Automatic engine start.
- Automatic Thrust Control System (ATCS).

## Ground Idle Propeller Blade Angle Scheduling

When the power levers over the gate from the flight range into the ground range, FADEC schedules blade angle differently for the inboard and outboard propellers according to airspeed. Above 110 knots, the outboard propellers are set to 1° pitch. Between 110 and 90 knots, the outboards are set to 8°, transitioning back to 1° between 70 and 35 knots. The inboard propellers are set at -2° above 70 knots: between 70 and 35 knots, the pitch increases to 1°. Below 35 knots, all propeller blades are set to 1° for taxi operation.

The difference in blade angles increases directional control during an engine failure on takeoff or landing. The negative pitch of the inboard propellers creates slightly more drag than the positive pitch of the outboard propellers, which helps to reduce asymmetric yaw. The outboard propellers change pitch more frequently to balance yawing tendencies throughout the airspeed range.

## Propeller Autofeather

When an engine failure occurs, the resulting loss of thrust causes a yaw and roll moment towards the dead engine. After the engine fails, the propeller is still set to a coarse blade angle which causes the propeller disc to act as a solid object and create a large amount of drag. This drag can be reduced by feathering the propeller, which aligns the propeller blades with the oncoming airflow and eliminates the drag of a windmilling propeller. Using FADEC, propellers can be feathered automatically.

While the FADEC is in control of the propellers, MC permission is required for propeller feathering to occur. Permission is granted automatically for the outboard engines, or when the aircraft is below 15,500 feet and the other engines are running normally for the inboards. If these conditions are not met, the FADEC will windmill the propeller at 100% NP. The windmilling propeller guarantees hydraulic and electric power will be available to the aircraft.

An autofeather request is sent to the MC when the power levers are at flight idle or above, and any of the following occurs:

1. The FADEC loses control over a propeller.
2. At high power settings, engine horsepower is less than 74% of the commanded power setting and NG is decelerating.
3. At low power settings, NG is less than 69%.



## Auto Ignition and Relight

Following a propeller autofeather, the FADEC on the affected engine attempts to maintain NG at flight idle by initiating ignition and monitoring for a relight. If a relight is not detected before NG decelerates below 56%, fuel flow to the engine is cut off and the engine shuts down.

## Propeller Synchrophasing

FADEC accomplishes propeller synchrophasing by transmitting the propeller phase of the master engine to the other engine's FADEC units, which adjust their propellers to match the phase of the master. By matching propeller phases, the noticeable drumming effect of multiple propellers operating at slightly different RPMs is eliminated.

## Propeller Underspeed and Overspeed Protection

FADEC utilizes a software underspeed governor to prevent a propeller underspeed condition. The governor commands the pitch control unit on the offending propeller to disregard speed and synchrophasing logic and decrease propeller blade angle. Underspeed protection is disabled when the propeller is in the beta range.

During normal operation, overspeed protection is accomplished by FADEC's propeller speed control logic. If a propeller's NP exceeds 104.5%, the overspeed governor diverts oil away from the pitch control unit to increase propeller blade angle and lower NP. If NP exceeds 119%, FADEC automatically shuts down the engine.

## Gas Generator Overspeed Protection

FADEC constantly monitors NG and varies fuel flow to maintain the desired operating speed. If an NG overspeed condition is detected, fuel flow is automatically reduced to slow the compressor's rotation. If NG exceeds 109%, FADEC automatically shuts down the engine.

## Automatic Engine Start

When a start signal is received from the engine control switches, FADEC automatically sequences the starter control valve, ignition, fuel flow, and compressor variable geometry vanes to start the engine. The start sequence is monitored and will be aborted automatically if any of the following conditions occur:

1. No light-off: A 50°C MGT rise is not detected within 12 seconds of fuel flow and ignition.
2. Stagnated start: NG has not reached the starter cut-out speed of 65.5% within 70 seconds of start cycle initiation.
3. Flameout: A flameout condition has occurred.

Note: an engine start will **NOT** occur if the engine's throttle is below 13 degrees PLA, or above 33 degrees PLA. To view a granular readout of throttle PLA, utilize the ENGINE DATA AMU page.



## Nacelle Interface Unit

A Nacelle Interface Unit (NIU) is provided for each engine. The NIU accomplishes the following functions:

1. Provides oil temperature, pressure, and quantity indications.
2. Provides oil cooler flap position and fuel flow indications.
3. Controls the oil cooler flap and engine/nacelle anti-ice valves.
4. Provides engine health and usage monitoring.

## Engine Operating States

On the ground, the engines can operate in three distinctive states: hotel mode, Low Speed Ground Idle (LSGI), and High Speed Ground Idle (HSGI). These modes provide flexibility for operating the airplane on the ground in differing scenarios. For example, hotel mode can be used to minimize prop wash on a running engine.

Hotel mode is achieved by using the auxiliary feather pump to feather the propeller of an engine running in LSGI. The reduced pitch of the propeller blades causes less lift to be produced, which greatly reduces noise and propwash behind the engine. This configuration is particularly useful when conducting an Engine Running Onload (ERO) as it minimizes hazards to ground crew operating behind the engines.

LSGI reduces fuel flow to the engine, which lowers NG and NP to a sub-idle condition. LSGI can be enabled by the LSGI switches aft of the power levers. The reduction in NG allows for a more gradual warm-up of engine components following an engine start, while the reduction in NP reduces propwash and brake applications during taxi. It should be noted that the engine electrical generators do not function while in LSGI, so an alternate power source such as the APU or an engine running in HSGI is required to supply AC power to the airplane.

Note: If an engine is running in LSGI and the respective power lever is moved out of the ground range, the engine will automatically upspeed to HSGI.

HSGI is the default idle state of the engine. In HSGI, the electrical generators are powered, and the engine is ready to transition to the flight or reverse ranges.



## FADEC Control Panel

The FADEC control panel allows for each engine's FADEC unit to be changed or reset.



## FADEC Reset Switches

The FADEC reset switches are spring-loaded to NORM from ALT and RESET.

**ALT:** The alternate FADEC unit is selected as FIC.

**NORM:** The FADEC operates normally.

**RESET:** A reset signal is sent to both FADEC units to clear all fault indications.

## Propeller Control Panel

The propeller control panel allows for the blade angle of each engine's propeller to be manually adjusted. The propeller control switches are only functional when the engine is shut down, or running in LSGI with the power lever at the GND IDLE position.



## Propeller Control Switches

**FEATHER:** The auxiliary feather pump for the respective propeller is activated and the propeller blades are driven towards the feather position.

**NORMAL:** The auxiliary feather pump for the respective propeller is shut off.

**UNFEATHER:** The auxiliary feather pump for the respective propeller is activated and the propeller blades are driven towards the unfeather position.

Note: If the engine is shutdown and the switch is positioned to UNFEATHER and not released, the propeller blades will be driven to the full reverse position.

## ATCS Switch

The guarded ATCS switch allows for the automatic thrust control system to be deactivated.

**ON:** ATCS is active.

**OFF:** ATCS is deactivated.

**WARNING:** In the event of an outboard engine failure at low speed, positive aircraft control is not guaranteed with ATCS deactivated.



## Prop Sync Switch

The propeller sync switch controls whether the automatic propeller sync is active or not.

**ON:** Propeller synchrophasing is activated.

**OFF:** Propeller synchrophasing is deactivated.



## Throttle Quadrant

The throttle quadrant includes power levers for each of the four engines, power lever override switches, as well as the LSGI select switches.

### 1. Engine Power Levers

Four identical power levers control the output of their respective engines. The throttle quadrant is labeled with various power settings such as takeoff power, flight idle, ground idle, and max reverse.

A mechanical stop is positioned at flight idle to prevent inadvertent selection of ground range while in the air, and at ground idle to prevent selection of reverse range on the ground.

### 2. LSGI Select Switches

An LSGI select switch is provided behind each engine's power lever. Selecting the switch with weight on wheels and the power lever in the ground range will activate LSGI for the respective engine.

When LSGI has been selected, a green "LOW" light will illuminate on the switch face.

### 3. Power Lever Override Switches

A power lever override switch is positioned on the outside of engine 1 and 4's power levers. When pressed, the switches can be used to disconnect the autothrottles, or override ATCS when active.



## Engine Start Panel

The engine start panel is used for ground and air starts, engine motoring, and engine shutdowns.



### 1. Engine Control Switch

The engine control switches are used to control engine operations. The switches are spring-loaded to STOP from MOTOR, and to RUN from START.

**MOTOR:** The nacelle shutoff valve is opened, and the starter is engaged to spin the gas generator to clear unburned fuel from the combustion chamber and cool the engine following an aborted start attempt. No fuel or ignition is provided.

Note: Motoring an engine with the fire handle pulled, or the nacelle shutoff valve manually closed, is not possible.

**STOP:** The engine is shut down by shutting off fuel to the engine, de-energizing the respective main tank fuel boost pump, and closing the nacelle shutoff valve. Selecting STOP during start will close the start valve and de-energize the ignition.

**RUN:** The respective main tank fuel boost pump is energized and the nacelle shutoff valve is opened. This is the engine operating position.

**START:** The start sequence is initiated, the green start light illuminates, and a white box is displayed around the engine parameters on the ENGINE STATUS HDD page, along with a timer. FADEC automatically initiates fuel flow and ignition at the proper time and monitors the start sequence for abnormalities. Upon completion of engine start, the start valve closes, the start light is turned off, and the symbology is removed from the system status HDD page.

### 2. Engine Start Light

The engine start light illuminates in green whenever the engine's air turbine starter is engaged.



## Automatic Thrust Control System

The Automatic Thrust Control System (ATCS) limits asymmetric thrust between the two outboard engines at slow speeds to reduce minimum control speeds. In the event of thrust loss on an outboard engine, horsepower on the other outboard engine is automatically reduced if airspeed is below the Minimum Power Restoration Speed ( $V_{MPR}$ ).  $V_{MPR}$  is defined as the minimum speed at which full power may be restored to an opposing outboard engine with the aircraft still being controllable.  $V_{MPR}$  is a function of temperature and pressure altitude.

The magnitude of horsepower reduction is based on how far below  $V_{MPR}$  the aircraft's airspeed is. At 30 knots CAS or greater below  $V_{MPR}$ , horsepower on the remaining outboard engine is limited to 60% horsepower. As airspeed increases, ATCS automatically restores power linearly to 100% power over a 30-knot range, so that 100% power is achieved as the aircraft reaches  $V_{MPR}$ . Due to how  $V_{MPR}$  is scheduled,  $V_{MCA3}$  will always be greater.

## ATCS Visual Indications

When ATCS has been activated, a blue "ATCS" label is displayed below the limited engine's horsepower dial. A blue pie-wedge is also displayed inside the dial which starts at the 100% power position and arcs around the horsepower dial to the reduced horsepower that ATCS is scheduling.

## ATCS Override

If a situation makes it necessary to override ATCS, three rapid depressions of the autothrottle disconnect switches within two seconds will allow the power lever position on the limited engine to override ATCS thrust reduction.

When override is activated, the ATCS system will be disabled, with the "ATCS OFF" caution appearing. An amber "OVERRIDE" label will both replace the "ATCS" label on the limited engine and appear below the operative outboard engine. Cycling the ATCS switch OFF and back to ON is required to reset the system when the override function has been used.

ATCS thrust limiting can also be disabled by positioning the ATCS switch to OFF. Thrust on the limited engine will be restored at 500 horsepower per second up to the horsepower commanded by the power lever.

**WARNING: If ATCS is active, restoring the operating outboard engine to full power may cause the aircraft to depart controlled flight if airspeed is below  $V_{MCA3}$ .**



## Auxiliary Power Unit

The Auxiliary Power Unit (APU) is a small jet engine, located in the forward section of the left wheel well that supplies electrical power and bleed air to the aircraft when the engines are not running. Air is supplied to the APU via the air intake door, and fuel is supplied via the Number 2 main fuel tank through a fuel shutoff valve. A governor controls the APU to maintain a constant RPM of 100-101%, varying fuel flow according to bleed air and electrical demand. In the event of an APU overspeed, defined by an RPM above 110%, the shutoff valve is automatically closed, and a shutdown occurs.

## APU Intake Door

The intake door of the APU opens and closes automatically during APU operation. Positioning the APU control switch to RUN commands the door to open to either 35 degrees if weight is on wheels, or 15 degrees if weight is off wheels. Opening of the door is annunciated by dashes showing on the APU RPM. When the APU is shut down, the door will remain open until approximately 18% RPM.

## APU Control Panel

The APU control panel is used to start and stop the APU.



## 1. APU Control Switch

The APU control switch is used to control APU operations. The switch is spring-loaded to RUN from START.

**STOP:** The APU is shut down by closing its fuel shutoff valve.

**RUN:** Power is supplied to open the APU air intake door.

**START:** The fuel shutoff valve is opened and the starter is energized. The starter will remain active until approximately 50% RPM.

## 2. APU Start Light

The APU start light illuminates in green whenever the APU's starter is engaged.

## 3. APU Alarm Switch

The APU ALARM switch controls whether the ACAWS warning tone will play over the cargo bay speakers in the event of an APU fire.

**OFF:** The warning tone will only be played over the cockpit speakers.

**ON:** The warning tone will be played over the cockpit and cargo bay speakers.

## 4. APU EGT Display

The APU EGT display shows the current EGT of the APU in °C.

## 5. APU RPM Display

The APU RPM display shows the current RPM of the RPM as a percentage. When the APU inlet door is opening, the display shows dashes.

## 6. APU Fire Handle

The APU fire handle functions in the same manner as the engine fire handles, except for some of the actions that occur when the handle is pulled.

**PUSHED:** The APU functions normally.

**PULLED:** The following actions occur to isolate the APU from the rest of the airplane:

1. The APU fuel shutoff valve is closed.
2. The APU inlet door closes as RPM decreased below 18%.
3. The fire extinguishing agent directional control valves are positioned to the APU.

**DISCH 1:** Fire bottle #1 is punctured and its extinguishing agent flows to the APU.

**DISCH 2:** Fire bottle #2 is punctured and its extinguishing agent flows to the APU.



## Fire and Overheat Detection System

A Fire and Overheat Detection System (F/ODS) monitors the engines, APU, underfloor avionics compartment, bleed air ducting, and cargo bay to alert the crew to fire or overheat conditions via ACAWS. The system consists of temperature-based, dual-loop fire detectors, a F/ODS controller, and smoke detectors. Fire detection is not available for the bleed air ducts, while overheat detection is not provided for the APU.

### Fire Detection System

A dual-loop fire detection system is located in the engine and APU nacelles. When exposed to high temperatures produced by a fire, the fire loops close a circuit and a fire signal is sent to the F/ODS controller, which triggers the associated ACAWS alerts to the crew. When a fire is detected, the following indications are presented to the crew:

- The MASTER WARNING light illuminates along with the master warning aural tone.
- The fire handle of the affected engine illuminates in red.
- An ACAWS warning for the affected engine is generated.
- The nacelle shutoff valve for the affected engine is closed.

### Overheat Detection System

Sensors located in the bleed air ducts monitor and detect overheat conditions in the engine nacelles, wing, cross ship, and underfloor heat portion of the air ducts. When a leak is detected, the F/ODS controller commands valves to close to isolate the affected duct. Duct isolation is annunciated by ACAWS messages.

### Smoke Detection

Four separate smoke detectors are installed in the aircraft: the first is located in the underdeck avionics compartment, while the other three are positioned along the cargo bay's ceiling. When a detector detects smoke, a signal is sent to the MC which triggers the associated ACAWS warning message.

### Fire Extinguishing System

A fire extinguishing system allows for an engine or APU fire to be extinguished via a chemical agent. The system is equipped with two individual fire bottles which are filled with a Halon fire extinguishing agent. The bottles are connected to the four engine nacelles and the APU compartment via a series of directional flow valves.

When a fire handle is positioned to the "DISCH 1" position, bottle #1 is punctured via a detonator and the directional valves position themselves to supply the extinguishing agent to the respective engine. The same occurs when a handle is positioned to "DISCH 2", except that bottle #2 is punctured.



## Fire Control Panel

The fire control panel contains separate fire handles for each of the four engines. Each fire handle is interfaced with the F/ODS controller to provide control over the fire extinguishing system. Use of a fire handle facilitates an immediate shutdown and isolation of the malfunctioning engine.



## Engine Fire Handles

The fire handles can be pulled and twisted, depending on the desired action. An inset, red light illuminates the fire handle of the engine where a fire was detected; the light remains illuminated until the fire is extinguished. When a fire handle is pulled, the engine and nacelle of the respective fire handle are isolated from the bleed air, fuel, and hydraulic systems to limit the spread of a fire. Twisting a handle will discharge fire extinguishing agent into the engine nacelle.

**PUSHED:** The engine functions normally.

**PULLED:** The following actions occur to isolate the engine and nacelle from the rest of the airplane:

1. The nacelle shutoff valve is closed.
2. The engine oil shutoff valve is closed.
3. The fire extinguishing agent directional control valves are positioned to the engine.
4. The firewall fuel shutoff valve is closed.
5. The firewall hydraulic shutoff valves are closed.
6. A command is sent to the FADEC to feather the propeller and shut down the engine.
7. The propeller auxiliary feather pump energizes for 20 seconds to feather the propeller.

**DISCH 1:** Fire bottle #1 is punctured and its extinguishing agent flows to the nacelle.

**DISCH 2:** Fire bottle #2 is punctured and its extinguishing agent flows to the nacelle.

Note: Pulling multiple fire handles in quick succession may result in a “FIRE EXT FAILURE” ACAWS warning due to a misdirection of the directional flow valves. To reset the system, cycle the fire handle for the desired engine.



## Oil System

Each engine has an independent oil system that supplies oil to the engine core, propeller gearbox, electrical generators, and accessory gearbox. A 20-gallon oil tank is located above the engine that gravity feeds to the gearbox and engine oil pumps through shutoff valves and oil filters. Oil is cooled via a fuel-cooled oil cooler in addition to an air oil cooler.

## Oil Cooler

An air-cooled radiator is mounted at the bottom of the nacelle which has its own, separate intake. A modulating flap is mounted behind the radiator and restricts the size of the air exit duct. The flaps can be controlled either automatically or manually via the oil cooler switches on the overhead panel.

## Oil Cooler Flap Schedule

When the oil cooler flap switches are positioned to AUTO, the flaps open and close automatically according to oil temperature and landing gear position. The system observes the following schedule:

- With weight on wheels, the flap is opened when the oil cooler outlet temperature is greater than 75°C and closed when outlet temperature falls below 60°C.
- With weight off wheels and the landing gear extended, the flaps open when the outlet temperature is greater than 82°C and close below 76°C.
- With the landing gear retracted, the flaps are commanded to the fully closed position.

## Oil Cooler Flap Panel



## Oil Cooler Flap Switches

The positioning of the oil cooler flaps is controlled via the switches on the oil cooler flaps panel. The switches are spring-loaded to the middle position from OPEN and CLOSE.

**OPEN:** The flap is driven open.

**CLOSE:** The flap is driven closed.

**HOLD:** The flap is fixed in its current position.

**AUTO:** The flap's position varies automatically according to the oil cooler flap schedule.



## Overview

The C-130J is outfitted with a plethora of emergency equipment designed to keep the crew and occupants safe in a number of emergency scenarios. This equipment includes an alarm system, life rafts, first aid kits, crash axes, fire extinguishers, an automatic emergency locator transmitter, emergency exits, portable oxygen bottles, and various open-water survival equipment.

## Alarm Bells

Four alarm bells are located around the cargo bay that activate via the ALARM switch on the Airdrop Control Panel.



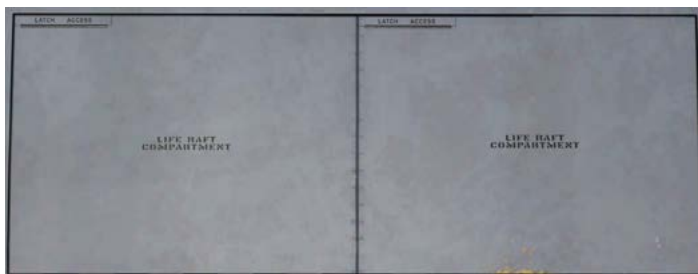
## First Aid Kits

Self-contained emergency first aid kits are located throughout the aircraft, both in the cockpit and in the cargo bay. Two are located in the back of the cockpit, with another five located in the cargo bay.



## Life Rafts

Two life raft lockers are mounted on top of each wing that allow for a total of four 20-man life rafts to be carried. Two handles located on the upper back wall of the cockpit allow for the life rafts to be deployed by the crew. These handles are nonfunctional in DCS.



## Crash Axes

Two crash axes are installed in the cargo bay: one on the aft side of the forward cargo compartment bulkhead, and another aft of the left paratroop door.

The axes allow the aircraft's fuselage to be cut open to facilitate an escape when other emergency exits are blocked or unavailable.



## Portable Oxygen Bottles

Four portable oxygen bottles are placed throughout the aircraft: two in the cockpit and two in the cargo bay. The tanks can be connected to oxygen masks to allow the crew to move freely through the aircraft with a clean oxygen supply.

Each tank is connected to a recharging outlet which allows oxygen from the main oxygen system to replenish the tank's contents.



## Fire Extinguishers

Four halon-type, hand-operated fire extinguishers are located around the aircraft: one in the cockpit, and three in the cargo bay.

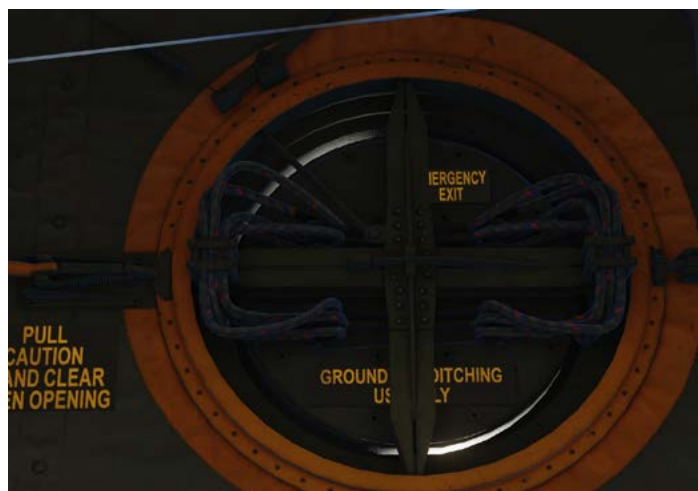
The halon extinguishing agent allows for fires to be extinguished without leaving a residue, unlike traditional extinguishers, and provides a low-toxicity environment to the crew using it.



## Emergency Exits

Five emergency escape points are located around the aircraft: three removable hatches are mounted in the upper fuselage, and two removable fuselage plugs. One escape hatch is mounted above the aft section of the flight deck, another in the cargo bay aft of the wing box, and a third above the cargo door in the cargo bay.

Both fuselage plugs are located forward of the wing box and just aft of the fuselage panel formation lights. Escape ropes are installed next to each escape hatch to facilitate a safe descent from the top of the aircraft to the ground.



## Emergency Exit Lighting

Eight portable, battery-operated emergency exit lights are installed around the aircraft located by each of the exit points, including each of the escape hatches, both paratroop doors, both emergency exits in the cargo bay, and the crew entrance door. These units provide green, NVIS-compatible lighting in the event of aircraft power loss. Internal batteries of each unit charge whenever AC power is applied to the aircraft.

## Emergency Exit Light Extinguish Switch

The emergency light extinguish switch allows for all the emergency exit lights throughout the aircraft to be extinguished at the same time.



## Cockpit Voice Recorder

The Cockpit Voice Recorder (CVR) is a four-channel digital recorder. The first three channels monitor and record audio from the cockpit area microphone and individual pilot and copilot ICS channels. The fourth channel is used to record the time stamp provided by the Digital Flight Data Recorder (DFDR). The CVR is in operation any time the essential DC bus is powered.



## Emergency Locator Transmitter

An Emergency Locator Transmitter (ELT) is located in the dorsal fin of the aircraft, with a blade antenna mounted above it. When armed, the ELT is automatically activated by impact-level deceleration forces and broadcasts encoded distress signals on multiple frequencies by utilizing an internal battery. These messages include the aircraft identification and geographic coordinates of the transmitter to aid first responders in timely locating the downed aircraft.

In addition to the encoded messages, a downward-sweeping homing signal is continuously broadcast on both VHF and UHF emergency frequencies. When the ELT battery is depleted, the unit ceases transmitting.



## ELT Switch

The ELT is controlled by a guarded switch. The switch is secured in the ARM position by a clip to prevent inadvertent movement.

**ARM:** The ELT is armed and will automatically activate based on detected impact forces.

**ON:** No function.

Note: ELT activation is not simulated.

## Overview

Overt and covert lighting is located around the aircraft's exterior, which allows for illumination in spectrums visible to the naked eye (overt) and invisible to the naked eye (covert). Covert lighting will be visible to night vision goggles only. Exterior lighting components include navigation lights, anti-collision lights, formation lights, landing and taxi lights, and leading edge lights.

Note: Due to limitations within DCS, covert lighting has not been implemented.

## Navigation Lights

Six dual-mode navigation lights are powered by the essential DC bus. A colored light is located on the outside of each wingtip, red on the left and green on the right; two white lights are located adjacent to each other on the tail cone. An additional two white lights are located on the upper and lower fuselage, in line with the propeller warning stripes.

## Anti-Collision Lights

Three strobing anti-collision lights are placed around the aircraft. One is located on the top of the fuselage just forward of the vertical stabilizer, another on the bottom of the fuselage aft of the nose landing gear door, and a third on top of the vertical stabilizer.

The fuselage-mounted lights are dual mode and can be toggled between overt and covert modes, while the stabilizer-mounted light is infrared-only and only operates when COVERT is the selected exterior lighting mode. The top and stabilizer strobes are supplied power by the essential DC bus and the bottom strobe by the main DC bus.

Note: The bottom strobe light is inhibited with weight-on-wheels unless the BOT STROBE TEST switch used.

## Formation Lights

Nine dual-mode, incandescent formation lights are embedded in the upper surface of the wings and fuselage, and 14 flat-panel electroluminescent (EL) lights are attached directly to the aircraft skin. All formation lights are powered by the essential AC bus.

On the upper surface of each wing, three circular, incandescent lights are embedded inboard of the ailerons in a slanted line. Another three are located on the centerline of the fuselage, aft of the center wing box.

The EL lights are located in a variety of places. The upper and lower surfaces of both horizontal stabilizers each have lights mounted at the outboard edges, while the vertical stabilizer has one on each side. Two are mounted on either side of the forward fuselage, and another two on the sides of the aft fuselage. Finally, lights are present on each wingtip.



## Landing Lights

Two dual-mode landing lights are mounted in recessed housings just aft of the leading edge on each wing. Extension and retraction are controlled by the LANDING LIGHTS MOTOR switches, with illumination controlled by the LANDING LIGHTS switches. Both lights are powered by the essential DC bus.

## Taxi Lights

Dual-mode taxi lights are mounted to the forward section of each main landing gear door. Both lights are powered by the main DC bus.

## Wingtip Taxi Lights

Two dual-mode taxi lights are located in a fairing on the forward edge of the left and right wingtips. Both lights are powered by the main DC bus.

## Leading Edge Lights

Angled, white flood lights are embedded on either side of the fuselage to illuminate the engine nacelles and leading edge of each wing. Unlike the other exterior lights, the leading edge lights do not have a covert mode; when COVERT is selected as the exterior lighting master mode, the lights are extinguished. Both lights are powered by the main DC bus.



## Exterior Lighting Control Panel

The exterior lighting control panel is used to control all exterior lighting, except for the landing, taxi, and wingtip taxi lights.



### 1. Exterior Lighting Master Switch

The master switch is used to select which visibility mode the exterior lights are operating in.

**COVERT:** All visible exterior lighting is extinguished.

**NORM:** All exterior lighting operates in the visible spectrum.

### 2. Navigation Light Mode Switch

The navigation light mode switch controls the illumination of the nav lights.

**FLASH:** The wing and tail nav lights blink simultaneously at a rate of 90 flashes per minute. The fuselage nav lights do not blink.

**OFF:** All nav lights are extinguished.

**STEADY:** All nav lights are illuminated continuously.



## 3. Navigation Light Brightness Switch

The brightness switch controls the illumination intensity of the navigation lights.

**DIM:** The nav lights operate at a reduced intensity.

**BRIGHT:** The nav lights operate at maximum intensity.

## 4. Covert/Formation Light Dimmer

The covert/formation light dimmer controls the brightness of the covert and formation lights, depending on which mode is selected via the exterior lighting MASTER MODE switch.

When NORM is selected, rotating the dimmer clockwise increases the brightness of the overt formation lights, while rotating it counterclockwise decreases brightness. When COVERT is selected, the dimmer has the same functionality, except that the covert formation lights are controlled.

## 5. Strobe Light Switches

The two strobe light switches control the illumination of the strobes mounted on the top and bottom of the fuselage.

**RED:** The respective strobe light flashes red at a rate of 90 flashes per minute.

**OFF:** The respective strobe light is extinguished.

**WHT:** The respective strobe light flashes white at a rate of 90 flashes per minute.

## 6. Bottom Strobe Test Switch

The bottom strobe test switch allows for the functionality of the bottom strobe light to be checked while the aircraft has weight-on-wheels. The switch is spring-loaded to the down (off) position. Holding the switch in the up position allows the bottom strobe light to illuminate as it would in the air.

## 7. Leading Edge Light Switch

The leading edge switch controls the illumination of the left and right leading edge lights.

**OFF:** Both lights are extinguished.

**ON:** Both lights are illuminated.



## Bleed Air System

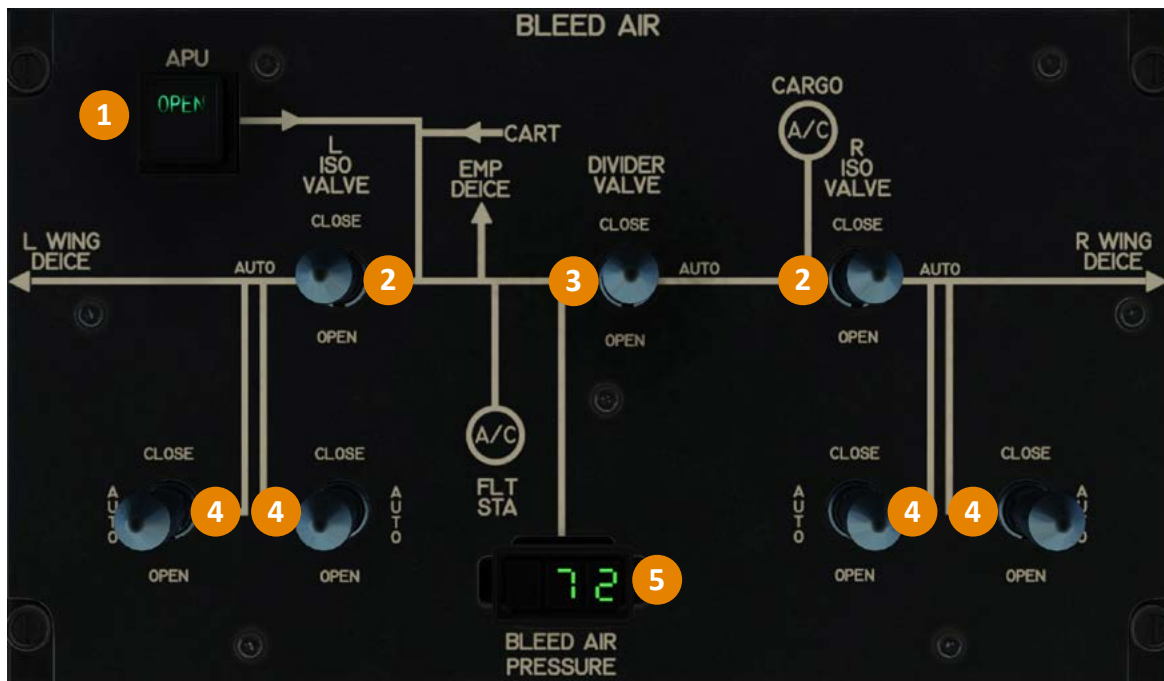
High-pressure bleed air is supplied to the aircraft from the 10th-stage compressor of each engine via a series of high-pressure ducts and bleed air shutoff valves. Bleed air is used for engine start, cabin pressurization, air conditioning/heat, and operation of the pneumatically-driven anti-icing systems. The APU is capable of supplying bleed air to the system when the engines are not running.

The system is managed via the Bleed Air/Environmental Control System (BA/ECS) controller which regulates the pressure and temperature of air delivered into the airplane's various systems. A 14th-stage augmenter valve opens when average engine power settings are below 1,000HP to supply additional air to the system; the valve closes when average engine horsepower reaches 1,100HP. The BA/ECS also provides automatic protection against overpressure and over-temperature by closing the nacelle shutoff valves on the problematic engine.

Divider and isolation valves are used to isolate portions of the ducting system when a bleed air leak or overheat is detected. The valves can be controlled manually, or automatically via the BA/ECS.

## Bleed Air Control Panel

The bleed air control panel allows for control over the various valves within the bleed air system.



### 1. APU Bleed Air Switch

The APU bleed air switch controls the position of the APU's bleed air valve. A green "OPEN" light is illuminated when the valve is open; the light is extinguished when the valve is closed. The valve is inhibited from opening when APU RPM is below 95%, and the valve will automatically close if RPM drops below 95%.



## 2. Wing Isolation Valve Switches

Two isolation valves allow the ducting of the left and right wings to be isolated from the rest of the bleed air system.

**CLOSE:** The isolation valve is closed

**AUTO:** The isolation valve is automatically closed when an overheat condition is detected.

**OPEN:** The isolation valve is open.

## 3. Divider Valve Switch

The divider valve is located between the flight station and cargo bay air conditioning systems and allows for one air conditioning system to supply air to the aircraft during an overheat condition.

**CLOSE:** The valve is closed.

**AUTO:** The valve is automatically closed when an overheat condition is detected in the left or right cross-ship ducts.

**OPEN:** The valve is open.

## 4. Nacelle Shutoff Valve Switches

Nacelle shutoff valves are provided for each engine that allow them to be isolated from the bleed air system.

**CLOSE:** The shutoff valve is closed.

**AUTO:** If the respective engine start selector is in the RUN, START, or MOTOR position, the valve will be controlled automatically by the BA/ECS.

**OPEN:** The shutoff valve is open.

Note: If an engine start is attempted with the shutoff valve closed, the starter will not engage due to a lack of bleed air.

## 5. Bleed Air Pressure Display

A digital readout displays the pressure of the wing's bleed air manifold in PSI. If manifold pressure sensor data is invalid or unavailable, dashes are displayed.



## Air Conditioning System

Two independent air conditioning units are installed, one for the flight station and another for the cargo compartment, which are operated by air from the bleed air system. The air conditioners use a mix of hot bleed air and cold air from heat exchangers to produce temperature-conditioned air, which is supplied to the aircraft through ducting. Both air conditioning units are identical and comprise a flow control valve (FCV), temperature control valve, refrigeration unit, and a water separator.

## Flow Control Valves

The flow control valve regulates the amount of air flowing through the air conditioning units. The valves are automatically closed under the following conditions:

- The air conditioning unit power switches are selected OFF.
- The pressurization mode selector is set to AUX VENT.
- The emergency depressurization switch is set to DUMP.
- Any engine control switch is placed to START.

Closure of an FCV is annunciated by a green "OFF" light illuminating on the respective air conditioner's power switch. If an FCV closed automatically due to an engine start, the valve will reopen upon completion of the start sequence; for all other conditions, the valve must be manually selected open again via the power switch.

## Temperature Control Valve

A temperature control valve mixes hot bleed air into the flow of cold air from the refrigeration unit. In automatic mode, the valve positions itself according to inputs from temperature probes located in the respective zones to achieve the desired temperature set by the crew. In manual mode, the valve is operated manually.

## Refrigeration Unit

The refrigeration unit cools hot bleed air by sending it through two stages: an air-to-air heat exchanger and a turbine. The heat exchanger core uses ambient ram air to provide initial cooling for the bleed air. The partially cooled air is used to turn a turbine, which reduces the air temperature even further. During ground operations, a cooling fan is used to cool the heat exchanger.

## Water Separator

The water separators remove between 70 to 85% of the condensation that occurs from air being refrigerated. The separator works by forcing intake air into a cone-shaped bag. The airflow around the bag causes the air to turn to fog, which throws water droplets against the sidewalls and allows it to drain. Discharge air from the heat exchanger is used to warm the inlet air to prevent ice from building up.



## Underfloor Heating and Ventilation

The cargo bay floor is provided with heating and ventilation via a mixture of bleed air and recirculated air that flows through distribution ducts. A shutoff valve controls the flow of bleed air to the section and is modulated to maintain an underfloor temperature of 73°F, plus or minus 8°F. A recirculating fan ensures proper air circulation and cooling of the avionics equipment.

## Air Conditioning Control Panel

Two identical sets of controls are provided for the Flight Station (FLT STA) and Cargo Compartment (CARGO COMPT) air conditioning units. The cross flow and underfloor heating valves can also be adjusted via the panel.

### 1. Air Conditioning Power Switches

The air conditioning unit power switches control the position of the FCVs for each unit.

A green “OFF” light is illuminated when the FCV is closed and bleed air is not reaching the unit. “ON” illuminates when the FCV is open and bleed air is reaching the unit.

### 2. Temperature Displays

Digital readouts are provided for each system that display the sensed temperature in the zone (ACTUAL) and the desired temperature set by the crew (SET).

### 3. Air Conditioning Mode Switches

The mode switches control the operating mode of the air conditioning units. Automatic mode is the default and indicated by the switch face being blank. When manual mode is selected, a green “MAN” light illuminates.

### 4. Temperature Control Switches

The temperature control switches are used to adjust the desired temperature. The desired temperature can be set between 60 and 90°F. In manual mode, the switches directly control the position of the temperature control valves.



## 5. Crossflow Valve Mode Switch

The crossflow valve mode switch controls the operating mode of the crossflow valve. Automatic mode is the default and annunciated by the switch face being blank. When manual mode is selected, a green “MAN” light illuminates.

In automatic mode, the crossflow valve positions itself to equalize the workload of the two air conditioning units. In manual mode, the crossflow valve switch directly controls the position of the crossflow valve.

## 6. Crossflow Valve Switch

The crossflow valve mode switch controls the operating mode of the crossflow valve. Automatic mode is the default and annunciated by the switch face being blank. When manual mode is selected, a green “MAN” light illuminates.

In automatic mode, the crossflow valve positions itself to equalize the workload of the two air conditioning units. In manual mode, the crossflow valve switch directly controls the position of the crossflow valve.

## 7. Underfloor Selector Switch

The underfloor selector switch controls the operating mode of the cargo bay’s underfloor ventilation system.

**FAN:** The recirculating fan is on and the heat shutoff valve is closed.

**OFF:** The recirculating fan is off and the heat shutoff valve is closed.

**HEAT/FAN:** The recirculating fan is on and the heat shutoff valve is open.

Note: If an engine start is initiated with the switch set to HEAT/FAN, the underfloor heat shutoff valve will automatically close.



## Pressurization System

The pressurization system consists of air conditioning units in the flight station and cargo compartment, an outflow valve, safety relief valve, and cabin pressure controller.

The bleed air system supplies hot air to the two air conditioning units, which cool the air and supply it to their respective zones; the inflow of air causes the pressure inside the aircraft to increase above the ambient pressure. An outflow valve, located in the cockpit, modulates its position in response to commands from the cabin pressure controller to manage cabin altitude. If the cabin pressure exceeds structural limits, the safety valve opens to relieve pressure.

The pressurization system can be operated in five distinct modes which are selectable via the PRESSURIZATION control panel. The available modes include automatic, manual, constant altitude, auxiliary ventilation, and no pressurization.

### Automatic Mode

In automatic mode, the cabin pressurization controller automatically adjusts the outflow valve to maintain cabin pressure at the scheduled cabin altitude or the selected landing altitude, whichever is higher. Automatic mode has six different submodes which are active during different phases of flight.

**Ground:** Active whenever there is weight on wheels with the power levers positioned to flight idle or less. In this mode, the outflow and safety valves are opened to provide an unpressurized cabin.

**Pre-pressurization:** Becomes active when there is weight on wheels, and the power levers are advanced above flight idle. When activated, the cabin begins a descent to 300 feet below the field elevation. If the power levers are brought below flight idle while pre-pressurization is occurring, the cabin altitude will climb at 500 feet per minute for 20 seconds, then 2,000 feet per minute until the cabin is depressurized. The system will then transition back to the ground submode.

**Climb:** Activates when weight is off wheels, or the landing gear is retracted and airspeed is above 100 knots. During the climb, a schedule of cabin altitude versus aircraft altitude determines the cabin altitude.

**Cruise:** Activates when the aircraft's altitude has not changed by more than 200 feet for 10 minutes. The cabin pressure controller maintains cabin altitude at the scheduled cabin altitude. Cruise mode remains active until the aircraft's altitude has changed by more than 200 feet over a 1-minute interval, or 500 feet from the previously-detected cruise altitude.



**Descent:** Activates when the aircraft's altitude has decreased 1,000 feet or more from the highest altitude achieved while in cruise mode. During the descent, a schedule of cabin altitude versus aircraft altitude determines the cabin altitude.

**Landing:** Activates when there is weight on wheels, or the landing gear is extended and airspeed is below 60 knots. If the landing altitude was correctly set and the airplane lands unpressurized, the ground mode activates 60 seconds after landing mode becomes active.

If the plane lands pressurized, such as it would if the landing altitude was set below the field elevation, a depressurization process occurs. During this depressurization, the cabin will climb at 500 feet per minute for 60 seconds after touchdown, then 2,000 feet per minute until depressurized. Ground mode will then become active.

## Manual Mode

Manual mode bypasses the cabin pressure controller and gives the crew direct control over the outflow valve's position. In manual mode, the outflow valve control rocker is used to manually open and close the valve to achieve the desired cabin altitude.

## Constant Altitude Mode

Constant altitude mode functions in the same manner as AUTO except that cabin altitude is maintained at the value selected via the LDG/CONST knob.

## Auxiliary Ventilation Mode

Auxiliary ventilation mode commands the outflow valve to depressurize the aircraft at 3,000 feet per minute. Once differential pressure drops below 0.5 inHg, the safety valve opens to fully depressurize the aircraft. When aux vent is active, the flight station and cargo compartment air conditioning units are automatically turned off. Underfloor heat is also deactivated.

Note: When Aux Vent is selected, operation of the two air conditioning units is inhibited. Aux Vent must be deselected in order to re-enable them.

## No Pressurization Mode

In no pressurization mode, the safety valve is opened to keep the aircraft depressurized. If NO PRESS was selected with the cabin pressurized, the cabin pressure controller will depressurize the cabin at the rate set by the AUTO RATE knob. Once differential pressure drops below 0.5 inHg, the safety valve opens to fully depressurize the aircraft.



## Safety Relief Valve

The safety relief valve is located on the cargo door and prevents the pressurization system from exceeding structural limits. The valve opens automatically to relieve excess pressure when positive differential pressure exceeds 15 inHg, or negative pressure exceeds 0.8 inHg. In addition to its safety functions, the valve is commanded open by the cabin pressure controller in the following scenarios:

1. Emergency depressurization has been selected via the EMER DEPRESS switch.
2. Auxiliary ventilation mode is active.
3. No pressurization mode is active.
4. The ground submode of automatic pressurization is active.

## Pressurization Control Panel

The pressurization control panel is used to interact with the pressurization system and view information related to cabin pressure.

### 1. Rate Display

The RATE display provides a digital readout of the cabin altitude's rate of change in feet per minute. Positive rates indicate the cabin altitude is increasing, while negative values indicate cabin altitude is decreasing.

### 2. Cabin Altitude Display

The CABIN ALT display provides a digital readout of the cabin's current altitude.

### 3. Differential Pressure Display

The DIF PRESS display provides a digital readout of the differential between the cabin's pressure and ambient pressure. Pressure values are shown in increments of 0.1 inHg.



## 4. Manual Outflow Valve Control Switch

The MANUAL VALVE CONTROL switch becomes active when manual pressurization is selected and directly controls the position of the outflow valve. Positioning the switch to OPEN will gradually drive the outflow valve towards full-open for as long as the switch is held. The valve is driven towards full-close when the switch is held to CLOSE.

## 5. Auto Rate Knob

The AUTO RATE selector knob is used to limit the climb and descent rate that the cabin pressure controller commands. When the knob is positioned to MIN, the controller limits the cabin rate to 0 feet per minute; when positioned to MAX, the cabin rate is limited to 3,000 feet per minute. In NORM, the cabin will climb at 500 feet per minute and descend at 300 feet per minute.

## 6. Emergency Depressurization Switch

The EMER DEPRESS switch is guarded to prevent inadvertent actuation. If the switch is actuated, the following actions occur to rapidly dump cabin pressure to ambient:

1. The outflow and safety valves are commanded open.
2. The flight station and cargo compartment air conditioning units are shut off.
3. The underfloor heat supply valve is closed.

## 7. Pressurization Mode Switch

The pressurization mode select switch selects which pressurization mode the system operates in.

**CONST ALT:** Constant altitude mode is active.

**MAN:** Manual mode is active.

**AUTO:** Automatic mode is active.

**NO PRESS:** No pressurization mode is active.

**AUX VENT:** Auxiliary ventilation mode is active.

## 8. Landing/Constant Altitude Selector and Display

The LDG/CONST selector knob is used to set the landing elevation for automatic mode, and the altitude to maintain in constant altitude mode. A digital indicator above the knob displays the current selection.



## Ice Protection System

The C-130J is outfitted with both anti-ice and de-icing systems that allow the aircraft to operate in known icing conditions. Anti-ice systems prevent the formation of ice while de-ice systems remove ice that has already formed. Ice detectors located on the nose alert the crew to ice formation via ACAWS.

The system uses hot bleed air to heat various engine components, as well as the wing and vertical stabilizer leading edges. Bleed air is also used to inflate a rubber de-icing boot at the base of the vertical stabilizer. Electrically heated propeller blades, propeller spinners, windshields, and instrument probes complete the system.

## Ice Detectors

Ice detection is facilitated by two nose-mounted ice detectors. Each ice detector contains an electrically powered, vibrating probe that resonates at a specific frequency. Ice accumulation on the probe causes the resonance frequency to decrease, which is sensed by the detector and relayed to the mission computer. When this occurs, the "ICE DETECTED" ACAWS advisory is presented to the crew, and any ice-protection systems that are in the AUTO mode activate.

## Propeller Heating

The propellers are equipped with electrical heating elements located on the blade roots and forward/aft spinner sections, which facilitate both anti-icing and de-icing. The heating elements are automatically tested after engine start.

When the system is ON, the forward spinner heat is on continuously while the propeller blades and aft spinner surface are cycled on and off. A deicing timer uses inputs from the total air temperature and propeller speed sensors, propeller ice protection switch positions, weight on wheels sensors, and ice detectors to automatically activate and compute the heating cycle times for the aft spinner and propeller blades.

For the system to operate in the air, the total air temperature must be less than or equal to 5°C (41°F). With weight on wheels, anti-ice is inhibited and de-ice operates in the shortest heat cycle to protect the heating elements from overheating.

## Probe Heating

The pitot-static tubes, angle-of-attack vanes, and total air temperature (TAT) probes contain electrical heating elements that provide anti-icing capabilities. TAT probe heating is automatically modulated to reduce excessive heating if the aircraft is on the ground below 50 knots; all other probe heat is applied continuously when the system is set to ON.



## Windshield Heating

The three windshields, two side windows, and lower window are NESA-type that are heated by applying AC power to a transparent resistance material between the layers of glass. This heating provides anti-icing and increases impact resistance from projectiles such as birds and hail. Power is automatically controlled to maintain window temperature within specified limits.

## Wing/Empennage Heating

The leading edges of the wing and empennage are provided anti-ice and de-ice capabilities via hot air from the bleed air system. The system is divided into seven zones, each with a control valve that regulates air flow into its respective zone.

Automatic temperature regulation of the leading edges is provided by the Bleed Air/Environmental Control System (BA/ECS) controller. The controller interfaces with the mission computer and F/ODS to alert the crew to any zone control failure or overheat condition.

While other components of the ice protection system are exclusively anti-ice or de-ice, the wing/empennage system is capable of operating in either, as selected by the ANTI-ICE/DE-ICE switch. In addition to anti-ice and de-ice, the system also features a test mode for use on the ground.

Note: The wing/empennage ice protection system is inhibited when airspeed is less than 60 knots.

## De-Ice Mode

In the de-icing mode, the zone control valves open and close in 60-second intervals in a repeating schedule to efficiently eliminate ice formation. The schedule operates in the following order:

1. Vertical stabilizer valves open for 60 seconds, then close.
2. Left and right horizontal stabilizer valves open for 60 seconds, then close.
3. Vertical stabilizer valves open for 60 seconds, then close.
4. Left and right outboard wing valves open for 60 seconds, then close.
5. Vertical stabilizer valves open for 60 seconds, then close.
6. Left and right inboard wing valves open for 60 seconds, then close.

## Anti-Ice Mode

In the anti-icing mode, the zone control valves open and close on the same schedule as the de-icing mode, except that the vertical stabilizer zone valves remain open continuously to prevent ice formation on the tail.



## Test Mode

The test mode allows for verification that the zone control valves, and the tail pneumatic boot are operating correctly before flight. The test runs for 90 seconds and can be initiated by moving the ANTI-ICE/DE-ICE switch from DE-ICE to ANTI-ICE and back to DE-ICE. The test sequence accomplishes the following actions:

- All wing/empennage zone control valves open in pairs at 5-second intervals.
- The vertical stabilizer pneumatic boot timer begins a de-ice cycle of 6-seconds on (inflation) and 54 seconds off (deflation). The cycle is repeated until the termination of the test.

Note: For the wing/empennage ground test to initiate, the WING/EMP ice protection switch must be set to AUTO.

## Vertical Stabilizer De-Ice Boot

The base of the vertical stabilizer is fitted with an inflatable de-ice boot into which the HF radio antenna is set. Whenever the wing/empennage ice protection switch is in AUTO and ice is detected, or the switch is turned ON, the boot inflates with bleed air for 6 seconds, then deflates for 54 seconds over a 60-second cycle. The cycle is controlled by a primary and secondary timer which provides redundancy in the event of a single timer failure.

## Engine and Nacelle Heating

Engine and nacelle components are heated with bleed air to prevent ice formation on critical components. The heated components include compressor inlet guide vanes, torque meter shaft, oil cooler inlet, and engine inlet.



## Ice Protection Panel

The ice protection panel is used to control the various anti-ice, de-ice, and heating systems.

### 1. Propeller Ice Protection Switches

The propeller ice protection control switches control the heating elements in each propeller.

**OFF:** The heating elements are de-energized. If the system was previously active, the heating elements will be de-energized after the current cycle completes, plus one additional cycle.

**AUTO:** The heating elements are energized automatically when ice is detected.

**ON:** If the respective propeller is rotating, the heating elements are energized depending on WOW status and total air temperature.

### 2. Engine Ice Protection Switch

The engine ice protection switch controls the engine and nacelle anti-ice system for all four engines.

**OFF:** Ice protection is deactivated for all engines.

**AUTO:** Engine ice protection is automatically activated when ice is detected.

**ON:** Ice protection is activated for all engines.

### 3. Wing/Empennage Ice Protection Switch

The wing/empennage switch controls the ice protection system for the wings, vertical stabilizer, and horizontal stabilizer.

**OFF:** Both the de-ice boot and wing/empennage system are deactivated.

**AUTO:** The wing/empennage system and de-ice boot activate when icing is detected.

**ON:** The stabilizer de-ice boot inflates, and the wing/empennage protection system is activated.



## 4. Anti-Ice/De-Ice Switch

The anti-ice/de-ice switch controls which mode the wing/empennage system operates in.

**DE-ICE:** The wing/empennage ice protection system operates in the de-ice mode.

**ANTI-ICE:** The wing/empennage ice protection system operates in the anti-ice mode.

Note: Cycling this switch from DE-ICE to ANTI-ICE and back to DE-ICE with weight-on-wheels will initiate the wing/empennage ground test mode.

## 5. Pitot Heat Switches

The pitot heat switches control the heating elements in the pilot's (P) and copilot's (CP) instrument probes.

**OFF:** The heating elements in the respective probes are de-energized.

**ON:** The heating elements in the respective probes are energized.

## 6. NESA Heat Switches

The NESA heat switches control the heating elements for the center and side/lower windows.

**OFF:** The heating elements in the respective windows are de-energized.

**ON:** The heating elements in the respective windows are energized.



## Avionics Management Units

Two identical AMUs are located on the glareshield, on either side of the CNBP. Each AMU consists of two screens with Line Select Keys (LSK) mounted to the bezels: the left AMU is reserved for the pilot, while the right AMU is reserved for the copilot. For a detailed description of the AMU pages, see the AMU section.



### 1. Line Select Key

The LSKs allow for navigation through the AMU interface. LSKs on the left side of each screen are labeled L1-L4, while the right LSKs are R1-R4.

### 2. Brightness Control Rocker

The brightness rocker adjusts the backlighting intensity for both screens.

## AMU Pages

The two AMU units share identical page structures which allows either crew member to conveniently access the full suite of AMU pages and functions. In normal operation, both screens of each AMU unit are used, unless an option has been selected that renders that screen empty.

## AMU Conventions

The AMU pages follow a series of conventions that make interaction intuitive to the crewmember; being aware of these is crucial for a positive experience with the system. Rather than burying options behind multiple menus, the AMU interface is designed in a manner that allows a page structure to be selected from the MAIN MENU page, and from there any additional pages of options are displayed on the right screen. Notable conventions include:

1. Carets adjacent to a line of text indicate selecting that option will branch to another page. If no caret is present, that line of text is simply a toggle.
2. "MAIN MENU>" is always displayed adjacent to R4 on the left screen.
3. Selected items are rendered in inverse video, while non-selected items are rendered in normal video.
4. The HDD POS menu is displayed on the right screen when a commonly used HDD page is selected (PFD, NAV-RADAR, etc.), or when "HDD POS>" is manually selected.
5. The right AMU screen can be switched to blank by deselecting an option that displays a page on the right screen (such as HDD POS).

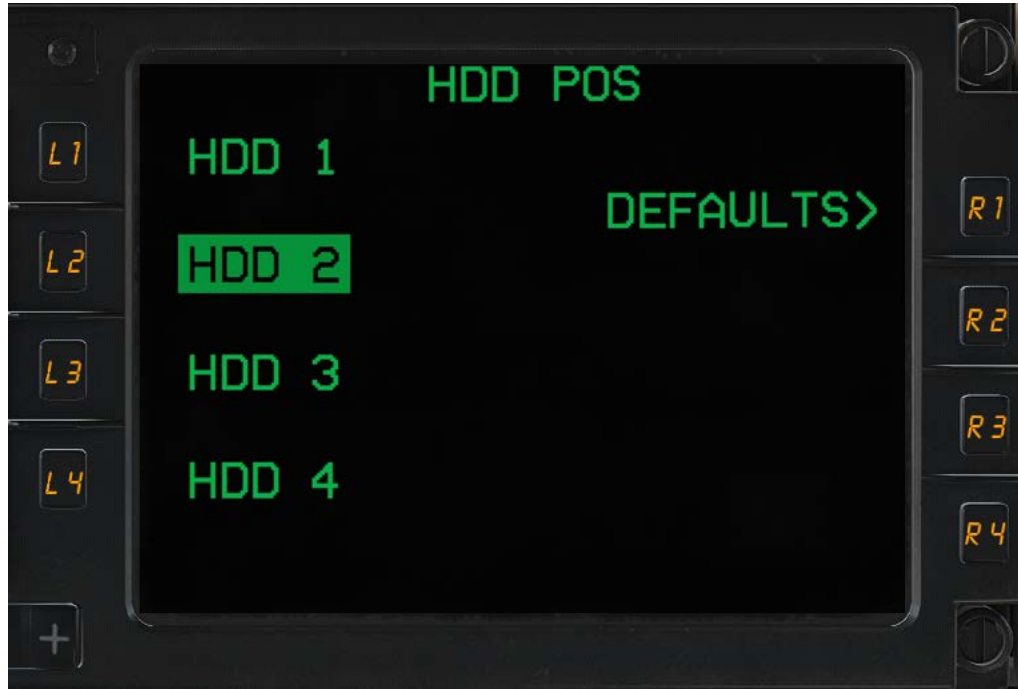
## MAIN MENU

The MAIN MENU page is the homepage of the AMU. All options presented branch to a different page structure. The name of the page structure is the same as the option that was selected on the MAIN MENU page. For example, pressing LSK L3 adjacent to CAPS will branch to the CAPS AMU page.



## HDD Position (HDD POS)

Throughout the AMU, any option that has the ability to display a page on an HDD will be accompanied by the HDD POS page. Using this menu allows the user to select which screen(s) that the desired page will be displayed on.



**L1-L4:** Used to select which HDD(s) the desired page will be displayed on.

**R1:** Branches to the DEFAULTS page.

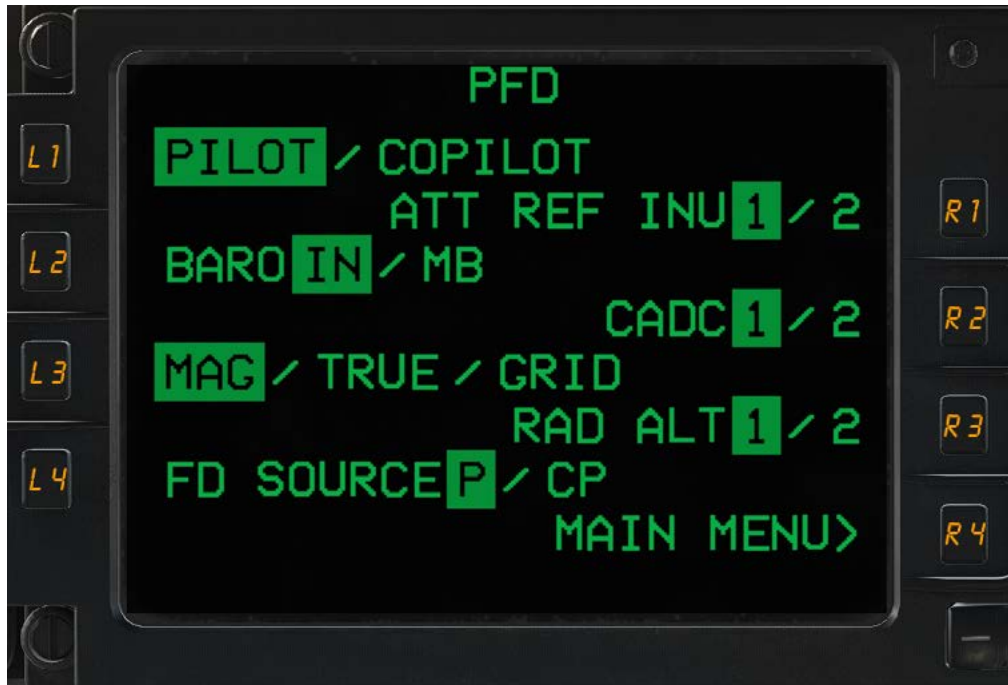
**R2-R4:** Blank.

Note: Deselecting an HDD position will return the HDD to the last-displayed page.



## PFD

The PFD page contains controls related to the PFD HDD display. Because the PFD and HUD share data sources, options changed on the PFD page will also affect the HUD.



**L1:** Selects which side the page's options will control. When PILOT is selected, PFDs displayed on HDD 1 and HDD 2 and the left HUD will be affected by changes made on the PFD page.

When COPILOT is selected, PFDs displayed on HDD 3 and the right HUD will be affected. Changing this option will also configure the page's options to reflect what has been selected and is in use on the opposite side PFD and HUD.

**L2:** Changes the units of the on-side PFD and HUD's altimeter. Select IN to use inches of mercury, and MB to use millibars.

**L3:** Changes the heading reference source for the on-side PFD and HUD. Select MAG to use magnetic north, TRUE to use true north, and GRID for the military grid system.

**L4:** Changes the flight director source for the on-side PFD and HUD.

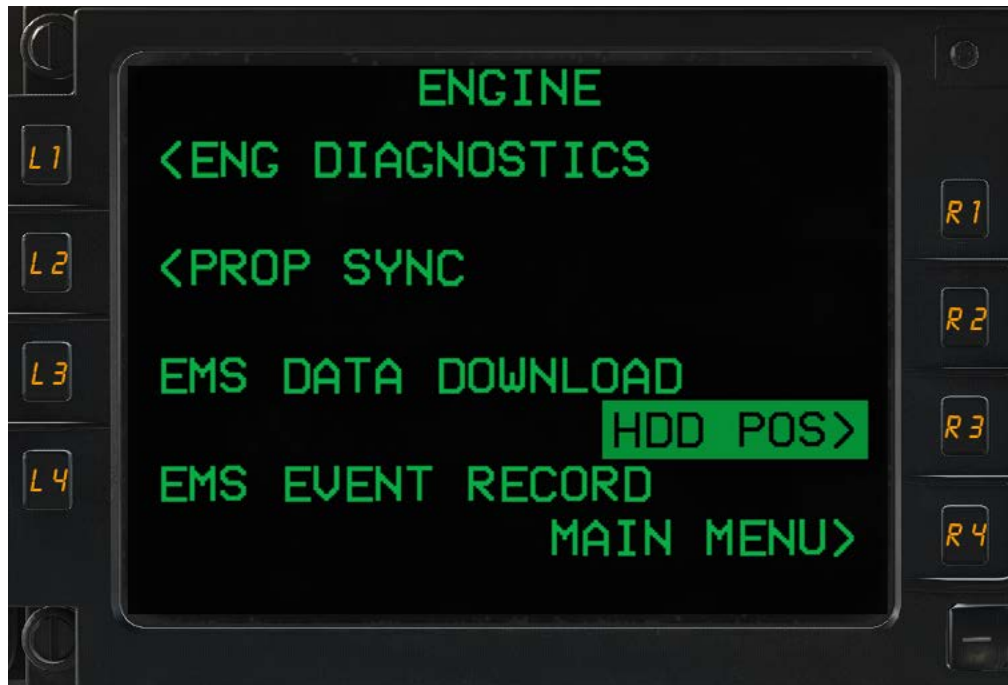
**R1:** Changes the attitude reference source for the on-side PFD and HUD. By default, the pilot's PFD uses ATT REF INU 1 and the copilot's side ATT REF INU 2.

Note: The "PFD ATTITUDE SAME" ACAWS will be generated if both PFDs are set to the same INU source.



## ENGINE

The ENGINE page serves as a menu for the engine-related functions.



**L1:** Branches to the ENGINE DIAGNOSTICS page.

**L2-L4:** No function.

**R1-R2:** Blank.

**R3:** Displays the HDD POS page.

**R4:** Branches to the MAIN MENU page.



## ENGINE DATA

The ENGINE DATA page displays Power Lever Angle and propeller blade angle for each engine/propeller, in addition to which FADEC is controlling the engine. PLA and Beta values will change in real time based on the positional data of the throttles and propeller blades. Positive PLA and beta angles are preceded by a plus (+) sign, while negative values are preceded by a minus (-) sign.



ENG	PLA	BETA	FIC
1	+22.9	+ 5.2	A B
2	+22.9	+ 5.4	A B
3	+22.9	+ 5.7	A B
4	+22.9	+ 5.5	A B

The PLA field is an angular readout of the physical throttle's position. PLA is 0.0 when the throttles are at the MAX REV stop, and 85.0 when they are in the TAKEOFF detent.

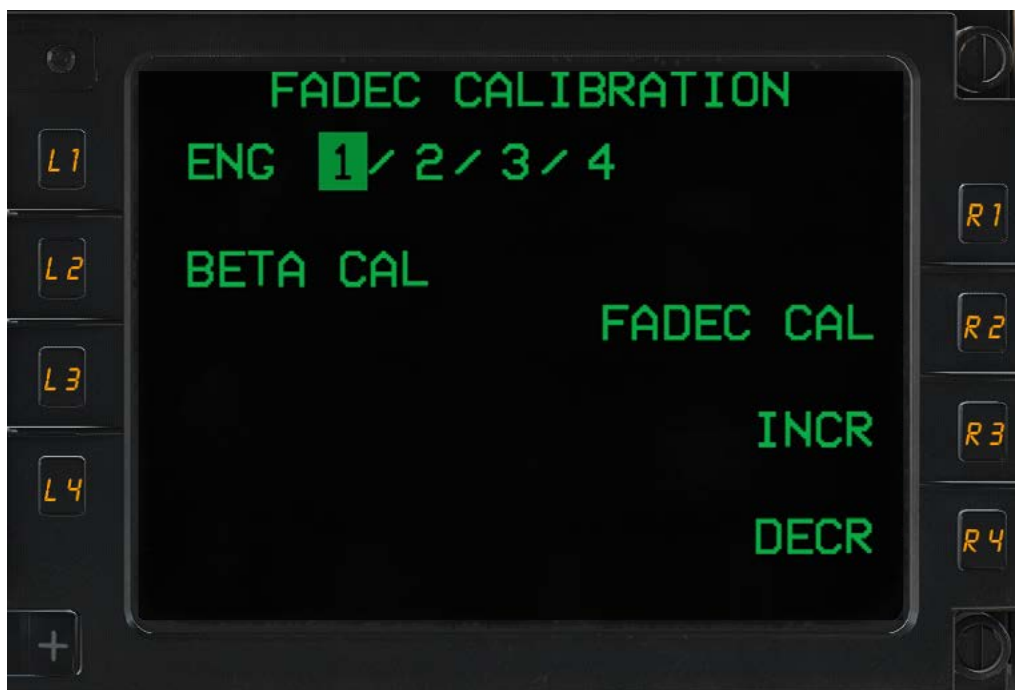
The BETA field displays the angle of the propeller blades in relation to the axis of the propeller's rotation. In max reverse, the propeller blade angle is -17.0 degrees, and +90.0 degrees when in the feather position.

The FADEC in Command (FIC) field indicates which FADEC unit (either A or B) is currently in control of the engine. Selecting LSKs R1- R4 will toggle the respective engine's FIC between A and B. The FIC can also be changed by the FADEC switches mounted on the overhead panel.



## FADEC CALIBRATION

No function. Display only.



## NIU RESET

The NIU RESET page is used to send a reset signal to the four NIUs to clear potential faults.



**L1:** Selects which NIU is to be reset.

**L2-L4:** Blank.

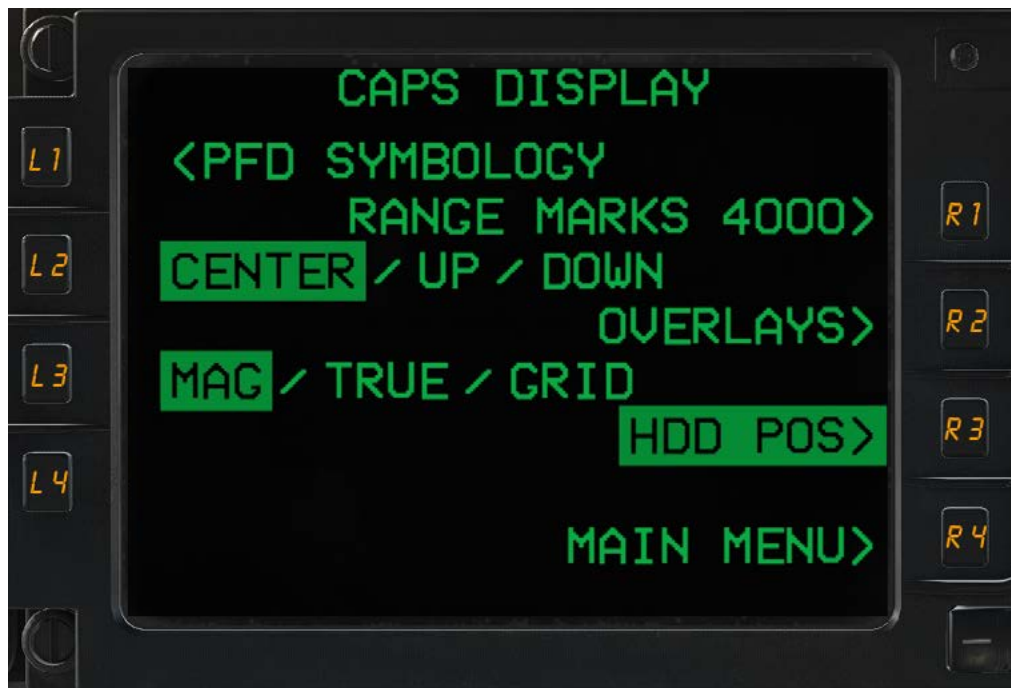
**R1:** Blank.

**R2:** Sends a reset signal to the NIU selected at L1.

**R3-R4:** Blank.

## CAPS

The CAPS page is used to configure the CAPS HDD page.



**L1:** Branches to the PFD SYMBOLOGY page.

**L2:** Selects the positioning of the ownship symbol. When CENTER is selected, the ownship symbol is placed in the center of the display. When UP is selected, the symbol is offset by 3 range rings from the center towards the top of the display; when DOWN is selected, the symbol is offset by 3 range rings towards the bottom of the display.

**L3:** Selects the heading reference of the CAPS display. When MAG is selected, the CAPS display is referenced to magnetic north. When TRUE is selected, the heading reference is set to true north. When GRID is selected, the heading reference set is set to a military grid.

**L4:** Blank.

**R1:** Displays the RANGE MARKS page. The current setting is displayed next to the key.

**R2:** Displays the OVERLAYS page.

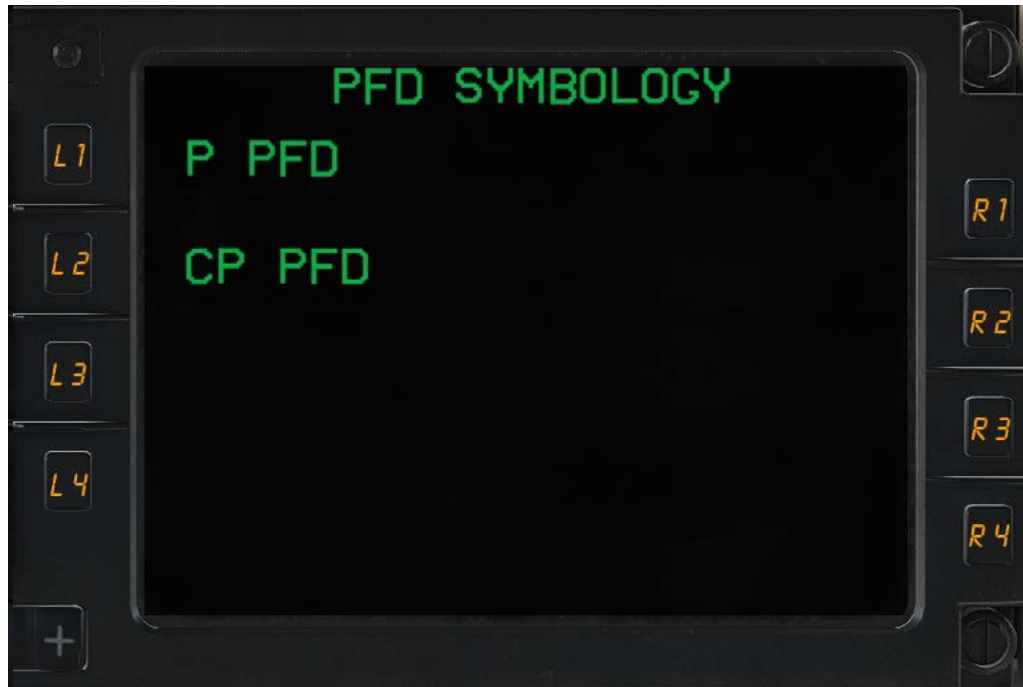
**R3:** Displays the HDD POS page.

**R4:** Branches to the MAIN MENU page.



## PFD SYMBOLOGY

The PFD SYMBOLOGY page is used to select which PFDs CAPS symbology is displayed on.



**L1:** CAPS symbology is displayed on the pilot's PFD.

**L2:** CAPS symbology is displayed on the copilot's PFD.

**L3-L4:** Blank.

**R1-R4:** Blank.



## OVERLAYS (CAPS)

The OVERLAYS page for CAPS selects which overlays are displayed on the CAPS HDD page.



**L1:** Adds symbols for nav aids such as VORs and TACANs to the CAPS display.

**L2:** Adds tactical symbology to the CAPS display. Tactical symbology includes threat rings, SAM sites, and initial points.

**L3:** Adds flight plan symbology to the CAPS display. Flight plan symbology includes course lines, turn point symbols, and alphanumeric waypoint identifiers.

**L4:** Adds the course lines and waypoint identifiers of the next two flight plan waypoints of the active flight plan to the CAPS display.

**R1:** Adds airport symbology and identifiers to the CAPS display.

**R2-R3:** Blank.

**R4:** Deselects and removes all overlays from the CAPS display.



## RANGE MARKS (CAPS)

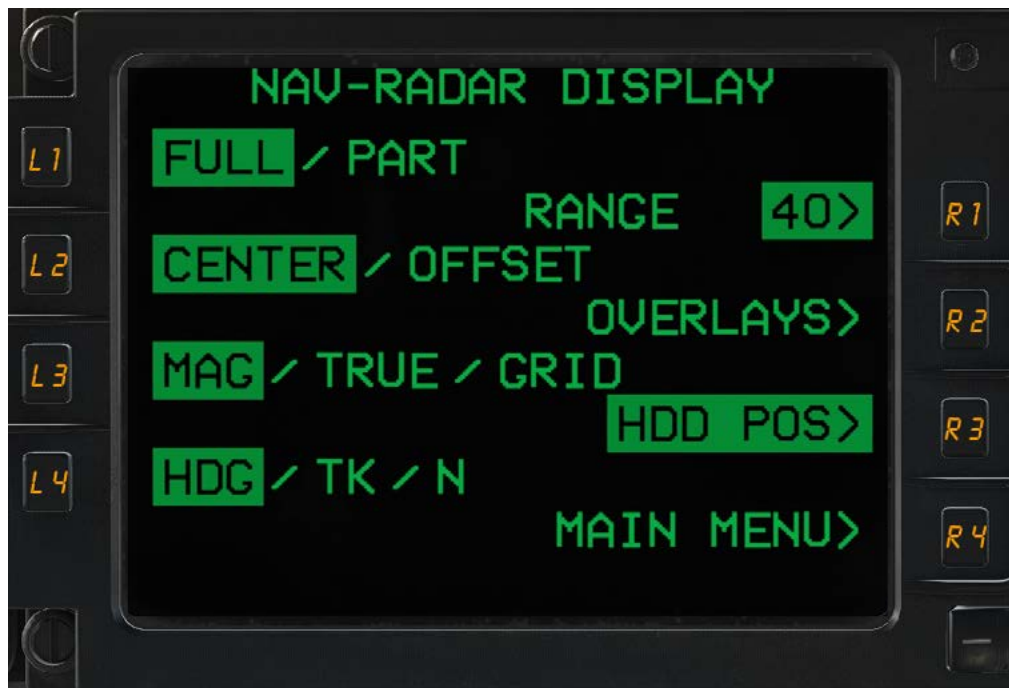
Allows for configuration of the radius of each range ring, in feet or nautical miles, from the ownship symbol on the CAPS HDD display.

Because the options on this page are self-explanatory, the specific function of each LSK will not be explained.



## NAV-RADAR DISPLAY

The NAV-RADAR DISPLAY page is used to configure the NAV-RADAR HDD page.



**L1:** Selects whether the nav-radar will operate on the full or partial channel.

**L2:** Selects whether the ownship symbol will appear in the center of the nav-radar display or if it is offset.

**L3:** Selects the heading reference of the nav-radar display. When MAG is selected, the nav-radar is referenced to magnetic north. When TRUE is selected, the heading reference is set to true north. When GRID is selected, the heading reference set is set to a military grid.

**L4:** Changes the lubber line reference between the aircraft's current heading, ground track, or north up.

**R1:** Displays the RANGE page. The current range ring distance, in nautical miles, is displayed next to the key.

**R2:** Displays the OVERLAYS page.

**R3:** Displays the HDD POS page.

**R4:** Branches back to MAIN MENU.



## RANGE (NAV-RADAR)

Allows for configuration over the radius of each range ring, in nautical miles, from the ownship symbol on the nav-radar HDD display.



Each number outside the parentheses represents the distance from the ownship symbol to the outer ring of the nav-radar circle. The number within parentheses represents the distance from one range ring to another.

Because the options on this page are self-explanatory, the specific function of each LSK will not be explained.



## OVERLAYS (NAV-RADAR)

The OVERLAYS page for the nav-radar selects which overlays are displayed on the nav-radar HDD page.



**L1:** Adds symbols for nav aids such as VORs and TACANs to the nav-radar display.

**L2:** Adds tactical symbology to the nav-radar display. Tactical symbology includes threat rings, SAM sites, and initial points.

**L3:** Adds flight plan symbology to the nav-radar display. Flight plan symbology includes course lines, turn point symbols, and alphanumeric waypoint identifiers.

**L4:** Adds the course lines and waypoint identifiers of the next two flight plan waypoints of the active flight plan to the nav-radar display.

**R1:** Adds airport symbology and identifiers to the nav-radar display.

**R2:** Adds RWR symbology to the nav-radar display.

**R3:** Blank.

**R4:** Deselects and removes all overlays from the nav-radar display



## SYS STATUS DISPLAY

The SYS STATUS DISPLAY page selects which HDD the system status HDD page will be displayed on.



**L1-L4:** Blank.

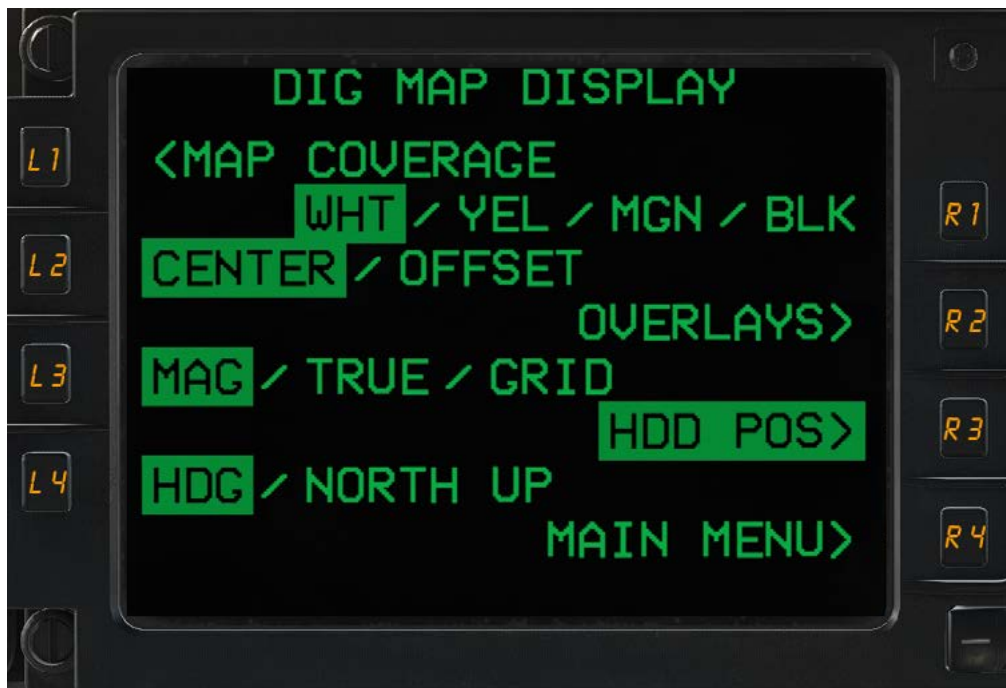
**R1-R2:** Blank.

**R3:** Displays the HDD POS page.

**R4:** Branches to the MAIN MENU page.

## DIG MAP DISPLAY

The DIG MAP DISPLAY page is used to configure the digital map HDD page.



**L1:** Displays the MAP COVERAGE page.

**L2:** Selects whether the ownship symbol will appear in the center of the dig map display or if it is off-set.

**L3:** Selects the heading reference of the nav-radar display. When MAG is selected, the nav-radar is referenced to magnetic north. When TRUE is selected, the heading reference is set to true north. When GRID is selected, the heading reference set is set to a military grid.

**L4:** Selects whether the dig map will be referenced to aircraft heading or north up.

**R1:** Selects what color the overlays and symbology will be rendered in.

**R2:** Displays the OVERLAYS page.

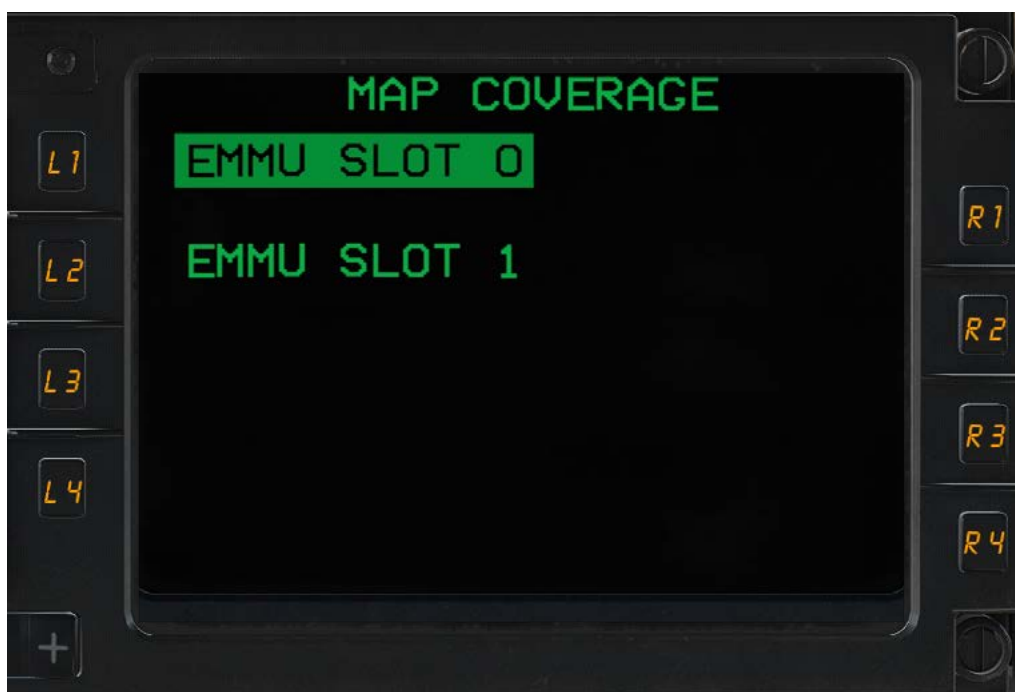
**R3:** Displays the HDD POS page.

**R4:** Branches to the MAIN MENU page.



## MAP COVERAGE

No function. Display only.



## OVERLAYS (DIG MAP)

The OVERLAYS page for the dig map selects which overlays are displayed on the dig map HDD page.



**L1:** Adds symbols for nav aids such as VORs and TACANs to the dig map.

**L2:** Adds tactical symbology to the dig map. Tactical symbology is shown in red regardless of the overlay color selection and includes threat rings, SAM sites, and initial points.

**L3:** Adds the course lines and waypoint identifiers of the active flight plan to the dig map display.

**L4:** Blank.

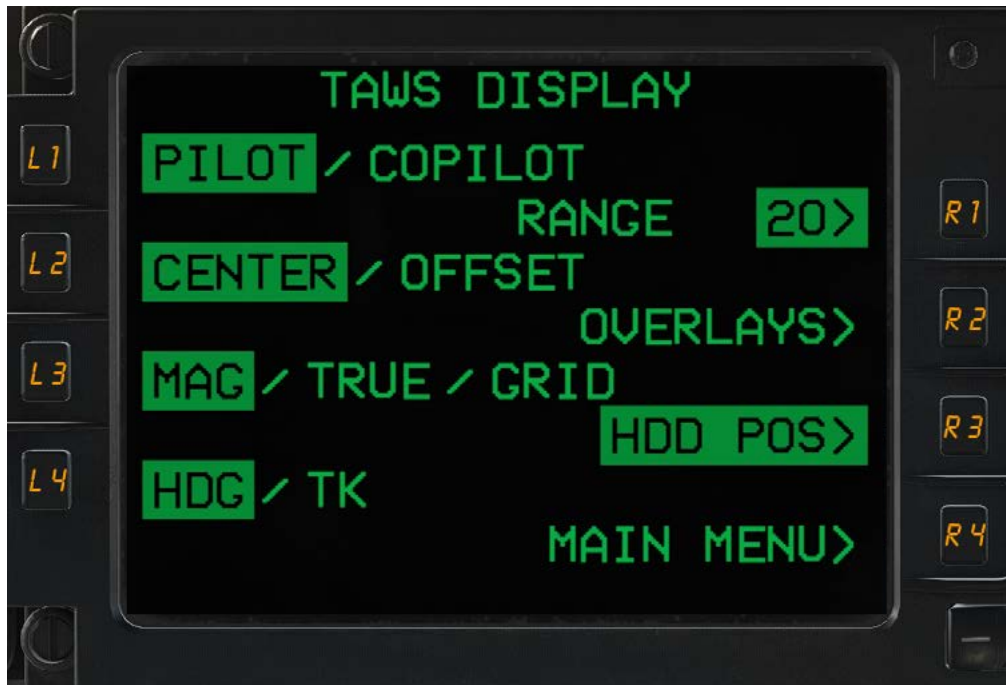
**R1-R3:** Blank.

**R4:** Deselects and removes all overlays from the dig map.



## TAWS DISPLAY

The TAWS DISPLAY page is used to configure the TAWS HDD page.



**L1:** Selects whether the options on the TAWS AMU page affect the pilot or copilot's TAWS display.

Note: For performance reasons, configuring the pilot and copilot TAWS pages independently is not possible.

**L2:** Selects whether the ownship symbol will appear in the center of the TAWS display or if it is offset.

**L3:** Selects the heading reference of the TAWS display. When MAG is selected, the TAWS is referenced to magnetic north. When TRUE is selected, the heading reference is set to true north. When GRID is selected, the heading reference set is set to a military grid.

**L4:** Selects whether the TAWS display will be referenced to aircraft heading or ground track.

**R1:** Displays the RANGE page. The current range ring distance, in nautical miles, is displayed to the right of the text.

**R2:** Displays the OVERLAYS page.

**R3:** Displays the HDD POS page.

**R4:** Branches to the MAIN MENU page.



## NAV SELECT

The NAV SELECT page allows for configuration of which navigation sources are used on the PFD and HUD.



**L1:** Selects whether the pilot or copilot PFD/HUD will be controlled by the page options.

**L2:** Displays the POINTER 1 page. The selected pointer is displayed at the right of the line.

**L3:** Displays the POINTER 2 page. The selected pointer is displayed at the right of the line.

**L4:** Selects which INAV solution will drive the on-side PFD and HUD.

**R1:** Displays the CDI page. The selected CDI source is displayed at the right of the line.

**R2:** Blank.

**R3:** Displays the EGI POWER page.

**R4:** Branches to the MAIN MENU page.



## POINTER 1/2

The POINTER 1 and POINTER 2 pages are used to select the navigation source that drives the bearing pointers on the on-side PFD, HUD, and nav-radar.



Because the options on this page are self-explanatory, the specific function of each LSK will not be explained.



## CDI

The CDI page is used to select which navigation source drives the CDI for the on-side PFD and HUD.



Because the options on this page are self-explanatory, the specific function of each LSK will not be explained.



## EGI POWER

The EGI POWER page is used to remove or recycle power to the individual EGI units.



**L1:** Initiates a shutdown of EGI 1 and EGI 2. When selected, the message “VERIFY EGI OFF” will appear adjacent to R4. Selecting R4 within 5 seconds is required to execute the change. If R4 is not selected within this time, the message will disappear, and no change will occur.

**L2:** Initiates a restart of EGI 1. When selected, the message “VERIFY EGI RECYCLE” will appear adjacent to R4. Selecting R4 within 5 seconds is required to execute the change. If R4 is not selected within this time, the message will disappear, and no change will occur. After a restart, EGI 1 will boot into a standby mode, ready for alignment.

If L2 is selected while airborne, an In-Flight Alignment (IFA) will need to be performed; if selected on the ground, a Gyro Compass (GC) alignment will need to be performed. The restart cycle takes approximately 35 seconds.

**L3-L4:** Blank.

**R1:** Blank.



**R2:** Initiates a restart of EGI 2. When selected, the message “VERIFY EGI RECYCLE” will appear adjacent to R4. Selecting R4 within 5 seconds is required to execute the change. If R4 is not selected within this time, the message will disappear, and no change will occur. After a restart, EGI 2 will boot into a standby mode, ready for alignment.

If R2 is selected while airborne, an IFA will need to be performed; if selected on the ground, a GC alignment will need to be performed. The restart cycle takes approximately 35 seconds.

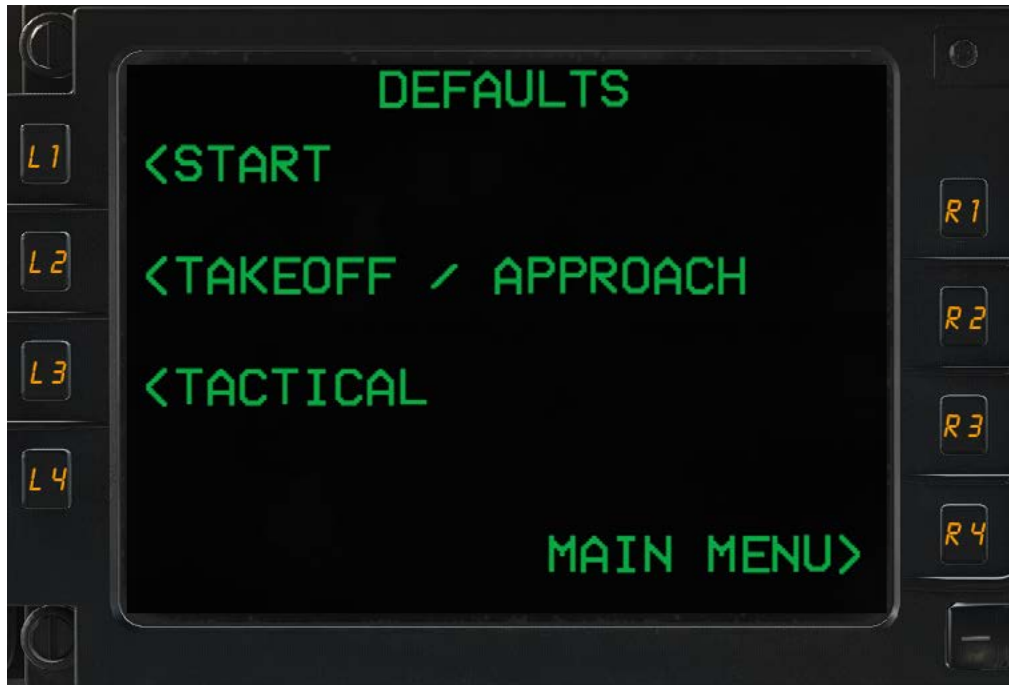
**R3:** Blank.

**R4:** Branches to the MAIN MENU page.



## DEFAULTS

The DEFAULTS page allows the crew to select a preset combination of HDD pages that are suited to a given phase of flight. The selected preset is displayed at the top of the right AMU page.



**L1:** Configures the HDDs in the following manner: HDD 1: PFD, HDD 2: Engine Status, HDD 3: System Status, HDD 4: PFD.

**L2:** Configures the HDDs in the following manner: HDD 1: nav-radar, HDD 2: Engine Status, HDD 3: System Status, HDD 4: nav-radar.

**L3:** Configures the HDDs in the following manner: HDD 1: Dig Map, HDD 2: Engine Status, HDD 3: nav-radar, HDD 4: Dig Map.

**L4:** Blank.

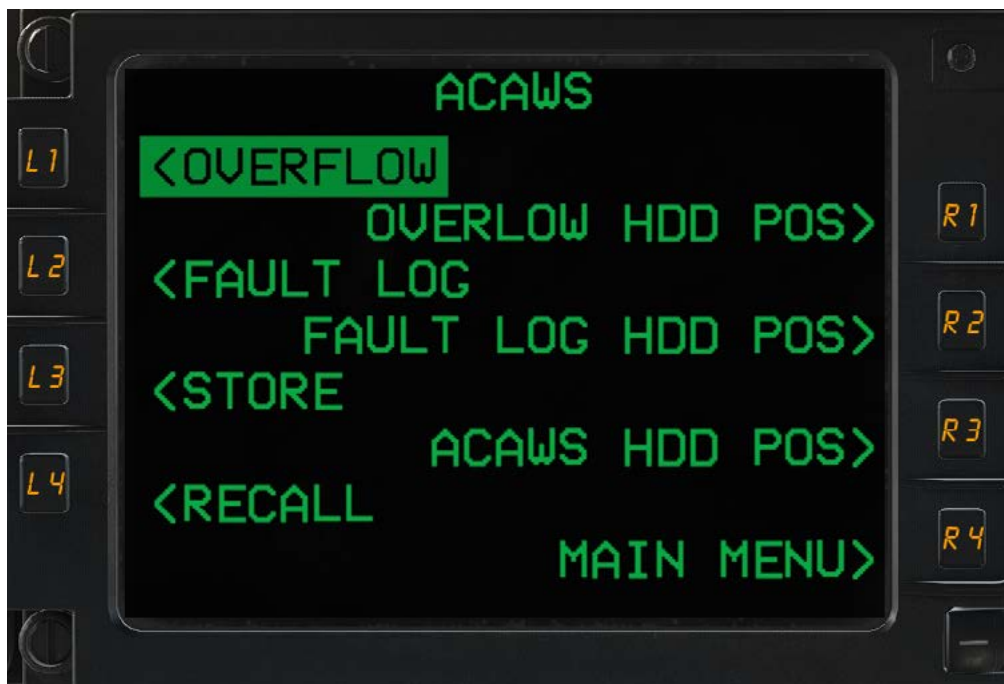
**R1-R3:** Blank.

**R4:** Branches to the MAIN MENU page.



## ACAWS

The ACAWS page is used to manipulate the ACAWS display area on the ENGINE HDD page.



**L1:** Displays the OVERFLOW page.

**L2:** Displays the FAULT LOG page (INOP).

**L3:** Displays the STORE page.

**L4:** Returns all stored ACAWS messages to the ACAWS message stack.

**R1:** Displays the HDD POS page for ACAWS OVERFLOW.

**R2:** Displays the HDD POS page for ACAWS FAULT LOG.

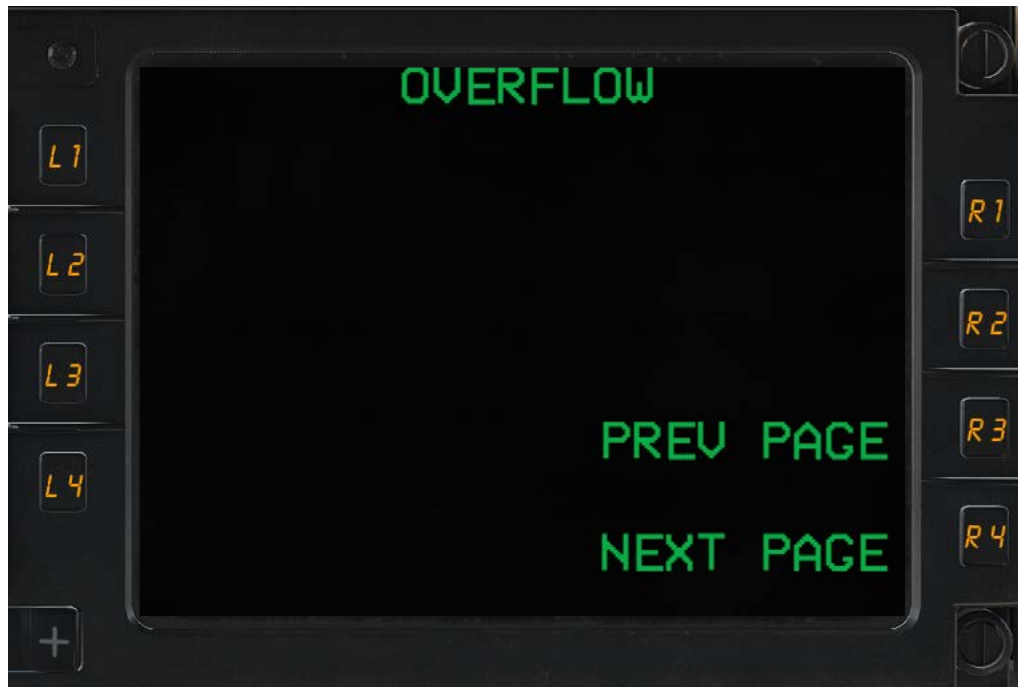
**R3:** Displays the HDD POS page for ACAWS.

**R4:** Branches to the MAIN MENU page.



## OVERFLOW (ACAWS)

The OVERFLOW page is used to navigate through the ACAWS OVERFLOW HDD page structure when more than one page exists.



**L1-L4:** Blank.

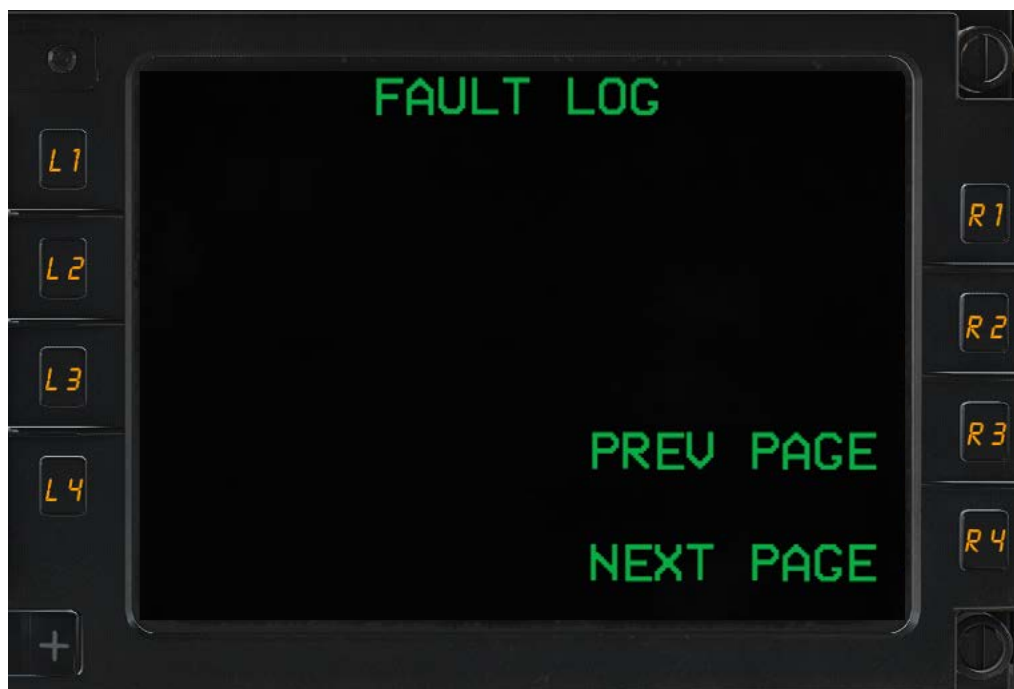
**R1-R2:** Blank.

**R3:** Cycles to the previous OVERFLOW page if more than one OVERFLOW page exists.

**R4:** Cycles to the next OVERFLOW page if more than one OVERFLOW page exists.

## FAULT LOG (ACAWS)

No function. Display only.



## STORE (ACAWS)

The STORE page is used to store ACAWS messages on the ENGINE HDD page.



**L1:** Selects the most recent caution message in the ACAWS stack.

**L2:** Selects the most recent advisory message in the ACAWS stack.

**L3:** Selects all cautions in the ACAWS stack.

**L4:** Selects all advisories in the ACAWS stack.

**R1:** Moves the ACAWS store cursor up one line.

**R2:** Moves the ACAWS store cursor down one line.

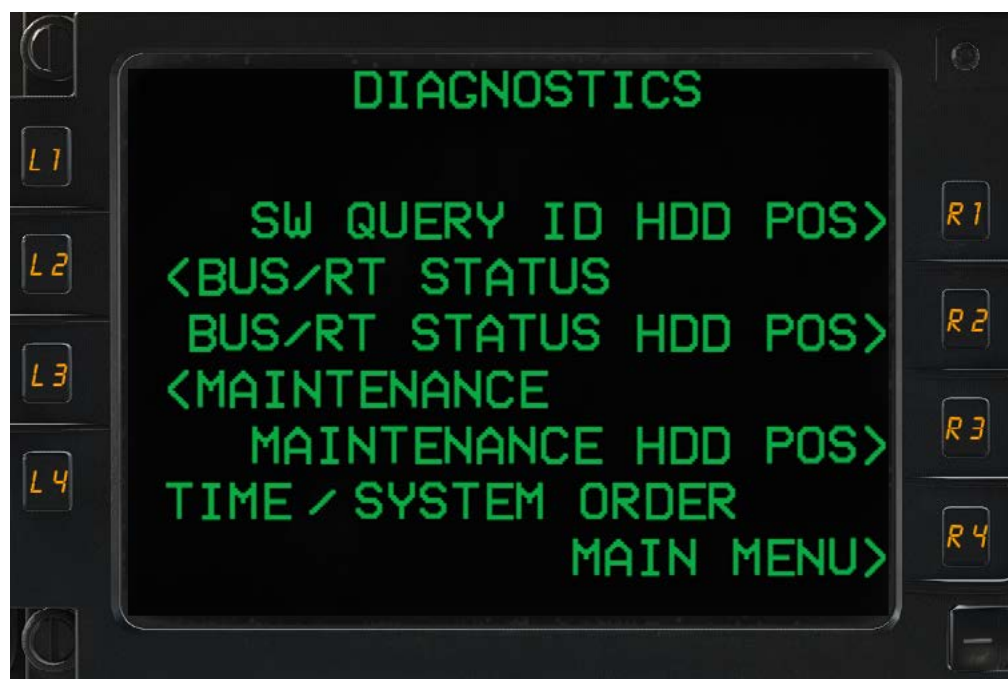
**R3:** Blank.

**R4:** Stores the selected ACAWS message.



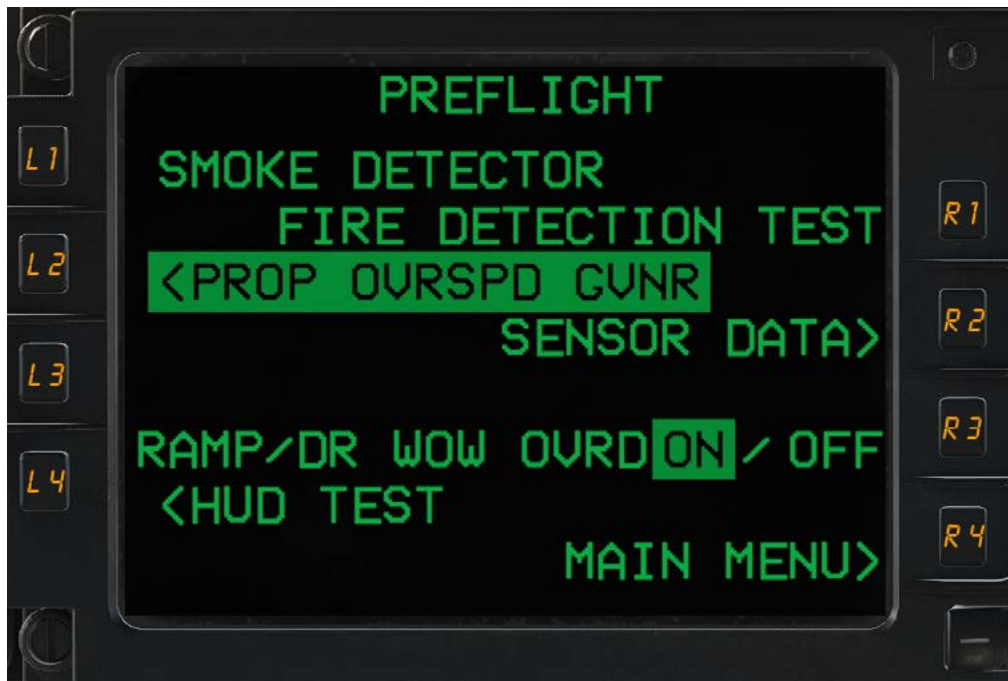
## DIAGNOSTICS

No function. Display only.



## PREFLIGHT

The PREFLIGHT page is to select items used during preflight actions.



**L1:** Initiates the smoke detector test.

**L2:** Displays the PROP OVRSPD GVNR page.

**L3:** Blank.

**L4:** Displays the HUD TEST page.

**R1:** Initiates the fire detector test.

**R2:** Displays the SENSOR DATA page.

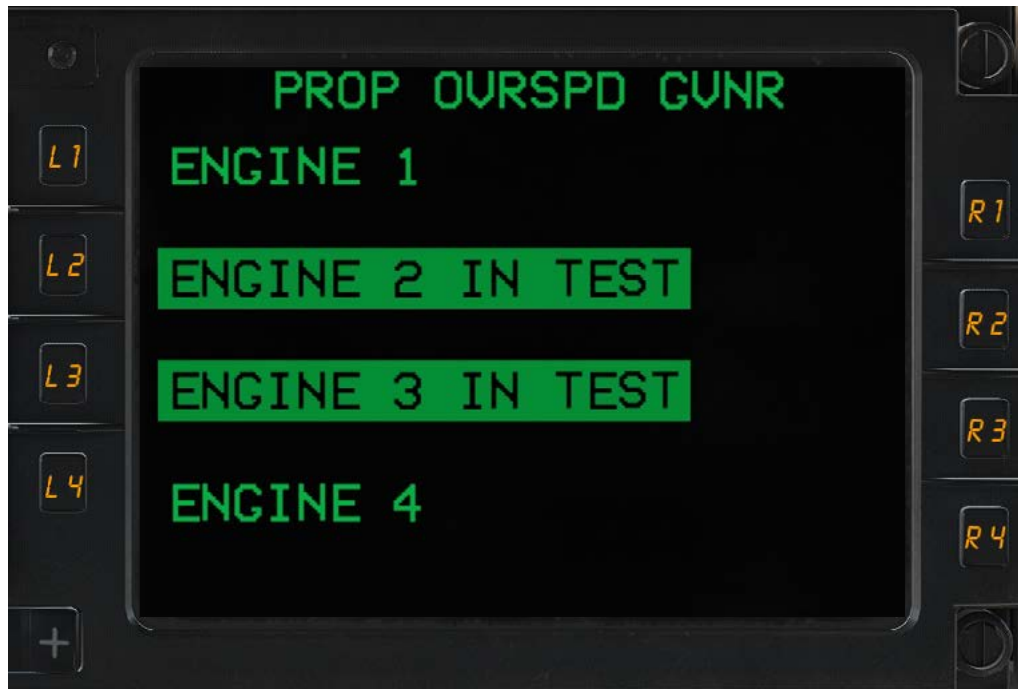
**R3:** Toggles the ramp/door weight-on-wheels override switch. When ON is selected, the cargo ramp and door can be opened via the cockpit RAMP/DOOR switch with weight-on-wheels. When OFF is selected, the cargo ramp and door can only be opened via the switch with weight-off-wheels.

**R4:** Branches back to the MAIN MENU page.



## PROP OVRSPD GVN

The PROP OVRSPD GVN page allows for the propeller overspeed governor test to be run on the engines.



**L1-L4:** Selects the desired engine(s) that the propeller overspeed governor test is to be performed on. If test criteria have not been met, selection results in no change occurring until the criteria have been met.

When the test is running, the respective label becomes inversed and changes to “ENG 1 (2, 3, or 4) IN TEST”. Upon completion of the test, “IN TEST” is removed and the label returns to normal video.

**R1-R4:** Blank.



## SENSOR DATA

The SENSOR DATA page provides a digital readout of the current flap position and aileron booster assembly pressures.



**L1:** Displays the current wing flap extension in percent.

**L2:** Displays the utility hydraulic system pressure reaching the aileron booster assembly.

**L3:** Displays the booster hydraulic system pressure reaching the aileron booster assembly.

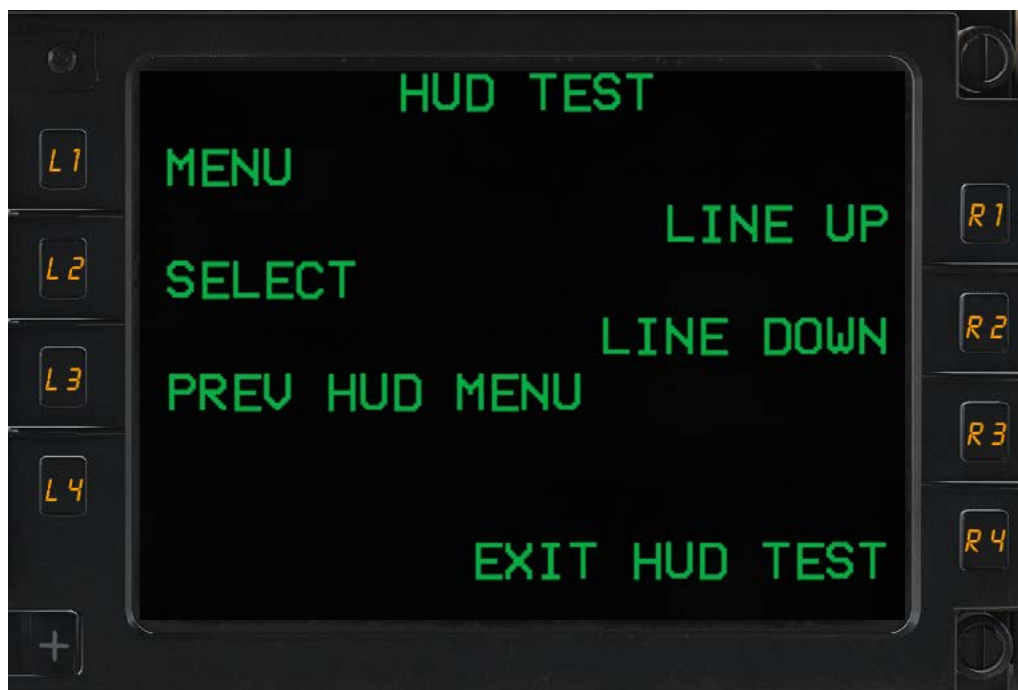
**L4:** Blank.

**R1-R4:** Blank.



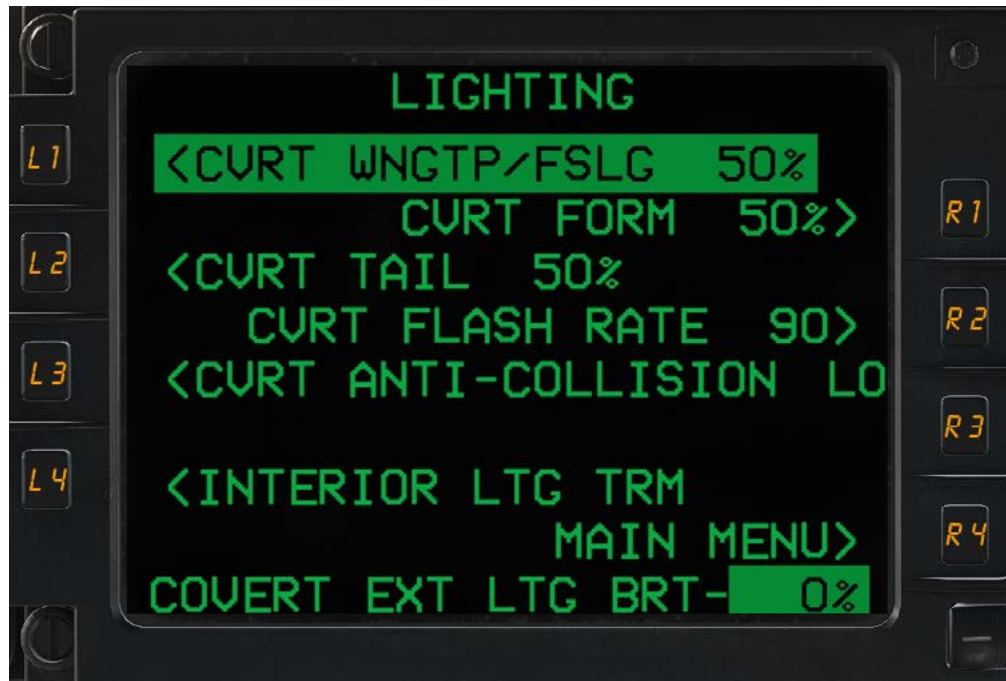
## HUD TEST

No function. Display only.



## LIGHTING

The LIGHTING page provides granular control over covert external lighting parameters. The current selection for each option is displayed to the right of each line. Because covert lighting is not functional in DCS, this page structure is for display only.



**L1:** Displays the COVERT WINGTIP/FUSELAGE page.

**L2:** Displays the COVERT TAIL page.

**L3:** Displays the COVERT ANTI-COLLISION page.

**L4:** No function.

**R1:** Displays the COVERT FORMATION page.

**R2:** Displays the COVERT FLASH RATE page.

**R3:** Blank.

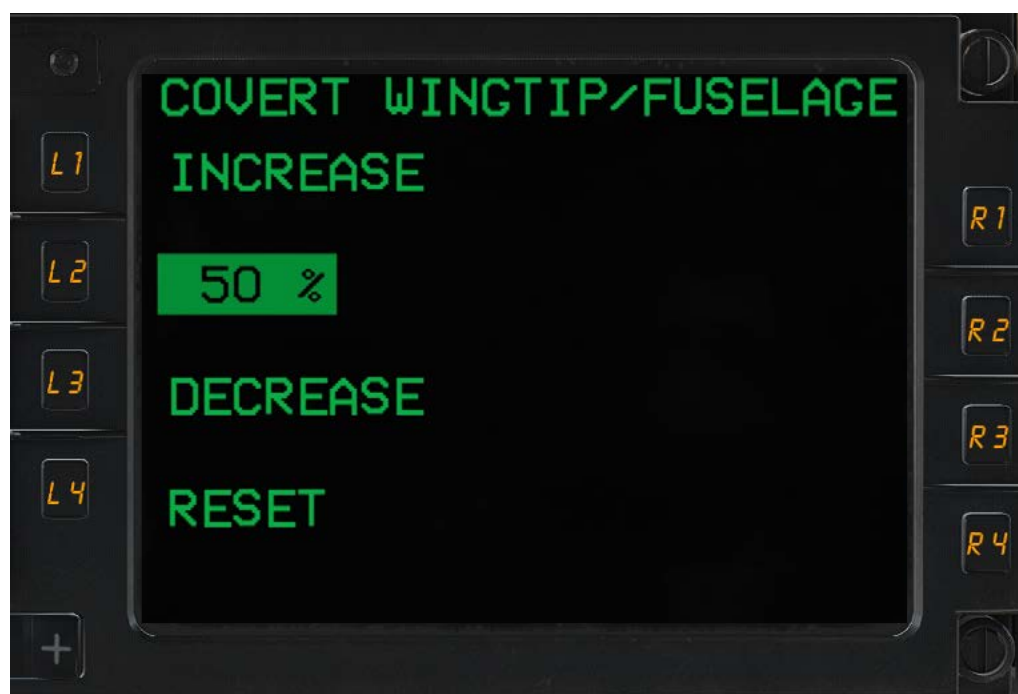
**R4:** Branches to the MAIN MENU page.

**Bottom:** Displays the position of the COVERT/FORMATION dimmer switch.



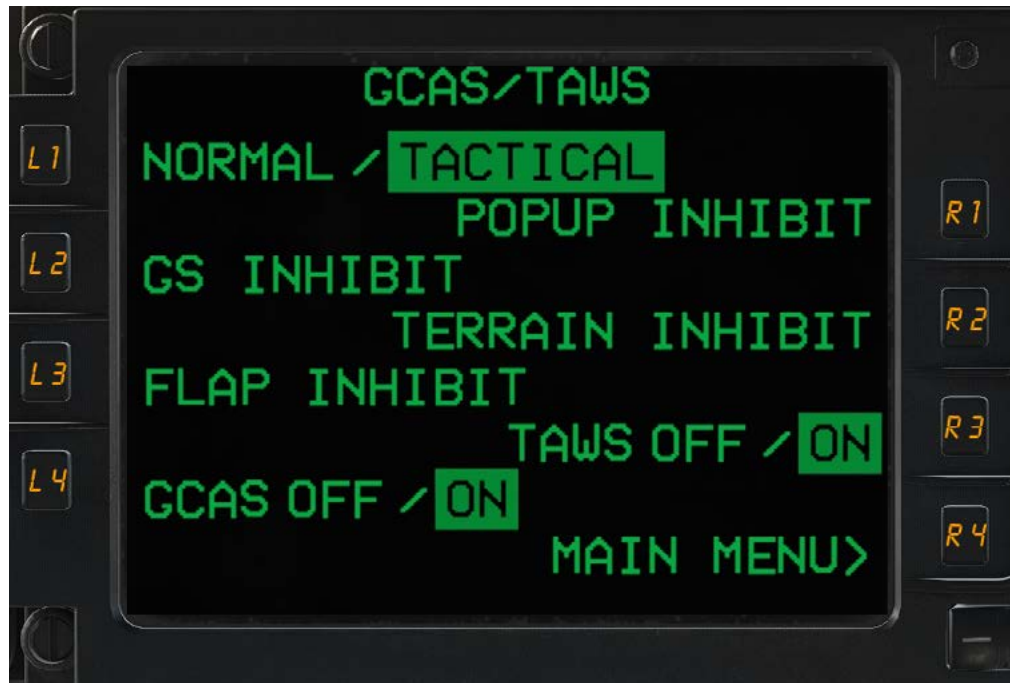
## Covert Lighting Trim Pages

The various covert lighting trim pages share an identical structure and are for display purposes only.



## GCAS/TAWS

The GCAS/TAWS page allows for control over the GCAS and TAWS systems.



**L1:** Toggles the GCAS and TAWS modes between NORMAL and TACTICAL.

**L2:** Inhibits the GLIDESLOPE warning function of the GCAS.

**L3:** Inhibits the FLAPS warning function of the GCAS.

**L4:** Toggles the GCAS power state

**R1:** When TACTICAL is selected as the GCAS/TAWS mode, “POPUP INHIBIT” appears. When selected, the TAWS display autopage functionality is inhibited. When NORMAL is selected as the GCAS/TAWS mode, this field is blank.

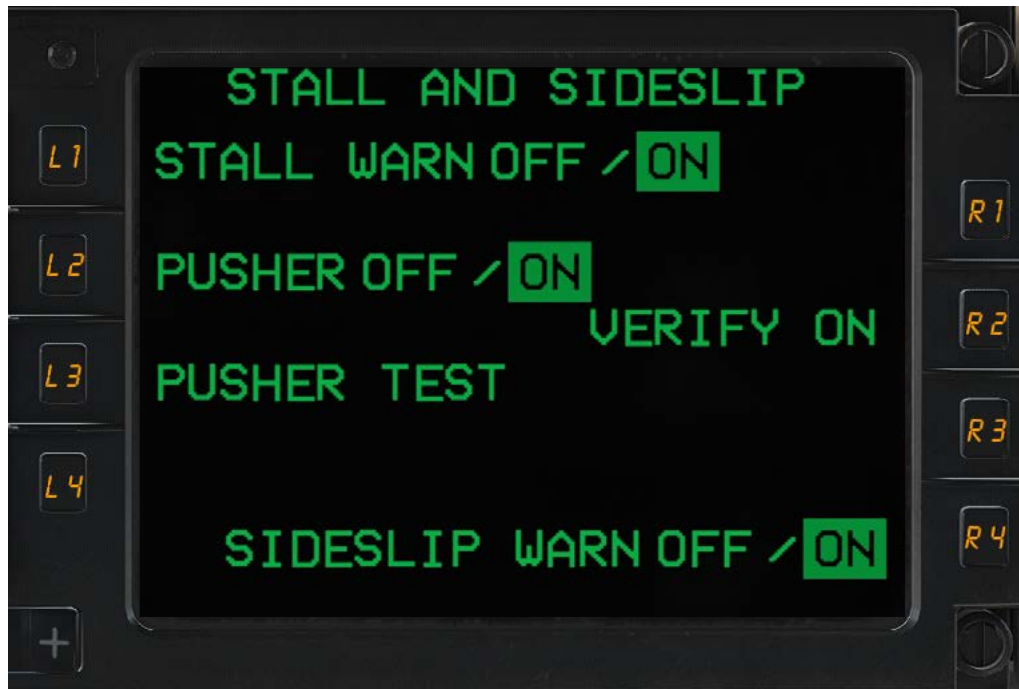
**R2:** When TACTICAL is selected as the GCAS/TAWS mode, “TERRAIN INHIBIT” appears. When selected, the aural and visual TERRAIN alerts are inhibited. When NORMAL is selected as the GCAS/TAWS mode, this field is blank.

**R3:** Toggles the TAWS power state.

**R4:** Branches to the MAIN MENU page.

## STALL AND SIDESLIP

The STALL AND SIDESLIP page is used to control various components of the stall and sideslip warning systems.



**L1:** Toggles the stall warning power state.

**L2:** Toggles the stick pusher power state. When the stick pusher is turned off, reapplying power must be substantiated by use of the “VERIFY ON” field adjacent to R2.

**L3:** Initiates the stick pusher test.

**L4:** Blank.

**R1:** Blank.

**R2:** Used to substantiate the return of power to the stick pusher. When L2 is selected with pusher power OFF, “VERIFY ON” will be shown in inverse video for 5 seconds. If R2 is selected within this 5-second window, pusher power is returned. If R2 is not selected, “VERIFY ON” returns to normal video, and pusher power remains OFF.

**R3:** Blank.

**R4:** Toggles the sideslip warning power state.

## Overview

The C-130J is equipped with a suite of communications and navigation radios that are managed via the CNBP and CNI. Audio monitoring panels at each crew station are used to monitor the navigation radios, while ICS control panels are used to monitor and transmit on the communications radios.

## Communications Radios

The communications radios include Very High Frequency (VHF), Ultra High Frequency (UHF), High Frequency (HF), and Satellite Communications (SATCOM).

Secure VHF communication is provided by two AN/ARC-222 SINCGARS radios. The ARC-222 is jam-resistant and utilizes frequency hopping to reduce the chance of transmission interception.

Secure UHF communication is provided by two AN/ARC-164 HAVE QUICK II radios. The ARC-164 is jam-resistant and utilizes frequency hopping to reduce the chance of transmission interception.

Beyond-line-of-sight communication is facilitated by two AN/ARC-190 HF radios. The HF radios do not utilize frequency hopping or other anti-jam techniques.

An AN/ARC-210 radio facilitates encrypted VHF/UHF SATCOM communications. The ARC-210 is currently inoperative in the current version of DCS: C-130J.

## Navigation Radios

The navigation radios include Tactical Air Navigation (TACAN), Very High Frequency Omni-directional Range (VOR), and Automatic Direction Finding (ADF).

Two AN/ARN-153 TACAN radios are installed that provide bearing and distance information to a ground-based TACAN station.

Two AN/ARN-147 VOR radios provide the ability to track signals from a VOR ground station as well as ILS transmitters such as a localizer and glideslope.

Two ADF-462 ADF radios provide bearing information to a ground-based Non-Directional Beacon (NDB).



## Audio Monitoring Panel

The audio monitoring panel allows for monitoring of audio channels associated with the various navigational radios, in addition to the RWR.



## Radio Channel Knobs

Combined switch/volume knobs allow for interaction with the respective nav radio's audio channel: push and pull controls whether the radio is active, while rotation controls the radio's volume. When a radio's knob is pulled out, a white band becomes visible at the base of the knob to indicate that radio monitoring is active. Clockwise rotation of the knob will increase volume while counterclockwise rotation decreases volume.



## ICS Control Panel

The Intercommunication System (ICS) control panel is used to monitor and transmit on communication radio channels.



### 1. Radio Channel Knobs

Combined switch/volume knobs allow for interaction with the respective radio's audio channel: push and pull controls whether the radio is active, while rotation controls the radio's volume. When a radio's knob is pulled out, a white band becomes visible at the base of the knob to indicate that radio monitoring is active. Clockwise rotation of the knob will increase volume while counterclockwise rotation decreases volume.

### 2. PA Gain Knob

The Public Address (PA) GAIN knob controls the volume of PA announcements in the cargo bay.

### 3. VOX Sensitivity Knob

The Voice Operated Transmitter Sensitivity (VOX SENS) knob adjusts the sensitivity of the respective crewmember's microphone. Lower settings will increase the volume required for the microphone to transmit the crewmember's voice over the interphone.



## 4. Interphone/Radio Transmit Switch

The interphone/radio transmit switch is used to transmit microphone input on either an interphone circuit or a communications radio.

**INT:** Transmits the crewmember's voice over the selected interphone channel.

**RADIO:** Transmits the crewmember's voice over the radio selected by the transmission selector switch.

## 5. Interphone Mode Switch

The interphone mode switch selects the transmission mode for the interphone. The switch is spring-loaded to INT from CALL.

**CALL:** Used for high-priority messages, CALL mode raises the transmission volume by 6 dB to override any other interphone transmission that may be occurring.

**INT:** Requires the use of the interphone/radio switch to transmit on the interphone system.

**VOX:** The interphone is voice-activated and only transmits when a crewmember's voice is detected.

**HOT MIC:** Transmits a crewmember's microphone input continuously,

## 6. Transmission Selector Switch

The transmission selector switch is used to select which radio the crewmember's microphone input will be transmitted on.

## 7. Volume Knob

The VOLUME knob is used to adjust the volume of transmissions received via a radio or the interphone.



## Windshield Wipers

Two electrically operated windshield wipers powered by the main DC bus are installed; one on the pilot windshield and another on the copilot windshield. The rubber wiper blades are mounted to metal arms, which attach to electric motors mounted just below each of the respective windshields. The speed of the wipers is controlled by a rotary switch which is spring-loaded to OFF from PARK.

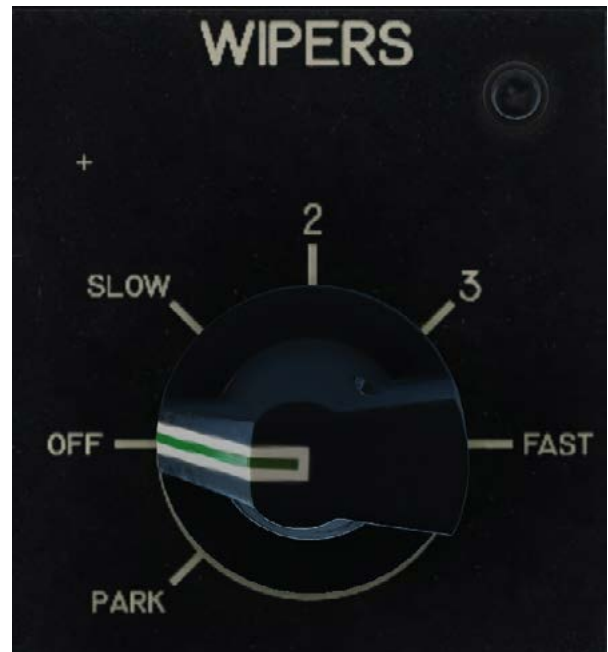
**PARK:** Holding the switch in this position will return both wipers to their stowed position. If the wipers are already in this position, no movement will occur.

**OFF:** Power is removed from the wiper motors, and they remain fixed in their last position.

**SLOW:** The slowest movement speed.

**2,3:** Intermediate speed settings, with 3 being faster than 2.

**FAST:** The fastest movement speed.



## Coffee Cup Holders

Two cup holders are installed in the flight deck, one on the pilot's side window tray and another on the copilot's side window tray. Clicking on the pilot's cup holder will display an ASC-branded coffee cup.



## Advisory Caution and Warning System

The Advisory Caution and Warning System (ACAWS) is a crew-alerting system that monitors aircraft systems and reports conditions requiring crew action or acknowledgment. ACAWS presents both aural and visual indications that are sorted into four categories of priority: special alerts, warnings, cautions, and advisories.

**Special Alerts:** Typically require immediate crew response and are accompanied by voice alerts, except where explicitly mentioned in the “ACAWS Alerts” table. Special alert messages are also displayed in the PFD and HUD.

**Warnings:** Alert the crew to emergency conditions that require immediate action to prevent injury or loss of life. Warnings are accompanied by the aural master warning tone and illumination of the master warning lights.

**Cautions:** Alert the crew to abnormal conditions that require crew corrective action to prevent aircraft damage. Cautions are accompanied by the aural master caution tone and illumination of the master caution lights.

**Advisories:** Alert the crew to conditions that may require crew action. Advisories are accompanied by the aural advisory tone.

## ACAWS Message Suppression

ACAWS messages that are considered to not be critical to safety of flight are suppressed during the takeoff and landing phases, which are defined as airspeed between 70 and 140 knots and altitude between 0 and 400 feet AGL.

Suppressed messages that are triggered within the above speed and altitude windows will be shown in inverse video on the ACAWS stack like normal, but the master caution and warning lights, along with their associated aural warning tones, are not triggered.

If the suppressed messages remain active after passing through the suppression zones, they will return to normal video, with the master caution/warning lights and aural warning tones triggering as normal. Messages that are not suppressed will be presented to the crew in normal fashion.

All ACAWS messages, except for the following warnings, are suppressed:

1. All Special Alerts.
2. APU FIRE.
3. ENGINE 1 (2, 3, or 4) FIRE.
4. DOORS OPEN.



## ACAWS Alerts

The following table lists the implemented ACAWS alerts and their display criteria. Alerts that are accompanied by an aural voice alert are marked as “(Voice)”.

SPECIAL ALERTS		
Message	Condition	Crew Action
1,000 TO GO (Voice)	The aircraft is within 1,000 feet of the altitude selected on the REF/MODE panel.	None. Awareness only.
ACFT CONFLICT (Voice)	A CAPS formation member has violated the conflict ring radius defined on the CAPS FORMATION PRMTR CNI page.	Identify the conflicting aircraft via sight or radio communication and take evasive action if separation is not guaranteed.
ALTITUDE (Voice)	The aircraft has descended below the radar altitude set on the REF/MODE panel.	Adjust altitude, if necessary.
AUTOPILOT (Voice)	The autopilot has been disengaged, either manually or automatically, and has not been acknowledged.	Acknowledge the alert by pressing the yoke autopilot switch.
AUTOTHRUST (Voice)	The parking brake is released, weight is on wheels, and 3 or more power levers are above 38 degrees PLA with the ATCS switch positioned to OFF.	Position the ATCS switch to ON.
BANK ANGLE (Voice)	The aircraft's bank angle is greater than 61 degrees above 130 feet AGL, reducing to 10 degrees below 30 feet AGL.	Adjust bank angle, if necessary.
CHECK ALTITUDE (Voice)	The aircraft has reached the altitude selected on the REF/MODE panel and has deviated from that altitude by more than +/- 200 feet.	Adjust altitude, if necessary.
CMDS READY	The RWR has detected a radar-guided threat launch and the CMDS mode is not in AUTO.	Use the countermeasure dispense switch to dispense chaff, as required.
DON'T SINK	The aircraft is descending at a rate which may result in controlled flight into terrain without corrective action.	Establish a positive rate of climb, if required.



<b>SPECIAL ALERTS</b>		
<b>Message</b>	<b>Condition</b>	<b>Corrective Action</b>
ENG 1 (2, 3, or 4) FAIL (Voice)	An engine has failed with three or more power levers above 40 degrees PLA and radar altitude is less than 400 feet AGL. The alert is repeated two consecutive times.	Maintain aircraft control.
FLAPS (Voice)	The parking brake is released, weight is on wheels, and 3 or more power levers are above 40 degrees PLA with the wing flaps not set between 42 and 58%.	Set the wing flaps to 50%.
GLIDESLOPE (Voice)	Glideslope mode is active and a deviation of greater than 1.3 dots below the glideslope has occurred.	Adjust descent rate, or level off, to recapture the glideslope.
LANDING GEAR (Voice)	Power levers are below 38 degrees PLA, airspeed is less than 168 knots, radar altitude is less than 1,500 feet AGL and landing gear is not down; OR wing flaps are extended more than 70% and the landing gear is not down.	Extend the landing gear.
LEFT RUD.....	The sideslip warning limit has been exceeded with a left sideslip.	Apply left rudder input.
MINIMUM (Voice)	The landing gear is down and the aircraft has descended below the baro minimums set on the REF/MODE panel.	Initiate the missed approach procedure if the runway is not in sight.
MWS ALERT	The MWS has detected an infrared guided threat launch.	Initiate defensive actions.
OBST AHEAD (Voice)	An obstacle has penetrated the TAWS caution envelope. Impact will occur if immediate evasive action is not taken.	Establish an immediate climb.
OBST PULL UP (Voice)	An obstacle has penetrated the TAWS warning envelope. Impact will occur if immediate, aggressive evasive action is not taken.	Establish an immediate, maximum power climb.



SPECIAL ALERTS		
Message	Condition	Corrective Action
OVERSPEED (Clacker only)	The aircraft has exceeded the maximum dive speed ( $V_D$ ), plus 5 knots.	Reduce airspeed below $V_D$ .
PULL UP (Voice)	An excessive closure rate with terrain has been detected. Impact with the terrain will occur if immediate, corrective action is not taken.	Establish an immediate, maximum power climb.
.....RIGHT RUD (Voice)	The sideslip warning limit has been exceeded with a right sideslip.	Apply right rudder input.
SIDESLIP..... (Voice)	An excessive left sideslip has been detected.	Apply left rudder input.
.....SIDESLIP (Voice)	An excessive right sideslip has been detected.	Apply right rudder input.
SINK RATE (Voice)	An excessive sink rate has been detected.	Adjust sink rate, if necessary.
STALL (Voice)	The aircraft has decelerated to the stall warning speed envelope.	Immediately initiate stall recovery procedures.
TERRAIN (Voice)	The aircraft has penetrated the GCAS Mode 2 warning envelope.	Establish a positive rate of climb, if required.
TERRAIN AHEAD (Voice)	Terrain has penetrated the TAWS caution envelope. Impact will occur if immediate evasive action is not taken.	Establish an immediate climb.
TERRAIN PULL UP (Voice)	Terrain has penetrated the TAWS warning envelope. Impact will occur if immediate, aggressive evasive action is not taken.	Establish an immediate, maximum power climb.
THROT GND RANGE	A power lever has been moved into the ground range with weight off wheels and radar altitude less than 8 feet AGL.	Position the power levers to the flight range.
THROTTLE THROTTLE (Voice)	Autothrottles were engaged and are now disengaged.	Reengage the autothrottles, if desired.



SPECIAL ALERTS		
Message	Condition	Corrective Action
TOO LOW FLAPS (Voice)	The landing gear is down, radar altitude is less than 245 feet AGL, airspeed is less than 159 knots, and the wing flap position is less than 40%.	Move the wing flaps to an approach position.
TOO LOW GEAR (Voice)	In GCAS NORMAL mode: the landing gear is up, radar altitude is less than 400 feet AGL, and airspeed is less than 178 knots. In TACTICAL mode: the landing gear is up, radar altitude is less than 150 feet AGL, and airspeed is less than 150 knots.	Extend the landing gear.
TOO LOW TERRAIN (Voice)	The aircraft has penetrated the GCAS Mode 4A warning envelope, or the TAWS Terrain Clearance Floor (TCF).	Adjust altitude and airspeed, as required.
TRIM (Voice)	The parking brake is released, weight is on wheels, and 3 or more power levers are above 40 degrees PLA with elevator trim not set to between -5 and +5 degrees.	Set elevator trim to the takeoff position.



<b>WARNINGS</b>		
<b>Message</b>	<b>Condition</b>	<b>Corrective Action</b>
APU FIRE	A fire is detected in the APU compartment. The APU will automatically shut down.	Accomplish engine/APU fire procedures.
CREW DOOR OPEN	The crew entrance door is not closed without weight on wheels.	Close the crew entrance door.
DOORS OPEN	Any door, or the ramp, is not closed and locked with weight on wheels, the parking brake not set, and any power lever above FLT IDLE.	Abort the takeoff and close any open doors.
ENGINE 1 (2, 3, or 4) FIRE	A fire is detected in the respective engine.	Accomplish engine/APU fire procedures.
ENGINE 1 (2, 3, or 4) MGT HI	The respective engine MGT is above 852°C.	Reduce the affected engine's power lever to achieve an MGT below 852°C.
FIRE EXT FAILURE	The directional flow valves for the fire extinguishing agent are mispositioned compared to fire handle positioning.	Recycle the fire handle on engine which requires fire extinguishing.
RAMP OPEN PRESSURIZED	The ramp is not in the closed and locked position with weight off wheels, and the aircraft is pressurized above 0.2 inHg.	Close the ramp.
SMOKE AFT CGO	Smoke has been detected in the aft cargo compartment.	Land ASAP.
SMOKE L FWD CGO	Smoke has been detected in the left forward cargo compartment.	Land ASAP.
SMOKE R FWD CGO	Smoke has been detected in the right forward cargo compartment.	Land ASAP.
SMOKE UNDER DECK	Smoke has been detected in the under deck area.	Land ASAP.
THROTTLE IN GROUND RANGE	A power lever has been moved into the ground range with weight off wheels and radar altitude less than 8 feet AGL.	Position the power levers to the flight range.



CAUTIONS		
Message	Condition	Corrective Action
ADC 1 (or 2) ALTITUDE FAIL	One or more values used to compute indicated altitude is invalid.	Adjust the BARO SET knob to produce an altitude greater than -1,000 feet.
AIL BSTR SWITCH OFF	The aileron control BOOST switch is positioned to OFF.	Position the switch to ON.
AIL PRESS LOW	Aileron pressure is less than 1,960 PSI in the low boost state, or less than 2,860 PSI in the high boost state.	Account for a reduced roll rate when maneuvering.
AIL UTIL SWITCH OFF	The aileron control UTIL switch is positioned to OFF.	Position the switch to ON.
AIRSPEED MISCOMPARE	The airspeed difference between DADS 1 and DADS 2 is greater than 10 knots.	Crosscheck the standby airspeed indicator with the two PFDs to determine the inaccurate airspeed indicator.
ALTITUDE MISCOMPARE	The altitude difference between DADS 1 and DADS 2 is greater than 100 feet.	Crosscheck the standby altimeter with the two PFDs to determine the inaccurate altimeter.
ANTI-SKID FAIL	The anti-skid switch is positioned to ON, the parking brake is not set, the brake select switch is selected to NORMAL, the left or right main gear is down, and a fault has been sensed by the anti-skid BIT.	Utilize care when applying brakes as anti-skid protection is unavailable.
APU OVRTEMP	APU EGT has exceeded 710°C for more than 3 seconds.	Reduce bleed air load on the APU.
ATCS OFF	The ATCS switch is positioned to OFF.	Position the switch to ON.
AV BAT DISCHARGE	The avionics battery is discharging to power the Avionics DC bus.	Establish a source of AC electrical power to the aircraft.
BSTR SYS PRESS LOSS	The booster hydraulic system pressure is less than 1,000 PSI with NP on engines 3 or 4 above 70%.	Anticipated increased control pressures when maneuvering.
CAB ALT HIGH	Cabin altitude has exceeded 10,000 feet.	Reduce cabin altitude or descent, as required.



CAUTIONS		
Message	Condition	Corrective Action
CAB DIFF PRESS HIGH	Cabin differential pressure has exceeded 14.7 inHg.	Reduce cabin pressure.
CAB DIFF PRESS NEG	Cabin differential pressure has exceeded negative 1.6 inHg.	Equalize cabin pressure.
CAB PRESSURIZED	The ramp and/or door are being commanded open and the aircraft is pressurized above 0.2 inHg.	Depressurize the aircraft before opening the ramp/door.
CGO DOOR OPEN	The cargo door is not closed and locked and airspeed is above 250 knots, or the aircraft is pressurized above 0.2 inHg.	Reduce airspeed, or close and lock the door.
CMDS FAIL	The CMDS has experienced a failure or loss of communication.	Ensure the DEF SYS CONTROL CNI page selections match the DEFENSIVE SYSTEMS panel configuration.
CP PITOT HEAT OFF	Any power lever is more than 5 degrees forward of FLT IDLE and the copilot's pitot heat switch is positioned to OFF.	Position the switch to ON.
ELEV BSTR SWITCH OFF	The elevator control BOOST switch is positioned to OFF.	Position the switch to ON.
ELEV UTIL SWITCH OFF	The elevator control UTIL switch is positioned to OFF.	Position the switch to ON.
ENG 1 (2, 3, or 4) FAIL	The FADEC or MC have identified a propulsion system failure and the engine has been shut-down.	Place the respective engine control switch to STOP and pull the engine's fire handle.
ENG 1 (2, 3, or 4) FLAMEOUT	During engine start, the FADEC identified a flameout and automatically terminated the start sequence. Otherwise, the engine flamed out and FADEC's automatic restart attempt has failed: an automatic engine shutdown has occurred.	Place the respective engine control switch to STOP and pull the engine's fire handle.



<b>CAUTIONS</b>		
<b>Message</b>	<b>Condition</b>	<b>Corrective Action</b>
ENG 1 (2, 3, or 4) FUEL PRESS LO	The fuel pressure entering the respective engine driven fuel pump is less than 8.5 PSI for 3 seconds.	Cease aircraft maneuvering. If the message persists, expect an imminent engine shutdown.
ENG 1 (2, 3, or 4) MGT HI	The respective engine MGT is above 833°C with the engine not in the start cycle and the power lever is between MAX REV and MAX CONT.	Reduce the affected engine's power lever to achieve an MGT below 833°C.
ENG 1 (2, 3, or 4) NO OIL PRESS	NG is greater than 2% and oil pressure is less than 5 PSI for 15 seconds during engine start or motoring.	Place the respective engine control switch to STOP.
ENG 1 (2, 3, or 4) OIL PRESS LO	The respective engine is running and oil pressure is below 35 PSI.	Place the respective engine control switch to STOP.
ENG 1 (2, 3, or 4) VIB HI	The respective propeller or engine's vibration limit has been exceeded.	Place the respective engine control switch to STOP.
GBOX 1 (2, 3, or 4) NO OIL PRESS	During engine start, gearbox oil pressure is less than 15 PSI and NP has been greater than 28% for 15 seconds.	Place the respective engine control switch to STOP.
GBOX 1 (2, 3, or 4) OIL PRESS HI	Gearbox oil pressure is above 250 PSI and oil temperature has been above 60°C for more than 2 seconds.	Place the respective engine control switch to STOP.
GBOX 1 (2, 3, or 4) OIL PRESS LO	Gearbox oil pressure is below 110 PSI, or below 15 PSI in hotel mode.	Place the respective engine control switch to STOP.
HOT START 1 (2, 3, or 4)	MGT on the respective engine is greater than 807°C for more than 3 seconds and NG is less than 72%.	Place the respective engine control switch to STOP.
INAV POS MISCOMPARE	The allowable position difference between INAV 1 and INAV 2 has exceeded the POS ALERT 2 distance on the PROGRESS 2/4 CNI page.	Accomplish an INAV position update to reduce the position difference.



CAUTIONS		
Message	Condition	Corrective Action
L DUMP VLV OPEN	The left fuel dump valve is not closed.	If fuel dump is not desired, position the left fuel DUMP switch to OFF.
L EXT TK HEAVY	A fuel quantity difference of more than 1,000 pounds exists between the external fuel tanks.	Accomplish a fuel transfer to balance the tanks.
L WING HEAVY	A fuel quantity difference of more than 1,500 pounds exists between the left and right wings (excluding external tanks).	Accomplish a fuel transfer to balance the wings.
LEFT GEAR NOT DOWN	The left main landing gear does not indicate down within 20 seconds of landing gear lever actuation.	Perform a landing gear check to verify gear status.
LEFT GEAR NOT UP	The left main landing gear does not indicate up within 20 seconds of landing gear lever actuation.	Perform a landing gear check to verify gear status.
LOX QTY LOW	Liquid oxygen quantity is below 2.5 liters.	None. Awareness only.
NG 1(2, 3, or 4) OVRSPED	NG on the respective engine is greater than 103% for more than 2 seconds.	Reduce the affected engine's power lever to reduce NG.
NOSE GEAR NOT DOWN	The nose landing gear does not indicate down within 20 seconds of landing gear lever actuation.	Perform a landing gear check to verify gear status.
NOSE GEAR NOT UP	The nose landing gear does not indicate up within 20 seconds of landing gear lever actuation.	Perform a landing gear check to verify gear status.
NP 1 (2, 3, or 4) LO	The respective engine has been running in HSGI for more than 10 seconds and NP is below 98%.	Place the respective engine control switch to STOP, if required.
OIL 1 (2, 3, or 4) HOT	The respective engine's oil temperature is greater than 93°C, or has been between 86°C and 93°C for more than 5 minutes.	Adjust the respective engine's oil cooler flap position to increase cooling.



CAUTIONS		
Message	Condition	Corrective Action
OIL TEMP 1 (2, 3, or 4) LO	The respective engine's oil temperature is below 0°C and the power lever is not in the GND IDLE position, <b>OR</b> oil temperature is between 0°C and 45°C with engine horsepower less than 1,000 HP, <b>OR</b> oil temperature is between 45°C and 60°C with engine horsepower greater than 1,000 HP for more than 5 minutes.	Limit the respective engine's horsepower to below 1,000 HP until oil temperature has warmed to above 45°C.
P PITOT HEAT OFF	Any power lever is more than 5 degrees forward of FLT IDLE and the pilot's pitot heat switch is positioned to OFF.	Position the switch to ON.
PFD ATTITUDE SAME	The pilot and copilot's attitude references are selected to the same source on the PFD AMU page.	Select differing ATT REF INU units via the PFD AMU page.
PROP 1 (2, 3, or 4) NO 119% PROTECT	Automatic engine shutdown due to NP overspeed is not available on the respective engine.	Shutdown the engine and restart it after NP reaches 0% to allow the overspeed protection circuit to be checked by the FADEC.
PROP 1 (2, 3, or 4) OVRSPEED	NP on the respective propeller is above 106% for more than 5 seconds with the power lever in the ground rage, <b>OR</b> NP is above 106% for more than 2 seconds and the power lever is in the flight range.	Place the respective engine control switch to STOP and pull the engine's fire handle.
PUSHER FAIL	Airspeed is greater than 60 knots, power levers are above FLT IDLE, and the autopilot disengage switch has been pushed for more than 5 seconds.	Release the autopilot disengage switch.
PUSHER OFF	The stick pusher was selected OFF automatically or manually.	Reapply pusher power via the STALL AND SIDESLIP AMU page.



<b>CAUTIONS</b>		
<b>Message</b>	<b>Condition</b>	<b>Corrective Action</b>
PUSHER TEST INCOMP	The autopilot disengage switch was not pressed within the 5-second time frame during the stick pusher test.	Re-accomplish the pusher test.
R DUMP VLV OPEN	The right fuel dump valve is not closed.	If fuel dump is not desired, position the right fuel DUMP switch to OFF.
R EXT TK HEAVY	A fuel quantity difference of more than 1,000 pounds exists between the external fuel tanks.	Accomplish a fuel transfer to balance the tanks.
R WING HEAVY	A fuel quantity difference of more than 1,500 pounds exists between the left and right wings (excluding external tanks).	Accomplish a fuel transfer to balance the wings.
RADAR FAIL	The LPCR radar has failed its BIT or lost communication.	Consider the LPCR inoperative.
RAMP OPEN	The cargo ramp is not closed and locked and airspeed is above 250 knots.	Reduce airspeed, or close and lock the ramp.
RIGHT GEAR NOT DOWN	The right main landing gear does not indicate down within 20 seconds of landing gear lever actuation.	Perform a landing gear check to verify gear status.
RIGHT GEAR NOT UP	The right main landing gear does not indicate up within 20 seconds of landing gear lever actuation.	Perform a landing gear check to verify gear status.
RUD BSTR SWITCH OFF	The rudder control BOOST switch is positioned to OFF.	Position the switch to ON.
RUD UTIL SWITCH OFF	The rudder control UTIL switch is positioned to OFF.	Position the switch to ON.
SIDESLIP OFF	The sideslip warning system was selected OFF via the STALL AND SIDESLIP AMU page.	Reapply sideslip system power via the STALL AND SIDESLIP AMU page, if desired.
SWS OFF	The stall warning system was selected OFF via the STALL AND SIDESLIP AMU page.	Reapply stall warning system power via the STALL AND SIDESLIP AMU page, if desired.



<b>CAUTIONS</b>		
<b>Message</b>	<b>Condition</b>	<b>Corrective Action</b>
TK 1 (2, 3, or 4) FUEL LOW	The fuel quantity in any main tank is 1,000 pounds or less.	Verify fuel quantity and accomplish a transfer or crossfeed, if necessary.
TK 1 (2, 3, or 4) HEAVY	A fuel quantity difference of more than 1,000 pounds exists between symmetrical main tanks. The heavier tank will be annunciated.	Accomplish a fuel transfer to balance the tanks.
TOTAL FUEL LOW	The total fuel quantity is below 6,000 pounds.	Open the crossfeed and cross-ship valves to ensure a continuous fuel supply to the engines.
UTIL BAT DISCHARGE	The utility battery is discharging to power the isolated DC bus.	Establish a source of AC electrical power to the aircraft.
UTIL SYS PRESS LOSS	The utility hydraulic system pressure is less than 1,000 PSI with NP on engines 3 or 4 above 70%.	Anticipate a loss of hydraulic pressure to the landing gear, wing flaps, and normal brake system.



ADVISORIES		
Message	Condition	Corrective Action
A/I AIR TEMP LO	The ice protection system is on and the average horsepower of the engines supplying bleed air to the system is below 750.	Increase horsepower on at least two engines until the message clears.
ADC SAME	The pilot and copilot's ADC references are selected to the same source on the PFD AMU page.	Select differing CADC units via the PFD AMU page, if desired.
ANTI-SKID OFF	The anti-skid system has been turned off, either via setting the ANTI-SKID switch to OFF or by setting the parking brake.	Position the anti-skid switch to ON, if not already.
APU DOOR NOT CLOSED	The APU door has been commanded closed but the door has not fully closed within 80 seconds.	Reduce airspeed to below 150 knots and allow the door to close.
APU SHUTDOWN OVRSPD	The APU 110% overspeed protection switch has automatically closed the fuel shutoff valve, shutting down the APU.	Reduce bleed air load and restart the APU, if necessary
CAB ALT NOT AS SET	Cabin altitude is greater than 200 feet or less than 500 feet of the selected cabin altitude while in constant altitude mode.	Verify cabin pressure and adjust as necessary.
CAB PRESSURIZED	Differential pressure exceeds 0.2 inHg with weight on wheels and power levers at FLT IDLE, <b>OR</b> 0.5 inHg without weight on wheels, gear down, and below 300 feet AGL.	Depressurize the cabin.
CGO DOOR OPEN	The cargo door is not in the closed and locked position.	Close and lock the cargo door, if desired.
CMDS CHAFF EMPTY	The CMDS reports 0 chaff remaining.	None. Awareness only.
CMDS CHAFF LOW	The CMDS reports 25% of the original chaff quantity remains.	Exercise discipline when using chaff if the aircraft is operating in a contested environment.
CMDS FLARES EMPTY	The CMDS reports 0 flares remaining.	None. Awareness only.



ADVISORIES		
Message	Condition	Corrective Action
CMDS FLARES LOW	The CMDS reports 25% of the original flare quantity remains.	Exercise discipline when using flares if the aircraft is operating in a contested environment.
CNI/NAV MODE DISENGAGE	The autopilot is engaged in LNAV mode, and the CNI steering solution has disengaged.	Reengage the CNI steering mode.
CNI MSG	A message is displayed on the CNI-MU scratchpad.	None. Awareness only.
CREW DOOR OPEN	The crew entrance door is open with weight on wheels.	None. Awareness only.
CROSS TRACK DEV	INAV steering is active and the course crosstrack error is greater than 3.75 NM.	Steer the aircraft back onto the flight plan course, as necessary.
DEFLECTORS OPEN 150	The air deflector doors are not in the closed and locked position.	Do not exceed 150 knots.
DSDTS DOOR OPEN	The DSDTS door is open.	None. Awareness only.
EGI 1 (or 2) FOM DEGRADED	The respective EGI Figure of Merit is greater than 6.9.	Verify EGI status and change the INAV solution, as required.
ENG 1 (2, 3, or 4) NO 109% PROTECT	Automatic shutdown of the respective engine due to NG over-speed is not available.	Shutdown the engine and restart it after NG reaches 0% to allow the overspeed protection circuit to be checked by the FADEC.
ENG 1 (2, 3, or 4) OIL PRESS HI	The respective engine's oil pressure is greater than 90 PSI for 30 seconds.	Reduce the power setting on the effected engine.
ENG 1 (2, 3, or 4) NO LIGHTOFF	FADEC has not detected a 50°C MGT rise within 12 seconds of initiating fuel flow and ignition.	Place the respective engine control switch to STOP
ENG 1 (2, 3, or 4) SHUTDOWN	The respective engine has been shut down in flight by pulling the FIRE handle, or by placing the engine control switch to STOP.	None. Awareness only.
ENG 1 (2, 3, or 4) STAGNATED START	NG on the respective engine has not reached starter cutout speed within 70 seconds of the initiation of the start cycle.	Place the respective engine control switch to STOP.



ADVISORIES		
Message	Condition	Corrective Action
ENG A/I ON	The engine ice protection system is functioning on one or more engines.	None. Awareness only.
FIRE BOT 1 (or 2) DISCH	The respective fire extinguisher bottle has been discharged.	None. Awareness only.
FUEL MGMT CNTL A (or B) FAIL	Channel A or B of the fuel management controller has failed or lost communication.	Ensure ECB #463 is not pulled open.
GCAS FAIL	A failure has been detected in the GCAS system, or its input data is unavailable.	None. Awareness only.
GCAS OFF	GCAS is selected OFF on the GCAS/TAWS AMU page.	Reapply GCAS power via the GCAS/TAWS AMU page, if desired.
GEN 1 (2, 3, or 4) OFF	The respective generator switch is set to OFF/RESET.	Position the switch to ON.
GPS 1 (or 2) FOM DEGRADED	The respective GPS Figure of Merit is greater than 6.9.	Verify GPS status and change the INAV solution, as required.
ICE DETECTED	Ice has been detected on the airframe.	Ensure the ice protection systems are operational.
INAV POS DIFFERENCE	The allowable position difference between INAV 1 and INAV 2 has exceeded the POS ALERT 1 distance on the PROGRESS 2/4 CNI page.	Accomplish an INAV position update to reduce the position difference.
L AUX TK AUTO SHUTOFF	The left auxiliary tank's transfer pump has automatically turned off while the transfer switch is in TO or FROM.	Select the transfer pump switch to OFF.
L AUX TK EMPTY	The left auxiliary tank's transfer pump is running with less than 100 pounds of fuel remaining in the tank, and a fuel pressure decrease has been observed.	Select the transfer pump switch to OFF.
L EXT TK AUTO SHUTOFF	The left external tank's transfer pump has automatically turned off while the transfer switch is in TO or FROM.	Select the transfer pump switch to OFF.



<b>ADVISORIES</b>		
<b>Message</b>	<b>Condition</b>	<b>Corrective Action</b>
L EXT TK EMPTY	The left external tank's transfer pump is running with less than 100 pounds of fuel remaining in the tank, and a fuel pressure decrease has been observed.	Select the transfer pump switch to OFF.
L MAIN FUEL IMBALANCE	The left outboard main tank does not have the required 500 to 1,000 pounds of additional fuel compared to the left inboard main tank.	Accomplish a fuel transfer to balance the tanks.
L TROOP DOOR OPEN 250	The left paratroop door is not in the closed and locked position.	Do not exceed 250 knots.
L WING ISOL	The left wing's isolation valve has been commanded closed.	None. Awareness only.
L XSHIP ISOL	The left wing's divider and isolation valve have been commanded closed.	None. Awareness only.
LOX QTY	Liquid oxygen quantity is below 5 liters.	None. Awareness only.
MAINT DTC NOT INSTLD	The maintenance data transfer card is not installed in the DS-DTS.	None. Awareness only.
MGPS 1 (or 2) FOM DEGRAD-ED	The respective military GPS Figure of Merit is greater than 6.9.	Verify GPS status and change the INAV solution, as required.
MGPS 1 (or 2) UNAVAILABLE	The respective military GPS is unavailable.	None. Awareness only.
MISSION DTC NOT INSTLD	The mission data transfer card is not installed in the DSDTS.	None. Awareness only.
NAC 1 (2, 3, or 4) ISOLATED	The respective nacelle shutoff valve has closed.	None. Awareness only.
NAC 1 (2, 3, or 4) SOV NOT OPEN	START or MOTOR is selected via the engine control switch for more than 2 seconds and the respective nacelle shutoff valve has not opened.	Open the nacelle shutoff valve for the desired engine.
NG 1 (2, 3, or 4) HI	NG on the respective engine is between 102% and 103% for more than 2 seconds.	Reduce the affected engine's power lever to achieve an NG within the normal operating range.



<b>ADVISORIES</b>		
<b>Message</b>	<b>Condition</b>	<b>Corrective Action</b>
NP 1 (2, 3, or 4) HI	NP is between 101% and 106% for more than 2 seconds on the respective propeller.	Reduce the affected engine's power lever to achieve an NP within the normal operating range.
OIL TEMP 1 (2, 3, or 4) HI	The respective engine is running and its oil temperature is in the transient range, but less than 93°C	Adjust the respective engine's oil cooler flap position to increase cooling.
OUTFLOW VLV FULL OPEN	The outflow valve is fully open and its control switch is being held to the OPEN position.	Release the outflow valve control switch.
PROP 1 (2, 3, or 4) - 104% GOV FAIL	The propeller overspeed governor test for the respective propeller has failed.	Reattempt the test.
PROP 1 (2, 3, or 4) OVSPEED TEST INCONCLUSIVE	The propeller overspeed governor test on the respective propeller has been interrupted before completion. Functionality of the overspeed governor has not been verified.	Reattempt the test.
PROP A/I ON	The propeller ice protection system is functioning on one or more propellers.	None. Awareness only.
R AUX TK AUTO SHUTOFF	The right auxiliary tank's transfer pump has automatically turned off while the transfer switch is in TO or FROM.	Select the transfer pump switch to OFF.
R AUX TK EMPTY	The right auxiliary tank's transfer pump is running with less than 100 pounds of fuel remaining in the tank, and a fuel pressure decrease has been observed.	Select the transfer pump switch to OFF.
R EXT TK AUTO SHUTOFF	The right external tank's transfer pump has automatically turned off while the transfer switch is in TO or FROM.	Select the transfer pump switch to OFF.



ADVISORIES		
Message	Condition	Corrective Action
R EXT TK EMPTY	The right external tank's transfer pump is running with less than 100 pounds of fuel remaining in the tank, and a fuel pressure decrease has been observed.	Select the transfer pump switch to OFF.
R MAIN FUEL IMBALANCE	The right outboard main tank does not have the required 500 to 1,000 pounds of additional fuel compared to the right in-board main tank.	Accomplish a fuel transfer to balance the tanks.
R TROOP DOOR OPEN 250	The left paratroop door is not in the closed and locked position.	Do not exceed 250 knots.
R WING ISOL	The right wing's isolation valve has been commanded closed.	None. Awareness only.
R XSHIP ISOL	The right wing's divider and isolation valve have been commanded closed.	None. Awareness only.
RADALT 1 (or 2) FAIL	The respective radar altimeter has failed or lost power.	Select the functioning radar altimeter on the PFD AMU page.
RADALT SAME	The pilot and copilot's radar altimeter references are selected to the same source on the PFD AMU page.	Select differing radar altimeter units via the PFD AMU page, if desired.
RAMP OPEN	The cargo ramp is not in the closed and locked position.	Do not exceed 250 knots.
SET CNI WPT AUTO	Displays for 20 seconds after deselecting IPRA as the CDI source. Serves as a reminder to set the WPT SEQ option on the RTE CNI page to AUTO.	None. Awareness only.
SET CNI WPT MANUAL	Displays when the IPRA steer point is the IAF or IF and IPRA is selected as the CDI source. Serves a reminder to set the WPT SEQ option on the RTE CNI page to MAN.	None. Awareness only.
TAWS FAIL	A failure has been detected in the TAWS system, or its input data is unavailable.	None. Awareness only.



ADVISORIES		
Message	Condition	Corrective Action
TAWS NORM NOT AVAIL	TAWS alerts in NORMAL mode are not available.	None. Awareness only.
TAWS OFF	TAWS is selected OFF on the GCAS/TAWS AMU page.	Reapply TAWS power via the GCAS/TAWS AMU page, if desired.
TAWS TACT NOT AVAIL	TAWS alerts in TACTICAL mode are not available.	None. Awareness only.
TAWS TACTICAL VOID	TAWS is transitioning from NORMAL to TACTICAL mode.	Maintain visual clearance with terrain during the database transition (approximately 30 seconds)
TAWS TCF INOP	The TAWS Terrain Clearance Floor is inoperative.	None. Awareness only.
TK 1 (2, 3, or 4) AUTO SHUT-OFF	The respective tank's transfer pump has automatically turned off during a fuel transfer.	Select the transfer pump switch to OFF.
UFLR HEAT ISOL	The UNDERFLOOR selector switch is set to HEAT/FAN and the under-floor heat supply valve has been commanded closed.	None. Awareness only.
WING/EMP A/I ON	The wing/empennage ice protection system is operating in the anti-ice mode.	None. Awareness only.
WING/EMP A/I TEST	The wing/empennage anti-ice test is in progress.	None. Awareness only.
WING/EMP DE-ICE ON	The wing/empennage ice protection system is operating in the de-ice mode.	None. Awareness only.
WING/EMP A/I TEST ABORT	The wing/empennage anti-ice test was terminated before completion. Functionality of the anti-ice system has not been verified.	None. Awareness only.
XTK LIMIT EXCEEDED	The crosstrack limit defined on PROGRESS 2/4 CNI page has been exceeded.	Maneuver the aircraft to reduce the CDI crosstrack.



## Cursor Control Panel

The cursor control panel is used to manipulate the common cursor on the nav-radar and dig map HDD pages. Controls are also provided that allow the dig map scale and range to be adjusted.

### 1. Cursor Priority Switch

The priority switch selects which CNI scratchpad receives the cursor coordinate after use of the cursor INSERT switch.

**P:** The pilot's CNI scratchpad receives the coordinate.

**3RD:** The augmented crew's CNI scratchpad receives the coordinate.

**CP:** The copilot's CNI scratchpad receives the coordinate.

### 2. Cursor Reset Switch

The reset switch is used to reset the cursor's position to ahead of the aircraft. The reset function is only functional with the cursor in manual or ground mode.

### 3. Display Select Switch

The display select switch selects which HDD receives inputs from the cursor hand controller and range/zoom switches.

When OFF is selected, cursor symbology is removed from the HDDs and HUD.

### 4. HUD Cursor Display Switch

The cursor's position symbol in the HUD is controlled by the HUD display switch. When the switch is pressed, the position symbol is removed from the HUD. Pressing the switch again returns the symbol.

### 5. Display Range Switch

The range switch adjusts the scale of the dig map display on the HDD selected by the display select switch.

### 6. Display Zoom Switch

The zoom switch adjusts the zoom of the dig map display on the HDD selected by the display select switch. Each press of the ZOOM switch changes the magnification of the map by 10%, up to 200% of the normal zoom level.



## Cursor Hand Controller

The cursor hand controller provides an ergonomic way for the common cursor to be manipulated and interacted with.

### 1. Insert/Update Switch

Used to send the coordinates of the cursor's position to the CNI scratch-pad selected by the cursor priority switch.

### 2. Computer Cursor Switch

The two-position trigger is used to quickly change the cursor mode. The first detent changes mode to computer cursor, while the second detent changes the mode to quick cursor.

### 3. Offset Aim Point Switch

The Offset Aim Point (OAP) hat switch moves in four directions.

**FORWARD:** Scrolls through the OAPs listed on the CURSOR TARGET CNI page.

**BACK:** The dig map is set to cursor stabilized and will slew with the cursor.

**LEFT:** The dig map is set to aircraft stabilized. The dig map will remain centered on the aircraft during map slewing.

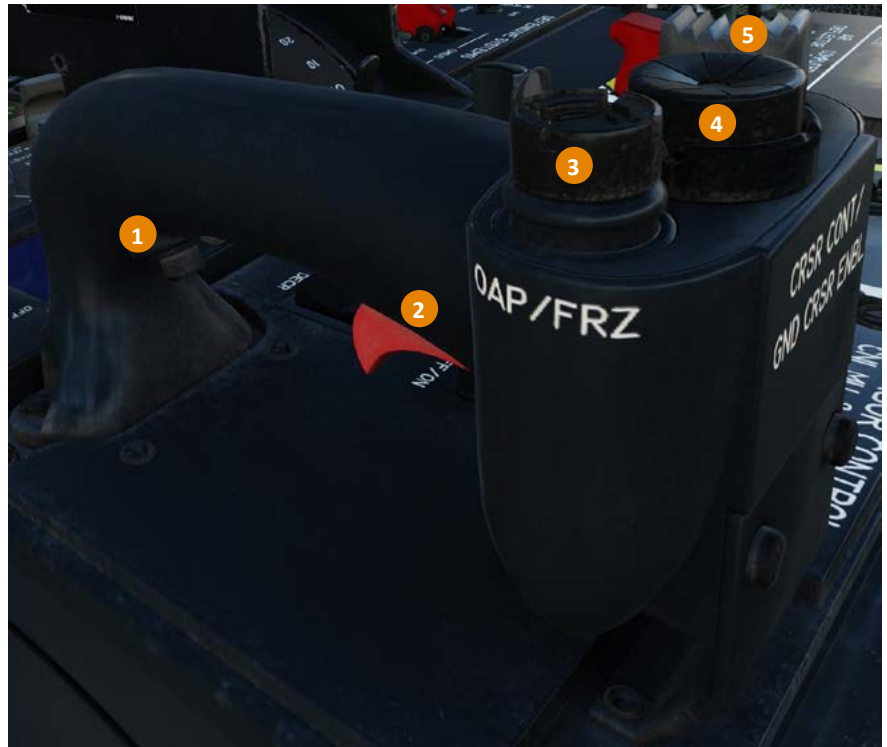
**RIGHT:** The dig map is set to ground stabilized. The dig map will slew without the cursor moving.

### 4. Cursor Control Switch

The cursor switch is used to slew the position of the common cursor. When the switch is pressed, the cursor is set to ground mode.

### 5. Tilt Switch

The tilt switch has no function except for the depress position. When the switch is pressed, the cursor will be set to manual mode.



## Overview

The C-130J is equipped with two separate systems that are designed to prevent Controlled Flight Into Terrain (CFIT), collision with ground-based obstacles, and unsafe aircraft configurations: these systems are the Ground Collision Avoidance System (GCAS) and Terrain Awareness and Warning System (TAWS).

## GCAS

GCAS uses nine predefined operating modes to monitor aircraft parameters such as power lever position, flap position, weight-on-wheels status, airspeed, barometric altitude, radar altitude and vertical speed. These modes are configured to detect conditions that would increase the aircraft's chances of impacting terrain. When a mode is triggered, its associated aural and visual alerts are presented to the crew to alert them to the situation.

## GCAS Operating Modes

GCAS can operate in two distinct modes: normal and tactical. In normal mode, the GCAS warning thresholds are optimized to detect potential CFIT and unsafe flight conditions in normal flight profiles. In tactical mode, the thresholds are relaxed to allow for more aggressive and tactical flight profiles without nuisance alerts, while still providing full GCAS protection and alerts.

## GCAS Alert Modes

GCAS uses nine predefined operating modes to monitor aircraft parameters such as power lever position, flap position, weight-on-wheels status, airspeed, barometric altitude, radar altitude and vertical speed. These modes are configured to detect conditions that would increase the aircraft's chances of impacting terrain. When a mode is triggered, its associated aural and visual alerts are presented to the crew to alert them to the situation.

## Mode 1: Excessive Descent Rate

Mode 1 evaluates the minimum height above ground allowed for a given descent rate and is active whenever radar altitude is between 30 and 2,450 feet AGL.

Two warning envelopes are provided and form a curved contour above the ground: the outer envelope is considered the caution envelope where the aircraft is not in immediate danger of terrain impact. The inner envelope is the warning envelope where immediate action must be taken to avoid terrain impact. The aural and visual alerts presented depend on which envelope the aircraft has penetrated.

When the outer envelope is penetrated, two "SINK RATE" special alerts will be generated; if the descent rate further increases, two additional "SINK RATE" alerts will be generated. When the aircraft exits the outer envelope, Mode 1's alerts will be deactivated. Penetration of the inner envelope is announced by a continuous "PULL UP" special alert, which is accompanied by the "WHOOOP WHOOOP" tone. Additionally, the pull-up cue will be shown on the PFD and HUD.



## Mode 2: Excessive Terrain Closure

In contrast to Mode 1, Mode 2 monitors the terrain closure rate with the aircraft. Mode 2 is active starting at 30 feet AGL. The upper edge of Mode 2 varies based on airspeed and descent rate and ranges from 1,650 feet AGL at 190 knots and a descent rate of 5,733 fpm to 2,450 feet AGL at 250 knots and a descent rate of 9,800 fpm. The envelopes also vary based on landing gear and flap configuration.

When the Mode 2 envelope is entered, the “TERRAIN TERRAIN” special alert will be generated. Following this, GCAS can respond in three different ways, depending on the GCAS mode selection, and aircraft configuration:

1. If the aircraft has exited the warning envelope, Mode 2’s alerts are deactivated.
2. If the aircraft has NOT exited the warning envelope and the flaps and landing gear are not in the landing configuration, or the selected GCAS mode is not TACTICAL, the special alert changes to a continuous “PULL UP”, which is accompanied by the “WHOOOP WHOOOP” tone. Additionally, the pull-up cue will be shown on the PFD and HUD.
3. If the aircraft has NOT exited the warning envelope and the flaps and landing gear are in the landing configuration, or the selected GCAS mode is TACTICAL, the “TERRAIN TERRAIN” special alerts continue.

## Mode 3: Excessive Altitude Loss After Takeoff

Mode 3 provides alerts when the aircraft experiences excessive altitude loss after takeoff, or a go-around from below 245 feet AGL. Mode 3 is active between 30 and 2,450 feet AGL when the wing flaps or landing gear are retracted.

When the Mode 3 warning envelope is entered, two instances of the “DONT SINK” special alert are generated. If the aircraft continues to descend, the special alerts are repeated. Mode 3’s alerts are deactivated when the aircraft exits the warning envelope.

## Mode 4: Unsafe Terrain Clearance

Mode 4 provides alerts when terrain clearance is insufficient for the aircraft configuration. One of three different submodes of Mode 4 are active at a time, depending on the phase of flight and aircraft configuration.

### Mode 4A/B

The A/B submode is active during the cruise and approach phases with the landing gear up. Two separate warning envelopes provide alerts based on radar altitude and airspeed.

The first envelope is active below 178 knots and below 400 feet AGL. When the aircraft enters this envelope, the “TOO LOW GEAR” special alert is displayed. This is intended to prevent landing with the landing gear inadvertently retracted. The second envelope extends from 400 to 800 feet AGL, and from 178 to 226 knots. Within this envelope, the “TOO LOW TERRAIN” alert is activated. Mode 4A/B’s alerts are deactivated when the aircraft exits the warning envelopes.

When TACTICAL is selected as the GCAS mode, the floor of both envelopes is reduced to 150 feet AGL.



## Mode 4C

Mode 4C is active during the takeoff or go-around phases with radar altitude above 245 feet AGL, or 100 feet AGL with either the flaps or landing gear not in the landing configuration. The floor of Mode 4C's warning envelope is set to 500 feet AGL below 190 knots; above 190 knots, the floor increases linearly with airspeed up to 1,000 feet AGL at 250 knots.

If the aircraft descends into the warning envelope with either the flaps or landing gear not in the landing configuration, the "TOO LOW TERRAIN" special alert is activated. Mode 4C's warnings are disabled when the aircraft exits the warning envelope, or the flaps and landing gear return to the landing configuration.

## Mode 5: Descent Below Glideslope

Mode 5 provides alerts for excessive deviation below an ILS glideslope. Mode 5 is active when all of the following conditions are met:

1. The CDI source is set to VOR with an ILS frequency tuned.
2. A valid glideslope signal is being received.
3. GCAS is in the approach phase, or flaps are in the landing range.
4. The glideslope alert inhibit function has not been activated via the AMU.
5. The landing gear is down.
6. Radar altitude is greater than 30 feet AGL.

An outer warning envelope has a variable upper limit of between 500 and 1,000 feet AGL, and provides alerts when glideslope deviation is greater than 1.3 dots. The upper limit varies based on descent rate: the ceiling is set to 1,000 feet when the descent rate is greater than 500 FPM, and decreases towards 500 feet as the descent rate approaches 0 FPM. When the outer envelope is penetrated, the "GLIDESLOPE" special alert is generated.

The inner envelope's ceiling is set to 300 feet AGL and provides alerts when glideslope deviation is greater than 2 dots. When the inner envelope is penetrated, the "GLIDESLOPE" special alert is generated at a slightly higher volume than the outer envelope's alert.

When Mode 5 is active and radar altitude is below 1,500 feet AGL, the GS INHIBIT selection on the GCAS/TAWS AMU page can be used to cancel deviation alerts. GS INHIBIT is automatically deselected when the ILS frequency is detuned, radar altitude increases above 1,500 feet AGL, or decreases below 30 feet AGL.



## Mode 6: Altitude Advisories

Mode 6 is always active and provides aural altitude advisories based on altitudes set via the REF/MODE panel. Mode 6 alerts vary slightly, depending on the selected GCAS mode.

When the selected GCAS mode is NORMAL and the landing gear is down, the “ALTITUDE ALTITUDE” special alert is generated when the aircraft descends below the selected RAD ALT value. When the aircraft descends below the selected MINS value, the “MINIMUM MINIMUM” special alert is generated. The “MINIMUMS” alert has priority over the “ALTITUDE” alert.

When the selected GCAS mode is TACTICAL and the landing gear is down, the two special alerts function in the same manner as they do in NORMAL mode. When the landing gear is up, descending below the selected RAD ALT value causes a continuous “ALTITUDE ALTITUDE” special alert to be generated. The alert continues until the aircraft climbs above the selected RAD ALT value. If the aircraft continues to descend and reaches 66% of the RAD ALT value, the special alert changes to a continuous “PULL UP”, which is accompanied by the “WHOO WHOO” tone. Additionally, the pull-up cue will be shown on the PFD and HUD. When the aircraft climbs above 66%, the alert resets to “ALTITUDE ALTITUDE”.

## Mode 7: Has yet to be invented.

## Mode 8: Excessive Bank Angle

Mode 8 provides alerts when the aircraft is banked excessively for the current radar altitude. Mode 8 is active when radar altitude is greater than 10 feet AGL.

The lower envelope is extends from 10 to 130 feet AGL. The allowable bank angle scales based on radar altitude: at 10 feet AGL, the maximum bank angle is set to 10 degrees: at 130 feet AGL, the maximum bank is set to 61 degrees. When the aircraft exceeds the allowable bank angle in this envelope, a continuous “BANK ANGLE” special alert will be played until the bank angle is reduced.

The upper envelope begins at 130 feet AGL, where the maximum allowable bank angle is set to 61 degrees. When this angle is exceeded, a single “BANK ANGLE” special alert will be generated. The alert will be played again each time the allowable bank angle is exceeded.

## Mode 9: Incorrect Takeoff Configuration

Mode 9 provides alerts when a takeoff is attempted with an improper flap, pitch trim, or ATCS configuration. Mode 9 is only active on the ground.

A continuous “FLAPS FLAPS” special alert is generated when the flaps are not positioned to the takeoff setting of 50%,  $\pm 8\%$  and any three power levers are positioned above 40 degrees PLA. The alert can be canceled by selecting the correct flap position, or reducing power.

A continuous “TRIM TRIM” special alert is generated when the pitch trim setting is not in the takeoff configuration of 0 degrees, 5 degrees and any three power levers are positioned above 40 degrees PLA. The alert can be canceled by positioning the pitch trim indicator within the white takeoff band, or reducing power.



A continuous “AUTOTHRUST AUTOTHRUST” special alert is generated when the ATCS control switch is positioned to OFF and any three power levers are positioned above 40 degrees PLA. The alert can be canceled by selecting the ATCS switch to ON, or reducing power.

## GCAS Alerts

GCAS Mode	Envelope	Aural Alert	Special Alert
Mode 1: Excessive Descent Rate	Outer	SINK RATE, SINK RATE	SINK RATE
	Inner	WHOO, WHOO PULL UP	PULL UP
Mode 2: Excessive Terrain Closure	Initial Alert	TERRAIN, TERRAIN	TERRAIN, TERRAIN
	Subsequent Alerts	WHOO, WHOO PULL UP	PULL UP
Mode 3: Excessive Altitude Loss After Takeoff	Warning	DONT SINK, DONT SINK	DONT SINK
Mode 4A/B: Unsafe Terrain Clearance	Lower	TOO LOW GEAR, TOO LOW GEAR	TOO LOW GEAR
	Upper	TOO LOW TERRAIN, TOO LOW TERRAIN	TOO LOW TERRAIN
Mode 4C: Unsafe Terrain Clearance	Warning	TOO LOW TERRAIN, TOO LOW TERRAIN	TOO LOW TERRAIN
Mode 5: Descent Below Glideslope	Inner and Outer	GLIDESLOPE	GLIDESLOPE
Mode 6: Altitude Advisories	Normal Mode	MINIMUMS, MINIMUMS	MINIMUMS
	Tactical Mode	ALTITUDE, ALTITUDE	ALTITUDE
Mode 8: Excessive Bank Angle	Lower	BANK ANGLE, BANK ANGLE	BANK ANGLE
	Upper	BANK ANGLE	BANK ANGE
Mode 9: Incorrect Takeoff Configuration	Flaps	FLAPS	FLAPS
	Pitch Trim	TRIM	TRIM
	ATCS	AUTOTHRUST	AUTOTHRUST



## Overview

A Heads Up Display (HUD) is provided for the pilot and copilot. The HUD functions by using a projector mounted above the pilot seats to project symbology onto a clear, glare-resistant combiner surface positioned in the crewmember's line of sight.

A plethora of symbology is presented on the combiner that allows the pilots to keep their focus outside the aircraft while still having access to critical flight information. Information presented in the HUD is a largely duplicate of the information displayed on the PFD HDD page.



## HUD Symbolology

### Acceleration Cue

The acceleration cue moves vertically to the left of the CDM to indicate aircraft acceleration and deceleration. Displacement is limited to 6 degrees in either direction from the CDM. The cue has a diamond inset when the autothrottle is engaged.



When the cue is displayed above the CDM, the aircraft is accelerating. When the cue is displayed next to the CDM, the aircraft is at zero acceleration. When the cue is displayed below the CDM, the aircraft is decelerating.

### Airspeed Bugs

Revolving carets are placed around the outside edge of the airspeed indicator that are accompanied by identifiers; the identifiers denote which speed the bug is associated with. The carets will not become visible until the aircraft's airspeed is within 40 knots of the airspeed associated with the caret.

$V_1$   $V_R$   $V_H$   $V_D$

Identifier	Airspeed	Value Set By
1	$V_1$	V SPEED CNI page
R	$V_R$	V SPEED CNI page
H	$V_H$	MC
C	CAPS Command	SKE
S	$V_S$	MC
D	$V_D$	MC
>	Reference Airspeed	REF/MODE Panel

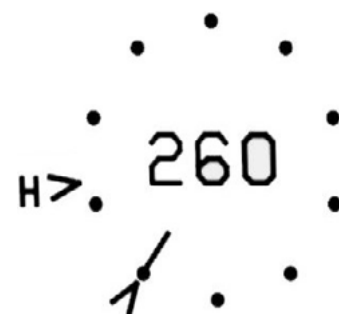
### Airspeed Error Cue

The airspeed error cue extends from the left side of the CDM to represent the magnitude of deviation from the selected reference airspeed. If the aircraft is slower than the reference airspeed, the line extends downwards; if the aircraft is faster than the reference airspeed, the line extends upwards.



### Airspeed Indicator

The airspeed indicator consists of a dotted circle, with an inset digital readout and revolving pointer. Each dot represents a 10-knot increment, with the pointer being placed at the position of the tens position of the current airspeed. The inset, digital readout begins at 30 knots and displays the aircraft's current airspeed.



## Airspeed Readouts

Digital airspeed readouts are placed above the airspeed indicator. The selected reference airspeed is always displayed, while other airspeeds such as the stall speed are displayed conditionally. Conditional airspeed readouts are accompanied by an identifier.

146 S  
260

## Altimeter

The altimeter consists of a dotted circle, with an inset digital readout and revolving pointer. Each dot represents a 10-foot increment, with the pointer being placed at the position of the tens position of the current altitude. The inset, digital readout displays the aircraft's current altitude.

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## Altitude Bugs

A revolving caret is placed on the outside edge of the altimeter at the reference altitude value selected via the ALT SEL knob. A caret with an "M" identifier appears at the reference minimums value selected by the REF/MODE panel. The carets will not become visible until the aircraft's altitude is within 400 feet of the caret's altitude.

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## Altitude Readouts

Digital altitude readouts are placed above the altimeter. The selected reference altitude is always displayed, while other altitudes such as minimums displayed conditionally. Conditional altitude readouts are accompanied by an identifier.

## Automation Status Field

Messages are displayed at the top left of the HUD that relate to the status of the aircraft's automation.

Message	Meaning
<AP	The pilot's autopilot is engaged.
AP>	The copilot's autopilot is engaged.
AP DSNG	The autopilot has been disconnected manually or automatically.
PTCH OFF	The pitch axis of the autopilot has been disconnected via the AFCS control panel.
LAT OFF	The lateral axis of the autopilot has been disconnected via the AFCS control panel.
P&L OFF	Both the pitch and lateral axes of the autopilot have been disconnected via the AFCS control panel.
A/T OFF	The autothrottle has been disengaged.



## Barometer

A digital readout of the barometer selected via the BARO SET knob is displayed below the mission datablock.

29.92

## Bearing Pointer

The bearing pointer consists of a segmented circle with an inset pointer arrow. Tick marks are spaced in increments of 30-degrees, with the arrow indicating the bearing towards the navaid selected for Pointer 1.



## Bearing Pointer Datablock

Displays the identifier and bearing/distance information for Pointer 1's navaid. When no information is available, dashes are displayed.

CAK 174/47.5

## CARP Steering Cue

The CARP steering cue consists of a vertical line that extends downward from the CDM, with a small, horizontal line at the bottom known as the release cue. The CARP steering cue replaces the CDI whenever the active waypoint is a drop zone.



During the CARP sequence, the release cue ticks upwards starting at 10 seconds from the green light, red light, and drop zone escape points. When the cue reaches the top of the line, the respective point has been reached.

## CDI Course Readout

A digital readout of the selected CDI course is displayed to the right of the heading indicator.

CRS 201

## CDI Datablock

The CDI datablock is positioned below the bank scale and displays the selected CDI source, as well as the course and distance towards the source's steerpoint. If a navigation radio is the selected CDI source, the tuned frequency will be displayed along with the course information.

INAV 1 201/17.5

## Climb Dive Marker (CDM)

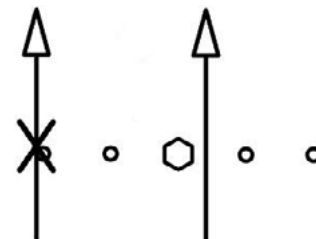
The CDM displays the aircraft's flight path, corrected for wind and acceleration. When the CDM reaches the edge of the HUD's field of view, the symbol becomes X'ed out.



## Course Deviation Indicator (CDI)

The CDI is located inset of the pitch ladder and displays the aircraft's displacement from the tuned CDI source. Components of the CDI include the CDI scale, LDI, and bearing pointer.

Four circular dots are located on the CDI that represent the aircraft's deviation from the tuned CDI source. The scale of the dots depends on the selected navigation source.



CDI Source	Dot Scale
INAV (distance to steerpoint greater than 50 nm)	1.5 nm per dot
INAV (distance to steerpoint less than 50 nm)	600 yards per dot
VOR/TACAN	5 degrees per dot
ILS	1.25 degrees per dot
IPRA (steerpoint is IAF, IF, MAP, or MAF)	1.5 nm per dot
IPRA (steerpoint is FAF, MAP, or RPI)	1.25 degrees per dot

The LDI is a needle inset of the CDI that displays the aircraft's displacement from the tuned CDI source's course. When the LDI is displaced to the left, the aircraft is right of course, and vice versa. The aircraft is on course when the LDI is centered. When the LDI reaches the limit of the CDI scale, the symbol will become X'ed out.

When the LDI is not receiving a course input from the CDI source, the LDI symbol is replaced with a "NO NAV" flag.

## Course Indicator

An upward-pointing caret is placed under the heading tape at the selected CDI course.



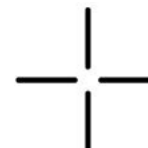
## CDI Bearing Pointer

The bearing pointer is located in the center of the CDI scale and points in the direction of the CDI source's navaid or steerpoint.



## Cursor Position Indicator

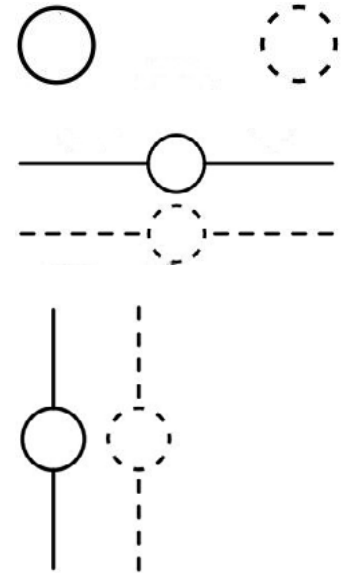
A cross symbol is positioned inside of the HUD's field of view that represents the common cursor's position on the ground in front of the aircraft. When the cursor is slewed out of the HUD's field of view, the cross is hidden.



## Flight Director (FD)

The FD represents the CDM position that will achieve the autopilot's targeted flight path. The FD symbol varies based on the selected vertical and lateral modes.

- When both lateral and vertical modes have been selected, the FD appears as a circle. If the on-side flight director is selected, the circle appears solid. If the off-side flight director is selected, the circle appears dashed.
- When only a vertical mode has been selected, the FD appears as a horizontal bar with a circle in the center. If the on-side flight director is selected, the bar and circle appear solid. If the off-side flight director is selected, the bar and circle appear dashed.
- When only a lateral mode has been selected, the FD appears as a vertical bar with a circle in the center. If the on-side flight director is selected, the bar and circle appear solid. If the off-side flight director is selected, the bar and circle appear dashed.



## Flight Mode Annunciator (FMA)

Two FMAs are displayed above the pitch ladder: the lateral mode FMA is on the left, with the vertical mode FMA on the right. Each FMA features two fields that denote the flight director mode's status: active and armed. The active mode is displayed on top of the dividing line, while the armed mode is displayed on the bottom.

**ALT HOLD**  
**ALT SEL**

## Flight Path Angle Marker (FPA)

The FPA marker is a dashed line that is placed at the selected reference FPA value on the pitch ladder.

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## G Meter

The G meter provides a digital readout of the aircraft's current load factor.

1.0 g

## Ghost Flight Path Marker (FPM)

The ghost FPM mirrors the vertical position of the CDM, but moves laterally to represent the aircraft's flight path affected by wind. When the ghost FPM reaches the edge of the HUD's field of view, the symbol becomes X'ed out.

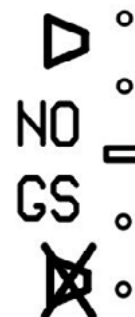
— | —



## Glideslope Scale

The glideslope scale appears to the left of the pitch ladder when the CDI source is set to either VOR 1 or VOR 2 and an ILS frequency is tuned. A triangular pointer moves along the scale to indicate the position of the glideslope in relation to the aircraft's current altitude.

When a glideslope signal is not received, the pointer is removed and a "NO GS" flag is displayed. The pointer becomes X'ed out at the scale limits.



## Ground Speed Readout

The ground speed field provides a digital readout of the aircraft's current ground speed in knots.



## Ground Track Indicator

An upside-down cross is positioned below the heading tape and represents the aircraft's current ground track.



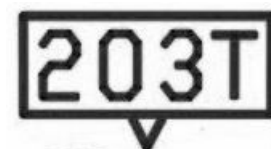
## Heading Bug

A heading bug symbol is overlaid on the heading tape at the selected reference heading. When the reference heading is outside of the heading tape window, half of the heading bug symbol will be displayed at the edge of the window.



## Heading Indicator

The aircraft's current heading is displayed in a box which is centered over the heading tape. When the heading indicator is referenced to a heading source other than magnetic, an identifier will appear to the right of the heading indicator.



Identifier	Meaning
T	The heading indicator is referenced to true north.
G	The heading indicator is referenced to MGRS.

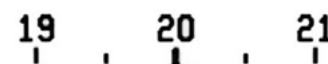
## Heading Readout

A digital readout of the selected reference heading is displayed to the left of the heading indicator.



## Heading Tape

A horizontally-scrolling heading tape is positioned below the heading indicator. The large tick marks represent increments of 10-degrees and have their corresponding heading placed over them; increments of 5-degrees are represented via small tick marks.



## Horizon Line

The horizon line is a solid line drawn at the 0-degree pitch position. When the aircraft's pitch places the 0-degree pitch position out of view, the horizon line will become dashed. This is meant to give the pilot an indication of where the horizon is during unusual attitude scenarios.

## Mission Datablock

Information related to the CMDS is presented in two lines at the bottom right corner of the HUD.

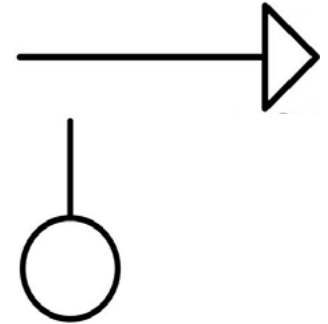
**\*\*NEW THREAT\*\***  
**FLR200 CHF220**

Top line: **\*\*NEW THREAT\*\*** is displayed for 15-seconds whenever the RWR detects a new threat and is accompanied by the RWR new guy tone.

The bottom line displays the remaining flare and chaff quantities when countermeasures are being dispensed, or when the CMDS system has been made active by setting the DEFENSIVE SYSTEMS MASTER switch to OPR and selecting a CMDS mode other than STBY.

## MWS Launch Cue

Four arrows can be displayed, one in each quadrant. When the MWS detects an inbound threat, an arrow will be shown that extends from the water-line symbol and points to the quadrant the threat was detected in.



## Nadir

The nadir symbol is a circle with a line extending upwards towards the 0-degree pitch position. The nadir represents the 90-degree nose down position.



## Navigation Datablock

The navigation datablock is shown at the bottom left of the HUD and displays information related to the flight plan in five separate lines.

Top line: The top line presents information related to time navigation, in addition to CARP error messages.

- If a time navigation target has been defined, the target ground-speed (TGS) and target speed (TSPD) is displayed.
- If the active steerpoint is a CARP waypoint and a CARP cross-track error exists, the associated message will flash to alert the crew to the condition. Possible messages include CARP XTK, CARP VERT, and CARP VERT/XTK.

Line 2: Displays the active waypoint and the distance to it.

Line 3: Displays the time remaining to the active waypoint.

Line 4: Displays the crosstrack deviation and direction from the CDI course. When the CDI is in sensitive steering, the crosstrack readout will be shown in yards; otherwise, nautical miles is used.

Bottom Line: The bottom line presents different information depending on the situation.

- If a time navigation target has been defined, the ahead (AHD) or behind (BHD) time is displayed.
- If the active steerpoint is a CARP waypoint, the position of the PI in relation to the release point is displayed. The release point can be positioned before (SH), after (LG), left (L), or right (R) of the PI due to wind correction.
- During a waypoint transition, “WAYPOINT TRANS” will be displayed. The WAYPOINT TRANS label has priority over the other two fields and will temporarily hide them until the transition is complete.

## Offside Indication

When the O/S button on the on-side HUD control panel is pressed and held, “OFFSIDE” will appear above the special alert field.

TGS273	TSPD251
W2	/ 17.5
TTG	3:41
XTK R	0.0 NM
AHD	0:06



## Pitch Ladder

The pitch ladder begins at the horizon line and extends to +85 and -85 degrees in 5-degree increments.

## Pitch Recovery Chevrons

Nose-high and nose-low recovery chevrons are placed on the pitch ladder to indicate the aircraft is pitched up or down excessively.

The nose-high chevrons are placed at the 25-degree, 50-degree, and 75-degree positions atop the pitch ladders. The nose-low chevrons are placed at the 25-degree, 50-degree, and 75-degree positions in between the pitch ladders.

## Pull Up Cue

A pull-up cue consisting of three large arrows is displayed below the CDM whenever the TAWS or GCAS system generates a PULL UP command.

## Radar Altimeter

A digital readout displays the aircraft's height Above Ground Level (AGL). The readout is hidden when the aircraft is above 5,000 feet AGL, and shows X's when the radar altimeters break their lock on the ground.

## Roll Recovery Arrow

The roll recovery arrow is shown when the aircraft rolls beyond 60-degrees of bank and the waterline symbol is below 0-degrees of pitch. The arrow is placed over the waterline symbol and points to the nearest horizon.

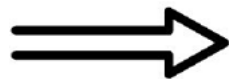
## Roll Scale

The roll scale consists of small and large tick marks that extend to 30-degrees left and right of level. The large tick marks represent 10-degree increments, and the small ticks 5-degree increments. When the aircraft exceeds 30 degrees of bank, an extension to the scale will appear, which extends to 60-degrees of bank.

A pointer above the roll scale represents the aircraft's current bank angle.

## Runway Outline

The runway outline is a rectangular box drawn around the perimeter of the landing runway as an aid for low-visibility operations. The outline becomes visible at 500 feet AGL and disappears at 100 feet AGL.



## RWR Launch Cue

When the RWR detects a missile launch, one of two launch cues will be displayed depending on whether the missile is correlated to a threat symbol. The cues extend from the waterline symbol towards the quadrant of the launch.

1. The correlated launch cue is a line with a circle on the end that extends from the waterline symbol.
2. The uncorrelated cue has a circle with four lines around the outside.



## Sideslip Indicator

The sideslip indicator is a doghouse-shaped symbol that is presented below the CDM. The indicator is displayed conditionally based on the aircraft's sideslip angle.



If the sideslip angle is below 2 degrees and the aircraft is coordinated, the symbol is hidden. When sideslip is less than 2 degrees but the aircraft is not in coordinated flight, the symbol will appear as a trapezoid as an indicator that the aircraft is uncoordinated.

If the sideslip angle is greater than 2 degrees, the base of the triangle will separate from the rest of the symbol and move laterally to indicate the direction and magnitude of the rudder input needed to eliminate the sideslip.

The indicator changes to a dashed symbol after the aircraft has been in coordinated flight for 1 second. The symbol is removed from the HUD after 5 seconds of coordinated flight have been observed.

## Sideslip Alert Fence

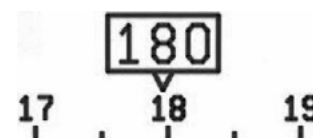
The sideslip alert fence represents the maximum allowable sideslip angle for the current flight conditions. The fence becomes visible when the aircraft's sideslip angle reaches 2/3 of the maximum angle.



When the sideslip slip indicator reaches the fence, the sideslip warning system will generate the "SIDESLIP" message. If the fence is exceeded, the message transitions to "LEFT [or RIGHT] RUDDER", depending on the slip direction.

## Special Alert Field

The special alert field is presented in the top portion of the attitude indicator and displays the highest-priority special alert in a textual fashion.

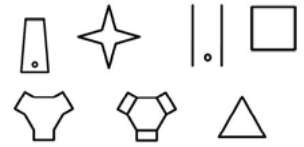


**BANK ANGLE**



## Steerpoint Symbols

Symbols are presented in the HUD as a graphical representation of the positioning of steerpoints, nav aids, drop zones, and airfields. Ground-based nav aids, airfields, and drop zones are placed on the ground while way-points are located at their defined altitude.



## Stopwatch

When the stopwatch function has been activated, a readout will appear below the bearing pointer datablock that displays the stopwatch's value. When the stopwatch is reset, the readout will disappear and the field becomes blank.

0002:58

## Vertical Speed Indicator

The vertical speed indicator is posited below the altimeter and displays the aircraft's current vertical speed in thousands of feet per minute. The field is constrained to a maximum value of +9.9 and a minimum value of -9.9.

0.0

## Waterline Symbol

The waterline symbol is imposed over the pitch ladder and represents the position of the nose of the aircraft.



## Wind Indicator

The wind indicator shows the direction the wind is blowing to, along with a digital readout of the speed in knots.



12

## Zenith

The zenith symbol is a star with a line extending down towards the 0-degree pitch position. The zenith represents the 90-degree nose up position.



## Unusual Attitude Mode

The HUD's unusual attitude mode activates when excessive pitch or bank angles are encountered. When activated, all non-critical symbology is removed from the HUD which allows the pilot to focus on recovering to normal flight.

## Warning Flags

Like the PFD, the HUD displays different warning flags when data required to drive certain indications is missing.

Flag	Meaning
ATTITUDE FAIL	Inertial data required to display the attitude indicator is not available.
HDG FAIL	Inertial data required to display the heading indicator is not available.
NO NAV	The CDI is not receiving course information.
NO G/S	An ILS is set as the CDI source, but a glideslope signal is not received.

## HUD Control Panel

A HUD control panel is provided for each HUD. The panel contains controls related to HUD symbology and brightness, each affecting their respective HUD. Each button has a small, green light at the top left corner that illuminates when the function is active.

### 1. VIS Button

The Visual (VIS) button is used to display or remove the visual symbology layer.

### 2. Unused

### 3. CAT 2 Button

The Category 2 (CAT2) button is used to display symbology and activate monitoring for a Category 2 ILS.

### 4. O/S Button

The Offside (O/S) button is used to momentarily replace the displayed HUD symbology with what the other crew-member has selected.

### 5. TACT Button

The Tactical (TACT) button is used to display or remove the tactical symbology layer.

### 6. NAV Button

The Navigation (NAV) button is used to display or remove the navigation symbology layer.



## 7. UNCG Button

The Uncage (UNCG) button is used to uncage the CDM. When the CDM is uncaged, the CDM will be allowed to move laterally.

## 8. Brightness Control Knob

The brightness control knob is used to adjust the brightness of the HUD. Rotating the knob counter-clockwise decreases brightness, while clockwise rotation increases brightness.

If the knob is pulled, brightness is controlled automatically and varies based on ambient lighting. Pushing the knob in from AUTO re-enables manual brightness control.



## Fuel System

The fuel system supplies fuel to the engines and APU under pressure via boost pumps from fuel tanks located inside the wings. Transfer pumps located in each fuel tank facilitate fuel transfer, balancing, and jettison in the event of an emergency. Crossfeed and cross-ship valves complete the system.

## Fuel Tanks

Three separate fuel tanks are located inside each wing: two main tanks, and an auxiliary tank. The main tanks are numbered according to which engine they supply fuel to, while the auxiliary tanks are differentiated by what wing they are located in. Optional, external fuel tanks can be equipped to further increase range and endurance.

The main tanks supply fuel directly to their respective engines via an AC-powered boost pump. The boost pump operates whenever the engine's control knob is positioned to RUN. The tanks are also equipped with a transfer pump that allows fuel to be transferred into and out of the tank.

The auxiliary tanks are located inboard of the main tanks and are only equipped with a transfer pump. The fuel in the aux tanks is used to replenish the main tanks as fuel burns off during a mission.

Two external tanks can be equipped outside of the mission via the mission editor or within the mission via the payload editor. The fuel tanks are mounted between the engines on each wing and are used to increase fuel capacity beyond what the internal tanks can hold. The external tanks use a transfer pump to transfer their fuel to the airplane's internal tanks.

## Fuel Level Control Valves

Each tank is equipped with a Fuel Level Control Valve (FLCV) that is used to control fuel flow into the tank. The FLCV is an electrically-operated valve that is controlled by floats in the tank, or by the Fuel Management Controller (FMC).

The FLCVs close automatically when floats inside the tank indicate that tank capacity has been reached. They can also close by input from the FMC when the tank's preset fuel quantity has been reached.

## Cross-ship Valve

The cross-ship valve separates the left wing manifold from the right wing manifold. When the valve is open, both manifolds are connected, enabling fuel to be transferred from one wing to the other.

## Crossfeed Valves

Each main fuel tank is equipped with a crossfeed valve which allows for fuel from a main tank to directly supply another engine.



## Fuel Control Panel

The fuel control panel is used to control components of the fuel system and view the fuel quantity for each tank.



### 1. Fuel Dump Valve Switch

The guarded fuel dump valve switches control the position of the respective wing's fuel dump valve. When the switch is positioned to ON, the valve is opened.

### 2. No function

### 3. Cross-ship Valve Switch

The cross-ship valve switch controls the position of the cross-ship valve. When the switch is vertical, the valve is closed: when the switch is horizontal, the valve is open.

### 4. SPR Valve Switch

The Single Point Refueling (SPR) valve switch controls the SPR valve and a pump that drains the refueling manifold. A small, green light illuminates whenever the pump is running.

**DRAIN:** The SPR valve is closed, and the drain pump is energized for 5 minutes to drain the refueling manifold.

**CLOSED:** The SPR valve is closed.

**OPEN:** The SPR valve is open.

### 5. Fuel Manifold Pressure Display

A digital indicator displays the pressure of the right wing's fuel manifold. To view the pressure in the left wing's manifold, the cross-ship valve must be opened.



## 6. Transfer Pump Switch

The transfer pump in each fuel tank is controlled by a selector switch. An arrow on top of each switch indicates the direction the transfer pump is sending fuel.

**FROM:** The FLCV is open and the pump is energized to send fuel from the tank to the wing manifold.

**OFF:** The pump is de-energized and the tank's FLCV is closed.

**TO:** The FLCV is open and the pump is energized to send fuel to the tank from the wing manifold.

## 7. Crossfeed Switch

The crossfeed switch controls the position of each main fuel tank's crossfeed valve. Lines on top of each switch indicate the valves position. When the switch is vertical, the valve is closed: when the switch is horizontal, the valve is open.

## 8. Fuel Quantity Indicator

Digital indicators are provided for each fuel tank that display the quantity of fuel present in the tanks, in pounds. The top line of the indicator becomes active when the tank select switch is in any position except OFF and displays the fuel quantity that the tank's FLCV will close at.

## 9. Quantity Set Knob

The quantity set knob is used to adjust the desired fuel quantity for the tank selected by the tank select switch

## 10. Tank Select Switch

The tank select switch is used to select which fuel tank's refuel quantity is changed by the quantity set knob. When a tank is selected, the top line of its fuel quantity indicator will flash.



## Airspeed Limits

Aircraft Condition	Limit (IAS)
Clean, Autopilot Disengaged	V <sub>D</sub>
Clean, Autopilot Engaged	V <sub>H</sub>
Flaps Extended 10%	220
Flaps Extended 20%	210
Flaps Extended 30%	200
Flaps Extended 40%	190
Flaps Extended 50%	183
Flaps Extended 60%	165
Flaps Extended 70%	155
Flaps Extended 80%	150
Flaps Extended 90%	145
Flaps Extended 100%	145
Landing Gear Extended	168
Landing Lights Extended	250
Ramp Open	250
Cargo Door Open	250
Air Deflectors Open	150
Paratroop Doors Open	250
Turbulence Penetration	181
Nose Gear Tire Speed (GS)	139
Main Gear Tire Speed (GS)	174

## APU Limits

Item	Limit
Max RPM	110%
Max Continuous EGT	680°C
Max EGT	710°C
Starter Cutout	50% RPM
Start Cycle	35 seconds
Bleed Air Use	Ground Only

## Fuel Limits

Tank	Capacity (lbs)
No. 1 Main	8,310
No. 2 Main	7,660
No. 3 Main	7,660
No. 4 Main	8,310
Total Main Tanks	31,940
Left Auxiliary	5,810
Right Auxiliary	5,810
Total Internal	43,560
Left External	8,900
Right External	8,900
Total Internal and External	61,360

## Weight Limits

Weight	Limit (lbs)
Maximum Normal Takeoff	164,000
Maximum Alternate Takeoff	175,000
Recommended Landing	162,285
Maximum Normal Landing	164,000
Maximum Alternate Landing	175,000

## Wind Limits

Maximum Crosswind Component	35 Knots
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## Load Factor Limits

Load factor limitations vary based on configuration and fuel quantity. The V SPEED CNI page can be used to view the aircraft's current symmetrical and asymmetrical load factor limits.



## Overview

Four LCD Heads Down Displays (HDDs) are located on the main instrument panel and display information to the crew based on AMU selections. Each HDD is identical and numbered 1-4, with the leftmost display being HDD 1 and the rightmost display HDD 4.

Each of the four HDD units can be configured independently via the AMUs to show different information based on the phase of flight or mission scenario.

### 1. Slip/Skid Indicator

HDDs 1 and 4 are equipped with an analog slip/skid indicator located in the center of the top bezel.

The indicator features a ball suspended in fluid, which moves left and right according to lateral acceleration. When the aircraft is in coordinated flight, the ball is centered. If a slip or skid condition exists, the ball will be displaced to the side which requires rudder input.

HDDs 2 and 3 have a blanking plate installed in place of the indicator.

### 2. Brightness Rocker

The brightness rocker allows for the HDD's display brightness to be manually adjusted.



## Test Page

The HDD test page is displayed momentarily during the display's boot up cycle.

The displayed information includes software version numbers, serial numbers, system component temperatures, color verification strips, and system heartbeat information.



## Primary Flight Display (PFD)

The Primary Flight Display (PFD) displays flight-related information to the pilot such as attitude, airspeed, heading, altitude, and navigation utilities.

Due to the aircraft's internal logic of always requiring flight-critical information to be shown, the PFD will be automatically displayed on HDD 1 or HDD 4 if the respective HUD is stowed. The PFD will remain locked on the display until the HUD is lowered again.

### Acceleration Cue

The acceleration cue is a white caret that moves vertically to the left of the CDM to indicate aircraft acceleration and deceleration.

Displacement is limited to 6 degrees in either direction from the CDM. The cue has a diamond inset when the autothrottle is engaged.

When the cue is displayed above the CDM, the aircraft is accelerating. When the cue is displayed next to the CDM, the aircraft is at zero acceleration.

When the cue is displayed below the CDM, the aircraft is decelerating.



### Airspeed Carets

White carets are placed on the airspeed scale that are accompanied by identifiers; the identifiers denote which speed the bug is associated with. The carets will not become visible until the aircraft's airspeed is within 40 knots of the airspeed associated with the caret.

Identifier	Airspeed	Value Set By
1	V <sub>1</sub>	V SPEED CNI page
R	V <sub>R</sub>	V SPEED CNI page
H	V <sub>H</sub>	MC
C	CAPS Command	SKE



## Airspeed Bug

A cyan symbol is placed on the airspeed tape at the selected reference airspeed value.



## Airspeed Error Cue

The airspeed error cue extends from the left side of the CDM to represent the magnitude of deviation from the selected reference airspeed. If the aircraft is slower than the reference airspeed, the line extends downwards; if the aircraft is faster than the reference airspeed, the line extends upwards.



## Airspeed Indicator

The airspeed indicator window is imposed over the airspeed tape and displays a digital readout of the current airspeed in increments of 1 knot.



## Airspeed Readout

The selected reference airspeed is displayed above the airspeed tape in cyan.



## Airspeed Tape

The airspeed tape is composed of green numerical values and tick marks. Numerical values are shown in increments of 20 knots to 400 knots, with the tick marks representing 10 knots.



## Altitude Bug

A cyan symbol is placed on the altitude tape at the reference altitude value selected via the ALT SEL knob.



## Altimeter Window

The altimeter window is imposed over the altitude tape and shows a digital indication of the aircraft's current altitude in increments of 20 feet. A negative sign precedes negative altitudes. If altitude information is invalid, the window is filled with white Xs.



## Altitude Readout

The reference altitude selected via the ALT SEL knob is displayed in cyan over the altitude tape.



## Altitude Tape

The altitude tape is composed of green numerical values and tick marks. The numerical values are displayed in increments of 500 feet from -1,000 to 50,000, with each tick mark representing 100 feet.



## Automation Status Field

Messages are displayed at the top left of the PFD that relate to the status of the aircraft's automation. Advisory messages, which only require crew awareness, are displayed in white text, while caution messages, which may require crew action, are displayed in yellow text.

Message	Meaning	Category
<AP	The pilot's autopilot is engaged.	Advisory
AP>	The copilot's autopilot is engaged.	Advisory
AP DSNG	The autopilot has been disconnected manually or automatically.	Caution
PTCH OFF	The pitch axis of the autopilot has been disconnected via the AFCS control panel.	Caution
LAT OFF	The lateral axis of the autopilot has been disconnected via the AFCS control panel.	Caution
P&L OFF	Both the pitch and lateral axes of the autopilot have been disconnected via the AFCS control panel.	Caution
A/T OFF	The autothrottle has been disengaged.	Caution

## Barometer

The barometer setting selected by the BARO SET knob is displayed in cyan. If IN is selected as the PFD's barometer format, "IN HG" will be displayed in cyan above the readout; if MB is selected, "MB" will be displayed in cyan.

IN HG  
30.02

## Bearing Pointers

Two bearing pointers are placed on the outside of the HSI and rotate to point in the direction of the tuned navaid. Each pointer has a head and a tail, with the head pointing towards the station and the tail pointing away. Pointer 1 is labeled with a "1" on its head, while Pointer 2 has a "2" label.



## Bearing Pointer Datablock

At the bottom right of the PFD, two bearing pointer fields, one for Pointer 1 and another for Pointer 2, display the identifier, distance, and frequency for the selected bearing pointer's tuned navaid. If information is missing, blanks will be displayed. If information is invalid, X's will be displayed.

↑ 2  
T1 V2  
84X 116.20  
RMD CAK  
40.7



## Compass Card

The compass card is circle comprised of large and small, green tick marks. The large tick marks are spaced in increments of 10 degrees, while the short ticks are 5 degrees. Numbers and cardinal directions are placed every 30 degrees.

White tick marks are placed on the outside edge of the compass card, spaced 45 degrees apart.



## CDI Datablock

The CDI datablock is displayed at the bottom left of the PFD and is comprised of the CDI source field, course readout, and distance readout.

The navigation source driving CDI indications, as selected via the AMU NAV SELECT page, is displayed at the bottom left of the PFD in green font. If the CDI source is a navigation radio, the tuned frequency will be displayed below the source field.



Source Field Display	Selected CDI Source
INAV_1 (or 2)	INAV 1 (or 2)
VOR_1 (or 2)	VOR 1 (or 2)
TAC_1 (or 2)	TACAN 1 (or 2)
ILS_1 (or 2)	VOR 1 (or 2) with a localizer frequency tuned.
IPRA	IPRA

The selected course of the CDI source is displayed under the CRS header. When the red CRS flag is displayed on the HSI, the CRS readout will be shown in red font. When the CDI source supports manual course inputs (VOR, TAC, and ILS) the readout will be shown in cyan font. When the CDI source does not support course inputs, the readout will be shown in white font.

The distance to the selected CDI source's active navaid is displayed in white font under the DIST header. When no distance information is available, the field is filled with white Xs.

## Climb Dive Marker (CDM)

The CDM displays the aircraft's flight path, corrected for wind and acceleration.



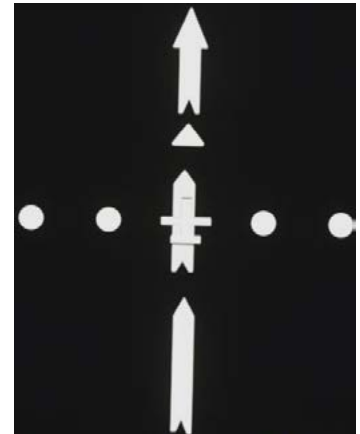
## Course Deviation Indicator (CDI)

The CDI is located inside of the compass card and displays the aircraft's displacement from the tuned CDI source. Components of the CDI include the Lateral Deviation Indicator (LDI), to/from pointer, CDI scale, and CDI pointer.

The LDI is a white needle inset of the CDI that displays the aircraft's displacement from the tuned CDI source's course. When the LDI is displaced to the left, the aircraft is right of course, and vice versa. The aircraft is on course when the LDI is centered.

Above the LDI is a white triangle, known as the to/from pointer. The pointer indicates whether the CDI is steering the aircraft to or from the CDI steerpoint.

Four circular dots comprise the CDI scale that represent degrees of displacement. Together with the LDI, the dots indicate the magnitude of deviation from the CDI course. The scale of the dots depends on the selected navigation source.



CDI Source	Dot Scale
INAV (distance to steerpoint greater than 50 nm)	1.5 nm per dot
INAV (distance to steerpoint less than 50 nm)	600 yards per dot
VOR/TACAN	5 degrees per dot
ILS	1.25 degrees per dot
IPRA (steerpoint is IAF, IF, MAP, or MAF)	1.5 nm per dot
IPRA (steerpoint is FAF, MAP, or RPI)	1.25 degrees per dot

The CDI pointer is shaped like a plane and sits over the center of the CDI scale. The pointer is oriented towards the CDI's steerpoint.

## Course Flag

When the CDI source has invalid course information, the LDI and CDI scale are removed from the CDI and replaced with a red "CRS" flag.



## Course Pointer

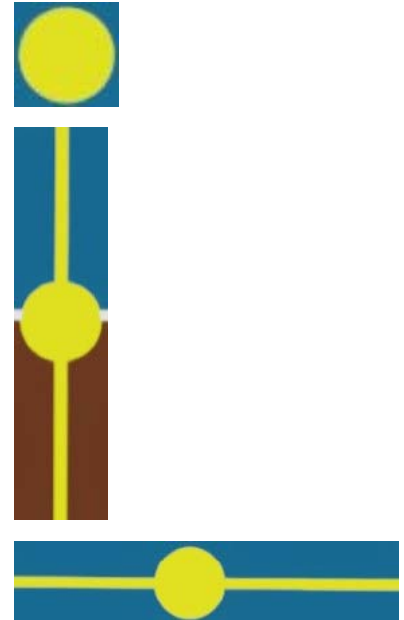
The course pointer is a white triangle positioned on the inside edge of the compass card. The pointer represents the course to the CDI steerpoint.



## Flight Director (FD)

The FD represents the CDM position that will achieve the autopilot's targeted flight path. The FD symbol is shown in yellow and varies based on the selected vertical and lateral modes.

- When both lateral and vertical modes have been selected, the FD appears as a circle. If the on-side flight director is selected, the circle appears solid. If the off-side flight director is selected, the circle appears dashed.
- When only a vertical mode has been selected, the FD appears as a horizontal bar with a circle in the center. If the on-side flight director is selected, the bar and circle appear solid. If the off-side flight director is selected, the bar and circle appear dashed.
- When only a lateral mode has been selected, the FD appears as a vertical bar with a circle in the center. If the on-side flight director is selected, the bar and circle appear solid. If the off-side flight director is selected, the bar and circle appear dashed.



## Flight Mode Annunciator (FMA)

Two FMAs are displayed above the pitch ladder: the lateral mode FMA is on the left, with the vertical mode FMA on the right. Each FMA features two fields that denote the flight director mode's status: active and armed. The active mode is displayed on top of the dividing line in green, while the armed mode is displayed on the bottom in white.



## Flight Path Angle Marker (FPA)

The FPA marker is a dashed, yellow line that is placed at the selected reference FPA value on the pitch ladder.



## G Meter

A digital readout of the aircraft's current load factor (G) is displayed in white font. The maximum load factor experienced by the aircraft is displayed in green font above the current G, with the minimum load factor experienced being displayed below the current G in green font. When applicable, a negative sign precedes the displayed values.



## Glideslope Scale

The glideslope scale appears to the left of the pitch ladder when the CDI source is set to either VOR 1 or VOR 2 and an ILS frequency is tuned. A triangular pointer moves along the scale to indicate the position of the glideslope in relation to the aircraft's current altitude.

When a glideslope signal is not received, the pointer is removed and a red "G/S" flag is displayed.



## Ground Speed Readout

The aircraft's current ground speed is displayed in white below the GS header.



## Ground Track Indicator

The aircraft's current ground track is represented by a magenta cross that rotates along the outside of the compass card.



## Heading Bug

A cyan heading bug symbol is overlaid on the compass card at the selected reference heading. When the lubber line is in the middle of the heading bug, the aircraft's heading matches the reference heading.



## Heading Indicator

The aircraft's current heading is displayed in a box which is centered over the compass card. A white lubber line extends below the heading indicator to the compass card as an analog indication of the heading.

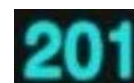


When the heading indicator is referenced to a heading source other than magnetic, an identifier will appear to the right of the heading indicator.

Identifier	Meaning
T	The heading indicator is referenced to true north.
G	The heading indicator is referenced to MGRS.

## Heading Readout

A digital readout of the selected reference heading is displayed in cyan to the left of the heading indicator.



## Horizon Line

The horizon line is a solid, white line drawn at the 0-degree pitch position. When the aircraft's pitch places the 0-degree pitch position out of view, the horizon line will become dashed with black and white line segments. This is meant to give the pilot an indication of where the horizon is during unusual attitude scenarios.



## Low Speed Awareness Cue

With weight off wheels, the low speed awareness cue is displayed in the form of a red and white barber pole. The cue begins at the stall warning speed and extends to the bottom of the airspeed tape. When the airspeed indicator reaches the top of the low speed cue, the stall warning system will activate.



## Minimums Bar

A thin cyan line is placed on the altitude tape at the reference minimums value selected via the REF/SET panel.



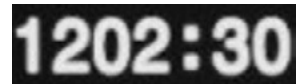
## Minimums Readout

The reference minimums value is displayed in cyan below the MIN header.



## Mission Time

The current mission time is displayed to the left of the HSI.



## Nadir

The nadir symbol is a circle with a line extending upwards towards the 0-degree pitch position. The nadir represents the 90-degree nose down position.



## Overspeed Awareness Cue

A red line is positioned at the top of the airspeed tape at VD. The airspeed indications and tick marks above this line are presented in red, to denote the overspeed zone.



## Pitch Ladder

The pitch ladder begins at the horizon line and extends to +85 and -85 degrees in 5-degree increments.



## Pitch Recovery Chevrons

Nose-high and nose-low recovery chevrons are placed on the pitch ladder to indicate the aircraft is pitched up or down excessively.



The nose-high chevrons are placed at the 25-degree, 50-degree, and 75-degree positions atop the pitch ladders. The nose-low chevrons are placed at the 25-degree, 50-degree, and 75-degree positions in between the pitch ladders.

## Pull Up Cue

A pull-up cue consisting of three large arrows is displayed below the CDM whenever the TAWS or GCAS system generates a PULL UP command.



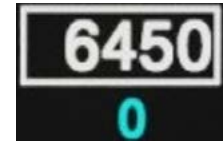
## Radar Altimeter

A digital readout displays the aircraft's height Above Ground Level (AGL). The readout is shown in white when the aircraft is at or above the reference radar altitude, and yellow when the aircraft is below the reference radar altitude.



## Radar Altitude Readout

The selected reference radar altitude is displayed in cyan and reflects the value set via the REF/SET panel.



## Reference Airspeed Field

The reference airspeed field displays a digital readout of the various positions of the reference airspeed bugs when the bugs are off scale. With weight on wheels, the refusal and rotation speeds are displayed.



## Roll Scale

The roll scale is placed at the bottom of the ADI and consists of white tick marks spaced 10 degrees apart from 0 to 30 degrees, and 15 degrees apart from 30 to 60 degrees.



## Roll Pointer

The roll pointer is a white triangle atop the roll scale that represents the aircraft's current bank angle.



## Roll Recovery Arrow

The roll recovery arrow is shown when the aircraft rolls beyond 60-degrees of bank and the waterline symbol is below 0-degrees of pitch. The arrow is placed over the waterline symbol and points to the nearest horizon.



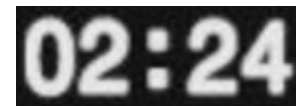
## Special Alert Field

The special alert field is presented in the top portion of the attitude indicator and displays the highest-priority special alert in a textual fashion.



## Stopwatch

When the stopwatch function has been activated, a readout will appear below the mission time field that displays the stopwatch's value. When the stopwatch is reset, the readout will disappear and the field becomes blank.



## Vertical Speed Indicator

The vertical speed indicator is a white arrow imposed over the vertical speed scale and represents the aircraft's current vertical speed.



## Vertical Speed Scale

The vertical speed scale is composed of green numerical values and tick marks. The numerical values are displayed in increments of 1,000 feet per minute from -3,000 to +3,000, with each tick mark representing 100 feet per minute.

A green 3.0 at the top of the vertical speed scale represents 3,000 feet per minute. If the aircraft's vertical speed exceeds 3,000 feet per minute, the readout will be replaced with a white, boxed readout of the current vertical speed, up to a maximum value of 9.9.



## Warning Flags

Red warning flags are displayed around the PFD when data becomes invalid, or data to drive a component on the PFD is not available.

Flag	Meaning
ATTITUDE FAIL	Inertial data required to display the attitude indicator is not available.
CDM	Data required to display the CDM is unavailable or invalid, and the CDM has been removed from the PFD.
CRS	The CDI source has invalid course information.
FD	Data required to display the FD is unavailable or invalid, and the FD has been removed from the PFD.
G/S	A valid glideslope signal is not being received.

## Waterline Symbol

The waterline symbol is imposed over the pitch ladder and represents the position of the nose of the aircraft.



## Zenith

The zenith symbol is a star with a line extending down towards the 0-degree pitch position. The zenith represents the 90-degree nose up position.



## Engine Display

The Engine Display contains digital readouts of engine parameters such as horsepower, MGT, NG, NP, and oil pressure/quantity, in addition to the ACAWS display area.

Values are displayed in white when in the normal range and will change colors to either yellow or red when in the abnormal range, depending on the exceedance. A box is shown around yellow or red values to draw attention to the abnormal indication.

## Engine Message Area

A message area is located below the HP dial for each engine which displays textual messages about the status of the engine. The following messages can be displayed:

- **ATCS** (Engines 1 and 4 only): Displayed in blue font below the HP dial of the engine that ATCS is limiting the power output of.
- **BETA**: Displayed in white font when the respective power lever is in the ground range, and the propeller has entered the beta range.
- **FAIL**: Displayed in red font when FADEC has detected an engine failure on the respective engine.
- **GND RNG**: Displayed in yellow font when the respective power lever is in the ground range with weight-off-wheels.
- **OVERRIDE** (Engines 1 and 4 only): Displayed in yellow font below the HP dial of the engine where ATCS power limiting has been overridden.
- **MCP Exceedance Timer**: Displayed in white font when engine power exceeds the MCP setting. The timer counts down from five minutes to indicate the remaining time in takeoff power; when the timer reaches zero, it turns yellow and begins to count upwards.
- **Start Sequence Timer**: Displayed in white font when the engine starter is engaged. The timer counts up from zero when the starter is first activated and continues to count until the starter is deactivated. If the timer exceeds 90 seconds, it will change to yellow font.



## Beta Display

A green B is displayed inset of the HP dials when the blade angle of the engine's propeller is between 23 and 10.5 degrees and the aircraft's airspeed is below 145 TAS. This indication signifies that beta range is available on the respective propeller.



## Engine Box

A white, rectangular box is displayed around all nine of an engine's parameters during either of the the following scenarios:

1. The start sequence is active.
2. The engine has failed and has not been secured by the crew via the fire handle.



## Horsepower Dial

Engine Horsepower (HP) is displayed via a circular dial with an inset analog pointer, and an accompanying digital readout. Reference symbols are located around the dial, which include the horsepower index and maximum continuous power index. The readout is shown in increments of 10 horsepower, with green tick marks spaced 1,000 HP apart around the inside edge of the dial.



A white index line is placed on the outside edge of the HP dial which indicates the Maximum Continuous Power (MCP) for the engine. MCP is continuously updated and varies based on altitude, temperature, and bleed air load.

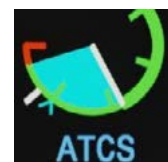
## Horsepower Index and Readout

A cyan caret is placed on the outside edge of the HP dials at the reference horsepower value selected via the REF/MODE panel. Between the HP dials for engines 2 and 3, a cyan readout located between engine 2 and 3's HP dials displays the selected reference horsepower value.



## ATCS Pie Wedge

A blue ATCS pie wedge is displayed on engine 1 or 4's HP dial when thrust limiting is active. The wedge begins at the MCP index and extends around the dial to the horsepower pointer.



## MGT Dial

Measured Gas Temperature (MGT) is displayed via a circular dial with an inset analog pointer, and an accompanying digital readout. The readout is shown in increments of 1°C.



## NG Dial

Gas Generator (NG) speed is displayed via a circular dial with an inset analog pointer, and an accompanying digital readout. The readout is shown in increments of 1%.



## NP and Fuel Flow

Propeller RPM (NP) is expressed as a percentage of the propeller's normal rated operated speed.

NP	99
FF	852

Engine Fuel Flow (FF) is displayed in increments of 1 Pound per Hour (PPH).

## Oil Indications

**Gearbox Oil Pressure (G PSI):** Displayed in increments of 1 PSI and indicates the oil pressure within the reduction gearbox.

G PSI	186
E PSI	65.5
TEMP	70
QTY	11.0

**Engine Oil Pressure (E PSI):** Displayed in increments of 1 PSI and indicates the oil pressure within the power section of the engine.

**Oil Temperature (TEMP):** Displayed in increments of 1°C and indicates the temperature of oil being supplied to the engine.

**Oil Quantity (QTY):** Displayed in increments of 0.1 gallons and indicates the quantity of oil in the engine's oil tank.

## ACAWS Message Stack

The ACAWS Message Stack consists of eight horizontal rows, each containing two message cells. Textual ACAWS messages are displayed in the cells via a priority hierarchy. The bottom right cell is reserved for the stored/overflow field, meaning a total of fifteen messages can be displayed to the crew at a time.

AC	
SMOKE UNDER DECK	
SMOKE L FWD CGO	
SMOKE AFT CGO	
SMOKE R FWD CGO	
AIL UTIL SWITCH OFF	
AIL BSTR SWITCH OFF	
RUD UTIL SWITCH OFF	
RUD BSTR SWITCH OFF	

The stack is sorted via severity, then recency: warnings will be placed on top of caution messages, and caution messages on top of advisories. When a new ACAWS message is generated, the message will be placed at the top of its category: the most recent warning will be displayed over any other warnings already present, and the same is true for cautions and advisories. New messages are displayed in inverse video for a period of ten seconds to get the crew's attention. Once this ten-second timer expires, the message will return to normal video.

## ACAWS Overflow

In the event that more than fifteen ACAWS messages are active at a time, the lowest-priority messages are pushed to the ACAWS Overflow HDD page. Messages on the overflow page will return to the stack as higher-priority messages are cleared.



## ACAWS Message Store/Recall

ACAWS messages can be manually removed from the stack using the AMU ACAWS page. When a message is selected via the AMU, the entire message cell will be shown in cyan inverse video; when the message is stored, it will disappear from the stack and the cell will return to normal video.

AIL UTIL SWITCH OFF  
AIL BSTR SWITCH OFF

Stored messages can be recalled to the stack via the same AMU page. Recalled messages are placed in their original positions within the stack.

## Store/Overflow Field

The bottom right of the ACAWS Message Stack features a yellow field consisting of a slash with two dashes on either side, and a white field of the same composition.

--/7 4/2

These fields display the number of ACAWS messages that have been stored by the crew, or are present on the overflow page. The yellow field is reserved for cautions, while the white field is reserved for advisories. Since warning messages are placed on top of the stack and cannot be stored, there is no stored/overflow field for them.

The field to the left of the slash displays the number of messages for each category that have been pushed to the ACAWS Overflow HDD page. The field to the right of the slash displays the number of messages that have been removed from the stack and stored by crew input.

## Engine Instrument Readout Colors

Indicator	Normal Range (White)	Transient Range (Yellow)	Warning Range (Red)
Horsepower	-1,000 to 4,760, <b>or</b> MCP + 80 for less than 5 minutes	MCP + 80 for more than 5 minutes, <b>or</b> 4,780 to 4,840 for less than 5 seconds	4,780 to 4,840 for more than 5 seconds, <b>or</b> greater than 4,860
Start Timer	Less than 90 seconds	90 seconds or greater	N/A
MCP Timer	0 to 5 minutes	Greater than 5 minutes	N/A
MGT (in °C)	-75° to 833°	834° to 852°	Greater than 852°
NG	0 to 101%	102 to 103%	103% or greater
NP	LSGI: 71 to 75% HSGI: 99 to 101%	0 to 70% (except during start), 76 to 98%, <b>or</b> 102 to 105%	106% or greater
G PSI (Hotel Mode)	15 PSI or greater	N/A	Less than 15 PSI
G PSI (LSGI)	110 to 210 PSI	Less than 110, <b>or</b> greater than 210 PSI	N/A



# Heads Down Display

HSGI	110 to 250 PSI	N/A	Less than 110, <b>or</b> greater than 250 PSI
E PSI	40 to 90 PSI	35 to 39 PSI, <b>or</b> greater than 90 PSI	0 to 34 PSI
TEMP (in °C)	Less than 0° with HP at idle or lower, <b>or</b> less than 45° with HP at 1,000 or less, <b>or</b> 45° to 60° at HP greater than 1,000 for less than or equal to 5 minutes, <b>or</b> 60° to 85°	Less than 0° at HP greater than idle, <b>or</b> less than 45° at HP greater than 1,000, <b>or</b> 45° to 60° at HP greater than 1,000 for 5 minutes, <b>or</b> 86° to 93° for less than 5 minutes	86° to 93° for more than 5 minutes, <b>or</b> greater than 93°
QTY	4 to 14.1 gallons	3.9 gallons or less	N/A



## System Status

The System Status page displays information related to the electrical, hydraulic, oil fuel, and oxygen systems.

Like the Engine Display, the numerical fields are presented in white font when the value is within the normal range, and yellow or red font when in the abnormal range.

## Electrical System Indications

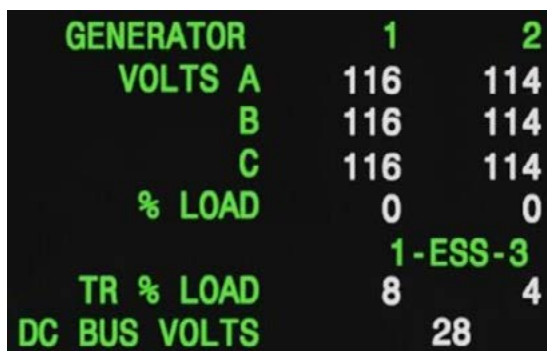
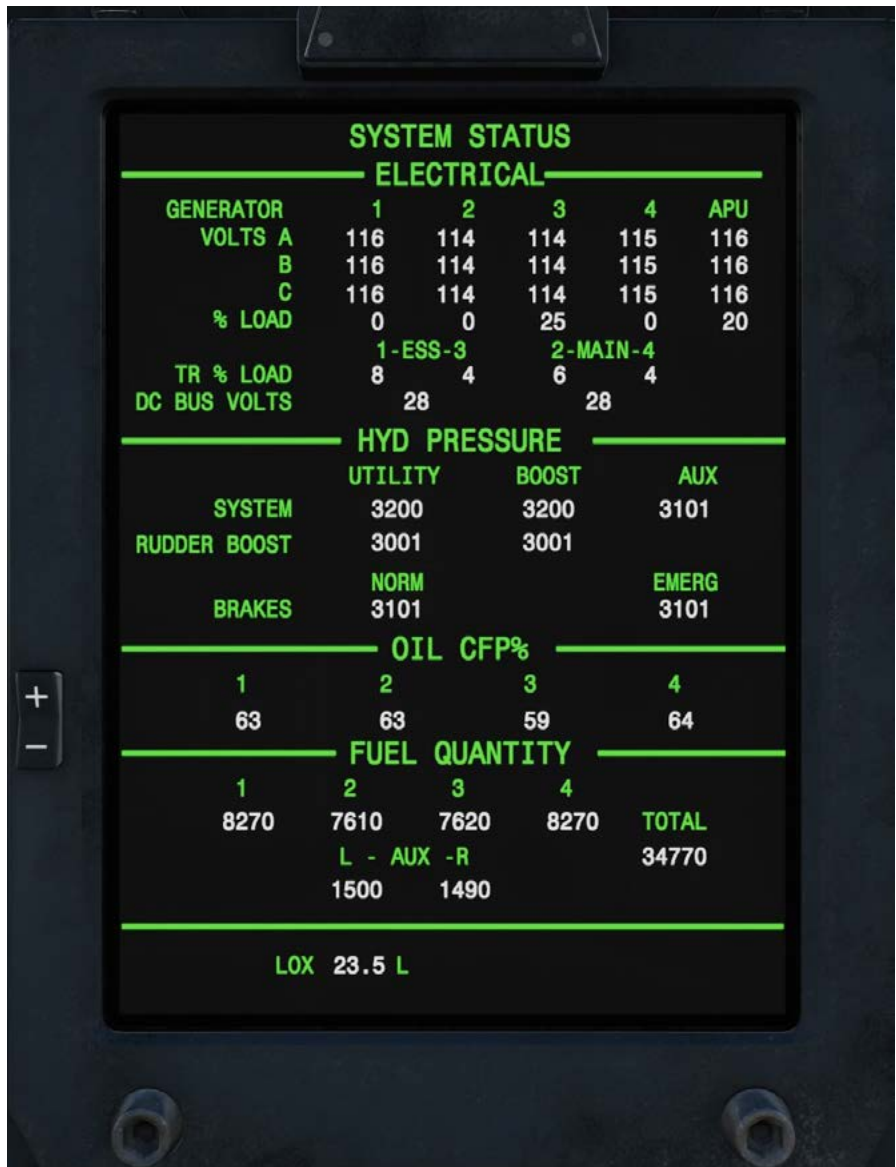
Information for the four engine generators, and the APU, is presented under the ELECTRICAL header.

**VOLTS (A, B, C):** Displays the voltage of each generator phase. When the respective generator switch is OFF, all three voltage values will be removed and "OFF" in white will be displayed in the VOLTS A field.

**% LOAD:** Displays the electrical load applied to the respective generator. The indicated percentage is referenced to the generator's maximum output capacity.

**TR % LOAD:** Displays the electrical load applied to each transformer rectifier unit. The indicated percentage is referenced to the TR's maximum output capacity.

**DC BUS VOLTS:** The essential DC bus voltage is displayed between the load indications for TR 1 and TR 3, while the main DC bus voltage is displayed between TR 2 and TR 4's loads.



## Hydraulic System Indications

**SYSTEM UTILITY:** Displays the pressure in the utility hydraulic system, in PSI.

	UTILITY	BOOST
SYSTEM	3200	3200
RUDDER BOOST	3001	3001

**SYSTEM BOOST:** Displays the pressure in the boost hydraulic system, in PSI.

**SYSTEM AUX:** Displays the pressure in the auxiliary hydraulic system, in PSI.

**UTILITY RUDDER BOOST:** Displays the utility hydraulic system pressure reaching the rudder booster assembly, in PSI.

**BOOST RUDDER BOOST:** Displays the boost hydraulic system pressure reaching the rudder booster assembly, in PSI.

## Brake System Indications

**BRAKES NORM:** Displays the pressure in the normal brake system, in PSI.

	NORM
BRAKES	3101

**BRAKES EMERG:** Displays the pressure in the emergency brake system, in PSI.

## Oil CFP%

Displays the position of the oil cooler flap for each engine. 0% is fully closed, while 100% is fully open.

1	2
63	63

## Fuel Quantity

Displays the fuel quantity, in pounds, for each individual fuel tank. When external tanks are installed, two additional quantity fields will be added to the page.

1	2
8270	7610

## LOX

Displays the volume of liquid oxygen, in liters, present in the converter.

LOX	23.5 L
-----	--------



## System Status Readout Colors

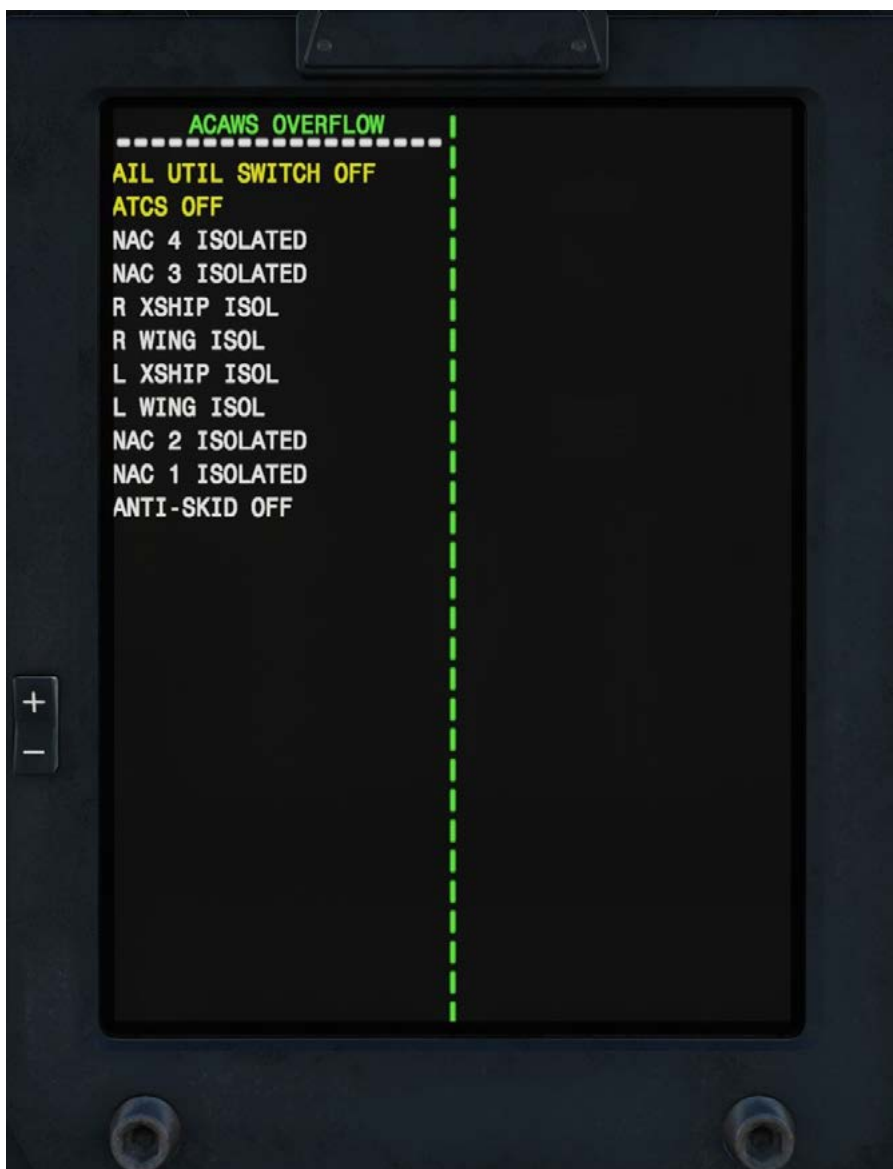
Indicator	Normal Range (White)	Transient Range (Yellow)	Warning Range (Red)
VOLTS	108 to 117V	100 to 107V, <b>or</b> 118 to 124V	0 to 99V, <b>or</b> greater than 125V
% LOAD	Less than or equal to 150%	151 to 187% for less than 5 minutes	151 to 187% for greater than 5 minutes, <b>or</b> greater than 187%
TR % LOAD	0 to 110%	Between 110 and less than or equal to 150% for less than 5 minutes	Greater than 110% for more greater than 5 minutes, <b>or</b> greater than 150%
DC BUS VOLTS	25 to 29V	30 to 31V, <b>or</b> 20 to 24V	Less than 19V, <b>or</b> greater than 32V
HYD UTILITY/BOOST	2,900 to 3,200 PSI	2,550 to 2,890 PSI, <b>or</b> 3,210 to 3,500 PSI	0 to 2,540 PSI, <b>or</b> greater than 3,510 PSI
HYD AUX	2,760 to 3,200 PSI	2,250 to 2,750 PSI, <b>or</b> 3,210 to 3,500 PSI	0 to 2,240 PSI, <b>or</b> greater than 3,510 PSI
RUDDER BOOST (0 to 15% flaps)	1,100 to 1,390 PSI	1,400 to 1,600 PSI	0 to 1,090 PSI, <b>or</b> greater than 1,610 PSI
RUDDER BOOST (15 to 100% flaps)	2,900 to 3,200 PSI	2,550 to 2,890 PSI, <b>or</b> 3,210 to 3,500 PSI	0 to 2,540 PSI, <b>or</b> greater than 3,510 PSI
BRAKES NORM	2,900 to 3,200 PSI	2,250 to 2,890 PSI, <b>or</b> 3,210 to 3,500 PSI	0 to 2,240 PSI, <b>or</b> greater than 3,510 PSI
BRAKES EMERG	2,900 to 3,300 PSI	2,250 to 2,890 PSI, <b>or</b> 3,310 to 3,500 PSI	0 to 2,240 PSI, <b>or</b> greater than 3,510 PSI
LOX	5 to 25 liters	2.5 to 5 liters	0 to 2.5 liters



## ACAWS Overflow

The ACAWS Overflow page is an extension of the ACAWS message stack on the Engine Display and stores messages that did not fit within the 19 message cells.

The page handles messages in the same way as the engine display. When messages on the Engine Display begin to clear, the overflow stack reduces in size.



## Overview

The Communications/Navigation/Identification-Management Unit (CNI-MU) is the interface to the heart of the C-130J. Using the CNI, the crew can accomplish tasks ranging from changing a radio frequency to computing takeoff and landing performance, defining a flight plan to creating an airdrop, and everything in between. The CNI can be thought of as two separate computers, unified by a single interface: these two computers are the Signal Processor (SP) and the Mission Computer (MC).

The SP is in control of the communications, navigation, and identification equipment, while the MC handles functions such as CARP, rendezvous, and LZs. For redundancy, two SPs and two MCs are present: SP1 and MC1 drive the pilot's CNI, while SP2 and MC2 drive all other CNI units.

## CNI Interaction

The CNI is interacted with via Line Select Keys (LSKs), mode keys, and the alphanumeric keypad.

### 1. Line Select Keys

Six LSKs are located on either side of the display screen. Keys on the left side of the display are referred to as L1-L6, while keys on the right side are R1-R6.



## 2. Mode Keys

Labeled mode keys below the display screen allow for quick navigation to the most-used CNI pages. PREV PAGE and NEXT PAGE are used to cycle through page structures, when applicable.

Mode Key	Branching CNI Page
COMM TUNE	COMM TUNE INDEX
NAV TUNE	NAV TUNE INDEX
IFF	IFF 1/3
NAV CTRL	INAV 1 (or 2) CTRL SOLN
MSN	MISSION
DIR INTC	DIR INTC
TOLD	TOLD INDEX
INDX	INDEX 1/2
MC INDX	MSN CMPTR INDEX
CAPS	CAPS COMMAND
LEGS	LEGS 1
MARK	MARK POSITION

## 3. Brightness Rocker

The brightness rocker allows for the CNI's display brightness to be manually adjusted.

## 4. Annunciator Lights

Four annunciator lights are located on the outer edges of the alphanumeric keypad, two on each side. These lights include Display (DSPY), Message (MSG), Fail (FAIL), and Offset (OFST).

**DSPY:** Illuminates when the display is showing information that is not controlling the aircraft, such as the second page of the active flight plan. The light illuminates when the following items are displayed on the CNI:

- Active flight plan pages other than page two.
- A stored flight plan page.
- The SID REVIEW and STAR REVIEW pages.
- An intercept waypoint on the active leg when being defined.

**MSG:** Illuminated any time a CNI message is displayed in the scratchpad. This light is often accompanied by the "CNI MSG" ACAWS advisory.

**FAIL:** Illuminates when the respective CNI is not receiving data from the SP or MC.

**OFST:** Not implemented.



## 5. Alphanumeric Keypad

The alphanumeric keypad is used to input characters into the CNI's scratchpad. Special characters are included on the keypad, including a decimal (.), minus symbol (-), and slash (/). While a plus (+) symbol is labeled on the minus key, it is not possible to enter a plus symbol into the scratchpad. This is because all numerical scratchpad entries are assumed to be positive numbers, unless preceded by the minus symbol.

Additional function keys are provided around the keypad. These keys are used to remove data from the CNI scratchpad, execute flight plan modifications, and adjust the display brightness.

**CLR:** The Clear (CLR) key is used to remove characters and CNI messages from the scratchpad. Each press of the key removes one character from the scratchpad; holding the key for greater than 3 seconds removes the entire scratchpad contents. CNI messages can be removed with a single key press.

**DEL:** The Delete (DEL) key inserts a right-justified **"\*DELETE\*"** prompt into the scratchpad. When used in conjunction with an LSK, data can be removed from CNI page fields that accept manual inputs.

Note: Using **\*DELETE\*** on a data field will return that field to its default value, if applicable.

**EXEC:** The Execute (EXEC) key becomes active when the green light above it, known as the EXEC light, is illuminated. The EXEC light illuminates when a change is made to the lateral or vertical profile of the flight plan; pressing the EXEC key will execute the modification, and extinguish the EXEC light.

## CNI Scratchpad

Data entered by the numeric keyboard is displayed in a 25-character wide scratchpad at the bottom of the display. When used in conjunction with an LSK, scratchpad entries can be entered into fields on a CNI page. Since the SP and MC are different computers, pages driven by SP and MC use independent scratchpads. This means that the scratchpad may clear when navigating between pages, depending on which computer drives that page.

## LSK Downselect

Certain datafields throughout the CNI have a "downselect" capability. When the field is selected using an LSK with an empty scratchpad, the field's data will be copied into the scratchpad. Fields that have this functionality will be denoted as such in the CNI page descriptions.



When the scratchpad is close to being full, a priority hierarchy is used to determine which inputs are displayed, and which are hidden. The “\*DELETE\*” prompt has the highest display priority, followed by CNI messages, with normal entries at the bottom. If the “\*DELETE\*” prompt or a CNI message will cause overlap with a scratchpad entry, the scratchpad contents are truncated. Clearing the “\*DELETE\*” prompt or CNI message will result in the full scratchpad contents being displayed again.

[illegible]

## CNI Conventions

### Large Font/Small Font

Every CNI page uses two different sizes of font to differentiate between computed values and crew input. Large font is used for data input by the crew, page headers, active branching prompts, and active selections. Small font is used for system-computed data, inactive branching prompts and inactive selections.

### Inverse Video

Inverse video is the technical term for what many would refer to as highlighting. When a text block or selection is “inversed”, the text and background color flip to their inverse state: green text turns black, and a black background turns green. Inverse video is used in various places around the CNI and will be explained in more detail where applicable.

### Input Sanitization

Input sanitization is the CNI’s method for ensuring valid data is entered into datafields. Sanitization is accomplished via two primary methods: pre-input and post-input.

Pre-input sanitization is utilized by MC pages and prohibits certain characters from being input into the scratchpad, depending on the page’s datafields. For example, an MC page that only contains numerical fields will not allow for an alphabetic character to be entered into the scratchpad, as it cannot be used in a valid input.

Post-input sanitization is utilized by SP pages and allows for any character to be input into the scratchpad. Using this method, the CNI only checks for a valid input after an LSK action has been performed. If an LSK is used while the scratchpad contains an invalid input for the selected field, no input will be accomplished and the CNI message “INVALID ENTRY” will be generated to alert the crew of the invalid action.

### Branching Prompts

Branching prompts are used to navigate or “branch” to a different page within the CNI. These prompts can be identified by a page title that contains a left or right caret pointing at the adjacent LSK. When the title and arrow are displayed in large font, the prompt is active and can be used; when they are displayed in small font, the prompt is inactive and cannot be used.

### INAV Identifier

An INAV identifier is present at the top left corner of SP pages and indicates which INAV control solution the page is using. A “1” represents INAV1, and a “2” represents INAV2. When the number is in inverse video, the page’s INAV solution matches the INAV SHIP SOLN selected on the NAV-SELECT AMU page.



## Page Headers

The headers at the top of each CNI page share common conventions. The INAV identifier will be displayed in the top left corner, if applicable. Pages related to the route will include prefixed labels that include ACT, MOD, and blank. If there is no label shown, the route has not been activated. MOD indicates that a provisional flight plan exists and has not been executed yet. ACT shows that the flight plan is active and not in standby. A postfix route identifier will also be applied to show whether the page is associated with route 1 or route 2.

At the top right corner, page counters will be shown if the page structure contains more than one page. The number to the left of the slash indicates which page is currently being shown, with the right number being how many pages are associated with the function.

## Dashes and Boxes

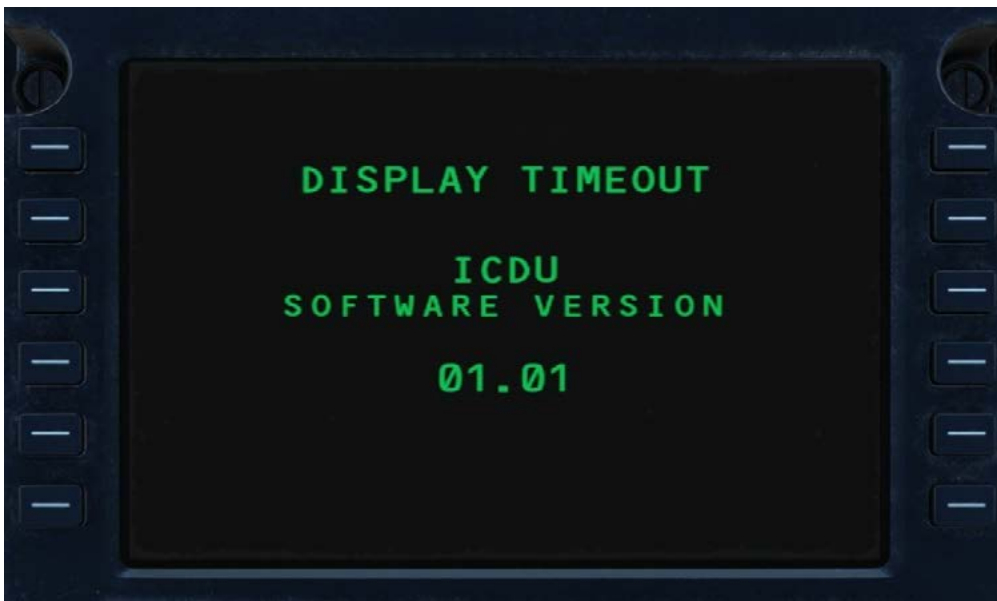
Throughout the CNI, three different ways of denoting data entry fields are utilized: dashes, box prompts, and default values. Fields that have a default value are considered to be filled already, and other functions that rely on that field having an entry will work normally. For fields that do not have a default value, dashes and box prompts are presented.

Box prompts signify that a value must be entered by the user in order for a dependency to operate, whether that be a calculation, function, or display.

Dashes represent that data entry is optional and not required. In some cases, dashed fields will be replaced with a computed value when other input requirements are met.

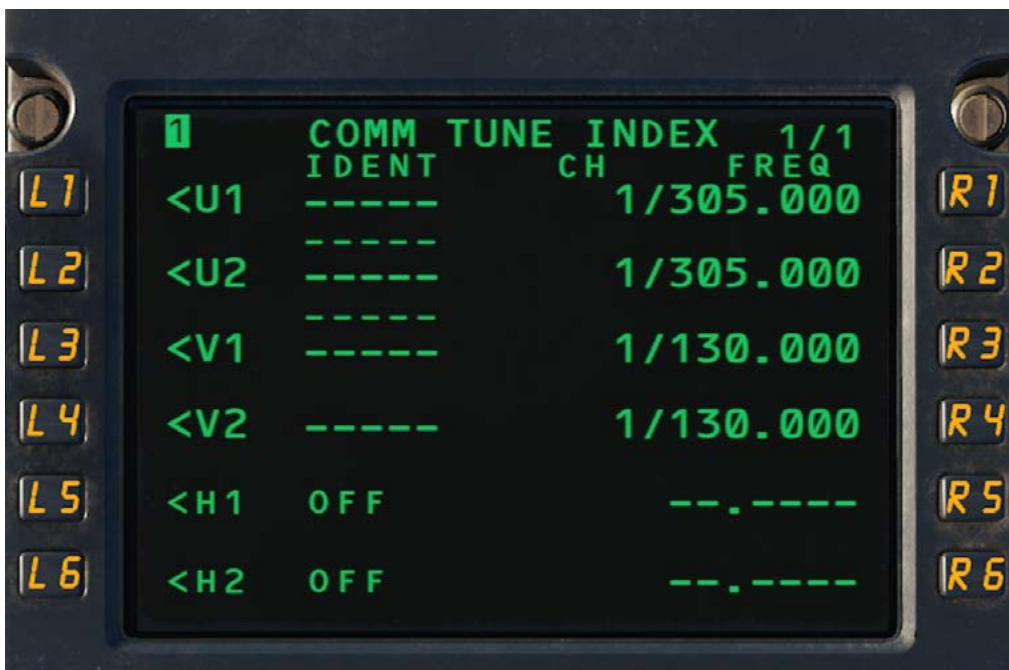
## Display Test Page

When power is first applied to the CNI-MU, the screen will briefly display a test page.



## COMM TUNE INDEX

Displays the tuned frequency and preset/identifier for each communication radio.



On the left side of the page, each radio has an IDENT field that displays the preset identifier of the tuned frequency, if one has been specified; otherwise, the field displays dashes. If the radio is unpowered, "OFF" is displayed in the IDENT field and the radio branching prompts are displayed in small font. Tuning a frequency into the radio will power it on and change the branching prompts to large font.

On the right side of the page, the active and standby frequencies for each radio are displayed. When a valid frequency is present in the scratchpad, using the LSK adjacent to the respective radio will tune the radio and move the previous primary frequency to the standby field. If the frequency is associated with a preset, the preset channel will be displayed to the left. Using an LSK with a blank scratchpad will swap the radio's standby frequency into the active frequency.

Tuning source identifiers are shown for each radio to the left of the preset channel field. The following identifiers can be displayed:

Identifier	Meaning
R (remote)	The radio was tuned using the CNI.
E (external)	The radio was tuned using the CNBP.



**L1:** Branches to COMM TUNE U1.

**L2:** Branches to COMM TUNE U2.

**L3:** Branches to COMM TUNE V1.

**L4:** Branches to COMM TUNE V2.

**L5:** Branches to COMM TUNE H1.

**L6:** Branches to COMM TUNE H2.

**R1:** Used to manage frequencies for the UHF1 radio.

**R2:** Used to manage frequencies for the UHF2 radio.

**R3:** Used to manage frequencies for the VHF1 radio.

**R4:** Used to manage frequencies for the VHF2 radio.

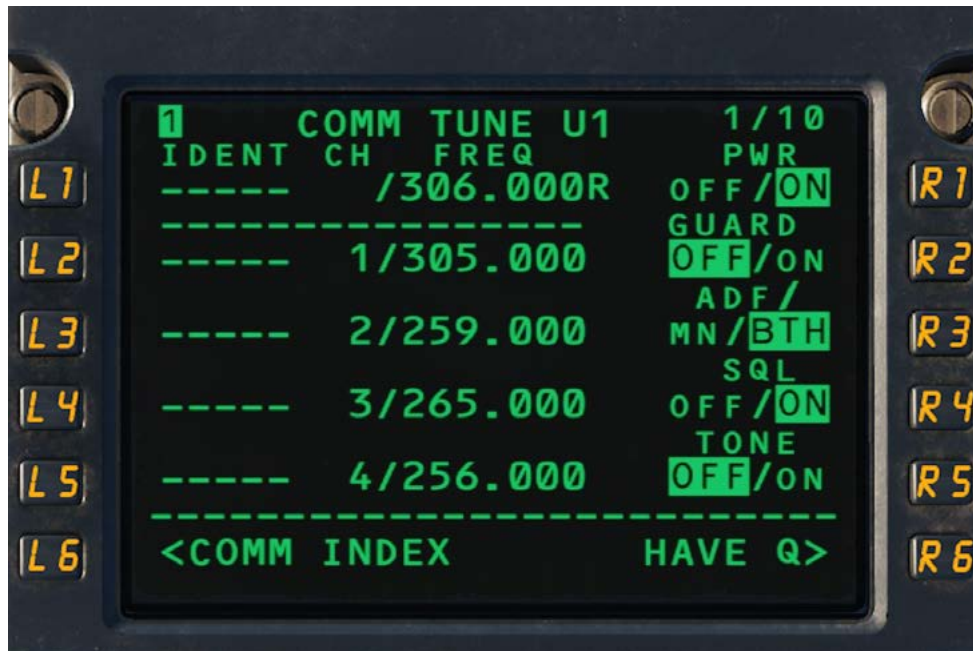
**R5:** Used to manage frequencies for the HF1 radio.

**R6:** Used to manage frequencies for the HF2 radio.



## COMM TUNE U1

Allows for the UHF1 radio to be configured.



**L1:** Displays the ident, channel preset identifier, active frequency, and frequency tuning source identifier of the UHF1 radio. The radio can be tuned by inputting the desired frequency, or by an ident or channel preset identifier associated with a frequency. Using L1 with a blank scratchpad will downselect the frequency into the scratchpad.

**L2-L5:** Displays the ident, preset identifier, and frequency for the frequencies stored in the preset list.

**L6:** Branches to COMM TUNE INDEX.

**R1:** Toggles the UHF1 radio power.

**R2:** Toggles the emergency guard frequency. When ON is selected, the radio is tuned to the emergency UHF frequency of 243.000 and GUARD is displayed in inverse video in the IDENT field.

**R3:** Selects whether the main or guard receiver is used in conjunction with the radio's transmitter.

- ADF: The guard receiver is disabled and the main receiver is switched to the UHF direction finding antenna.
- MN: The guard receiver is inoperative.
- BTH: The guard receiver monitors the guard frequency.

**R4:** Toggles the squelch setting.

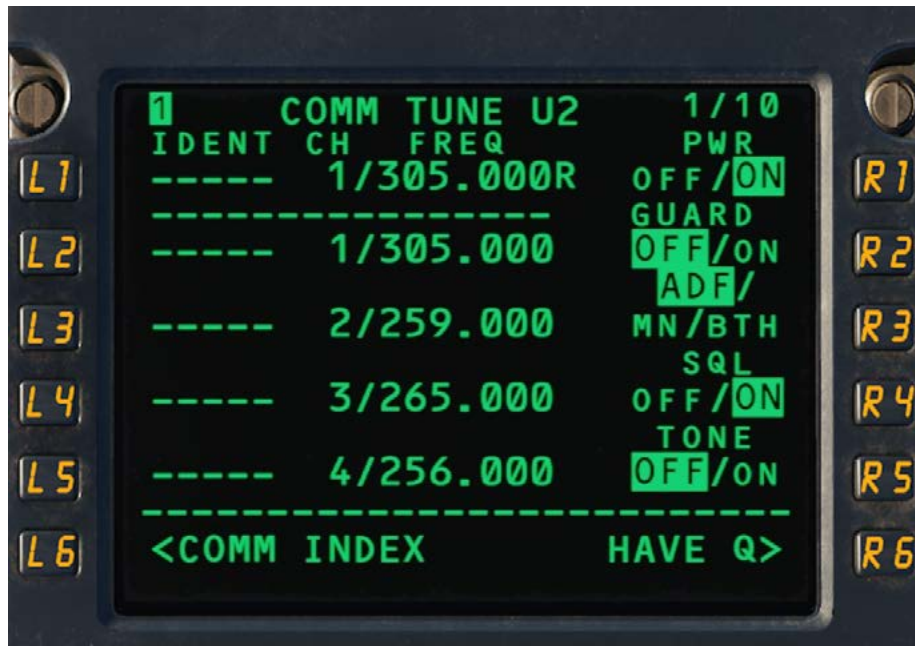
**R5:** Toggles the UHF homing tone. When tone is selected to ON, a 1,020hz frequency will be transmitted by the UHF radio.

**R6:** No function.



## COMM TUNE U2

Allows for the UHF2 radio to be configured.



**L1:** Displays the ident, channel preset identifier, active frequency, and frequency tuning source identifier of the UHF2 radio. The radio can be tuned by inputting the desired frequency, or by an ident or channel preset identifier associated with a frequency. Using L1 with a blank scratchpad will downselect the frequency into the scratchpad.

**L2-L5:** Displays the ident, preset identifier, and frequency for the frequencies stored in the preset list.

**L6:** Branches to COMM TUNE INDEX.

**R1:** Toggles the UHF2 radio power.

**R2:** Toggles the emergency guard frequency. When ON is selected, the radio is tuned to the emergency UHF frequency of 243.000 and “GUARD” is displayed in inverse video in the IDENT field.

**R3:** Selects whether the main or guard receiver is used in conjunction with the radio’s transmitter.

- ADF: The guard receiver is disabled and the main receiver is switched to the UHF direction-finding antenna.
- MN: The guard receiver is inoperative.
- BTH: The guard receiver monitors the guard frequency.

**R4:** Toggles the squelch setting.

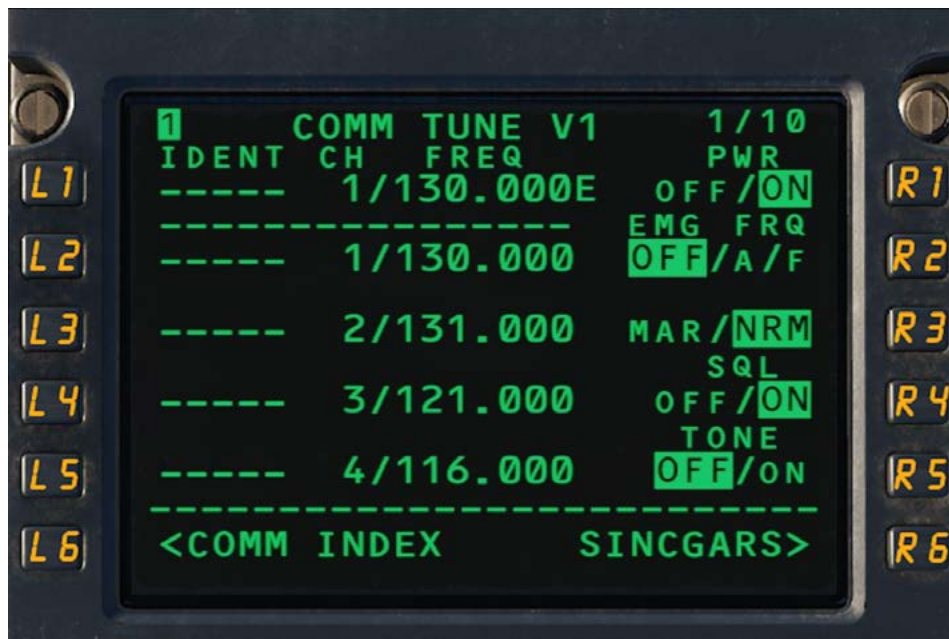
**R5:** Toggles the UHF homing tone. When tone is selected to ON, a 1,020hz frequency will be transmitted by the UHF radio.

**R6:** No function.



## COMM TUNE V1

Allows for the VHF1 radio to be configured.



**L1:** Displays the ident, channel preset identifier, active frequency, and frequency tuning source identifier of the VHF1 radio. The radio can be tuned by inputting the desired frequency, or by an ident or channel preset identifier associated with a frequency. Using L1 with a blank scratchpad will downselect the frequency into the scratchpad.

**L2-L5:** Displays the ident, preset identifier, and frequency for the frequencies stored in the preset list.

**L6:** Branches to COMM TUNE INDEX.

**R1:** Toggles the VHF1 radio power.

**R2:** Tunes the radio to a preset emergency frequency. When A is selected, the AM emergency frequency of 121.5 will be tuned; when F is selected, the FM frequency of 40.5 is tuned.

**R3:** Toggles the radio between maritime (MAR) or normal (NRM) modes.

**R4:** Toggles the squelch setting.

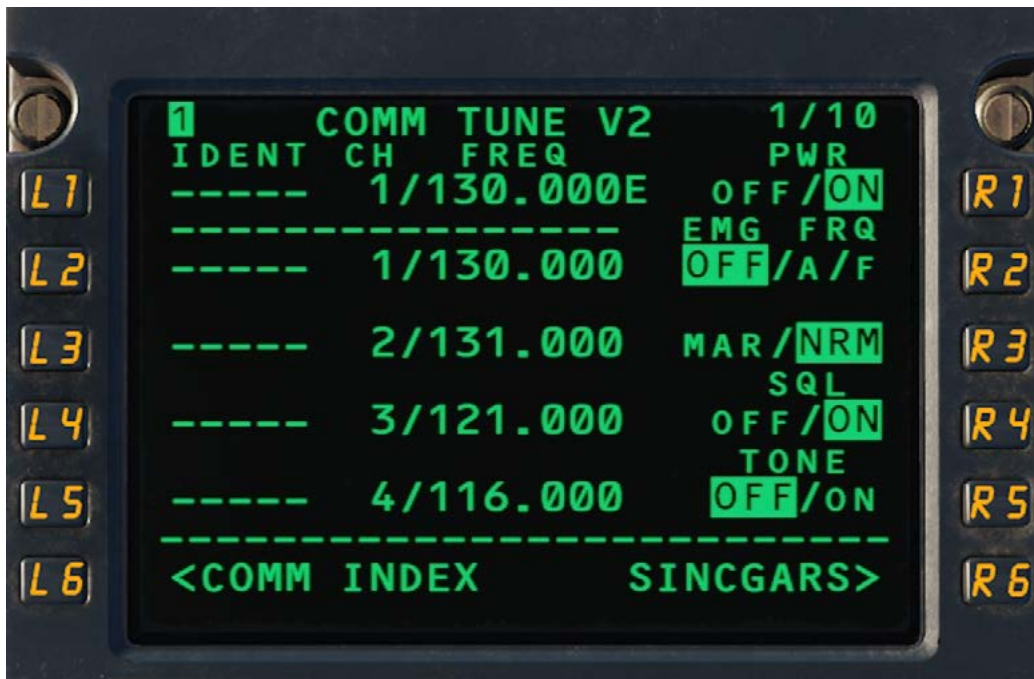
**R5:** Toggles the VHF tone.

**R6:** No function.



## COMM TUNE V2

Allows for the VHF2 radio to be configured.



**L1:** Displays the ident, channel preset identifier, active frequency, and frequency tuning source identifier of the VHF2 radio. The radio can be tuned by inputting the desired frequency, or by an ident or channel preset identifier associated with a frequency. Using L1 with a blank scratchpad will downselect the frequency into the scratchpad.

**L2-L5:** Displays the ident, preset identifier, and frequency for the frequencies stored in the preset list.

**L6:** Branches to COMM TUNE INDEX.

**R1:** Toggles the VHF2 radio power.

**R2:** Tunes the radio to a preset emergency frequency. When A is selected, the AM emergency frequency of 121.5 will be tuned; when F is selected, the FM frequency of 40.5 is tuned.

**R3:** Toggles the radio between maritime (MAR) or normal (NRM) modes.

**R4:** Toggles the squelch setting.

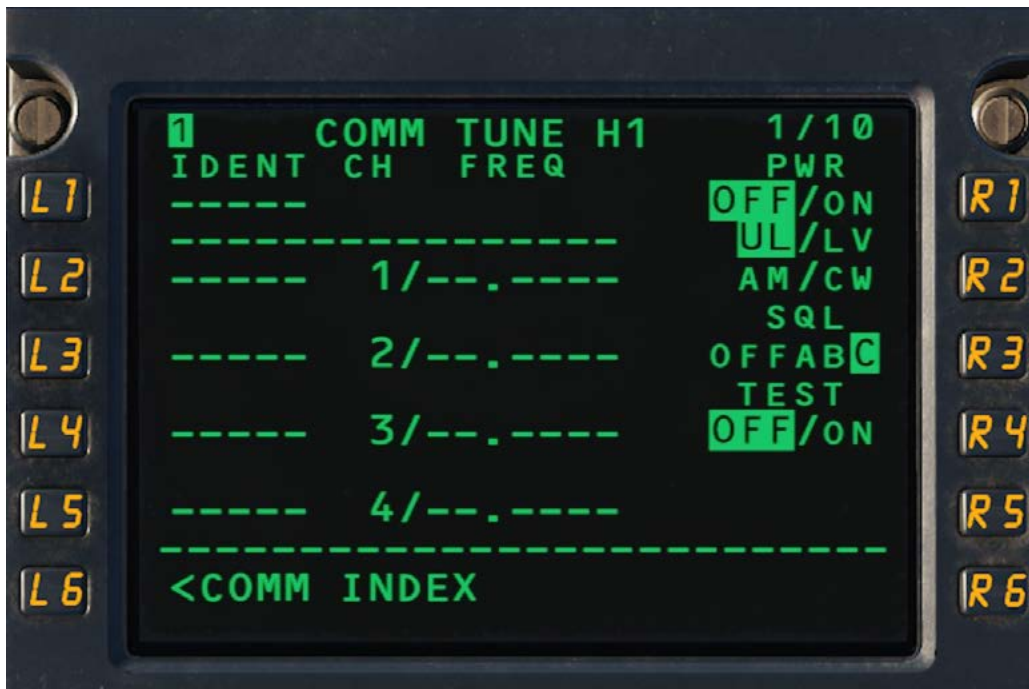
**R5:** Toggles the VHF tone.

**R6:** No function.



## COMM TUNE H1

Allows for the HF1 radio to be configured.



**L1:** Displays the ident, channel preset identifier, active frequency, and frequency tuning source identifier of the HF1 radio. The radio can be tuned by inputting the desired frequency, or by an ident or channel preset identifier associated with a frequency. Using L1 with a blank scratchpad will downselect the frequency into the scratchpad.

**L2-L5:** Displays the ident, preset identifier, and frequency for the frequencies stored in the preset list.

**L6:** Branches to COMM TUNE INDEX.

**R1:** Toggles the HF1 radio power.

**R2:** Allows for selection of the HF1 radio mode. Possible selections include Amplitude Modulation (AM), Continuous Band Wave (CW), Upper Sideband (UV), or Lower Sideband (LV).

**R3:** Selects the level of squelch for the HF1 radio.

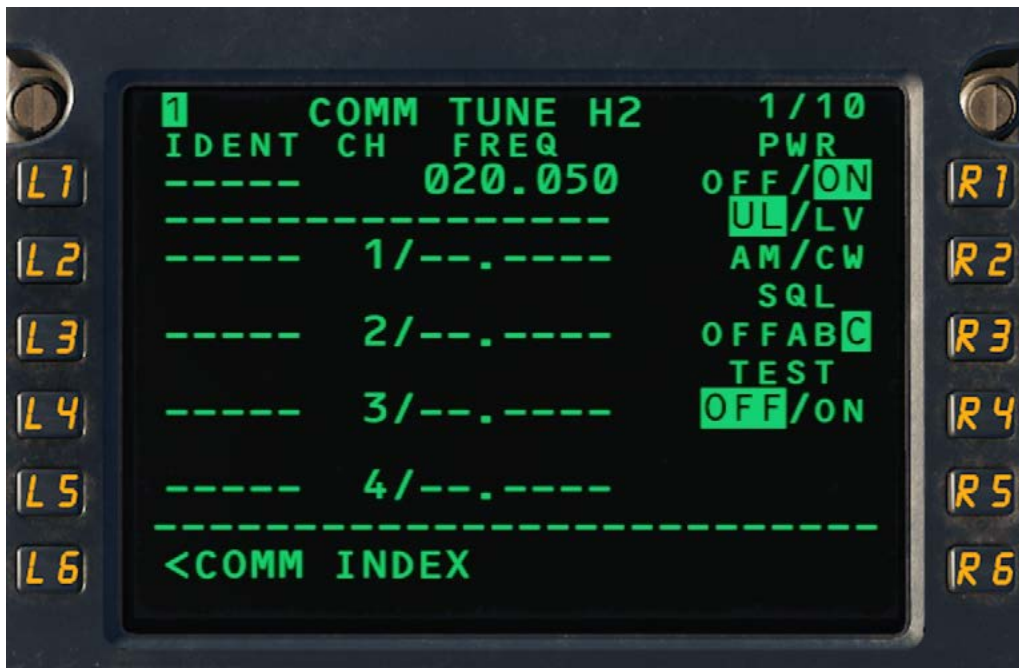
**R4:** No function.

**R5-R6:** Blank.



## COMM TUNE H2

Allows for the HF2 radio to be configured.



**L1:** Displays the ident, channel preset identifier, active frequency, and frequency tuning source identifier of the HF2 radio. The radio can be tuned by inputting the desired frequency, or by an ident or channel preset identifier associated with a frequency. Using L1 with a blank scratchpad will downselect the frequency into the scratchpad.

**L2-L5:** Displays the ident, preset identifier, and frequency for the frequencies stored in the preset list.

**L6:** Branches to COMM TUNE INDEX.

**R1:** Toggles the HF2 radio power.

**R2:** Allows for selection of the HF2 radio mode. Possible selections include Amplitude Modulation (AM), Continuous Band Wave (CW), Upper Sideband (UV), or Lower Sideband (LV).

**R3:** Selects the level of squelch for the HF2 radio.

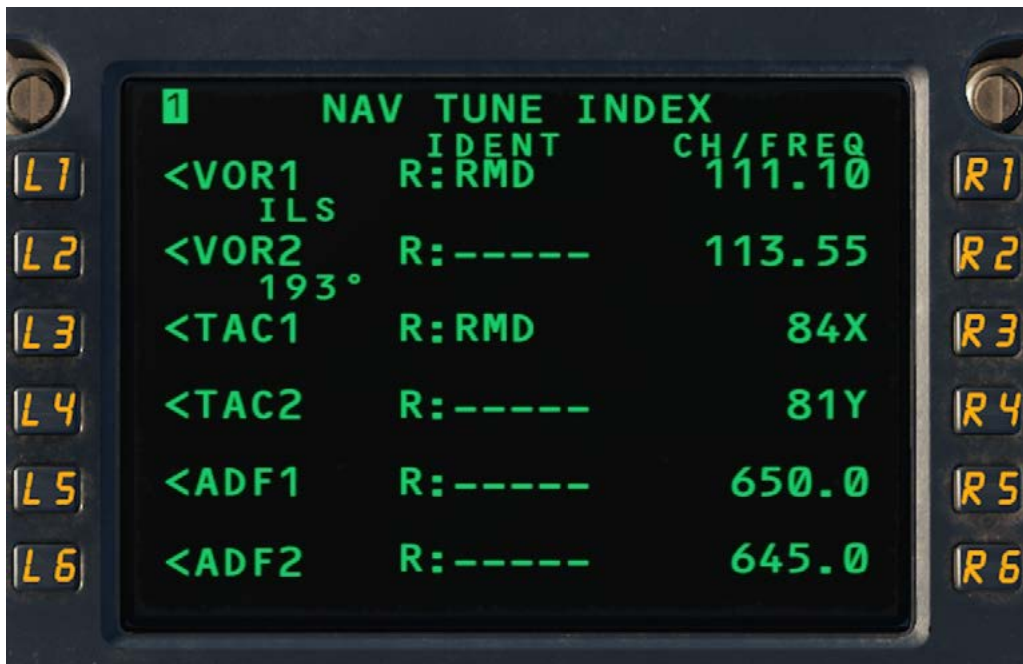
**R4:** No function.

**R5-R6:** Blank.



## NAV TUNE INDEX

Displays the tuned frequency and preset/identifier for each navigation radio.



On the left side of the page, each radio has an IDENT field that displays the navaid identifier of the tuned frequency, if one is defined in the navigation database; otherwise, the field displays dashes. If the radio is unpowered, “OFF” is displayed in the IDENT field and the radio branching prompts are displayed in small font. Tuning a frequency into the radio will power it on and change the branching prompts to large font.

On the right side of the page, the active frequencies for each radio are displayed. When a valid frequency is present in the scratchpad, using the LSK adjacent to the respective radio will tune the radio. Each radio can also be tuned via navaid identifiers; if the entered identifier is not found in the navigation database, the message “NOT IN DATABASE” will be displayed. Using an LSK with a blank scratchpad will downselect the frequency into the scratchpad.

Tuning source identifiers are shown for each radio to the left of the IDENT field. The following identifiers can be displayed:

Identifier	Meaning
R (remote)	The radio was tuned using the CNI.
E (external)	The radio was tuned using the CNBP.

Bearing and distance information for each radio’s tuned navaid is presented below the associated radio’s line, when available. If an ILS frequency is tuned into a VOR radio, “ILS” will be displayed in the bearing field.



**L1:** Branches to NAV TUNE VOR1.

**L2:** Branches to NAV TUNE VOR2.

**L3:** Branches to NAV TUNE TAC1.

**L4:** Branches to NAV TUNE TAC2.

**L5:** Branches to NAV TUNE ADF1.

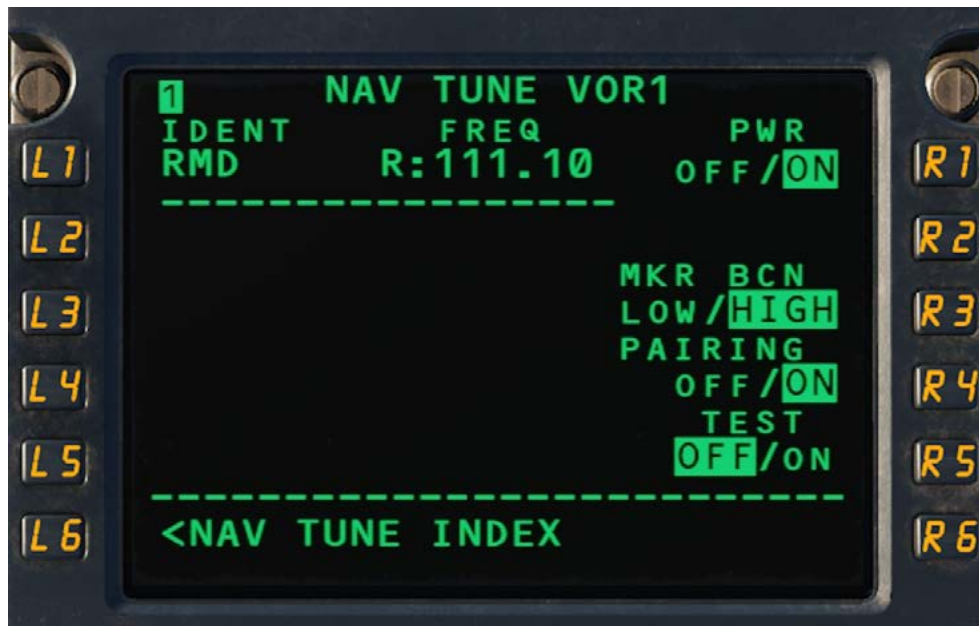
**L6:** Branches to NAV TUNE ADF2.

**R1-R6:** Displays the tuned channel and frequency for the navigation radios.



## NAV TUNE VOR1

Allows for the VOR1 radio to be configured.



**L1:** Allows for the radio to be tuned via a navaid identifier. If the entered navaid is not found in the navigation database, the message “NOT IN DATABASE” will be displayed. If the radio was tuned via a frequency, the identifier of the tuned navaid is displayed, if one is found in the database. Otherwise, the field displays dashes. Using L1 with a blank scratchpad will downselect the navaid identifier or tuned frequency into the scratchpad.

The tuned frequency is displayed to the right of the IDENT field. A tuning source identifier is displayed to the left of the frequency.

**L2-L5:** Blank.

**L6:** Branches to NAV TUNE INDEX.

**R1:** Toggles the VOR1 radio power.

**R2:** Blank.

**R3:** Toggles the marker beacon sensitivity setting.

**R4:** Enables or disables VOR/TACAN pairing. When a VORTAC frequency has been tuned into VOR1 and pairing is set to ON, the TACAN1 radio is automatically tuned to the TACAN channel associated with the VORTAC. When pairing is set to OFF, this behavior does not occur.

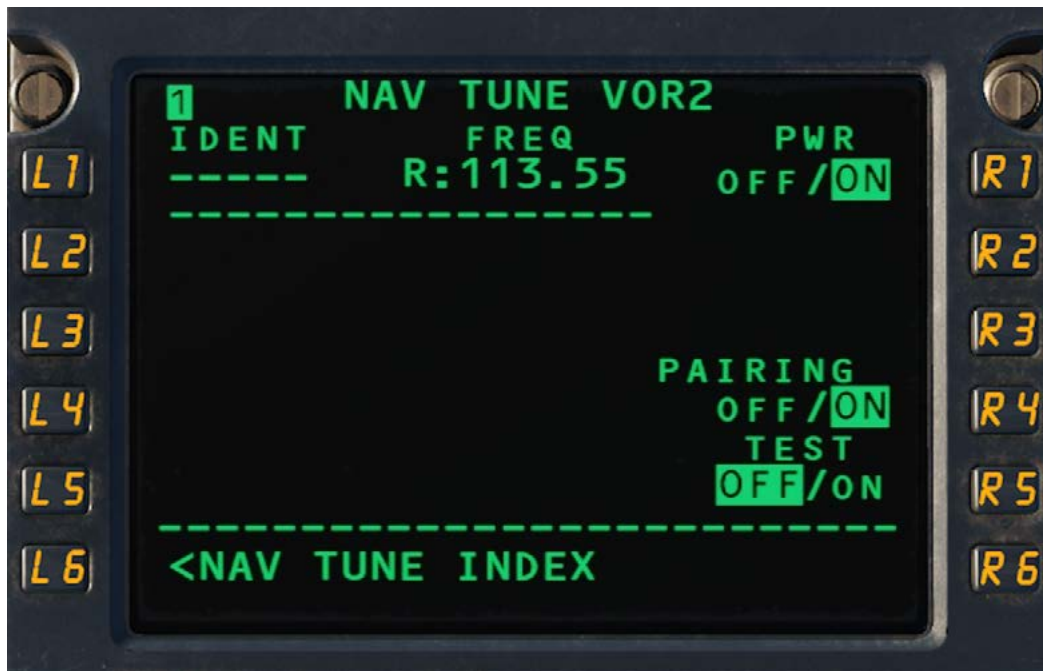
**R5:** No function.

**R6:** Blank.



## NAV TUNE VOR2

Allows for the VOR2 radio to be configured.



**L1:** Allows for the radio to be tuned via a navaid identifier. If the entered navaid is not found in the navigation database, the message “NOT IN DATABASE” will be displayed. If the radio was tuned via a frequency, the identifier of the tuned navaid is displayed, if one is found in the database. Otherwise, the field displays dashes. Using L1 with a blank scratchpad will downselect the navaid identifier or tuned frequency into the scratchpad.

The tuned frequency is displayed to the right of the IDENT field. A tuning source identifier is displayed to the left of the frequency.

**L2-L5:** Blank.

**L6:** Branches to NAV TUNE INDEX.

**R1:** Toggles the VOR2 radio power.

**R2-R3:** Blank.

**R4:** Enables or disables VOR/TACAN pairing. When a VORTAC frequency has been tuned into VOR2 and pairing is set to ON, the TACAN2 radio is automatically tuned to the TACAN channel associated with the VORTAC. When pairing is set to OFF, this behavior does not occur.

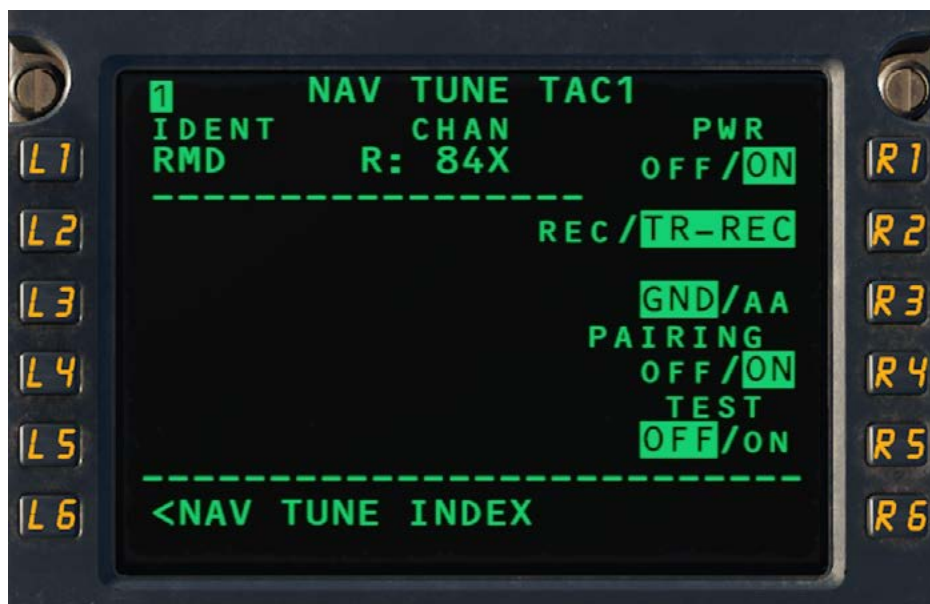
**R5:** No function.

**R6:** Blank.



## NAV TUNE TAC1

Allows for the TAC1 radio to be configured.



**L1:** Allows for the radio to be tuned via a navaid identifier. If the entered navaid is not found in the navigation database, the message “NOT IN DATABASE” will be displayed. If the radio was tuned via a TACAN channel, the identifier of the tuned navaid is displayed, if one is found in the database. Otherwise, the field displays dashes. Using L1 with a blank scratchpad will downselect the navaid identifier or tuned channel into the scratchpad.

The tuned TACAN channel is displayed to the right of the IDENT field. A tuning source identifier is displayed to the left of the channel.

**L2-L5:** Blank.

**L6:** Branches to NAV TUNE INDEX.

**R1:** Toggles the TAC1 radio power.

**R2:** Selects the radio’s transmit state. When set to REC, only bearing information will be received; when set to TR-REC, bearing and distance information will be received.

**R3:** Toggle’s the radio’s operating mode between ground (GND) and air-to-air (AA).

**R4:** Enables or disables VOR/TACAN pairing. When a VORTAC frequency has been tuned into TAC1 and pairing is set to ON, the VOR1 radio is automatically tuned to the TACAN channel associated with the VORTAC. When pairing is set to OFF, this behavior does not occur.

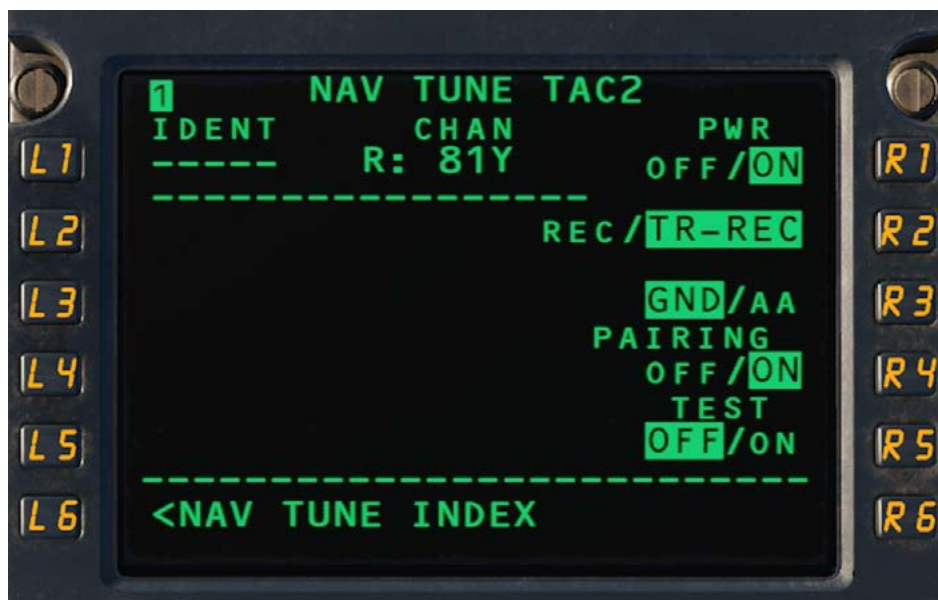
**R5:** No function.

**R6:** Blank.



## NAV TUNE TAC2

Allows for the TAC2 radio to be configured.



**L1:** Allows for the radio to be tuned via a navaid identifier. If the entered navaid is not found in the navigation database, the message “NOT IN DATABASE” will be displayed. If the radio was tuned via a TACAN channel, the identifier of the tuned navaid is displayed, if one is found in the database. Otherwise, the field displays dashes. Using L1 with a blank scratchpad will downselect the navaid identifier or tuned channel into the scratchpad.

The tuned TACAN channel is displayed to the right of the IDENT field. A tuning source identifier is displayed to the left of the channel.

**L2-L5:** Blank.

**L6:** Branches to NAV TUNE INDEX.

**R1:** Toggles the TAC2 radio power.

**R2:** Selects the radio’s transmit state. When set to REC, only bearing information will be received; when set to TR-REC, bearing and distance information will be received.

**R3:** Toggle’s the radio’s operating mode between ground (GND) and air-to-air (AA).

**R4:** Enables or disables VOR/TACAN pairing. When a VORTAC frequency has been tuned into TAC2 and pairing is set to ON, the VOR2 radio is automatically tuned to the TACAN channel associated with the VORTAC. When pairing is set to OFF, this behavior does not occur.

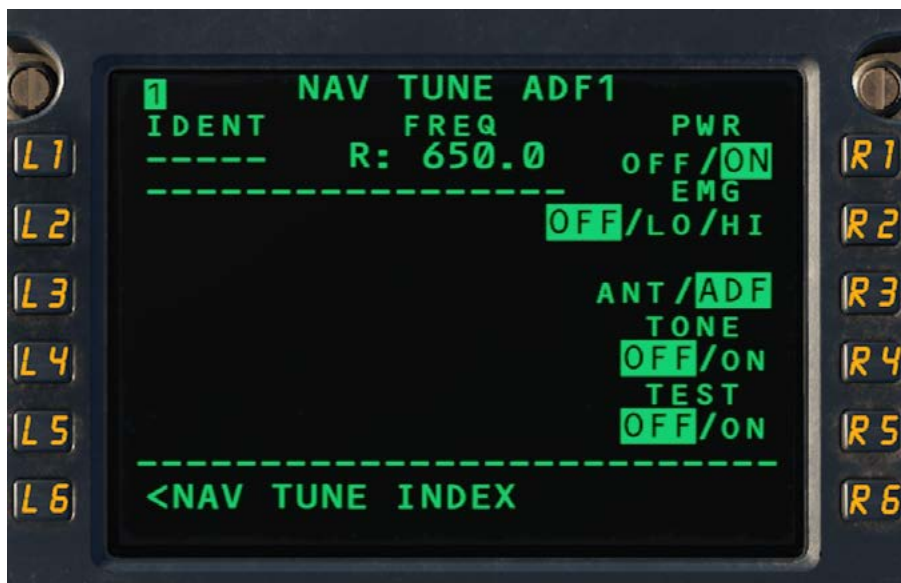
**R5:** No function.

**R6:** Blank.



## NAV TUNE ADF1

Allows for the ADF1 radio to be configured.



**L1:** Allows for the radio to be tuned via a navaid identifier. If the entered navaid is not found in the navigation database, the message “NOT IN DATABASE” will be displayed. If the radio was tuned via a frequency, the identifier of the tuned navaid is displayed, if one is found in the database. Otherwise, the field displays dashes. Using L1 with a blank scratchpad will downselect the navaid identifier or tuned channel into the scratchpad.

The tuned frequency is displayed to the right of the IDENT field. A tuning source identifier is displayed to the left of the frequency.

**L2-L5:** Blank.

**L6:** Branches to NAV TUNE INDEX.

**R1:** Toggles the ADF1 radio power.

**R2:** Tunes the radio to a preset emergency frequency. When LO is selected, the ADF is tuned to 500.0 and “EMGL” will be displayed in inverse video in the IDENT field. When HI is selected, 2182.0 will be tuned and “EMGH” is displayed in the IDENT field.

**R3:** Selects the radio’s operating mode. When ANT is selected, the loop antenna is disabled and no bearing information will be provided. When ADF is selected, the loop antenna is enabled and bearing information becomes available.

**R4:** No function.

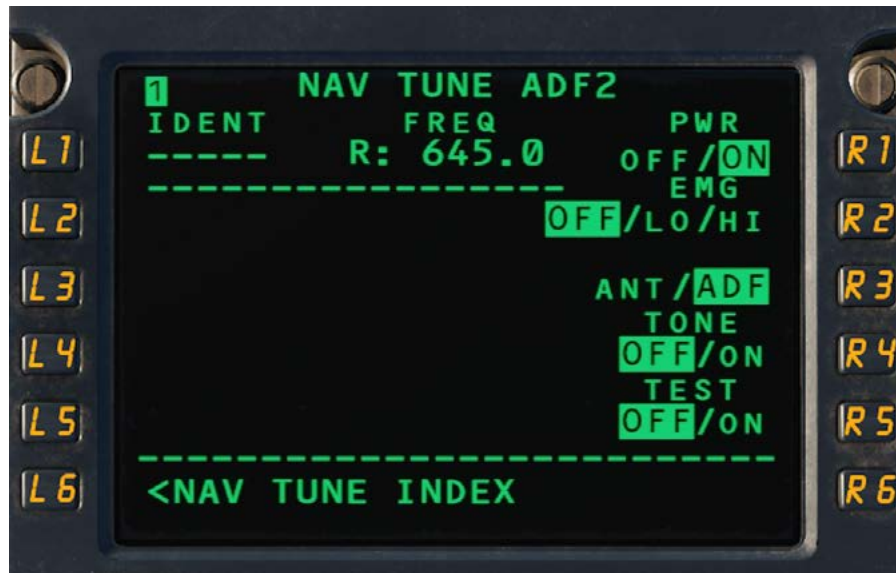
**R5:** No function.

**R6:** Blank.



## NAV TUNE ADF2

Allows for the ADF2 radio to be configured.



**L1:** Allows for the radio to be tuned via a navaid identifier. If the entered navaid is not found in the navigation database, the message “NOT IN DATABASE” will be displayed. If the radio was tuned via a frequency, the identifier of the tuned navaid is displayed, if one is found in the database. Otherwise, the field displays dashes. Using L1 with a blank scratchpad will downselect the navaid identifier or tuned channel into the scratchpad.

The tuned frequency is displayed to the right of the IDENT field. A tuning source identifier is displayed to the left of the frequency.

**L2-L5:** Blank.

**L6:** Branches to NAV TUNE INDEX.

**R1:** Toggles the ADF2 radio power.

**R2:** Tunes the radio to a preset emergency frequency. When LO is selected, the ADF is tuned to 500.0 and “EMGL” will be displayed in inverse video in the IDENT field. When HI is selected, 2182.0 will be tuned and “EMGH” is displayed in the IDENT field.

**R3:** Selects the radio’s operating mode. When ANT is selected, the loop antenna is disabled and no bearing information will be provided. When ADF is selected, the loop antenna is enabled and bearing information becomes available.

**R4:** No function.

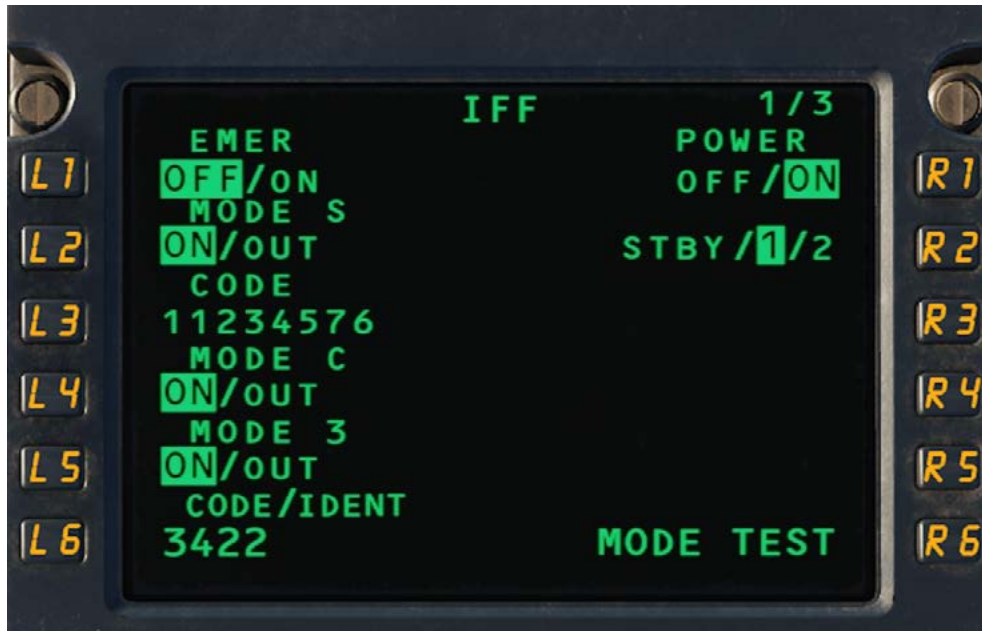
**R5:** No function.

**R6:** Blank.



## IFF 1/3

Allows for the transponders to be configured.



**L1:** Toggles the emergency mode of the IFF. When ON is selected, the following occurs:

- IFF power is selected to ON if it is not already.
- The Mode 3 code is set to 7700.

**L2:** Toggles the Mode S transmit state. When set to OUT, the system responds to interrogations.

**L3:** Displays the Mode S code.

**L4:** Toggles the Mode C transmit state. When set to OUT, the system responds to interrogations.

**L5:** Toggles the Mode 3 transmit state. When set to OUT, the system responds to interrogations.

**L6:** Allows for entry of the Mode 3 code. Valid entries are numbers between 0000 and 7700.

**R1:** Toggles power to the IFF system.

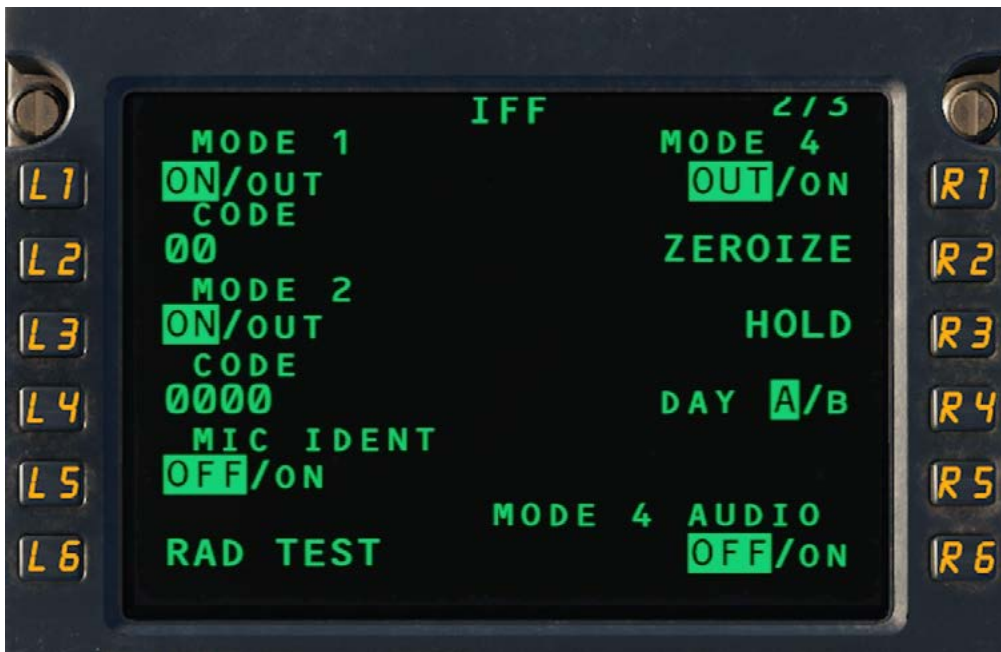
**R2:** Selects which IFF transmitter is active. When set to STBY, the IFF does not transmit or reply to interrogations.

**R3-R6:** Blank.



**IFF 2/3**

Allows for the transponders to be configured.



**L1:** Toggles the Mode 1 state between ON and OUT. When set to OUT, the system responds to interrogations.

**L2:** Displays the Mode 1 code.

**L3:** Toggles the Mode 2 state between ON and OUT. When set to OUT, the system responds to interrogations.

**L4:** Displays the Mode 2 code.

**L5-L6:** No function.

**R1:** Toggles the Mode 4 state between ON and OUT. When set to OUT, the system responds to interrogations.

**R2-R3:** No function.

**R4:** Toggles between the A and B crypto codes.

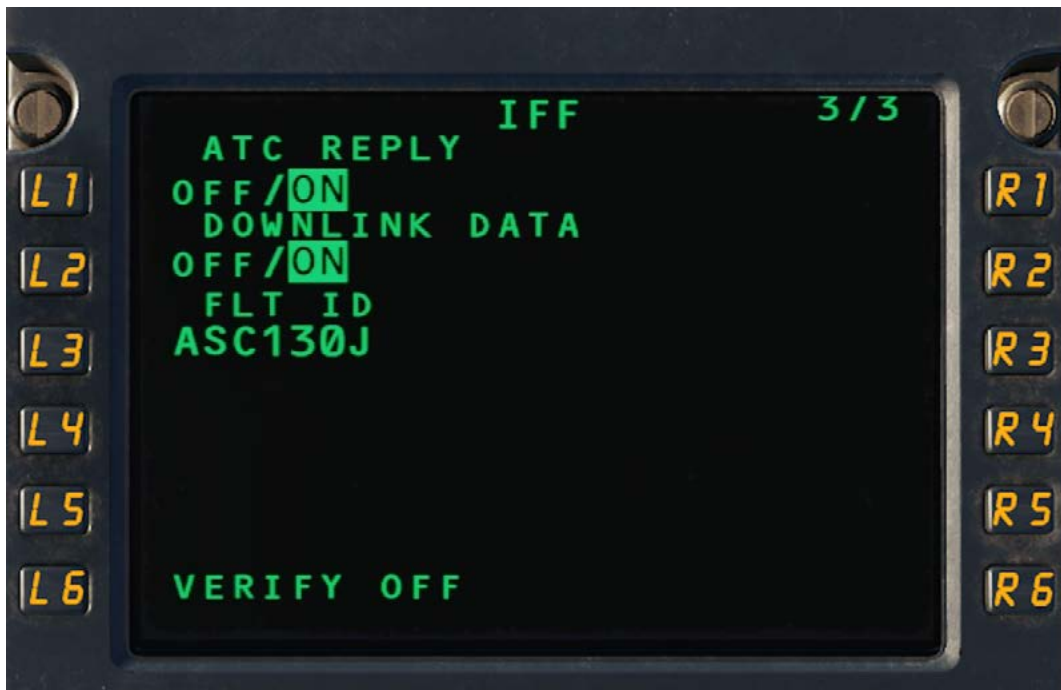
**R5:** Blank.

**R6:** No function.



## IFF 3/3

Allows for the transponders' datalink options to be configured.



**L1:** Toggles whether the IFF will reply to ATC interrogation. When OFF is selected, the VERIFY OFF legend at L6 will display in large font and inverse video. Selection of L6 is required within 5 seconds to select ATC REPLY to OFF. If L6 is not selected within this window, VERIFY OFF returns to small font, normal video and no change occurs.

**L2:** Toggles whether Mode S data is broadcast. When OFF is selected, the VERIFY OFF legend at L6 will display in large font and inverse video. Selection of L6 is required within 5 seconds to select DOWNLINK DATA to OFF. If L6 is not selected within this window, VERIFY OFF returns to small font and normal video and no change occurs.

**L3:** Allows for entry of a flight ID to be broadcast to ATC.

**L4-L5:** Blank.

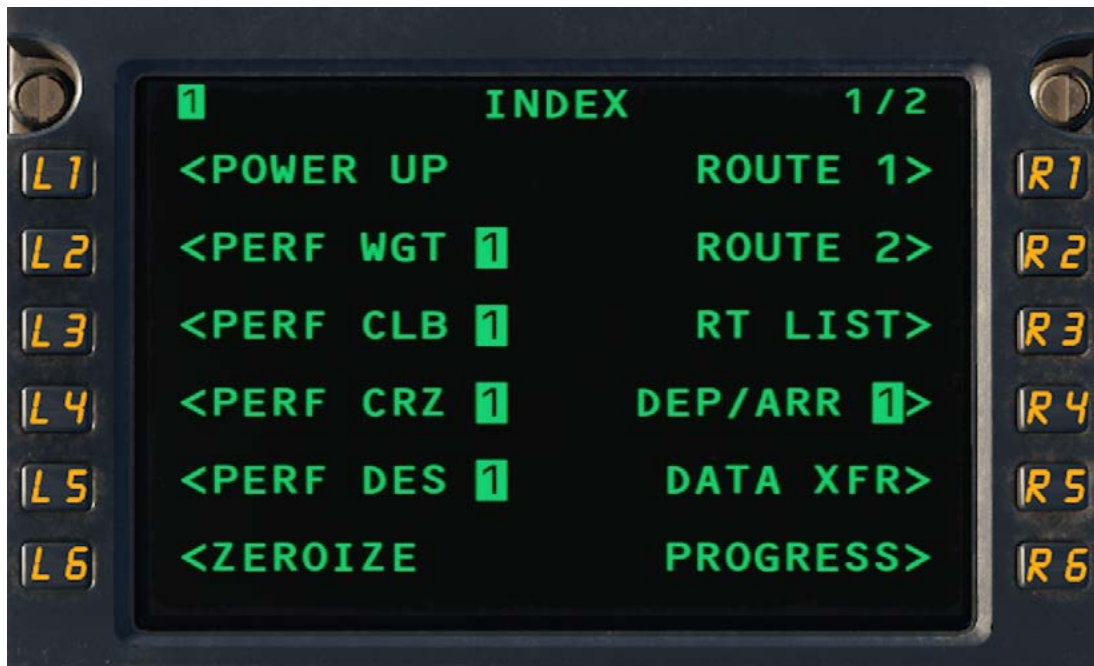
**L6:** Used to verify ATC REPLY and DOWNLINK DATA being selected to OFF.

**R1-R6:** Blank.



## INDEX 1/2

Serves as a menu for CNI pages not accessible by the mode keys.



**L1:** Branches to POWER UP.

**L2:** Branches to PERF INIT WEIGHT.

**L3:** Branches to PERF INIT CLIMB.

**L4:** Branches to PERF INIT CRUISE.

**L5:** Branches to PERF INIT DESCENT.

**L6:** Branches to ZEROIZE 1/2.

**R1:** Branches to RTE 1.

**R2:** Branches to RTE 2.

**R3:** Branches to STORED ROUTE LIST.

**R4:** Branches to DEP/ARR INDEX.

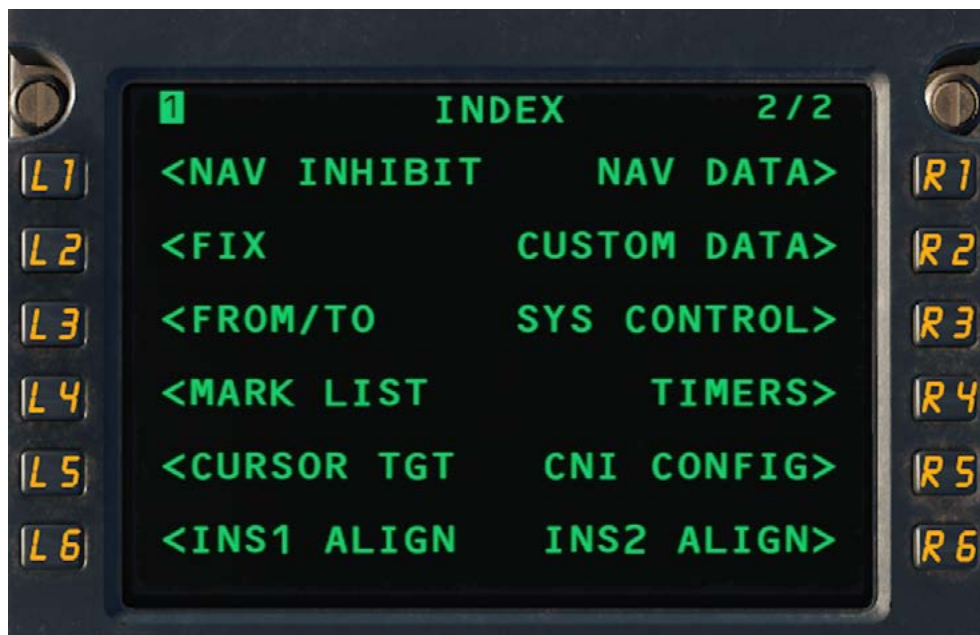
**R5:** Branches to DATA XFR.

**R6:** Branches to PROGRESS 1/4.



## INDEX 2/2

Serves as a menu for CNI pages not accessible by the mode keys.



**L1:** Branches to NAVAID INHIBIT.

**L2:** Branches to FIX INFO.

**L3:** Branches to FROM/TO.

**L4:** Branches to MARK LIST.

**L5:** Branches to CURSOR TARGET.

**L6:** Branches to INS1 ALIGN.

**R1:** Branches to NAV DATA.

**R2:** Branches to CUSTOM DATA LIST.

**R3:** Branches to SYSTEM CONTROL.

**R4:** Branches to TIMERS.

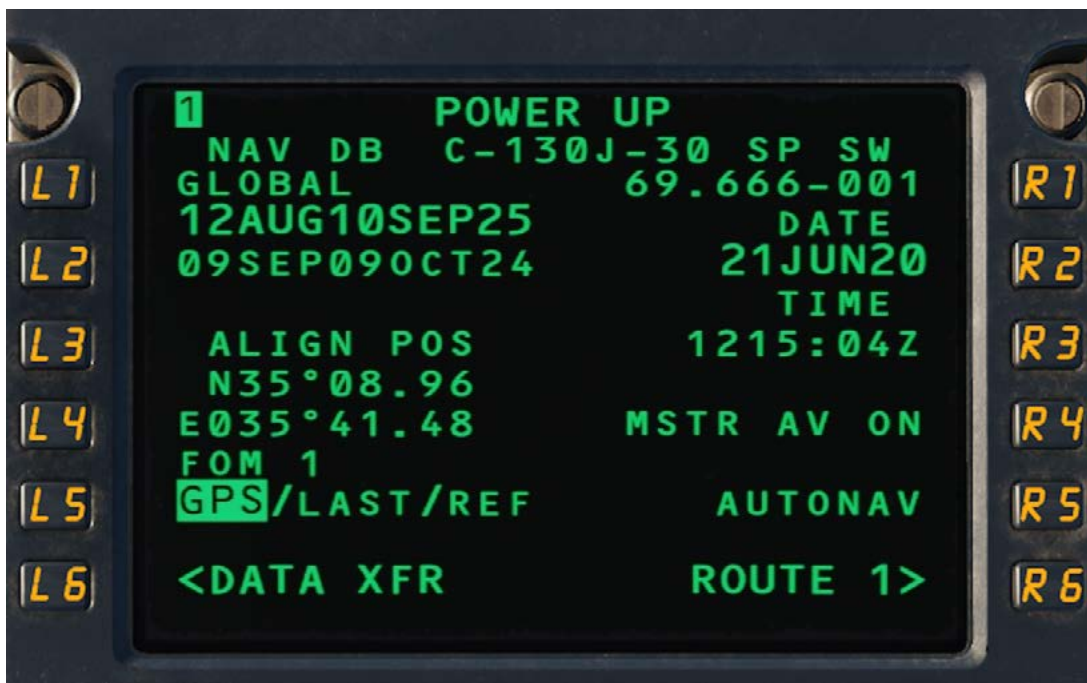
**R5:** Branches to CNI CONFIG.

**R6:** Branches to INS2 ALIGN.



## POWER UP

Used to verify navigation database currency, view the CNI's date and time, apply power to the communication and navigation radios, and initialize the EGI system.



**L1:** Displays the navigation database (NAV DB) identifier.

**L2:** Displays the active and inactive navigation database cycles. The active cycle is displayed in large font, with the inactive cycle shown in small font. Pressing L2 with weight-on-wheels will change the active cycle; if weight is off wheels, the CNI message “NOT ALLOWED” will be generated and no change will occur.

**L3:** Blank.

**L4:** Displays the geographic position of the reference source selected adjacent to L5. If the selected source has no valid position, dashes will be displayed.

If GPS is selected, the current GPS position will be displayed, along with the Figure of Merit (FOM) for the GPS solution. If GPS data is not valid, no position will be displayed and the FOM field will be blank. If LAST is selected, the FOM field becomes blank and the previous coordinate of when battery power was removed from the aircraft is displayed.

If REF is selected, the position field will turn to dashes and allow for a reference waypoint to be entered. After entry, the geographic position of the entered waypoint will be displayed.

**L5:** Selects which source will be used to supply a position to the ALIGN POS field.

**L6:** Branches to DATA XFR.



**R1:** Displays the airframe type, as well as the CNI software load version.

**R2:** Displays the current date. The field defaults to the mission date, unless manually changed.

**R3:** Displays the current time. The field defaults to the mission time, unless manually changed.

**R4:** Applies power to the navigation radios and communication radios, except for the HF radios. On initial power-up, the field will be shown in large font and change to small font once it has been selected.

**R5:** Initiates the EGI alignment process using the position displayed at L4. On initial power-up, the field will be shown in large font and change to small font once it has been selected. If no position is displayed at L4 and R5 is selected, "NO PRESENT POSITION" will be displayed

**R6:** Branches to RTE.



## Route Function Overview

The Route (RTE) function of the CNI-MU is a central component of operating the C-130J and allows for precise navigation along a string of waypoints that are accompanied by fuel and time navigation predictions. By using the Mission Flight Parameter (MFP) prompt, mission procedures such as CARP, LZ, and rendezvous can be added to the flight plan.

The CNI allows for two independent flight plans to be defined, known as Route 1 (RTE 1) and Route 2 (RTE 2). While these two routes can coexist, only one can be active at a time. This is known as the active flight plan, while the other route is known as the standby flight plan. Changes made to an standby flight plan have no effect on the active flight plan, and vice versa.

A subroute of the active and standby flight plans can also be created: these are known as Alternate (ALTN) routes. Alternate routes are created via the RTE ALTN page of the associated route and can be used when a diversion from the primary destination is likely to reduce workload when the diversion occurs.

## Route Construction

At its core, the route function draws connecting lines between waypoints entered on the LEGS page. Using data entered on the PERF INIT page structure, the MC predicts the ETE and fuel burn for each leg to determine the ETA and fuel remaining at each waypoint. Additional procedures can be added to the route via the WAYPOINT DATA and DEP/ARR pages, which include Standard Instrument Departures (SID), Standard Terminal Arrival Routes (STAR), holds, CARP, LZ, rendezvous and IPRA procedures.

The string of waypoints are connected by a user-specified transition procedure. The transition type can be defined for the entire route by using the RTE page, or for individual waypoints using the respective WAYPOINT DATA page. Three different transition types are available:

**Curved Path (CP):** The flight director will anticipate and lead the turn to smoothly intercept the course of the following leg. This will result in the active waypoint not being overflown.

**Radius of Turn (ROT):** The flight director will treat each waypoint as fly-over, which will result in the active waypoint being overflown before a turn is made. After the waypoint is passed, a course directly towards the next waypoint will be flown.

**Point to Point (P-P):** The aircraft will treat each waypoint as fly-over, which will result in the active waypoint being overflown before a turn is made. An intercept will then be flown onto the course towards the next waypoint.

Note: Changing this selection with an active route will result in a provisional flight plan being created. Use of the EXEC key is required to activate the change.



## Bezier Curve Errors

When a route is constructed using the Curved Path waypoint transition type, care must be taken to ensure that sufficient space is provided between waypoints that require large turns, especially at high speeds.

If sufficient space does not exist for a curved path to be drawn between the two points, a Bezier curve error may present itself in the flight plan display. There are multiple ways to eliminate the curve error:

1. Increase the distance between waypoints to allow a curve to be drawn.
2. Adjust waypoint positioning to reduce the angle of the turn.
3. Select P-P or ROT as the transition type.



## Route States

Three different route states exist: inactive, active, and provisional.

An inactive route is one that has not been activated. This can include RTE 1 on initial power up, RTE 2 when RTE 1 is active, or the alternate routes. As noted earlier, inactive routes can be identified by a lack of the “ACT” prefix in CNI page headers.

The active route is marked by the “ACT” prefix on all route pages and is the flight plan that has been activated by the crew. Because the active route is guiding the aircraft, any changes to the flight plan require a confirmation step: this intermediate state is known as the provisional flight plan.

The provisional flight plan includes pending changes to the active route and is denoted by a “MOD” prefix on the route pages. When a provisional flight plan exists, the CNI’s EXEC light will be illuminated and remain illuminated until the EXEC key is pressed. Route changes are then executed after the EXEC key is pressed.



## RTE1

Used to define the parameters of Route 1.



**L1:** Allows for entry of the flight plan origin. Using L1 with a blank scratchpad will downselect the origin into the scratchpad.

Valid entries consist of waypoint or airport identifiers in the navigation or custom database. If an identifier is entered that does not match anything contained in the two databases, a blank CUSTOM DATA page will be shown where waypoint information can be defined. Once definition is complete, the new identifier can be entered into L1.

If the \*DELETE\* prompt is used while on the ground, the entire flight plan will be cleared, if one has been built. The \*DELETE\* prompt is inoperative on this field while airborne.

**L2:** Allows for entry of a stored route label to copy into the flight plan. If the entered label matches a route in the STORED ROUTE LIST, the contents of the stored route will be copied into the RTE and LEGS pages, including origin, destination, and flight plan waypoints/procedures (STAR/SID).

If the entry does not match a route in the STORED ROUTE LIST, the CNI message "NOT IN DATABASE" will be displayed.

**L3:** Allows for entry of a stored route label. When a valid route label has been entered, the active flight plan and its contents are stored in the STORED ROUTE LIST. If a route with the same label already exists, the CNI message "ROUTE ALREADY EXISTS" will be generated.



**L4:** Allows for entry of a runway identifier for the origin airport, or displays the selected runway if one has been made via DEP/ARR. Valid entries are runways contained in the navigation database for the selected origin. If the entered runway does not match one in the database, the CNI message “NOT IN DATABASE” will be generated.

If a runway has been selected via DEP/ARR in conjunction with a STAR, it can only be changed from RTE if the new runway has the same STAR available. If the runway is not available for the STAR, the runway change will need to take place using DEP/ARR. The CNI message “RUNWAY N/A FOR SID” will be generated when this scenario occurs.

**L5:** Branches to DEP/ARR INDEX.

**L6:** If a provisional flight plan exists, ERASE is displayed; selecting L6 will result in the flight plan modification being erased. Otherwise, the <LEGS 1 prompt is shown and branches to LEGS 1.

**R1:** Allows for entry of the flight plan destination. For entry to be possible, an origin must be entered at L1. Otherwise, blanks are displayed.

Valid entries consist of waypoint or airport identifiers in the navigation or custom database. If an identifier is entered that does match anything contained in the two databases, a blank CUSTOM DATA page will be shown where waypoint information can be defined. Once definition is complete, the new identifier can be entered into R1.

If a destination has already been specified, overwriting the field with a new identifier will clear any STAR or approaches from the flight plan.

**R2:** Allows for an alternate destination to be entered. For entry to be possible, a destination must be entered at R1. Otherwise, blanks are displayed.

If an alternate destination has been specified, the RTE 1 ALTN page will show the alternate destination as the TO waypoint. If the destination is deleted, the entire alternate flight plan will be cleared.

**R3:** Specifies the maximum bank angle used by the flight director for waypoint transitions and procedures that do not prescribe a bank angle.

Note: Changing this selection with an active route will result in a provisional flight plan being created. Use of the EXEC key is required to activate the change.



**R4:** Selects the flight plan sequence behavior. The two selections are as follows:

**AUTO:** the next waypoint in the flight plan is automatically sequenced after reaching the active waypoint.

**MAN:** the next waypoint in the flight plan must be automatically sequenced, either via DIR INTC or via the LEGS page. The aircraft will overfly the active waypoint and remain on the last leg's course until manual intervention by the flight crew.

Note: Changing this selection with an active route will result in a provisional flight plan being created. Use of the EXEC key is required to activate the change.

**R5:** Selects the waypoint transition type used by the flight director.

**R6:** If a flight plan activation is in progress, ACTIVATE is displayed. Selecting R6 will result in the EXEC light illuminating for final confirmation. Otherwise, the PERF INIT> branching prompt is shown and will branch to PERF INIT WEIGHT.



## LEGS

Displays information about the waypoints in the active flight plan.



Each line on the LEGS page is associated with a waypoint in the flight plan route. Using L1-L5 when waypoints are present will downselect the identifier into the scratchpad, if it is empty. Using R1-R5 will open the WAYPOINT DATA page for the associated waypoint.

Waypoint Procedure: displays the procedure associated with the waypoint. Possible labels include DIR, CARP, HOLD, and APPR.

Leg Course: displays the leg course to the next waypoint. Courses are referenced to magnetic north, unless followed by a 'T'; when the T is displayed, the course is referenced to true north.

Leg Distance: displays the leg distance to the next waypoint.

ETA/ETE: when the aircraft is airborne, the ETA to the next waypoint is displayed. When the aircraft is on the ground, ETE is displayed.

Speed Constraint: speed constraints can manually be entered for situational awareness, or automatically set by a procedure loaded from the navigation database.

Altitude Constraint: altitude constraints can be entered to manually create a vertical profile within the flight plan.



Discontinuity Prompt: a flight plan discontinuity is a segment of the flight plan where the course from one waypoint to another has not been defined. This is denoted by the “>> DISCONTINUITY <<” label appearing below the last leg that has a defined course.

**L6:** Different prompts are presented depending on the situation. These prompts include the following:

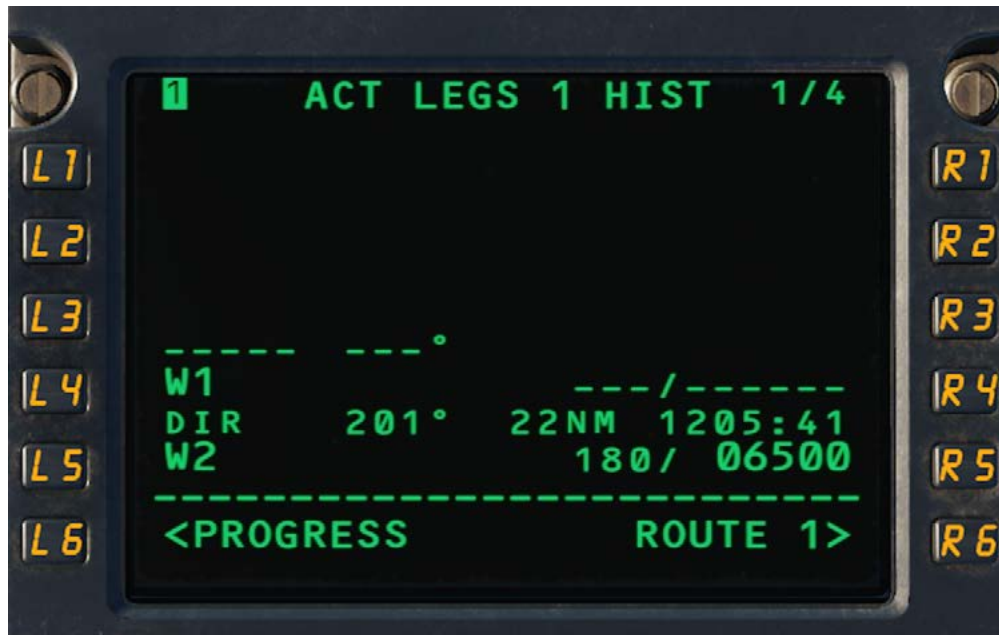
- **ERASE:** a provisional flight plan exists. Selecting ERASE will erase any pending flight plan modification.
- **EXIT HOLD:** a hold is active, or will become active within 1 minute. Selecting EXIT HOLD will result in the hold being deleted if it was not active, or a hold exit being drawn if it is active. Both changes result in a provisional flight plan being created, with the EXEC button being required to activate the change.
- **<PROGRESS:** displayed when a provisional flight plan does not exist, and a hold is not active or will not become active within 1 minute. Branches to PROGRESS 1/4.
- **<CARP PROG:** displayed when a CARP is active. Branches to CARP PROG 1/2.

**R6:** Branches to RTE 1.



## LEGS HIST

Displays information about flight plan waypoints that have been passed.



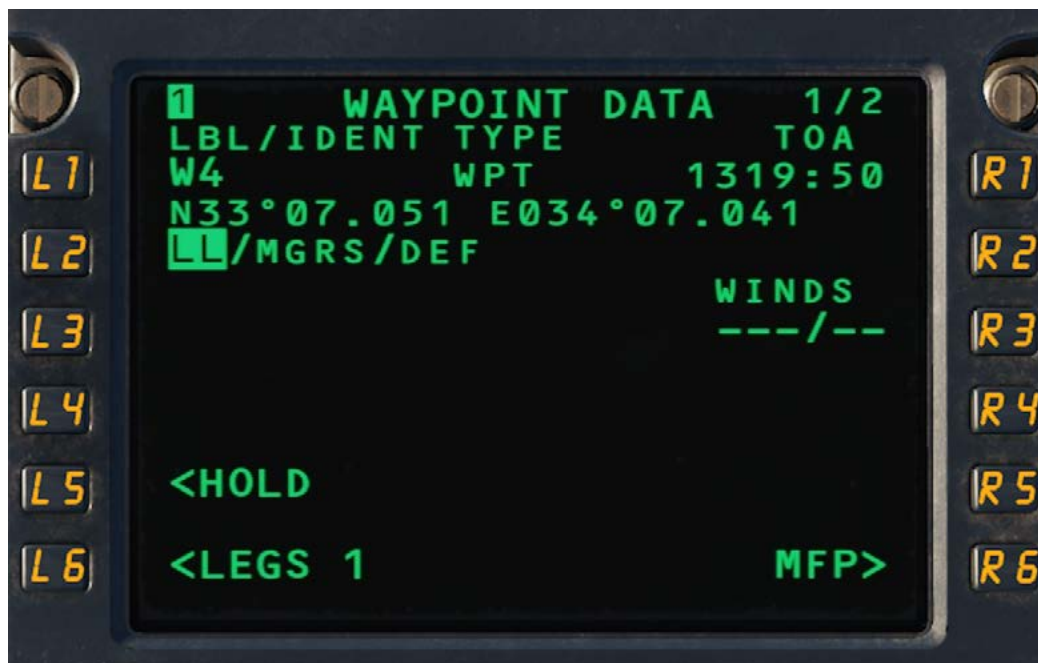
The LEGS HIST page is formatted identically to the LEGS page and displays flight plan waypoints that have been sequenced behind the active waypoint. The most recent waypoint is added to the bottom of the page and pushes existing page entries up one line.

Waypoints are automatically added to the LEGS HIST page as they are passed sequentially, as well as when a DIRECT-TO operation is performed, in which case all intermediate waypoints/legs are considered passed.



## WAYPOINT DATA 1/2

Displays the information about a flight plan waypoint such as the geographic position, wind at the waypoint, and predicted time of arrival. ACT is displayed in the page header when the active waypoint is being viewed.



**L1:** Displays the waypoint label/identifier. To the right of the field, the waypoint type is displayed. Possible types include WPT, HOLD, CARP, RNDZ, and LZ.

**L2:** Selects which format the waypoint's position will be displayed in. The waypoint position is displayed above the selections in the specified format.

**L3-L4:** Blank.

**L5:** Branches to RTE HOLD.

**L6:** Multiple options can be displayed:

- ERASE: Displayed when the route is provisional.
- <LEGS: Displayed when the route is not provisional. Branches to LEGS.

**R1:** Displays the aircraft's Time of Arrival over the waypoint, if a TOT has not been defined for the waypoint. If a TOT has been defined, the field's header will change to TOT and display the TOT.

**R2:** Blank.

**R3:** Displays the wind defined for the waypoint, if applicable. Otherwise, dashes are displayed.



**R4-R5:** Blank.

**R6:** The MFP branching prompt is displayed at R6, but its functionality differs based on the waypoint's type:

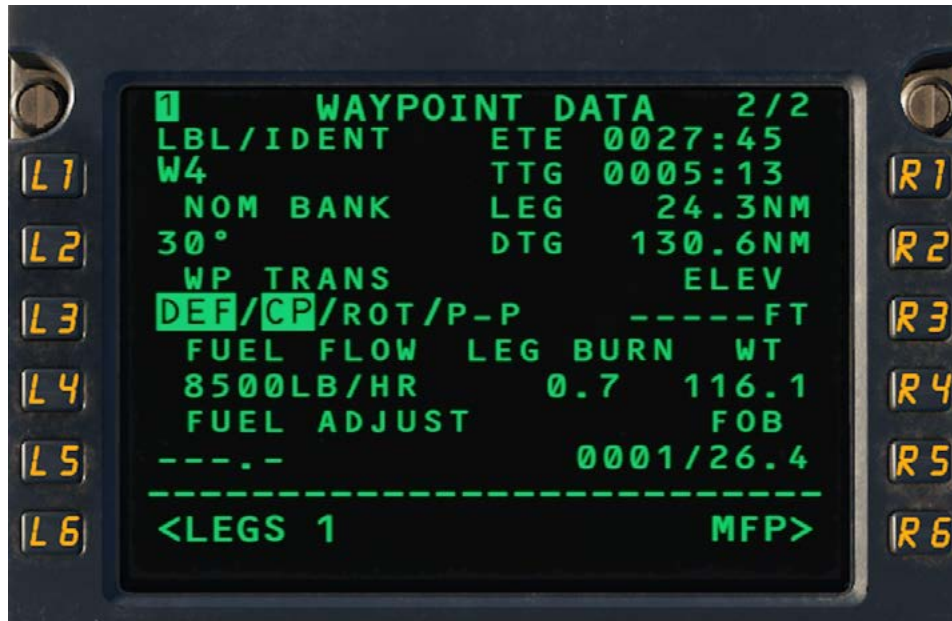
- WPT: Branches to MISSIONS.
- CARP: Branches to CARP INIT 1/5.
- LZ: Branches to LZ INIT 1/2.
- RNDZ: Branches to RENDEZVOUS.

MFP is displayed in small font when the waypoint is associated with a database procedure, such as a STAR or SID.



## WAYPOINT DATA 2/2

Displays the information about a flight plan waypoint such as fuel and time predictions. The page can also be used to edit waypoint transition behavior. ACT is displayed in the page header when the active waypoint is being viewed.



**L1:** Displays the waypoint label/identifier. To the right of the field, the waypoint type is displayed. Possible types include WPT, HOLD, CARP, RNDZ, and LZ.

**L2:** Displays the bank angle limit for the leg. The default value is mirrors the NOM BANK entry on RTE. Changing the bank angle limit will only affect the leg to the waypoint displayed at L1.

**L3:** Selects the waypoint transition type for the leg. Changing the waypoint transition will only affect the leg to the waypoint displayed at L1.

**L4:** Displays the fuel flow being used for fuel predictions.

**L5:** Allows for the predicted leg fuel burn to be adjusted,

**L6:** Multiple options can be displayed:

- ERASE: Displayed when the route is provisional.
- <LEGS: Displayed when the route is not provisional. Branches to LEGS.

**R1:** Displays the leg ETE and remaining TTG.



**R2:** Displays the leg distance and distance remaining, in nautical miles.

**R3:** Displays the waypoint elevation, if one has been defined. Dashes are displayed if the elevation is undefined.

**R4:** Displays the predicted fuel burn on the leg, and the predicted aircraft gross weight at the end of the leg, in thousands of pounds.

**R5:** Displays the current endurance and fuel on board.

**R6:** The MFP branching prompt is displayed at R6, but its functionality differs based on the waypoint's type:

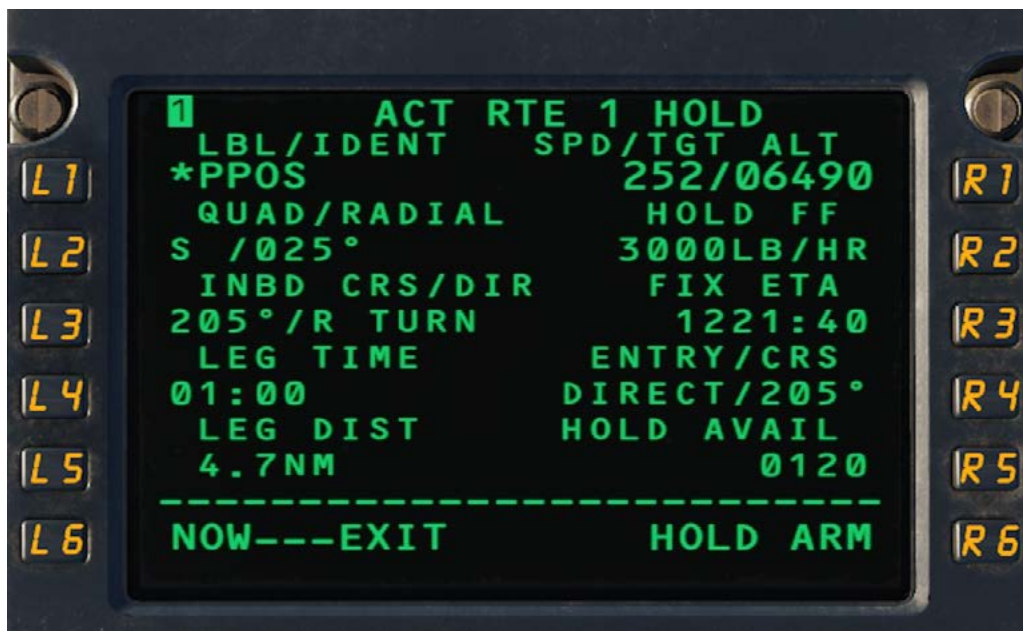
- WPT: Branches to MISSIONS.
- CARP: Branches to CARP INIT 1/5.
- LZ: Branches to LZ INIT 1/2.
- RNDZ: Branches to RENDEZVOUS.

MFP is displayed in small font when the waypoint is associated with a database procedure, such as a STAR or SID.



## RTE HOLD

Used to define a racetrack holding pattern that is anchored to a waypoint in the flight plan.



**L1:** Displays the identifier of the waypoint the hold is being created at. If the PPOS HOLD function was used, “\*PPOS” will be displayed.

**L2:** Displays the quadrant and radial of the hold pattern. The quadrant is where the pattern is positioned in relation to the hold waypoint, referenced to north. The radial is the reciprocal of the inbound course and extends away from the hold waypoint. When an inbound course is specified, L2 displays the quadrant of the pattern and the reciprocal of the course is displayed as the radial.

Manual definition of the quadrant and radial are allowed. Changes to either parameter will automatically update the inbound course displayed at L3. Entry of a radial will automatically update the quadrant according to the table below, while entering only a quadrant will use the default radial for the respective quadrant.

Quadrant	Radial Range	Default Radial
North (N)	337.6° to 22.5°	0°
North East (NE)	22.6° to 67.5°	45°
East (E)	67.6° to 112.5°	90°
South East (SE)	112.6° to 157.5°	135°
South (S)	157.6° to 202.5°	180°
South West (SW)	202.6° to 247.5°	225°
West (W)	247.6° to 292.5°	270°
North West (NW)	292.6° to 337.5°	315°



**L3:** Defines the inbound course and turn direction of the hold pattern. The inbound course will default to the flight plan course to the waypoint the hold is being created at, while the turn direction will default to right turns. The inbound course is also updated whenever the QUAD/RADIAL field at L2 is changed.

**L4:** Defines the length of time that the aircraft should take to fly the inbound leg of the hold. When the LEG TIME is changed, the LEG DIST value at L5 is also updated to reflect the new distance of the leg.

**L5:** Defines the length of the inbound and outbound legs of the hold. Changing the leg distance will also update the LEG TIME value at L3.

**L6:** Multiple different prompts can be displayed at L6, depending on the scenario. The available prompts include the following:

- **ERASE:** displayed if the route containing the hold is provisional. Using L6 will erase any changes made to the flight plan.
- **LEGS:** displayed if the hold is not the active leg of the active flight plan. Using L6 will result in a branch to the LEGS page for the route containing the hold.
- **NOW—EXIT:** displayed if the hold is the active leg. Using L6 will create a provisional flight plan that contains an immediate exit of the hold.

**R1:** Displays and defines the target speed and altitude for the hold fix.

**R2:** Displays the fuel flow used to calculate the available holding time.

**R3:** Displays the ETA of when the aircraft will cross the holding fix next. An Exit At Time (EAT) may be specified which defines the time when the aircraft should cross the holding fix on the final lap of the hold. When an EAT is entered, the “ETA” header changes to read “EAT”.

**R4:** Displays the entry type and course into the holding pattern.

**R5:** Displays the time available for the aircraft to remain in the hold before reaching the fuel reserves specified on PERF INIT WEIGHT. The time shown varies based on the hold fuel flow entered at R2.

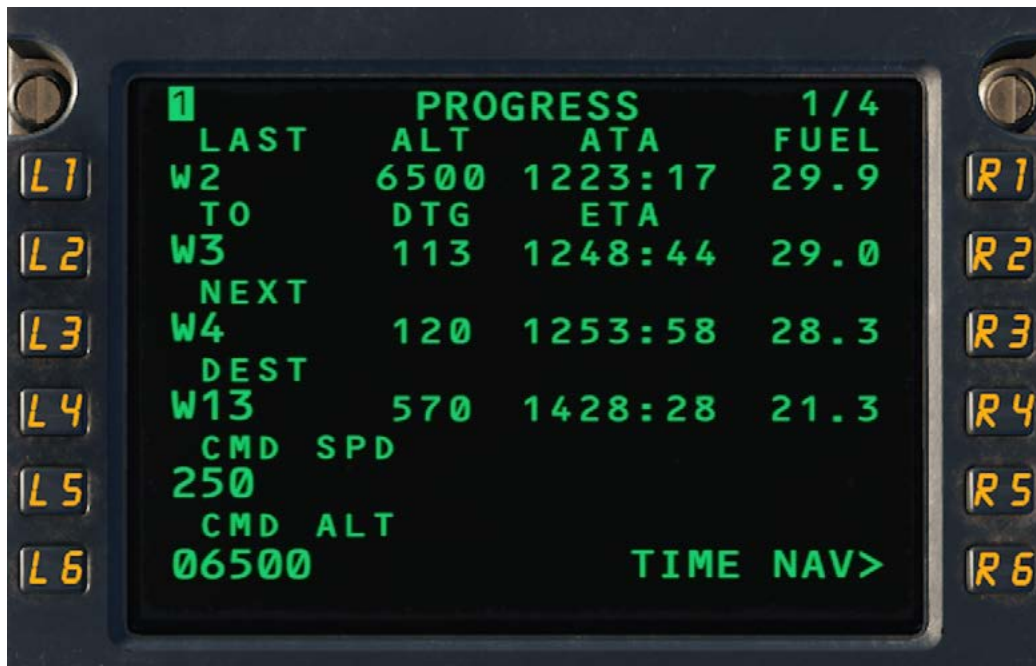
**R6:** Multiple different prompts can be displayed at L6, depending on the scenario. The available prompts include the following:

- **DELETE HOLD:** displayed if the hold is the active leg. Using R6 will create a provisional flight plan where the hold pattern is deleted.
- **HOLD—ARM:** displayed if the hold is the active leg. Using R6 will create a provisional flight plan that contains an exit of the hold after the holding fix is passed.



## PROGRESS 1/4

Used to view time and fuel predictions for waypoints in the flight plan.



**L1:** Displays the identifier of the previous waypoint. To the right of the identifier, the altitude, Actual Time of Arrival (ATA) and fuel onboard as the waypoint was passed is displayed.

**L2:** Displays the identifier of the active waypoint. To the right of the identifier, the altitude, ETA, and predicted fuel onboard upon reaching the waypoint is displayed. If weight is on wheels, the ETA field displays ETE.

**L3:** Displays the identifier of the waypoint following the active waypoint. To the right of the identifier, the altitude, ETA, and predicted fuel onboard upon reaching the waypoint is displayed. If weight is on wheels, the ETA field displays ETE.

**L4:** Displays the identifier of the destination waypoint. To the right of the identifier, the altitude, ETA, and predicted fuel onboard upon reaching the waypoint is displayed. If weight is on wheels, the ETA field displays ETE.

**L5:** Displays the speed constraint for the current leg.

**L6:** Displays the altitude constraint for the current leg.

**R1-R5:** Blank.

**R6:** Branches to TIME NAV.



## PROGRESS 2/4

Used to display wind and speed information for the flight.



**L1:** Displays the current wind component. The field's header displays "H/WIND" when the wind component is a headwind, and "T/WIND" when the component is a tailwind. To the right of the wind component, the sensed wind is displayed.

**L2:** Displays the aircraft's lateral displacement from the flight plan course. An "L" character is displayed when the aircraft is left of course, and "R" when the aircraft is right of course.

**L3:** Displays the aircraft's current true airspeed.

**L4:** Displays the aircraft's current ground speed.

**L5:** Displays the current Static Air Temperature (SAT).

**L6:** Multiple prompts can be displayed depending on the situation. The available options include:

- ERASE: displayed when the active flight plan is provisional. Using L6 will erase any flight plan changes that have been made.
- CARP PROG: displayed when the active waypoint is part of a CARP. Using L6 will branch to CARP PROGRESS 1/2.

**R1:** Displays the current crosswind component. An "L" character is displayed when a left crosswind exists, and "R" when a right crosswind exists.



**R2:** Displays the current Vertical Track Error (VTK). The VTK is the vertical distance from the commanded altitude defined on PROGRESS 1/4.

**R3:** Toggles the crosstrack alert status. When set to ON, the “XTK LIMIT EXCEEDED” advisory will be generated when the crosstrack value at L2 exceeds the defined distance at R4.

**R4:** Defines the distance at which the crosstrack alert triggers.

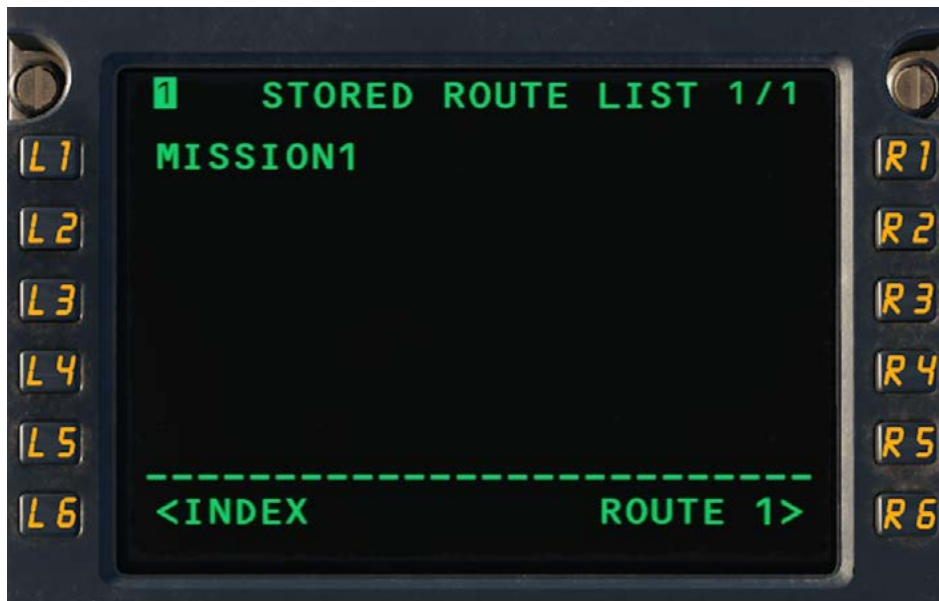
**R5:** Defines the distances at which the INAV alerts trigger. When the distance between the INAV 1 and INAV 2 positions exceeds the distance specified in the POS ALERT1 field, the “INAV POS DIFFERENCE” advisory will be generated. When the position distance exceeds the POS2 field, the “INAV POS MISCOMPARE” caution will be generated. The POS ALERT2 distance cannot be less than the POS ALERT 1 distance.

**R6:** FLT CMPLT is displayed in small font by default. When the aircraft has weight on wheels within 10 nautical miles of the primary flight plan destination, the field will change to large font. Using R6 will result in the active flight plan being cleared, and the field will return to small font.



## STORED ROUTE LIST

Used to view the names of flight plans stored within the CNI.



**L1-L5:** Displays the titles associated with routes stored in the database. Using an LSK with a blank scratchpad will downselect the title to the scratchpad.

**L6:** Branches to INDEX 1/2.

**R1-R5:** **L1-L5:** Displays the titles associated with routes stored in the database. Using an LSK with a blank scratchpad will downselect the title to the scratchpad.

**R6:** Branches to RTE 1.

Note: The stored route database is available locally in the following location:

*"Saved Games/DCS.C130J/Cockpit/Resources/user\_data.db"*.

The file can be distributed to other users to allow them to operate with the same route database.



## MARK POSITION

Displays detailed information about each mark point, including the identifier, position, and date/time it was created.



**L1:** Displays the identifier of the mark position. Selecting L1 will downselect the identifier into the scratchpad.

**L2:** Displays the geographic location of when the MARK key was pressed.

**L3:** Displays the MGRS position of when the MARK key was pressed.

**L4:** Displays the time the MARK key was pressed.

**L5:** Displays the date the MARK key was pressed.

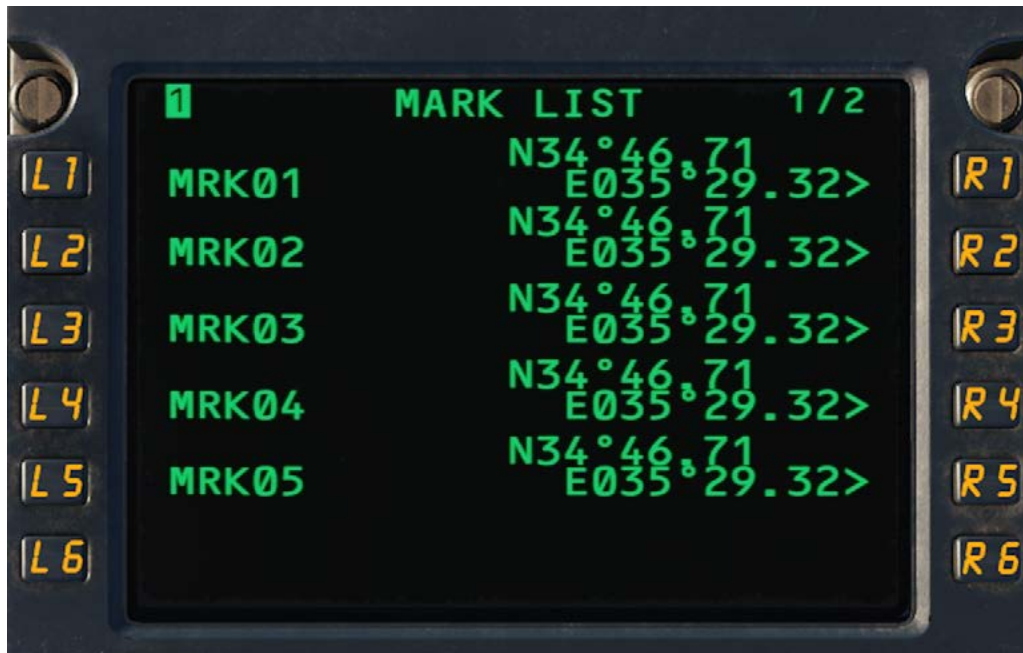
**R1-R5:** Blank.

**R6:** Branches to MARK LIST.



## MARK LIST

Each press of the MARK key creates a waypoint with the identifier “MRKxx” where “xx” is a number between 01 and 10 that increments with each press of the MARK key. The MARK LIST pages display the mark point identifiers and their corresponding geographic coordinates.



**L1-L5:** Displays the identifier of each mark position. Selecting an LSK will downselect the identifier into the scratchpad.

**L6:** Blank.

**R1-R5:** Displays the geographic coordinates associated with each mark point identifier. The fields will be blank until a mark point is created via the MARK key. Selecting an LSK will branch to the point's MARK POSITION page.

**R6:** Blank.



## CNI CONFIG

CNI CONFIG is for display purposes only.



**L1:** No function.

**L2:** Displays the HF1 radio model.

**L3:** Displays the UHF radio model.

**L4:** Displays the VHF radio model.

**L5:** Blank.

**L6:** Branches to the INDEX 2/2 page.

**R1:** Displays the airframe type.

**R2:** Displays the HF2 radio model.

**R3-R4:** Blank.

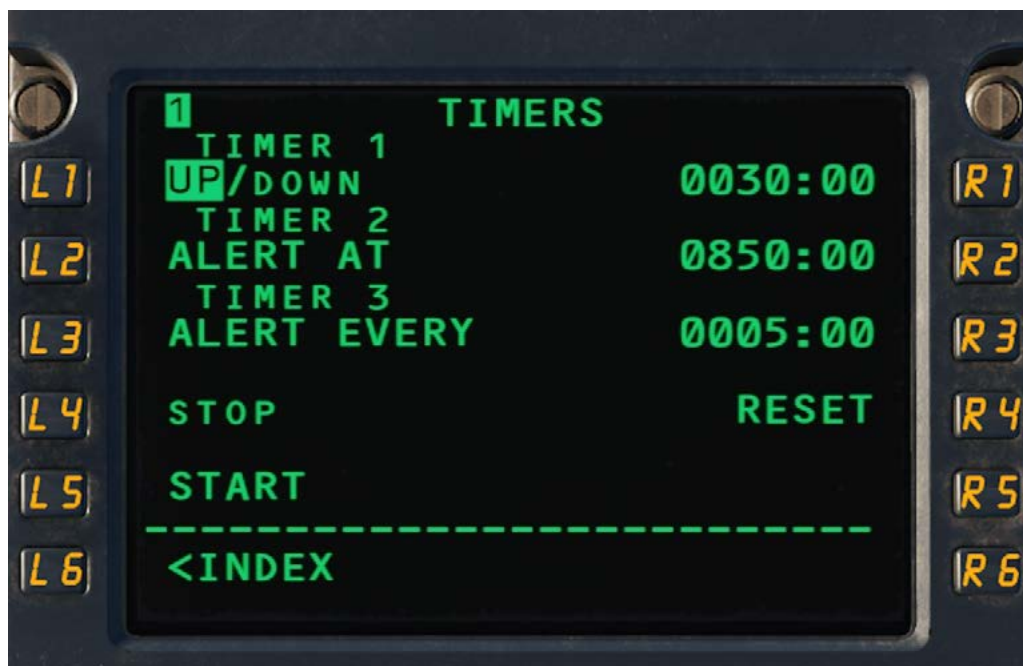
**R5:** Displays the model of Doppler Velocity Sensor (DVS) that is installed. Because the simulated variant of the C-130J does not include a Doppler sensor, "NONE" is displayed.

**R6:** Blank.



## TIMERS

Unlike the basic stopwatch function on the HDDs and HUD, TIMERS allows users to create timers specific to their needs.



**L1:** Selects whether TIMER 1 counts up or down.

**L2-L3:** No function, but display the function of the corresponding LSK R key.

**L4:** Displayed in large font if TIMER 1 is running, selection will stop TIMER 1. If TIMER 1 is not running, STOP will be displayed in small font.

**L5:** Displayed in large font if TIMER 1 is set to UP or DOWN and a time has been entered at R1. Otherwise, START is displayed in small font.

**L6:** Branches to the INDEX page.

**R1:** If TIMER 1 is set to UP and a time has not been entered, the elapsed time since START was selected is displayed. If a time has been entered, the timer begins counting up from the entered time.

If TIMER 1 is set to DOWN, a time must be entered. Once START is pressed, the timer will begin counting down from that time; once 0000:00 has been reached, the CNI message TIMER 1 EXPIRED will be generated.

Data entry while TIMER 1 is active results in the CNI message NOT ALLOWED being generated.

\*DELETE\* can be used to both clear the field and stop the timer, if it is active.



**R2:** Displays the time at which TIMER 2 will activate. When the current time is equal to the entry, the CNI message TIMER 2 TARGET will be generated.

**R3:** Displays the time interval at which TIMER 3 will activate. The CNI message TIMER 3 INTERVAL will be generated every time the interval is reached.

**R4:** If no time is present at R1, RESET is displayed in small font. If a time is present, RESET is displayed in large font and will both stop TIMER 1 and clear R1's field.

**R5-R6:** Blank.



## CUSTOM DATA LIST

Displays the identifiers of all the custom waypoints in the custom database.



**L1:** Allows for entry of a custom waypoint identifier to view the information associated with it. If the waypoint entered is not already defined in the custom data list, entry will result in a blank CUSTOM DATA page being displayed so the waypoint can be defined.

**L2-L5:** Displays the identifiers in the custom waypoint database in alphabetical order. Selection results in the identifier being downselected into the scratchpad.

**L6:** Branches to the INDEX page.

**R1-R5:** Displays the identifiers in the custom waypoint database in alphabetical order. Selection results in the identifier being downselected into the scratchpad.

**R6:** Blank.



## NAV DATA

Displays information about identifiers in the navigation database.



**L1:** Allows for entry of an identifier in the navigation to view the information associated with it. If the entered identifier is not found in the database, “NOT IN DATABASE” will be generated. Using L1 with an identifier shown will downselect it into the scratchpad.

**L2:** Displays the latitude associated with the entered identifier. If no identifier has been entered, the field is blank.

**L3:** Displays the magnetic variation associated with the entered identifier. If no identifier has been entered, the field is blank.

**L4:** When a navaid has not been entered at L1, the field is blank. Otherwise, the field’s behavior is as follows:

- If a TACAN identifier has been entered at L1, the field’s header will be CHAN, with the associated channel being displayed below.
- If a VOR or DME has been entered, the field’s header will be FREQ, with the associated frequency being displayed below.
- If a VORTAC has been entered, the field’s header will be FREQ CHAN, with the associated frequency and channel being displayed below.

**L5:** If an ILS identifier has been entered at L1, the field’s header will be FCRS, with the front course of the localizer being displayed below. Otherwise, the field is blank.

**L6:** Branches to the INDEX page.



**R1:** Blank.

**R2:** Displays the longitude associated with the entered identifier. If no identifier has been entered, the field is blank.

**R3:** If the identifier entered at L1 has an elevation associated in the database, it will be displayed. If there is no elevation associated, the field will be blank.

**R4:** If the identifier at L1 has an associated type, the header will be TYPE and display information about the type of waypoint that is being displayed. If there is no type associated, the field will be blank. Possible types include ILS, VOR, VORTAC, VORDME, TACAN, WPT, NDB, LOC, and DME.

**R5:** If the entry at L1 is an ILS, the field's header will be CATEGORY and show information about the ILS' category. If the entry at L1 is not an ILS, the field will be blank.  
The following indications are shown:

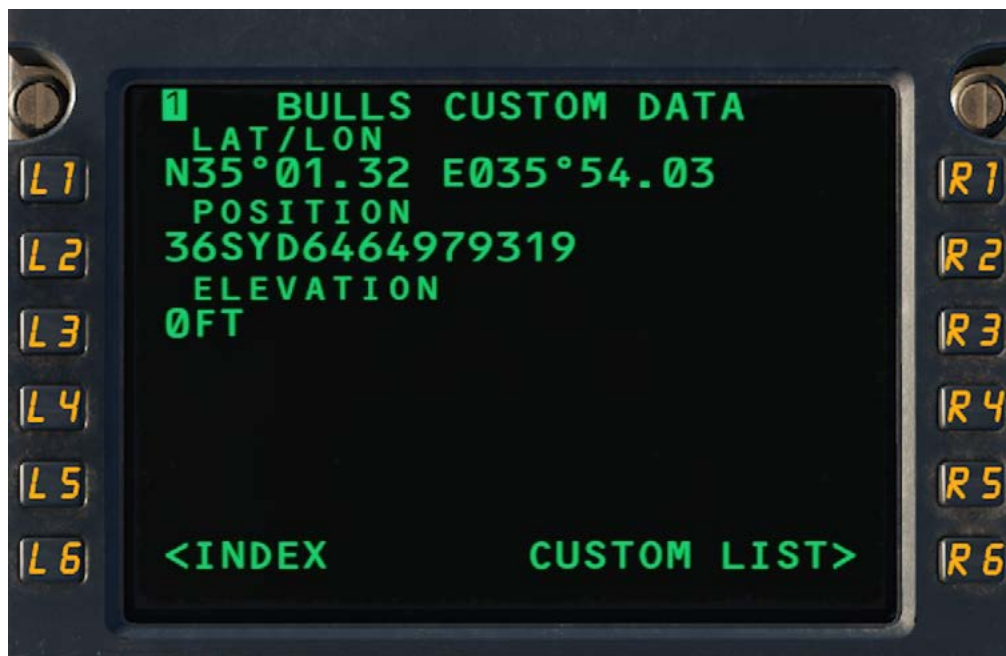
- LOC: Shown when only a localizer is present. Lateral guidance only.
- I: Shown when the ILS is a category 1. The lowest descent height permissible in IMC is 200 AGL.

**R6:** Blank.



## CUSTOM DATA

Used to view or define the parameters of a custom data point.



**L1:** Displays the latitude and longitude of the custom data point.

**L2:** Displays the position information of the custom data point.

**L3:** Displays the elevation of the custom data point.

**L4-L5:** Blank.

**L6:** Branches to the INDEX page.

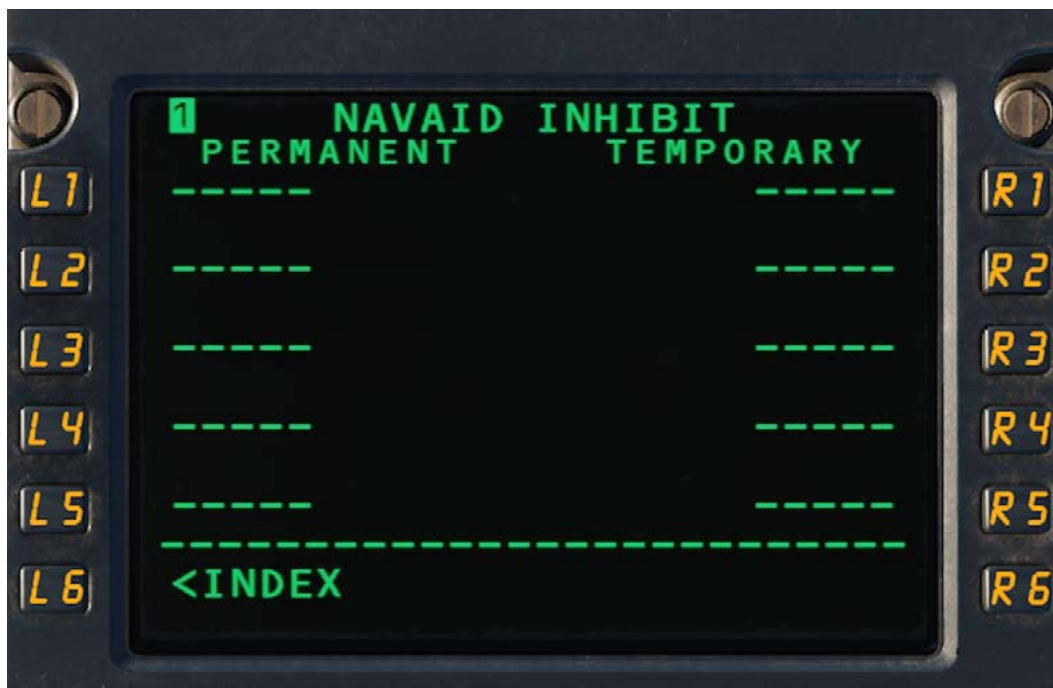
**R1-R5:** Blank.

**R6:** Branches to the CUSTOM DATA LIST page.



## NAVAID INHIBIT

This page is for display purposes only.



**L1-L5:** No function.

**L6:** Branches to INDEX 2/2.

**R1-R5:** No function

**R6:** Blank.



## FROM/TO

Used to view bearing, distance and time predictions between two waypoints or airports.



**L1-L5:** Allows for entry of two points to compute the bearing, distance and time between them.

Valid point entries are identifiers that are present in either the navigation or custom database, or PPOS. If PPOS is entered as the FROM point, the aircraft's present position will be used to compute information for the TO point.

Regardless of entry type, the bearing from the first point to the second will be displayed, along with the distance; ETA to the TO point will be shown if the FROM point is PPOS, and ETE will be shown otherwise.

**L6:** Branches to INDEX 2/2.

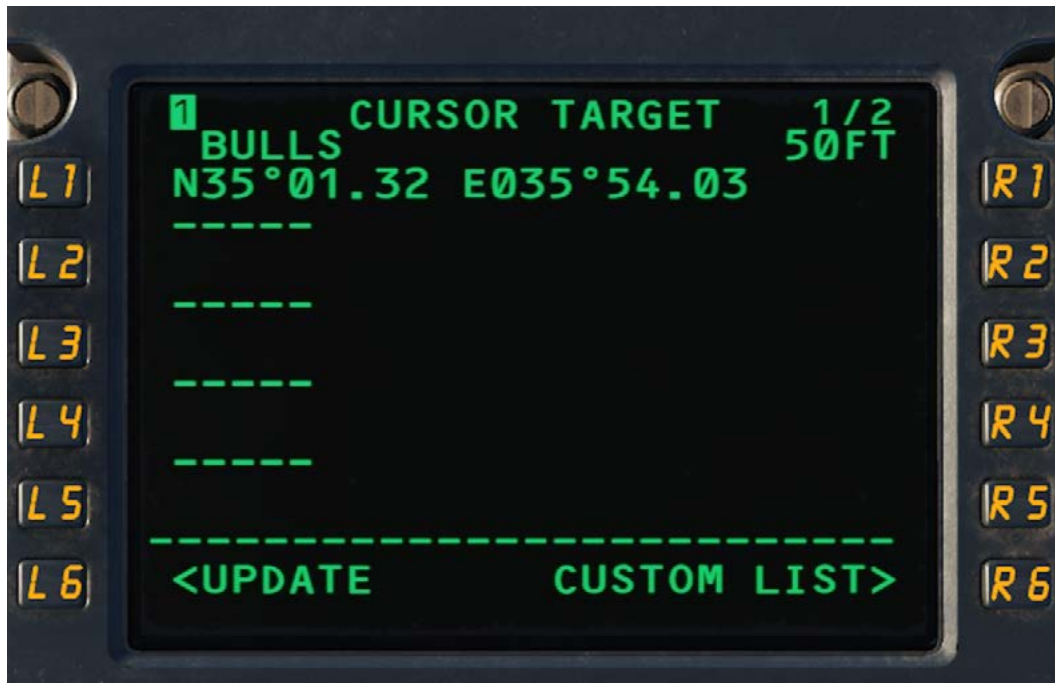
**R1-R5:** Displays the groundspeed used for each FROM/TO calculation. If the aircraft has weight-on-wheels, the field will default to 320 knots; otherwise, the aircraft's current groundspeed will be the default. The default groundspeed can be overridden with a manual input, if desired.

**R6:** Blank.



## CURSOR TARGET

Used to define and select identifiers that will be used to send a position update to the navigation systems.



**L1-L5:** Allows for entry of a waypoint in the navigation or custom database to use as an Offset Aim Point (OAP).

If the entered identifier is not present in the navigation or custom databases, a blank CUSTOM DATA page will be displayed to allow for the point to be defined.

The OAP's coordinates will be displayed below the identifier. Selection of an LSK with an identifier present will downselect the identifier to the scratchpad.

**L6:** Branches to POSITION UPDATE.

**R1-R5:** Displays the elevation associated with the OAP. If no elevation has been defined, dashes will be presented to allow for an elevation to be specified.

**R6:** Branches to CUSTOM DATA LIST.



## MISSIONS

Serves as a menu to access the various mission function pages.



**L1:** If the MISSIONS page is accessed via the MSN mode key, a toggle is available to select which flight plan the procedures are associated with. If the MISSIONS page is accessed via the MFP prompt on WAYPOINT DATA, only the route associated with that waypoint is available.

**L2:** No function.

**L3:** No function.

**L4:** Up to four separate Landing Zone (LZ) procedures can be defined at a time. The procedures are differentiated via identifier numbers, ranging between 1 and 4. Use of L4 with a valid LZ identifier in the scratchpad will result in a branch to LZ INIT 1/2 for that identifier.

**L5:** Up to five separate Rendezvous (RNDZ) procedures can be defined at a time. The procedures are differentiated via identifier numbers, ranging between 1 and 5. Use of L5 with a valid RNDZ identifier in the scratchpad will result in a branch to RENDEZVOUS for that identifier.



**L6:** PPOS HOLD is displayed in small font except for when all of the following conditions are met:

1. LNAV mode is not degraded.
2. The active route does not contain a holding pattern.
3. An active waypoint exists in the flight plan, and is not “\*CARP” or “\*DZESC”.
4. The lateral crosstrack error is less than 0.25 nautical miles.
5. Waypoint transition is not active.

When L6 is used with PPOS HOLD shown in large font, the RTE HOLD page is shown and a hold at the aircraft's present position is defined in the provisional flight plan.

**R1:** Blank.

**R2:** Up to ten separate CARP procedures can be defined at a time. The procedures are differentiated via identifier numbers, ranging between 1 and 10. Use of R2 with a valid CARP identifier in the scratchpad will result in a branch to CARP INIT 1/5 for that identifier.

**R3:** If a CARP identifier is not present in the scratchpad, use of R3 will branch to CARP PROG 1/2 for the last-accessed CARP procedure. If an identifier is present, R3 will branch to CARP PROG 1/2 for the CARP associated with the identifier.

**R4:** Branches to CHUTE LIST.

**R5:** Branches to WEAPONS.

**R6:** Branches to TIME NAV.



## Computed Air Release Point (CARP) Overview

CARP exists as a way to quickly plan and execute accurate airdrop procedures without the need for consulting paper-based charts. When given information about the drop zone, payload, and ambient weather conditions, the MC produces an airdrop procedure that can be linked to the active flight plan.

CARP takes inputs made into the CNI-MU to define a flight director-guided airdrop that includes lateral guidance, lateral and vertical deviation advisories, a continuously-computed release point, and time navigation advisories. The CARP INIT page structure is used to define the airdrop, while the CARP PROG page structure is used to view more granular information such as green light timing, sensed winds, and drop accuracy.

Like other self-contained procedures within the mission computer, CARP exists as an addition to the active flight plan. By using the Mission Flight Parameter (MFP) prompt on a WAYPOINT DATA page, the airdrop can be tied into the route page.

### Drop Zone Definition

CARP INIT 1/5 is used to define the drop zone's dimensions, as well as the positioning of the CARP waypoints. The following terms are used on the page:

**Run-in Course:** the magnetic, or true, course that all of the CARP points are aligned to. The run-in course begins at the TP and extends to the Drop zone Escape (DZ ESC) waypoint.

**Turn Point (TP):** the first waypoint of the airdrop procedure and is the point at which the aircraft transitions from the flight plan to the CARP's run-in course. The TP distance is referenced to the release point.

**Slow Down (SD):** the second waypoint of the airdrop procedure and is the point at which the aircraft should begin to slow to the airdrop speed entered on CARP INIT 2/5. CARP time predictions assume a deceleration rate of 90 knots/minute once the SD point has been reached. The SD distance is also referenced to the release point.

**Point of Impact (PI):** the latitude and longitude of where CARP is targeting the first element of the airdrop to land on. The PI coordinates can be defined using a number of methods other than a raw lat/long, however these alternate methods include the following:

1. Navigation database identifier.
2. Custom database identifier.
3. Place/bearing/distance.
4. Place/bearing/place/bearing.
5. MGRS.

**Leading Edge to Trailing Edge (LE-TE):** the length of the drop zone, in yards.



**Leading Edge to Point of Impact (LE-PI):** the distance between the beginning of the drop zone and the PI, in yards.

**Drop Zone Escape (DZ ESC):** the last waypoint of the airdrop procedure and is the point at which the aircraft transitions from the CARP to the flight plan. The DZ ESC distance is referenced to the release point.

Three different options are available that determine flight plan behavior after the DZ ESC point. These options include the following:

**ESC:** the flight plan waypoint following the airdrop will be sequenced.

**L:** a left-hand racetrack pattern will be drawn from the DZ ESC point back to the turnpoint. This race-track behavior allows for multiple airdrops over the same DZ without having to redefine a CARP for each drop run. The length of the racetrack legs can be changed by shortening or lengthening the TP DIST.

**R:** the same behavior as L applies, except that right-hand turns will be used for the racetrack.

## Vertical Profile

Data entered on CARP INIT 4/5 defines the minimum drop height for the airdrop, considering factors such as obstacle elevation, required clearance height, and PI elevation. The following terms are used on the page:

**PI Elevation:** the elevation at the point of impact.

**Drop Zone Elevation (DZ ELEV):** the highest elevation in the drop zone area.

**Obstruction Elevation (OBSTR ELEV):** the elevation of the highest obstacle in the drop zone area.

**Required Clearance Height (RQD CLNC HT):** the minimum clearance that must be maintained above the obstruction elevation.

**Minimum Drop Altitude:** the minimum altitude required to assure obstacle clearance (if applicable) and full parachute deployment before the load reaches the ground. The minimum drop altitude varies based on the parachute and is not displayed on the CNI.

**Minimum Drop Height (MIN DROP HT):** the minimum altitude required for full parachute deployment. Only two sets of values need to be defined for the minimum drop height to be computed:

1. Required clearance height and obstruction elevation.
2. Minimum drop height and drop zone elevation.

In both cases, the minimum drop height is set to the sum of the entered values. In the event all four fields are filled in, the minimum drop height is the higher of the two altitudes.



## CARP Steering Cue

An Azimuth Steering Line (ASL), presented below the CDM, represents a bomb fall line. At the bottom of the line is a release cue that begins to ticks upwards 10 seconds from the release point. Once the release cue reaches the top of the ASL, the release point has been reached and the greenlight signal becomes active.

After the release point has been reached, the release cue returns to the bottom of the ASL and begins to tick upwards again 10 seconds from the red light point, and 10 seconds from the DZ ESC point.

## Parachute Ballistics

Parachute ballistics have been compiled, and are available, for the following parachute types:

- G-12D
- G-12E

Using data entered on CARP INIT pages 2-4, CARP INIT 5/5 displays ballistics information that includes the following for single-stage airdrops:

**Vertical Distance:** the distance, in feet, between the drop altitude and when the load will be stabilized under a full parachute deployment at the specified Rate of Fall.

**Forward Travel Time (FTT):** the elapsed time, in seconds, that the load will spend moving horizontally. FTT is affected by drop speed, drop altitude, winds aloft, and parachute type and is the sum of exit time and deceleration coefficient.

**Time of Fall Constant (TFC):** compensates for the nonlinear rate of fall of the load. Depending on the load type and parachute deployment sequence, the load will be in freefall for a period of time before the parachute fully inflates and slows the rate of descent. This constant ensures that an accurate time of fall is accounted for in the CARP solution.

**Exit Time (ET):** the elapsed time, in seconds, between the greenlight signal being received and the first load element exiting the aircraft.

**Rate of Fall (RF):** the vertical velocity, in feet per second, of the load under a full parachute deployment.

**Deceleration Quotient:** the compensation factor, in seconds, that accounts for the load's transition from aircraft velocity to its horizontal velocity while under a full parachute deployment.



## Weather Parameters

CARP INIT 3/5 defines the ambient weather conditions at and above the drop zone. The temperature and barometer entries are used to compute air density and the parachute's ability to arrest the fall of the load, while the wind fields are used to compute drift of the load. Updating the values on this page will have a direct impact on the release point's placement. The following terms are used on the page:

**Altitude Wind Velocity (ALT W/V):** the wind direction and speed at the drop altitude.

**Surface Wind Velocity (SFC W/V):** the wind direction and speed at the PI.

**Ballistic Wind Velocity (BAL W/V):** the vector average of the altitude and surface wind velocity.

**Drop Altitude Temperature (ALT TEMP):** the air temperature at the drop altitude.

**Surface Temperature (SFC TEMP):** the air temperature at the PI.

**Altimeter:** the barometer setting at the PI.

## Green and Red Light Signals

Green Light, also known as the release point, is the first point in which the cargo is guaranteed to land within the DZ. If the COMPUTER DROP switch on the airdrop panel is in AUTO, the JUMP light will automatically be selected upon reaching green light.

Red Light is triggered at the end of the DZ when the load is no longer guaranteed to land within the DZ. If the COMPUTER DROP switch on the airdrop panel is in AUTO, the CAUTION light will automatically be selected upon reaching red light.

## CARP Monitoring

Vertical and lateral deviation monitoring begins 30 seconds prior to the release point and is intended to inhibit automatic green light selection if the aircraft has deviated from the lateral path or selected drop altitude. If deviations from the paths are detected, messages will appear on the CNI and the HUD nav datablock to alert the crew of the condition.

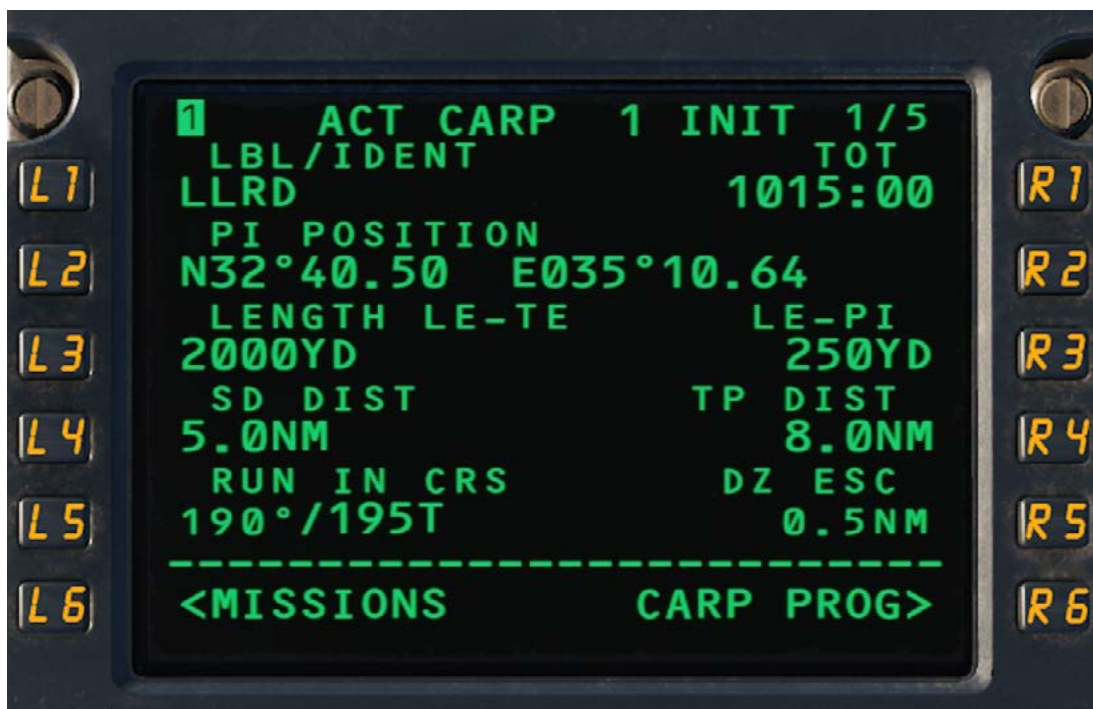
Message	Display Criteria
CARP VERT	The aircraft is more than 200 feet off the planned drop altitude.
CARP XTRK	The lateral crosstrack error is greater than 164 yards.
CARP VERT/XTRK	Both the VERT and XTRK message conditions have been met.

If any of the above messages are active, the JUMP light will not automatically be activated at the release point. This safety measure ensures that the load will not be released if the aircraft is outside of the CARP solution.



## CARP INIT 1/5

Used to define the CARP drop zone and waypoint placement.



**L1:** Displays the label or identifier of the Point of Impact (PI). If CARP INIT 1/5 was accessed via MFP from WAYPOINT DATA, L1 defaults to the waypoint label/ident.

If CARP INIT 1/5 was accessed via MISSIONS, a waypoint identifier can manually be entered. Valid entries consist of waypoint or airport identifiers in the navigation or custom database. If an identifier is entered that does match anything contained in the two databases, a blank CUSTOM DATA page will be shown where waypoint information can be defined. Once definition is complete, the new identifier can be entered into L1.

The PI can also be defined using place/bearing/distance, place/bearing/place/bearing, latitude/longitude, or MGRS entries. If the PI is defined using these methods, a waypoint label will be created by the CNI.

**L2:** Displays the latitude and longitude of the identifier entered at L1.

**L3:** Specifies the drop zone length from Leading Edge (LE) to Trailing Edge (TE).

**L4:** Specifies the slowdown (SD) point distance from the PI.

**L5:** Allows for specification of the run in course.

**L6:** Branches to MISSIONS if CARP INIT was accessed via MISSIONS. Branches to LEGS 1 if CARP INIT was accessed via a WAYPOINT DATA page. If the route is provisional, ERASE is displayed.



**R1:** Specifies a time navigation target to reach the green light position at.

**R2:** Blank.

**R3:** Specifies the drop zone length from Leading Edge (LE) to the Point of Impact (PI).

**R4:** Specifies the Turn Point (TP) distance from the PI.

**R5:** Specifies the distance from the red light position to the turn onto the next waypoint in the flight plan.

**R6:** Branches to CARP PROG 1/2.



## CARP INIT 2/5

Used to define the airdrop load.



**L1:** Selects the load type for the airdrop. The acronyms listed are defined as follows:

Load Type	Meaning
PER	Personnel
CDS	Container Delivery System
HE	Heavy Equipment
BDL-OTH	Training Bundle-Other

**L2:** Selects the number of airdrop stages.

**L3:** Specifies the type and number of parachutes to be used for each piece of cargo.

**L4:** Specifies the calibrated airspeed of the airdrop. The field defaults to 140 for all load selections except for PER, which defaults to 130 knots.

**L5:** Selects the behavior of the flight plan route after the drop zone escape point is passed. When ESC is selected, the next flight plan waypoint will be sequenced after the DZ ESC point is reached. If L or R is selected, a left or right racetrack pattern will be drawn.

**L6:** Branches to MISSIONS if CARP INIT was accessed via MISSIONS. Branches to LEGS 1 if CARP INIT was accessed via a WAYPOINT DATA page. If the route is provisional, ERASE is displayed.



**R1:** If the load type selected at L1 is PER or BDL-OTH, the field is blank. For loads other than PER, the FUS STA field is displayed.

The FUS STA field defines the location of the first airdrop element in the cargo bay. This setting affects the payload exit time displayed on CARP INIT 5/5.

**R2:** If the load type selected at L1 is PER or BDL-OTH, R2 displays the EXIT field. The field specifies which exit the load will be using.

If the load type selected at L1 is CDS or HE, R2 displays the RELEASE SYS field. Two selections are available, Towplate (TOW) and Extraction Chute (EXTR), which specify how the load will be exiting the aircraft.

**R3:** Specifies the weight and quantity of the cargo load.

**R4:** Displays the total weight of the airdrop load using the entries at R3. The weight can be manually entered, if desired.

**R5:** Branches to CHUTE LIST.

**R6:** Branches to CARP PROG.



**CARP INIT 3/5**

Used to define the weather parameters at and above the drop zone.



**L1:** Specifies the wind direction and speed at the drop altitude.

**L2:** Blank.

**L3:** Specifies the wind direction and speed at the PI elevation.

**L4:** Displays the vector average of the altitude and surface wind velocities.

**L5:**

**L6:** Branches to MISSIONS if CARP INIT was accessed via MISSIONS. Branches to LEGS 1 if CARP INIT was accessed via a WAYPOINT DATA page.

**R1:** Specifies the temperature at the drop altitude.

**R2:** Blank.

**R3:** Specifies the temperature at the PI elevation.

**R4:** Blank.

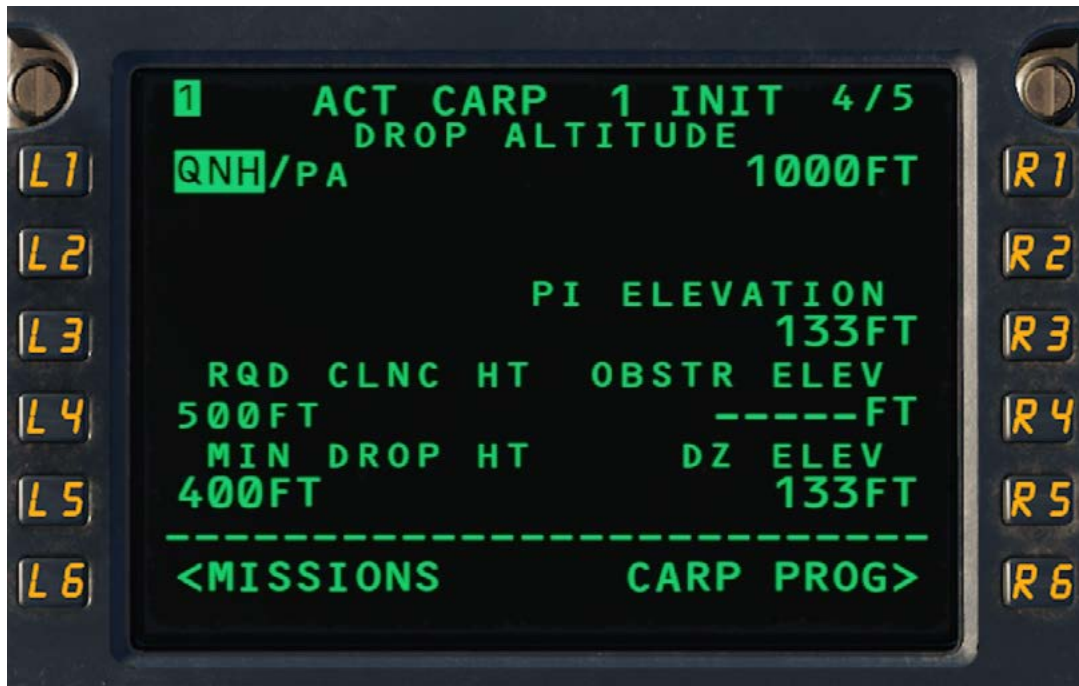
**R5:**

**R6:** Branches to CARP PROG.



## CARP INIT 4/5

Used to define the drop altitude, drop zone elevation, and any obstacles in the vicinity of the drop zone.



**L1:**

**L2-L3:** Blank.

**L4:** Specifies the required clearance height above the defined obstruction elevation.

**L5:** Specifies the minimum drop height above the DZ. If a required clearance height and obstruction elevation have been specified, the field displays dashes.

**L6:** Branches to MISSIONS if CARP INIT was accessed via MISSIONS. Branches to LEGS 1 if CARP INIT was accessed via a WAYPOINT DATA page. If the route is provisional, ERASE is displayed.

**R1:** Specifies the drop altitude. If the entered altitude is lower than the required clearance height or minimum drop height, the CNI message "DROP ALT BELOW MIN" will be displayed.

**R2:** Blank.

**R3:** Specifies the elevation of the Point of Impact.

**R4:** Specifies the elevation of the highest obstruction in the drop zone. The obstruction elevation is used in conjunction with the required clearance height to determine the minimum drop altitude.



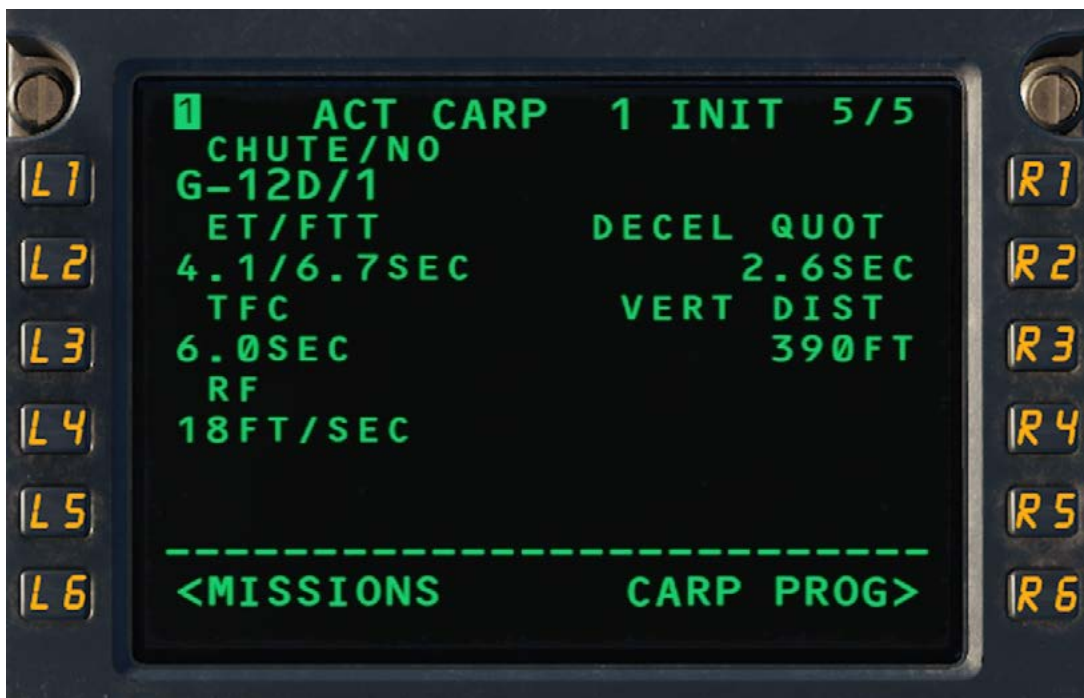
**R5:** Specifies the elevation of the drop zone. The drop zone elevation is used in conjunction with the minimum drop height to determine the minimum drop altitude. If a required clearance height and obstruction elevation have been specified, the field displays dashes.

**R6:** Branches to CARP PROG.



**CARP INIT 5/5**

Displays the ballistic information of the airdrop load.



**L1:** Displays the chute identifier.

**L2:** Displays the Exit Time (ET) and Forward Travel Time (FTT)

**L3:** Displays the Time of Fall Constant (TFC)

**L4:** Displays the Rate of Fall (RF).

**L5:** Displays the deceleration time.

**L6:** Branches to MISSIONS if CARP INIT was accessed via MISSIONS. Branches to LEGS 1 if CARP INIT was accessed via a WAYPOINT DATA page. If the route is provisional, ERASE is displayed.

**R1:** Blank.

**R2:** Displays the deceleration coefficient.

**R3:** Displays the vertical fall distance.

**R4-R5:** Blank.

**R6:** Branches to CARP PROG.



## CHUTE LIST

Displays the identifier of parachutes that have ballistics information in the CNI database.



**L1-L5, R1-R5:** Displays parachute identifiers that have ballistics information available in the database. Using an LSK adjacent to an identifier will downselect it into the scratchpad.

**L6:** Branches to CARP INIT 2/5.

**R6:** Blank.



## CARP PROG 1/2

Displays granular information about the defined air drop, including release point positioning relative to the PI, wind information, and red light timing. Using this page, the crew can switch the CARP calculations to use entered winds instead of sensed, which will freeze the release point calculation if the sensed wind data is changing rapidly.



**L1:** Displays the release point positioning relative to the PI. The release point can be positioned before (SH), after (LG), left (L), or right (R) of the PI due to wind correction.

**L2:** Selects whether the release point calculation is being driven by sensed (SEN) or entered (ENT) winds.

To the right of the WINDS toggle, the current FOM of both INAV solutions is displayed.

**L3:** Displays the drop altitude (D ALT) and drop speed (CAS) defined on CARP INIT. Changing either value will pass the new altitude/speed back to the CARP INIT pages.

**L4:** If a time navigation target has been defined for the CARP on CARP INIT 1/5, the TOT will be displayed. Changing the TOT will update the time nav target and propagate the change back to CARP INIT. When a TOT has been defined, the time nav delta will be shown to the right: an “AHD” label will be shown if the aircraft is ahead of schedule, while “BHD” is shown if behind schedule. If a TOT has not been defined, the field will show dashes.

**L5:** Toggles the CARP racetrack option between ESCAPE (ESC), and left or right racetrack patterns.



**L6:** Branches to CARP INIT 1/5. The remaining Time to Go (TTG) to the CARP turnpoint is displayed above the branching prompt.

**R1:** Sensed wind information is supplied from the PROGRESS 2/4 page and displayed to the right of the SEN label. When SEN is selected at L2, this value will be used to compute the release point position.

Entered wind is pulled from ALT W/V field on CARP INIT 3/5 and can be manually overridden, if desired. When ENT is selected at L2, this value will be used to compute the release point position.

Using R1 with a blank scratchpad will downselect the current sensed wind into the scratchpad.

**R2:** Displays the computed ballistic wind. The computed value can be manually overridden and the new wind entry will be propagated back to CARP INIT.

**R3-R4:** Blank.

**R5:** Displays the defined surface wind. Changing the wind direction or speed will pass the new direction/speed back to CARP INIT.

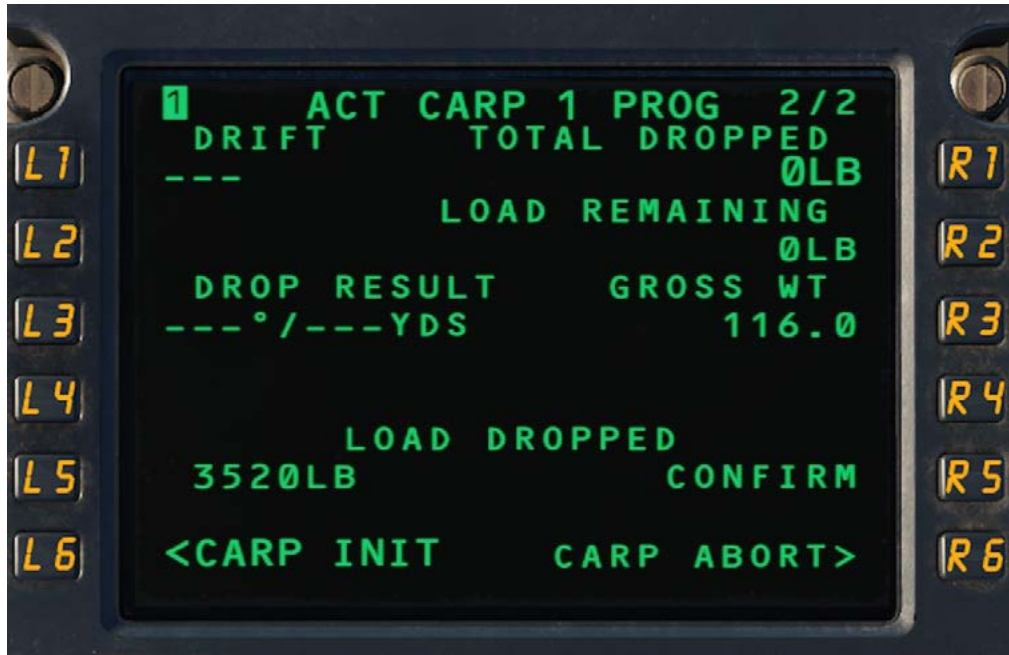
**R6:** When the CARP turnpoint has been passed, the CARP ABORT prompt is displayed in large font. Using R6 will bypass the drop zone and sequence the DZ ESC point as the active waypoint. The field will return to small font after being used, or when the DZ ESC point has been passed.

The estimated red light time based on the drop zone length and defined drop speed is displayed above the CARP ABORT prompt.



## CARP PROG 2/2

Allows for the release point's position to be refined based on where the load actually landed in relation to the PI. Additionally, the page provides a method for updating the aircraft's weight and balance after an airdrop.



**L1:** Displays the current drift angle of the airplane, in degrees. Drift is defined as the difference between the aircraft's heading and ground track. Left drift is denoted with an "L" suffix, while right is denoted with an "R".

**L2:** Blank.

**L3:** When multiple passes are conducted over the same drop zone, DROP RESULTS can be used to refine the release point position based on where the airdropped loads are landing on the ground in relation to their desired position. The direction field is relative to the run in course, while the yard value is the deviation from the desired position. CARP applies this correction to the ballistics calculations to refine the accuracy of the next pass.

**L4:** Blank.

**L5:** Displays the drop payload from CARP INIT 2/5.

**L6:** Branches to CARP INIT.



**R1:** Displays the total payload that has been confirmed dropped using R5.

**R2:** Displays the payload remaining onboard the aircraft. The value at R1 is subtracted from the payload weight on PERF INIT WEIGHT to give the weight of the remaining payload.

**R3:** Displays the aircraft's current gross weight.

**R4:** Blank.

**R5:** CONFIRM is shown in small font when the turnpoint of the CARP has not been passed. Upon passing the turnpoint, CONFIRM changes to large font. When CONFIRM is shown in large font and R4 is used, the following actions occur:

1. The EXEC key is illuminated.
2. The LOAD DROPPED value at L5 is added to TOTAL DROPPED at R1.
3. The LOAD DROPPED value is subtracted from the payload weight on PERF INIT WEIGHT.
4. The LOAD REMAINING value is updated to reflect PERF INIT WEIGHT's new payload weight.
5. The aircraft gross weight is updated to reflect the reduced payload.

**R6:** When the CARP turnpoint has been passed, the CARP ABORT prompt is displayed in large font. Using R6 will bypass the drop zone and sequence the DZ ESC point as the active waypoint. The field will return to small font after being used, or when the DZ ESC point has been passed.



## Coordinated Aircraft Positioning System (CAPS) Overview

CAPS, like CARP, is another system on the C-130J that automates an otherwise high-workload task, which is formation flight in this case. CAPS is a form of Station Keeping Equipment (SKE) that sends commands to the flight director to maintain the aircraft's position in a formation of multiple aircraft. By using the CAPS pages within the CNI, the crew of each aircraft can specify the desired position of their aircraft in relation to the formation lead, down to the foot.

In addition to station keeping, CAPS also provides the capability for text-based maneuver commands and advisories to be shared between formation members. These messages allow the formation leader to keep other aircraft informed of any changes to aircraft positioning without the use of radios. A conflict alerting system automatically alerts crewmembers when a formation aircraft violates a predefined safety margin.

When a formation has been defined, coupling CAPS to the flight director and autothrottles will result in a hands-off experience that follows the lateral positioning of the lead aircraft.

## Station Keeping

The primary function of CAPS is station keeping, which holds the aircraft in a defined lateral and longitudinal position within the formation. Station keeping, as a concept, can be thought of the lead aircraft towing a circle through the air: the circle can be towed at a defined distance behind, left, or right of the lead. In this metaphor, the circle is the desired position entered on the CAPS FORMATION PRMTR page. Unless changed by the crew, the desired position circle remains in a constant position relative to the lead aircraft; CAPS will generate flight director and autothrottle commands to maneuver the aircraft to remain within the desired position circle.

Note: CAPS will not follow the lead aircraft's vertical position. Any altitude adjustments must be performed manually by the crew.

## Station Keeping Inputs

CAPS FORMATION PRMTR is used to define the aircraft's position in relation to a specified lead aircraft. The specified lead does not have to be the formation leader, however: the lead can be any aircraft within the formation. The desired position circle will be placed in relation to the aircraft specified as the lead. Two distances are used to position the circle:

**Along Path (A-PATH):** the desired distance in trail of the lead aircraft, in feet.

**Cross Path (X-PATH):** the desired distance left or right of the lead aircraft, in feet.



## CAPS SKE CTRL

Used to configure the SKE system's operating parameters and power state.



**L1:** Toggles the SKE frequency the formation is operating on,

**L2:** Selects whether the SKE system is transmitting.

**L3:** Selects which mode the clock is operating in.

**L4-L5:** Blank.

**L6:** Branches to CAPS AIRCRAFT.

**R1:** Toggles power to the SKE system.

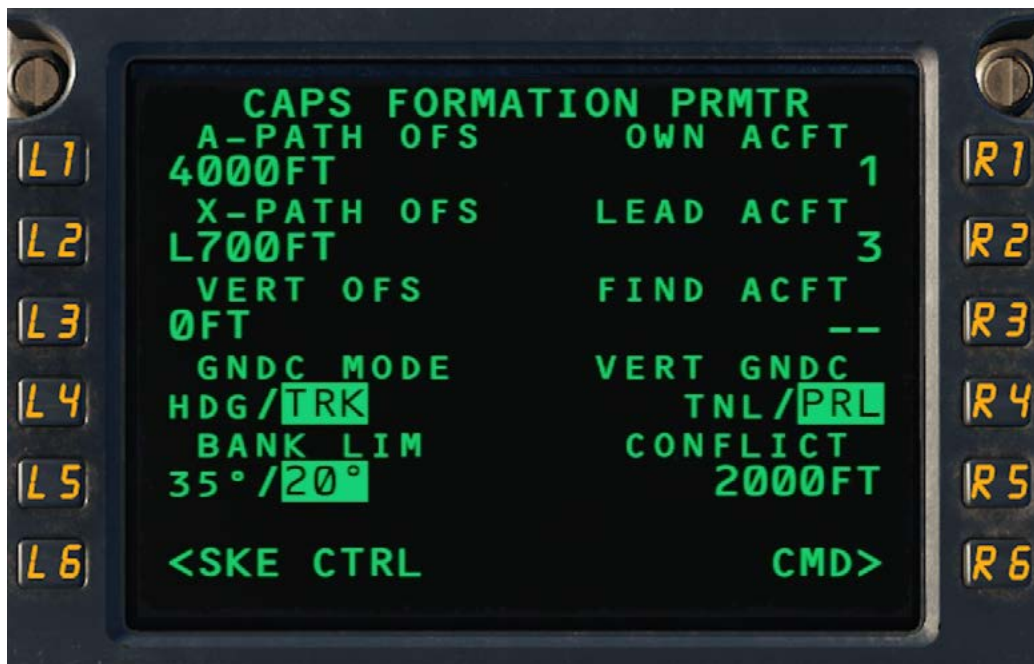
**R2-R5:** Blank.

**R6:** Branches to CAPS FORMATION PRMTR.



## CAPS FORMATION PRMTR

Used to define aspects about the formation's flight.



**L1:** Defines the Along Path Offset of the ownship.

**L2:** Defines the Crosspath Offset of the ownship.

**L3:** Defines the vertical offset of the ownship.

**L4:** Selects which heading reference SKE is using.

**L5:** Selects the maximum bank angle sent to the flight director.

**L6:** Branches to CAPS SKE CTRL.

**R1:** Displays the aircraft identifier of the ownship.

**R2:** Displays the aircraft identifier of the formation lead.

**R3:** Allows for entry of an aircraft identifier to display on the CAPS HDD page. The selected aircraft's symbol will be surrounded by a pentagon symbol.

**R4:** Selects the vertical guidance mode.

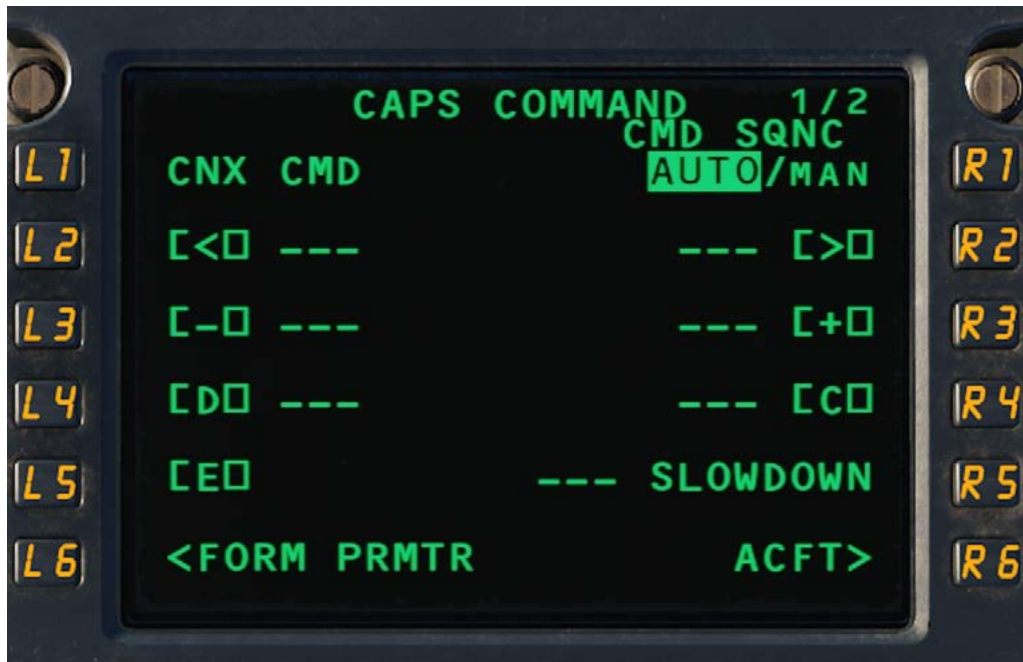
**R5:** Allows for definition of the conflict ring. The entered distance is used as a radius to create a protected zone around the ownship airplane; if another member of the formation is predicted to be inside of the conflict ring within 15 seconds, the "CONFLICT, CONFLICT" special alert will be generated.

**R6:** Branches to CAPS COMMAND.



## CAPS COMMAND 1/2

Used to send maneuver commands to formation members.



**L1:** If a command is being transmitted to the formation, as evidenced by a line on one of the two CAPS COMMAND pages being inversed, CNX CMD will remove the message from the formation element's message areas. "CNX LAST CMD" will be shown in the issuer's CAPS message area.

**L2:** Sends the "LEFT" CAPS message to the formation. The command can be sent with or without a heading.

**L3:** Sends the "DECEL" CAPS message to the formation. The command can be sent with or without a speed.

**L4:** Sends the "DESCEND" CAPS message to the formation. The command can be sent with or without an altitude.

**L5:** Sends the "EXECUTE" CAPS message to the formation.

**L6:** Branches to CAPS FORMATION PRMTR.

**R1:** Toggles the CAPS command sequence selection.



**R2:** Sends the “RIGHT” CAPS message to the formation. The command can be sent with or without a heading.

**R3:** Sends the “ACCEL” CAPS message to the formation. The command can be sent with or without a speed.

**R4:** Sends the “CLIMB” CAPS message to the formation. The command can be sent with or without an altitude.

**R5:** Sends the “SLOWDOWN” CAPS message to the formation. The command can be sent with or without a speed.

**R6:** Branches to CAPS AIRCRAFT.



## CAPS COMMAND 2/2

Used to send maneuver commands to formation members.



**L1:** If a command is being transmitted to the formation, as evidenced by a line on one of the two CAPS COMMAND pages being inversed, CNX CMD will remove the message from the formation element's message areas. "CNX LAST CMD" will be shown in the issuer's CAPS message area.

**L2:** Sends the "L DRIFT" CAPS message to the formation. The command can be sent with or without a degree.

**L3:** Sends the "BARO" CAPS message to the formation. A barometer value must be entered for the message to send.

**L4:** Sends the "FORMATION PRMTR" CAPS message to the formation. The command can be sent with or without an associated value.

**L5:** Sends the "NO DROP" CAPS message to the formation.

**L6:** Branches to CAPS FORMATION PRMTR.

**R1:** Toggles the CAPS command relay selection.



**R2:** Sends the “R DRIFT” CAPS message to the formation. The command can be sent with or without a degree.

**R3:** Sends the “FREQ” CAPS message to the formation. A frequency must be entered for the message to send.

**R4:** Sends the “TOT” CAPS message to the formation. A TOT value must be entered for the message to send

**R5:** Sends the “OVERRUN” CAPS message to the formation.

**R6:** Branches to CAPS AIRCRAFT.



## CAPS AIRCRAFT

Used to select which formation aircraft will appear on the CAPS HDD page.



**L1-L2, R1-R2:** Displays the aircraft identifiers selected to appear on the CAPS display.

**L3:** Adds the aircraft identifier(s) in the scratchpad to the selected aircraft list. Valid identifiers range from 1-36, excluding 10, 20, and 30.

Note: Multiple identifiers can be added or deleted with one LSK use by using a decimal (.) to separate them.

**L4:** Deletes the aircraft identifier(s) in the scratchpad from the selected aircraft list.

**L5:** Removes all identifiers from the selected aircraft list.

**L6:** Branches to CAPS COMMAND 1/2.

**R3:** Blank.

**R4:** Controls which aircraft are displayed on the CAPS HDD page. The two selections include:

- **SELECTED:** Only the aircraft in the selected aircraft list will be shown.
- **ALL:** All formation elements will be shown.

**R6:** Branches to CAPS SKE CTRL.



## DIR INTC

Used to generate flight path guidance directly to a navigation point.



When the DIR INTC key is pressed and an active route exists, a modified version of the LEGS page will be displayed. At the bottom of the page, the branching prompts on the normal LEGS page are replaced with two fields: DIRECT TO and INTC TO LEG.

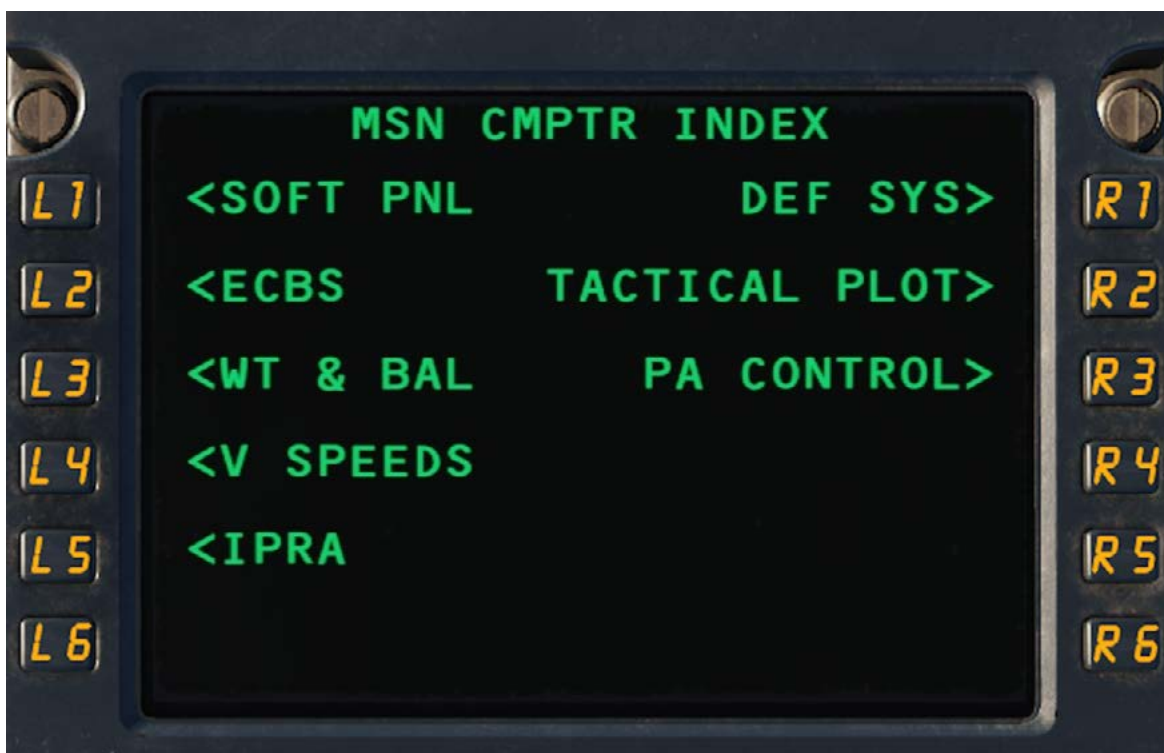
The DIRECT TO field accepts navigation and custom datapoints identifiers: if an identifier is entered that does not exist in either database, a blank CUSTOM DATA page will be created to allow for definition of that point. When an identifier is entered that exists in either database, a provisional route will be created with a curved-path turn towards the entered waypoint.

If the DIR INTC mode key is pressed without an active route, the CNI message “NO ACTIVE ROUTE” will be displayed.



## MSN CMPTR INDEX

Serves as a menu page for the various functions within the mission computer.



**L1:** Branches to SOFT PANEL MENU.

**L2:** Branches to ECB.

**L3:** Branches to WT + BAL.

**L4:** Branches to V SPEED.

**L5:** Branches to IPRA 1/2.

**L6:** Blank.

**R1:** Branches to DEF SYS CONTROL.

**R2:** Branches to TACTICAL PLOT.

**R3:** Branches to PA CONTROL.

**R4-R6:** Blank.



## ECB

Used to interact with the aircraft's Electronic Circuit Breakers.



**L1:** Controls the ECB HDD page visibility. On a hot start, HDD 3 is the designated HDD that the ECB page will be displayed on; this can be changed by entering an HDD identifier in the CNI scratchpad and pressing the L1. Valid HDD identifiers range from 1 to 4. "INVALID HDD" will be presented if the identifier is invalid. Pressing the LSK with the CNI scratchpad blank will toggle the HDD screen on and off.

NOTE: On initial powerup, the HDD field will be blank: an HDD identifier must be entered using the scratchpad for the LSK to function. If the aircraft loses AC power, this field will also be reset to blank.

**L2:** Controls which ECB page is shown on the designated HDD. Pressing the LSK will cycle through the 3 different page options. "OPEN" is the default selection.

- **SYS:** ECB BY SYSTEM. The ECB list is sorted by what system they belong to.
- **BUS:** ECB BY BUS. The ECB list is sorted by what electrical bus they belong to.
- **OPEN:** ECB BY SYSTEM – OPEN ONLY. Only open ECBs are displayed and are sorted by which system they belong to.

**L3:** Blank.

**L4:** When an ECB identifier(s) is present in the scratchpad, pressing L4 will select the ECBs from the list and display them in inverse video on the ECB HDD page. Further actions such as pull and reset can then be performed.



**L5:** Blank.

**L6:** Branches to MSN CMPTR INDEX.

**R1-R2:** No function.

**R3:** When an ECB identifier(s) is present in the scratchpad, pressing R3 will reset the entered ECBs. If more than one ECB was present in the scratchpad, the message "VERIFY RESET" will be displayed and the LSK must be pressed a second time to carry out the operation.

**R4:** When an ECB identifier(s) is present in the scratchpad, pressing R4 will pull the entered ECBs. If more than one ECB was present in the scratchpad, the message "VERIFY PULL" will be displayed and the LSK must be pressed a second time to carry out the operation.

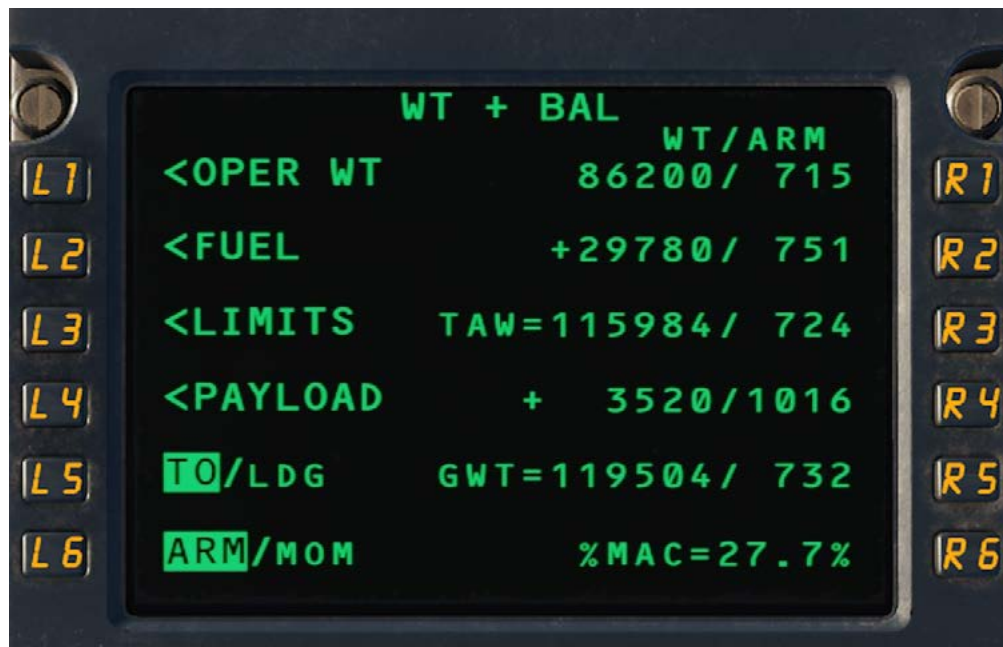
**R5:** Cycles to the next page of the ECB page structure. If the current page is the last page of the structure, pressing NEXT PAGE will cycle to the first page.

**R6:** Cycles to the previous page of the ECB page structure. If the current page is the first page of the structure, pressing PREV PAGE will cycle to the last page.



**WT + BAL**

Displays information about the aircraft's weight and balance. All weights are displayed in pounds.



**L1:** Branches to OPERATING WEIGHT.

**L2:** Branches to FUELS.

**L3:** Branches to LIMITS.

**L4:** Branches to PAYLOAD.

**L5:** Selects whether the takeoff or landing weights for FUELS and PAYLOAD are used for the calculations on the right side of the page.

**L6:** Selects whether payload arm or moment is used for data entry and display on the WT + BAL, OPERATING WEIGHT, FUELS, and PAYLOAD pages.

**R1:** Displays the operating weight and arm/moment.

**R2:** If TO is selected at L5, the takeoff fuel and its arm is displayed. If LDG is selected, the estimated landing fuel and its arm is displayed.

**R3:** Displays the total aircraft weight and arm. TAW is the sum of operating weight and either takeoff fuel or estimated landing fuel, depending on the selection at L5.

**R4:** Displays the payload weight and arm. If LDG is selected at L5, any payload marked as airdrop on the PAYLOAD page will not be included in the displayed weight.

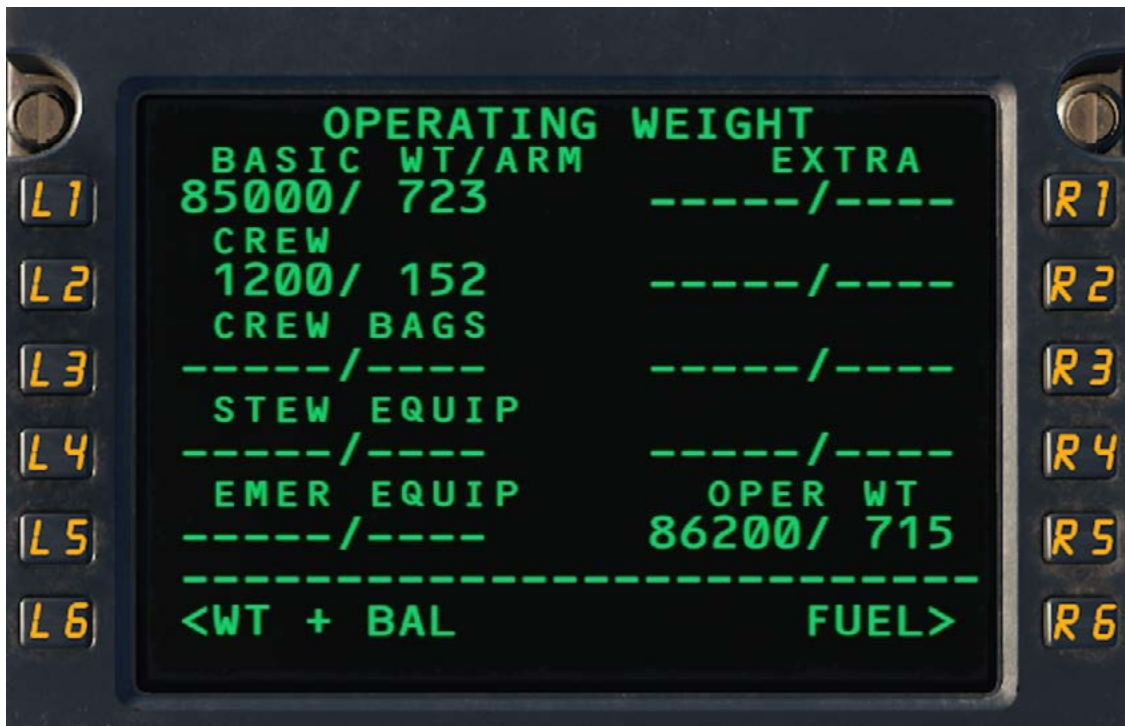
**R5:** Displays the aircraft's gross weight and arm.

**R6:** Displays the calculated %MAC based on the information at R5.



## OPERATING WEIGHT

Used to define and edit parameters that factor into the aircraft's operating weight. All weights are displayed in pounds.



**L1:** Displays the Basic Operating Weight (BOW) and CG of the aircraft.

**L2:** Displays the weight and position of the crew.

**L3:** Displays the weight and position of the crew's baggage.

**L4:** Displays the weight and position of the loadmaster's equipment.

**L5:** Displays the weight and position of the emergency equipment.

**L6:** Branches to WT + BAL.

**R1-R4:** Allows for entry of any extra weight that is not considered to be payload.

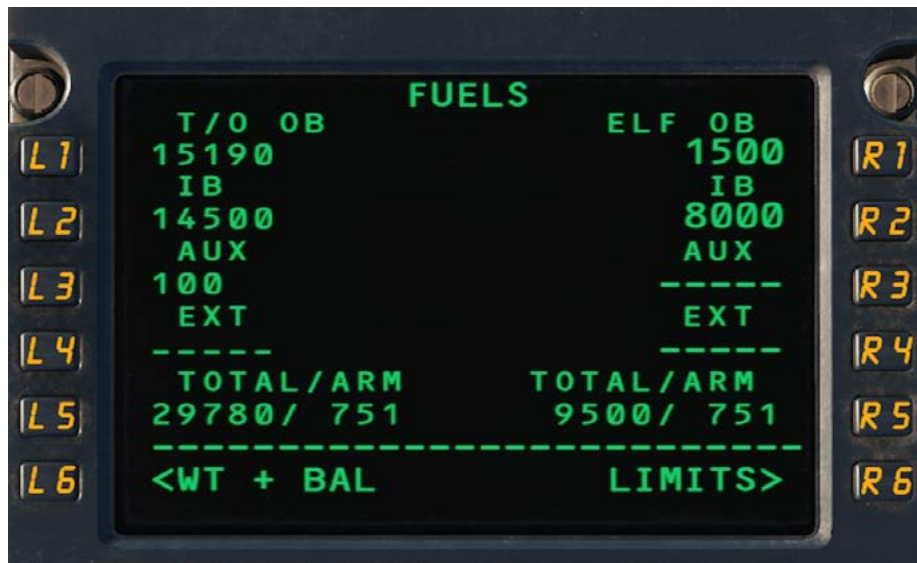
**R5:** Displays the total weight of all page entries, and the new CG.

**R6:** Branches to FUELS.



## FUELS

Used to define the takeoff and landing fuel on board. The default fuel quantity values are pulled from the fuel quantity sensors and shown in small font. All weights are displayed in pounds.



**L1:** Displays the total quantity of fuel, in pounds, in the outboard fuel tanks.

**L2:** Displays the total quantity of fuel, in pounds, in the inboard fuel tanks.

**L3:** Displays the total quantity of fuel, in pounds, in the auxiliary fuel tanks.

**L4:** Displays the total quantity of fuel, in pounds, in the external fuel tanks. If external tanks are not installed, dashes will be displayed.

**L5:** Displays the total takeoff fuel and its CG position.

**L6:** Branches to WT + BAL.

**R1:** Allows for entry of the estimated landing fuel remaining in the outboard fuel tanks. The default value is box prompts.

**R2:** Allows for entry of the estimated landing fuel remaining in the inboard fuel tanks.

**R3:** Allows for entry of the estimated landing fuel remaining in the inboard fuel tanks.

**R4:** Allows for entry of the estimated landing fuel remaining in the external fuel tanks. The default value is dashes.

**R5:** Displays the total landing fuel and its CG position. The field is dashed until data is entered into any of the fields at R1-R4.

**R6:** Branches to LIMITS.



## PAYLOAD

Used to define the weight and location of payloads in the cargo bay. All weights are displayed in pounds.



**L1-L5:** Allows for entry of payload weight and station. Entries made with a double slash will be denoted as an airdrop payload, which will be marked with a single inverse slash between the payload weight and station.

**L6:** Branches to WT + BAL.

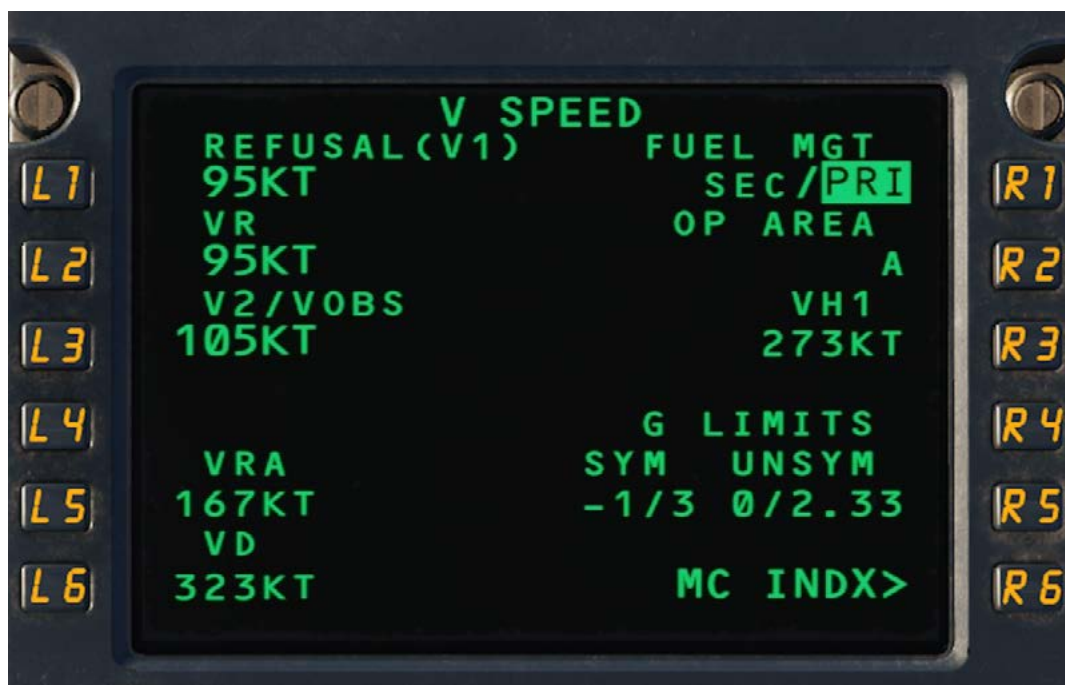
**R1-R5:** Allows for entry of payload weight and station. Entries made with a double slash will be denoted as an airdrop payload, which will be marked with a single inverse slash between the payload weight and station.

**R6:** If TO is selected at L5 on WT + BAL, the takeoff payload and CG is displayed. If LDG is selected, payload marked for airdrop is removed from the payload weight and CG.



## V SPEED

Used to define and view the airspeeds associated with the airspeed reference carets on the PFD and HUD.



**L1:** Allows for entry of the refusal speed ( $V_1$ ). The refusal speed entered corresponds to the “<1” carets on the PFD speed tape and the HUD airspeed indicator.

**L2:** Allows for entry of the rotation speed ( $V_R$ ). The refusal speed entered corresponds to the “<R” carets on the PFD speed tape and the HUD airspeed indicator.

**L3:** Allows for entry of the obstacle clearance speed ( $V_{OBS}$ ).  $V_{OBS}$  is not displayed on the PFD or HUD like the  $V_1$  and  $V_R$  carets are: instead, the PFD reference airspeed bug and HUD caret are set to the speed entered at L3 while on the ground. The effect is that when the  $V_1$  and  $V_R$  carets are automatically hidden with weight-off-wheels, the airspeed carets are displaying  $V_{OBS}$  without any crew input.

**L4:** Blank.

**L5:** Displays the recommended speed for turbulence penetration ( $V_{RA}$ ).

**L6:** Displays the maximum permissible airspeed based on the ambient conditions. The speed displayed at L6 corresponds to the overspeed awareness cue on the PFD, and the “<D” caret in the HUD.

**R1:** Selects whether primary or secondary fuel management is used for computing the operating area, maximum recommended airspeed ( $V_H$ ), and G limits.



**R2:** Displays the current operating area the aircraft is in.

**R3:** Displays the maximum recommended airspeed.  $V_H$  corresponds to the "<H" carets on the PFD and HUD.

**R4:** Blank.

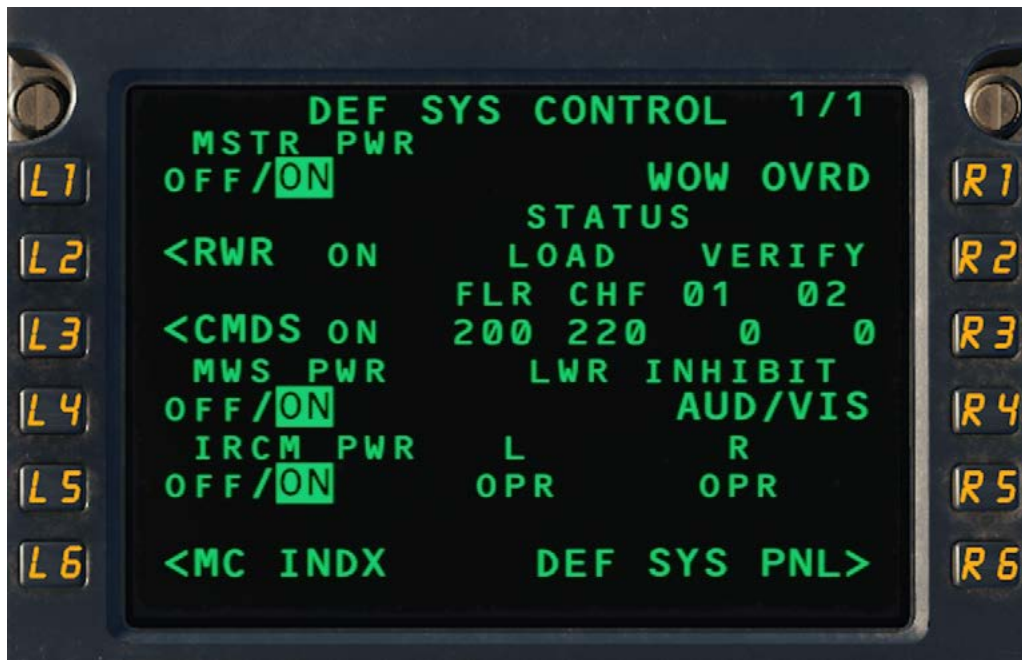
**R5:** Displays the symmetrical and asymmetrical G limits for the current operating area.

**R6:** Branches to MSN CMPTR INDEX.



## DEF SYS CONTROL

Used to manage the components of the defensive system.



**L1:** Toggles power to the RWR, CMDS, MWS, and IRCM systems. If any of the subsystems have been manually turned off via their respective CNI pages, the toggle will be set to OFF to represent that some defensive systems are not operational.

**L2:** Branches to RWR CONTROL. To the right of the branching prompt, the RWR's power state is displayed.

**L3:** Branches to CMDS CONTROL. To the right of the branching prompt, the CMDS power state is displayed.

**L4:** Toggles power to the Missile Warning System.

**L5:** Toggles power to the Infrared Countermeasures System.

**L6:** Branches to MSN CMPTR INDEX.

**R1:** Allows for the weight-on-wheels lockout of the CMDS to be overridden. R1 is interfaced with R2 to provide verification before the lockout is disabled.



**R2:** VERIFY is displayed in small font by default. When R1 is utilized, VERIFY changes to large font, inverse video for 5 seconds: if R2 is pressed within this 5 second window, the CMDS lockout will be overridden. If R2 is not pressed, VERIFY returns to small font, normal video, and the lockout remains functional.

To the left of VERIFY, the CMDS status is displayed. "LOAD" is shown whenever chaff and flares are loaded. When CMDS power is set to OFF, the field becomes blank.

**R3:** Displays the quantity of flares (FLR), chaff (CHF), and other countermeasures (01/01). When CMDS power is set to OFF, or the CMDS startup BIT is in progress, the fields are dashed.

**R4:** Allows for the audio (AUD) and visual (VIS) aspects of the Laser Warning Receiver to be inhibited. Pressing R4 once will inhibit the LWR's audio warnings, pressing R4 a second time will inhibit both the audio and visual warnings. Pressing R4 a third time will enable both warnings again. When MWS PWR is set to OFF, AUD/VIS is displayed in small font and is nonfunctional.

**R5:** Displays the status of the left (L) and right (R) IRCM transmitters. When IRCM power is set to OFF, "OFF" is displayed. During the warmup period, "WARMUP" is displayed; after the warmup is completed, "STANDBY" is displayed. When the IRCM switch on the DEFENSIVE SYSTEMS panel is set to OPR, "OPR" is displayed.

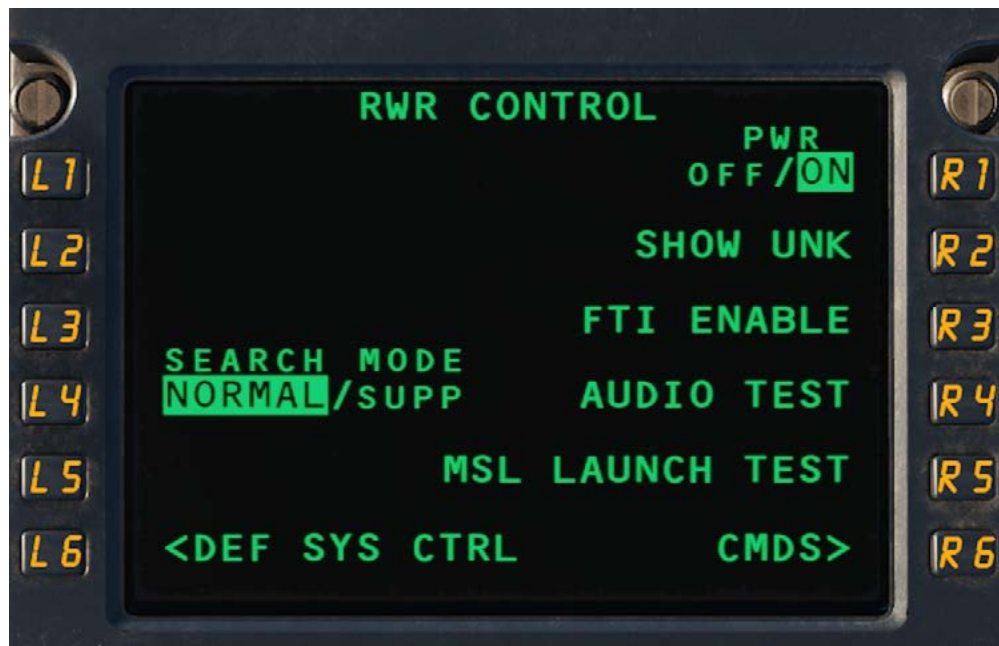
"WOW OVRD" is displayed in large font, inverse video below the IRCM transmitter status fields whenever the CMDS weight-on-wheels lockout has been overridden.

**R6:** Nonfunctional.



## RWR CONTROL

Used to configure the RWR's operating parameters.



**L1-L3:** Blank.

**L4:** Selects which search mode the RWR is operating in. Selection is only operable when the SRCH pushbutton on the DEFENSIVE SYSTEMS panel is enabled; otherwise, the last-selected option is locked. NORMAL is the default selection.

**L5:** Blank.

**L6:** Branches to DEF SYS CONTROL.

**R1:** Toggles power to the RWR.

**R2:** Enables unknown threats to be displayed on the RWR overlay.

**R3:** Enables the Floating Target Indicator on the RWR overlay.

**R4:** Runs the RWR audio test. When selected, all RWR tones are played.

**R5:** Runs the RWR missile launch test. When selected, the missile launch tone is played.

“WOW OVRD” is displayed in large font, inverse video below MSL LAUNCH TEST whenever the CMDS weight-on-wheels lockout has been overridden.

**R6:** Branches to CMDS CONTROL



## CMDS CONTROL

Used to configure the CMDS system.



**L1:** Toggles the flare countermeasure status. When SAFE is selected, flares cannot be dispensed. To the right of the status selection, the remaining flare quantity is displayed.

**L2:** Toggles the chaff countermeasure status. When SAFE is selected, chaff cannot be dispensed. To the right of the status selection, the remaining chaff quantity is displayed.

**L3:** No function.

**L4:** No function.

**L5:** Enables or disables the IRCM Jammer Interface (JMR INTF). When ON is selected, the IRCM systems will respond to MWS commands to counter inbound threats. When OFF is selected, the IRCM systems will not respond.

**L6:** Branches to DEF SYS CONTROL.

**R1:** Toggles power to the CMDS.

**R2:** Selects which countermeasure programs are used when the DEFENSIVE SYSTEMS MAN PR-GRMS switch is set to 1-4.



**R3:** Enables or disables the remote CMDS hand controllers. When OFF is selected, the hand controllers in the cargo bay and augmented crew station are non-functional.

**R4:** Enables or disables the MWS Jammer Interface (MWS INTF). When ON is selected, the CMDS will respond to MWS dispense commands to counter inbound threats. When OFF is selected, the CMDS will not respond.

**R5:** Enables or disables the RWR Jammer Interface (RWR INTF). When ON is selected, the CMDS will respond to RWR inputs to counter inbound threats. When OFF is selected, the RWR systems will not respond.

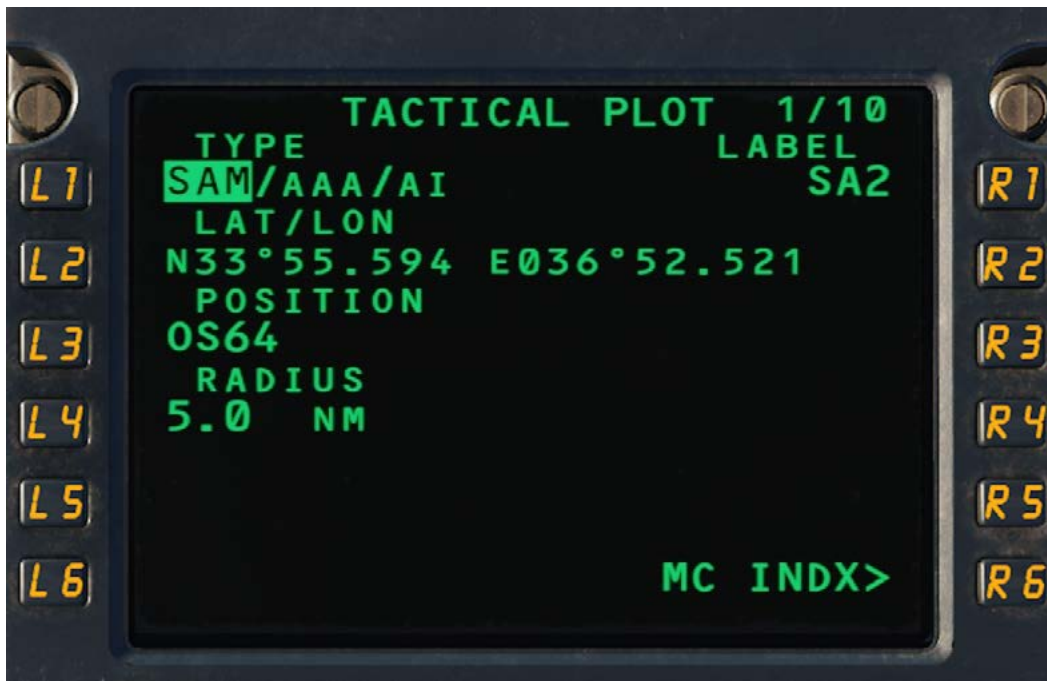
“WOW OVRD” is displayed in large font, inverse video beneath the JMR and RWT INTF fields whenever the CMDS weight-on-wheels lockout has been overridden.

**R6:** Branches to RWR CONTROL.



## TACTICAL PLOT

Used to create tactical plots for display on the nav-radar and dig map HDD pages.



**L1:** Selects the default label for the tact plot on the nav-radar and dig map. The label is displayed only if a custom label has not been specified at R1.

**L2:** Displays the latitude and longitude of the tac plot's center point.

**L3:** Allows for definition of the tac plot's center point. Valid entries include identifiers in the navigation and custom databases, lat/long coordinates and MRGS.

**L4:** Defines the radius of the tac plot's ring. Numerical entries without a suffix are assumed to be nautical miles, but a radius can also be defined in feet by using the "FT" suffix.

**L5-L6:** Blank.

**R1:** Allows for a custom label to be defined for the tac plot.

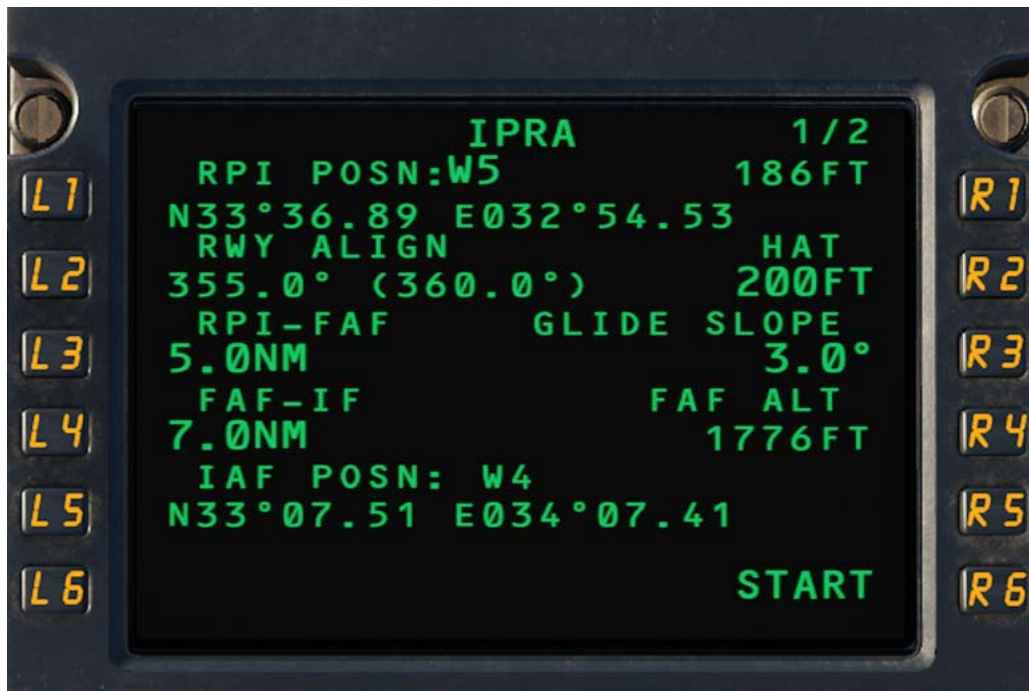
**R2-R5:** Blank.

**R6:** Branches to MSN CMPTR INDEX.



## IPRA 1/2

IPRA 1/2 is used to define the IPRA procedure's parameters.



**L1:** Defines the RPI's location. Valid entries are in the form of a waypoint identifier located in the active flight plan and is not the first or last waypoint. When a valid identifier has been entered, its geographic position will be displayed below the RPI POSN header.

**L2:** Defines the orientation of the IPRA runway.

**L3:** Defines the distance from the RPI to the Final Approach Fix (FAF).

**L4:** Defines the distance from the FAF to the Initial Approach Fix (IAF).

**L5:** Displays the geographic position and identifier of the IAF.

**L6:** Blank.

**R1:** Defines and displays the RPI elevation. When an identifier is entered at L1, the elevation associated with the waypoint in the navigation database is populated automatically.

**R2:** Defines the desired Height Above Threshold (HAT) where the Missed Approach Point (MAP) is placed.

**R3:** Defines the desired glideslope angle.



**R4:** Displays the calculated FAF altitude. The altitude will automatically be recalculated when the distance at L3 is changed, or the glideslope angle is altered.

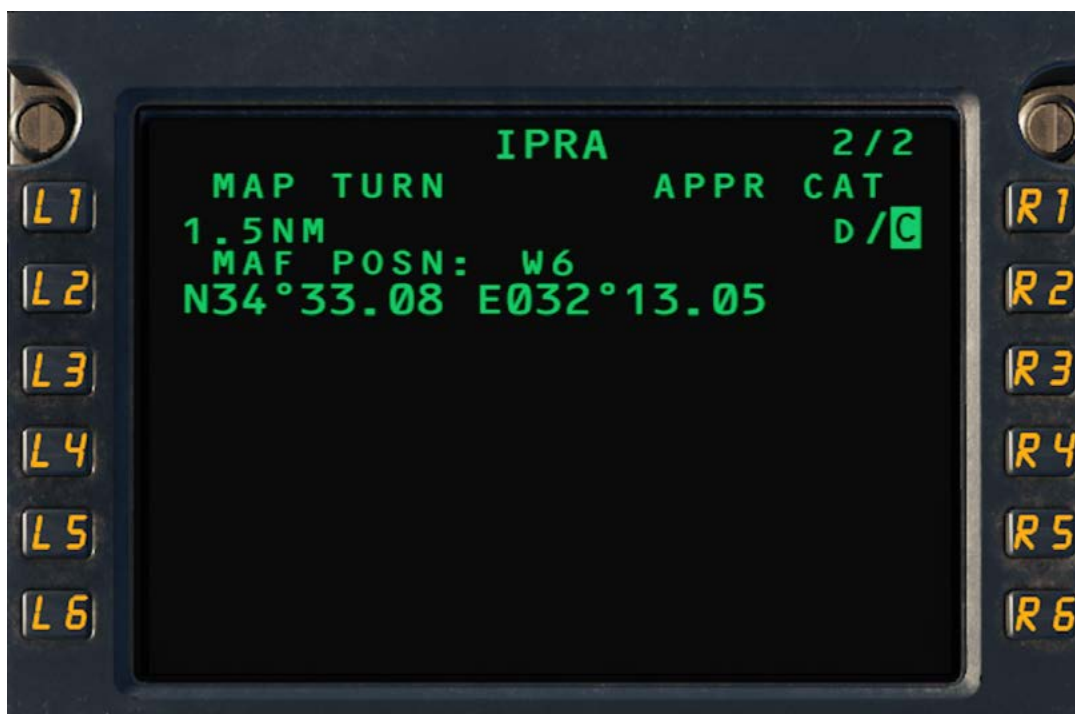
**R5:** Blank.

**R6:** START is used to initiate IPRA lateral and vertical guidance and must be selected prior to reaching the IAF defined at L5; if the IAF has already been passed, guidance will be provided towards the IAF and may result in an unachievable flight plan path. When R6 is selected, START is displayed in small font.



## IPRA 2/2

IPRA 2/2 is used to define the Missed Approach Procedure (MAP) parameters.



**L1:** Defines the distance between the MAP and the MAP Turn point.

**L2:** Displays the geographic position and identifier of the MAO.

**L3-L6:** Blank.

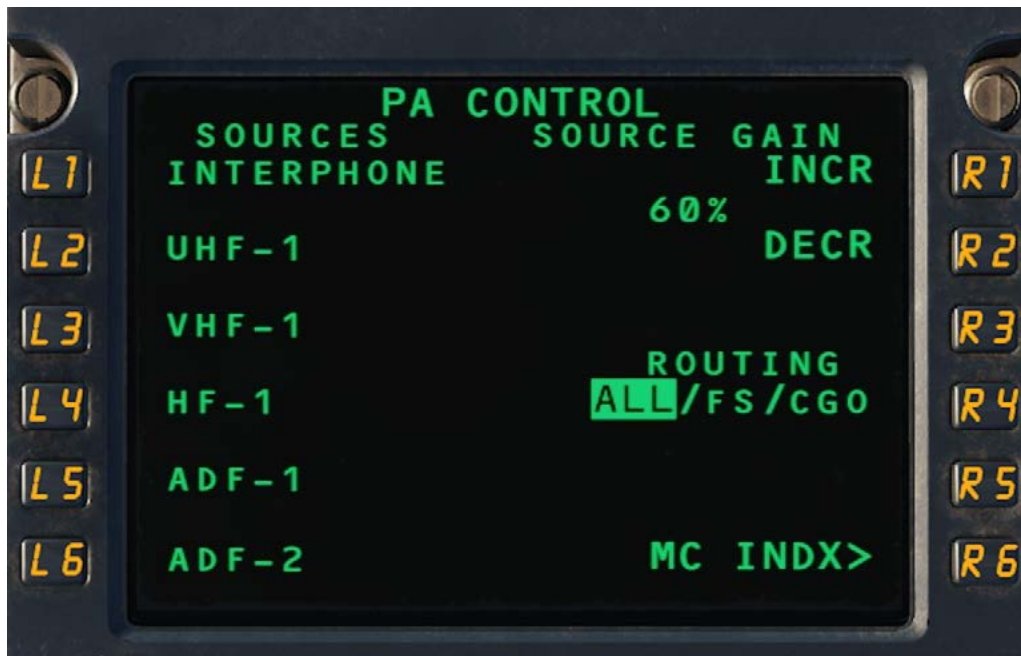
**R1:** Selects the approach category to be used in calculating the turn radius for the missed approach. When C is selected, a radius of 1.5 nm is used; when D is selected, 1.75 nm is used.

**R2-R6:** Blank.



## PA CONTROL

This page is for display purposes only.



**L1-L6:** No function.

**R1:** Increases the PA source gain. The gain setting is displayed between R1 and R2.

**R2:** Decreases the PA source gain.

**R3:** Blank.

**R4:** Selects whether the PA is routed to the Flight Station (FS), Cargo Bay (CGO), or both stations (ALL).

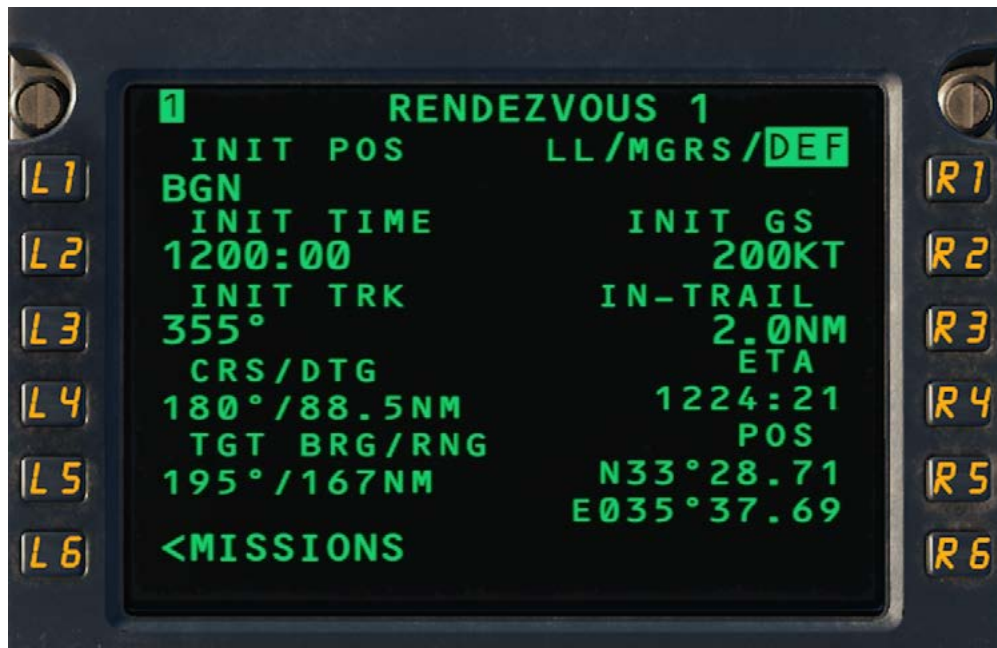
**R5:** Blank.

**R6:** Branches to MSN CMPTR INDEX.



## RENDEZVOUS

The Rendezvous (RNDZ) mission function allows for a moving target to be intercepted with great precision and minimal workload. By defining the target aircraft's initial location, ground track, and groundspeed, the CNI will determine the point and time at which the aircraft will rendezvous with the target aircraft.



**L1:** Defines the target aircraft's initial position. Valid entries are identifiers found in either the navigation or custom databases.

When the toggle at R1 is set to LL, the latitude and longitude of the defined point will be displayed. Likewise, the MGRS selection will display the defined point's grid coordinates. When DEF is displayed, the identifier for the defined point will be displayed.

**L2:** Defines the time that the target aircraft was at the initial position at L1.

**L3:** Defines the target aircraft's ground track.

**L4:** Displays the course and distance to go to the intercept point.

**L5:** Displays the bearing and range to the target aircraft.

**L6:** Branches to MISSIONS.



**R1:** Selects which format the INIT POS waypoint is displayed in.

**R2:** Defines the target aircraft's groundspeed at the initial position.

**R3:** Defines how far behind the target aircraft the rendezvous point is positioned.

**R4:** Displays the ETA to the intercept position.

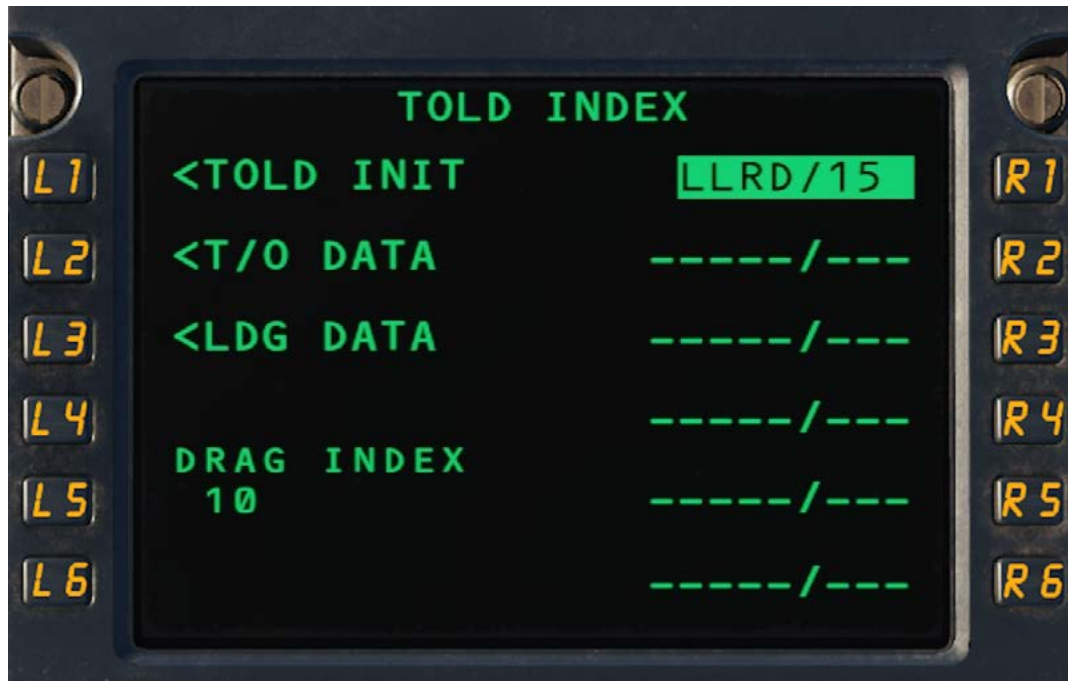
**R5:** Displays the intercept position's latitude and longitude.

**R6:** Blank.



## TOLD INDEX

Used to specify which runways TOLD will create data for. Only 6 runways can be defined on TOLD INDEX



**L1:** Branches to TOLD INIT.

**L2:** Branches to TAKEOFF DATA.

**L3:** Branches to LANDING DATA.

**L4:** Blank.

**L5:** Displays and allows entry of the aircraft's current drag index. The default drag index is dynamic based on the configuration of the aircraft set via the mission editor.

**L6:** Blank.

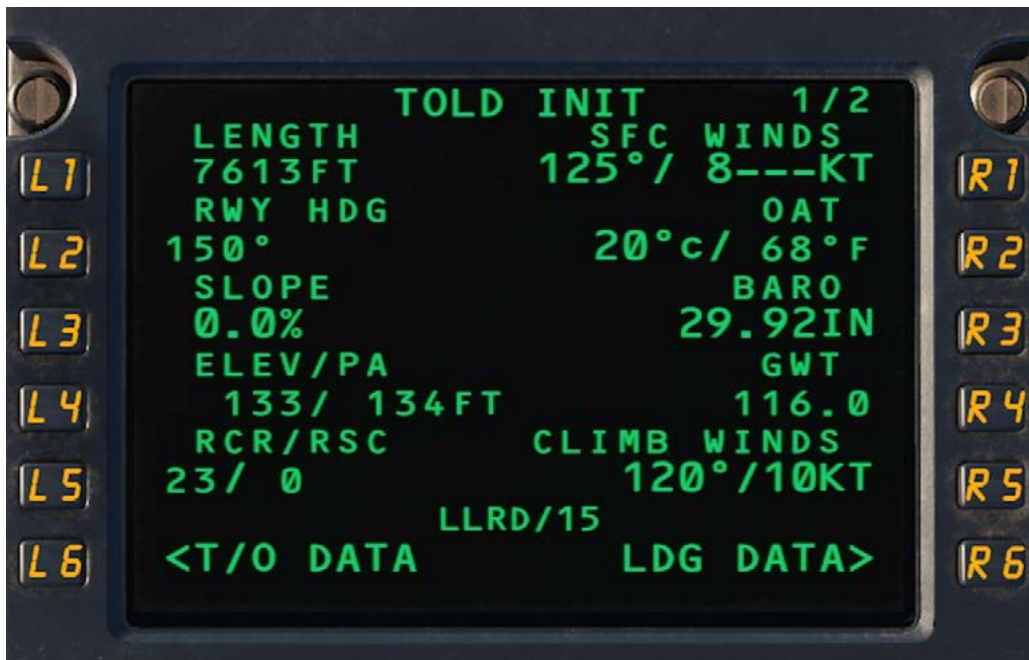
**R1-R6:** Allows for airport/runway combinations to be defined for use in the TOLD pages. If the entered airport is not found in the database, the CNI message "NOT IN DATABASE" will be displayed. If the airport is found in the database but the entered runway is not associated with the airport, the message "RUNWAY NOT FOUND" will be displayed. Custom data points can also be used as airport/runway combinations by utilizing the LZ function.

If multiple runways have been entered on the page, the LSKs can be used to select which runway will be used on TOLD INIT, TAKEOFF DATA, and LANDING DATA.



## TOLD INIT 1/2

Used to define the runway and weather parameters to be used for TOLD calculations.



**L1:** Displays the runway length, in feet. Default values are pulled from the navigation database and shown in small font.

**L2:** Displays the runway heading.

**L3:** Allows for entry of the runway's average slope. Because slope values are not pulled from the database, the field defaults to dashes. If a slope is not entered, TOLD calculations assume it to be 0,

**L4:** Displays the elevation of the runway threshold in MSL. To the right, the current pressure altitude of the threshold elevation is displayed.

**L5:** Allows for entry of the Runway Condition Reading (RCR) and Runway Surface Condition (RSC). The default values of 23/0 indicate a dry runway with 0 inches of contaminants.

**L6:** Branches to TAKEOFF DATA.

**R1:** Allows for entry of the current surface winds.

**R2:** Allows for entry of the current Outside Air Temperature (OAT).

**R3:** Allows for entry of the current altimeter setting. Both MB and inHg values are accepted.



**R4:** Displays the current gross weight.

**R5:** Allows for entry of the planned climb winds.

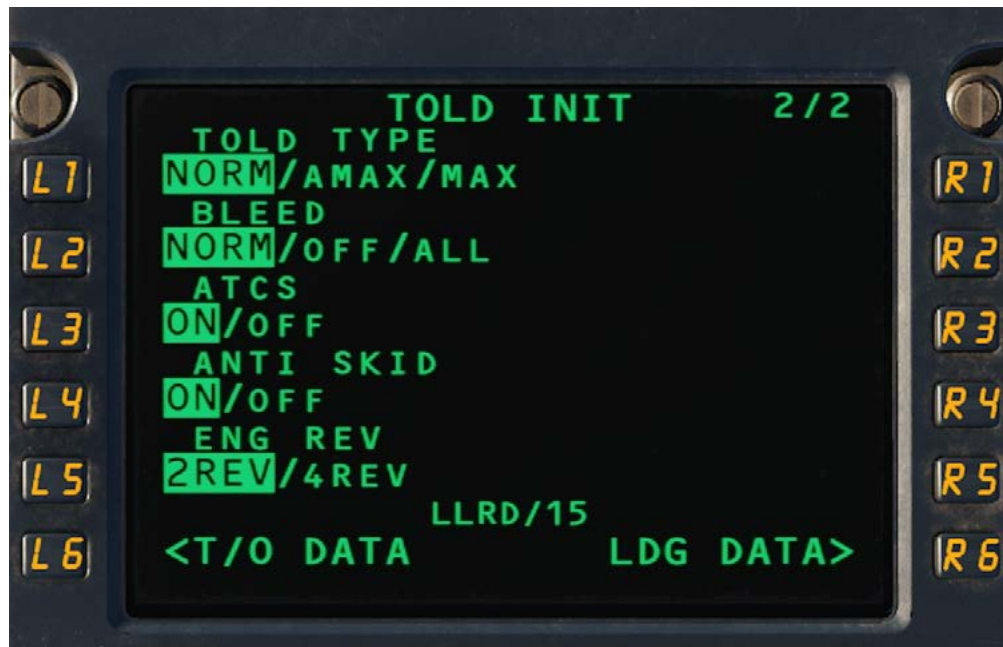
Below the CLIMB WINDS field, the airport/runway combination being used for TOLD calculations is displayed. Whenever an input is made that requires TOLD to be recomputed, the airport/runway combination is shown in inverse video while calculations are occurring. During this time, no entries may be made.

**R6:** Branches to LANDING DATA 1/2.



**TOLD INIT 2/2**

Used to configure various parameters used in TOLD calculations.



**L1:** Selects the TOLD type being used for calculations. Selections include Normal (NORM), Adjusted Maximum Effort (AMAX), and Maximum Effort (MAX).

**L2:** Selects which bleed air configuration is being used for TOLD.

**L3:** Selects whether operable ATCS is factored into takeoff calculations.

**L4:** Selects whether anti-skid is factored into takeoff and landing calculations.

**L5:** Selects whether 2 or 4 engines in reverse are used for takeoff and landing calculations.

Below the ENG REV field, the airport/runway combination being used for TOLD calculations is displayed. Whenever an input is made that requires TOLD to be recomputed, the airport/runway combination is shown in inverse video while calculations are occurring. During this time, no entries may be made.

**L6:** Branches to TAKEOFF DATA.

**R1-R5:** Blank.

**R6:** Branches to LANDING DATA 1/2.



## TAKEOFF DATA 1/4

Displays horsepower and airspeeds for the takeoff runway.



**L1:** Displays the computed takeoff horsepower setting. If the crosswind component is greater than 15 knots, a "XWND>15" label will be shown to the right of the horsepower. If the crosswind component is greater than 35 knots, the "XWND>35" label will be shown. These labels denote exceedance of certain propeller crosswind limits.

**L2:** Displays the 4-engine  $V_{MCG}$ .

**L3:** Displays the 3-engine  $V_{MCA}$ .

**L4:** Displays the 2-engine  $V_{MCA}$ .

**L5:** Displays the maximum recommended crosswind limit.

**L6:** Branches to TOLD INIT 1/2.

**R1:** Displays the refusal speed ( $V_1$ ).

**R2:** Displays the rotation speed ( $V_R$ ). When AMAX is selected on TOLD INIT 2/2, the "AMAX" label will be added to the left of the field header; when MAX is selected, "MAX" will be displayed.



**R3:** Displays the obstacle clearance speed ( $V_{OBS}$ ). When AMAX is selected on TOLD INIT 2/2, the “AMAX” label will be added to the left of the field header; when MAX is selected, “MAX” will be displayed.

**R4:** Displays the best climb speed.

**R5:** Displays the crosswind component for the takeoff runway. When surface winds have not been entered on TOLD INIT 1/2, the field will display dashes.

**R6:** Branches to LANDING DATA 1/2.



## TAKEOFF DATA 2/4

Displays takeoff distances for the takeoff runway.



**L1:** Displays the Critical Field Length (CFL) and Adjusted Minimum Field Length for Maximum Effort Takeoff (AMFLMETO).

**L2:** Displays the ground run and distance to clear a 50-foot obstacle for a normal takeoff.

**L3:** Displays the ground run and distance to clear a 50-foot obstacle for a maximum effort takeoff.

**L4:** Blank.

**L5:** Displays the maximum takeoff gross weight limited by brake energy, and the maximum gross weight for takeoff considering the most limiting TOLD factor.

A 3-character label is displayed to the right of the maximum takeoff gross weight, which indicates which TOLD factor is limiting the gross weight. The following labels can be displayed:

Label	Limiting TOLD Factor
B/E	Takeoff Brake Energy
CFL	Critical Field Length
AFL	AMFLMETO
MFL	MFLMETO
3EN	3-Engine Climb Performance
GRA	3 or 4-Engine Climb Out Gradient
OBS	3 or 4-Engine Obstacle Clearance
MTD	Maximum Effort Takeoff Ground Run



Below the MAX GWT field, the airport/runway combination being used for TOLD calculations is displayed. Whenever an input is made that requires TOLD to be recomputed, the airport/runway combination is shown in inverse video while calculations are occurring. During this time, no entries may be made.

**L6:** Branches to TOLD INIT 1/2.

**R1:** Displays the Minimum Field Length for Maximum Effort Takeoff (MFLMETO).

**R2-R3:** Blank.

**R4:** Displays the Minimum Acceleration Check Speed and Time (MACT).

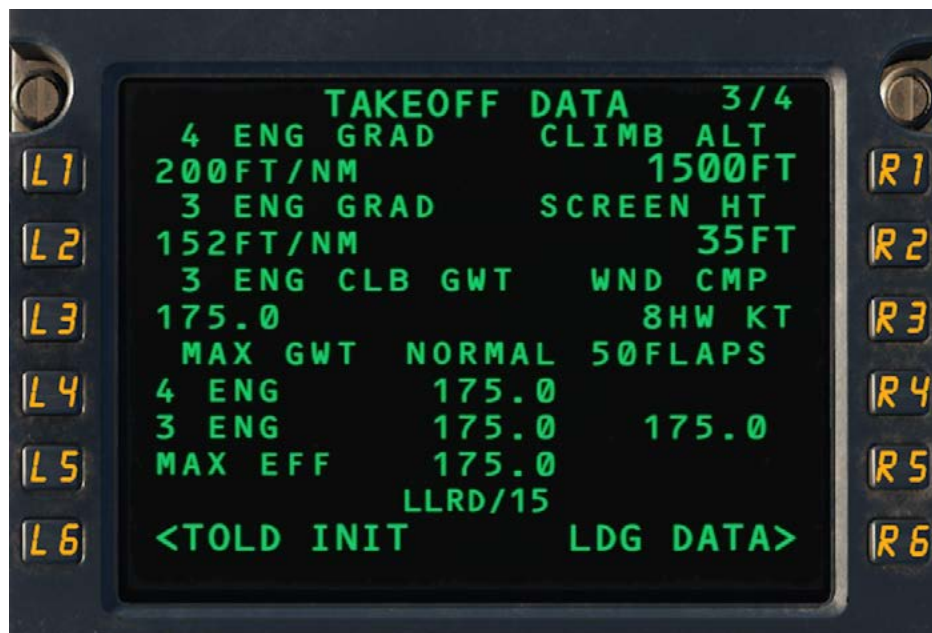
**R5:** Displays the takeoff gross weight.

**R6:** Branches to LANDING DATA 1/2.



## TAKEOFF DATA 3/4

Used to define required climb gradients for the initial climb.



**L1:** Defines the desired 4-engine climb gradient. The default value is 200 feet per nautical mile.

**L2:** Defines the desired 3-engine climb gradient. The default value is 48 feet lower than the 4-engine climb gradient defined at L1.

**L3:** Displays the maximum gross weight limited by 3-engine climb performance.

**L4:** Displays the maximum allowable gross weight to meet the 4-engine climb gradient.

**L5:**

**L6:** Branches to TOLD INIT 1/2.

**R1:** Defines the altitude until which the entered climb gradients must be maintained.

**R2:** Defines the height above the end of the runway that the aircraft must attain. Entered values are in AGL.

**R3:** Displays the calculated takeoff wind component. Headwinds are denoted with a "HW" suffix, while tailwinds use "TW". The default value can be overridden by using the "XXH" format for headwind entries, and "XXT" for tailwinds. The maximum wind component entry is 99 knots.

**R4:** Blank.

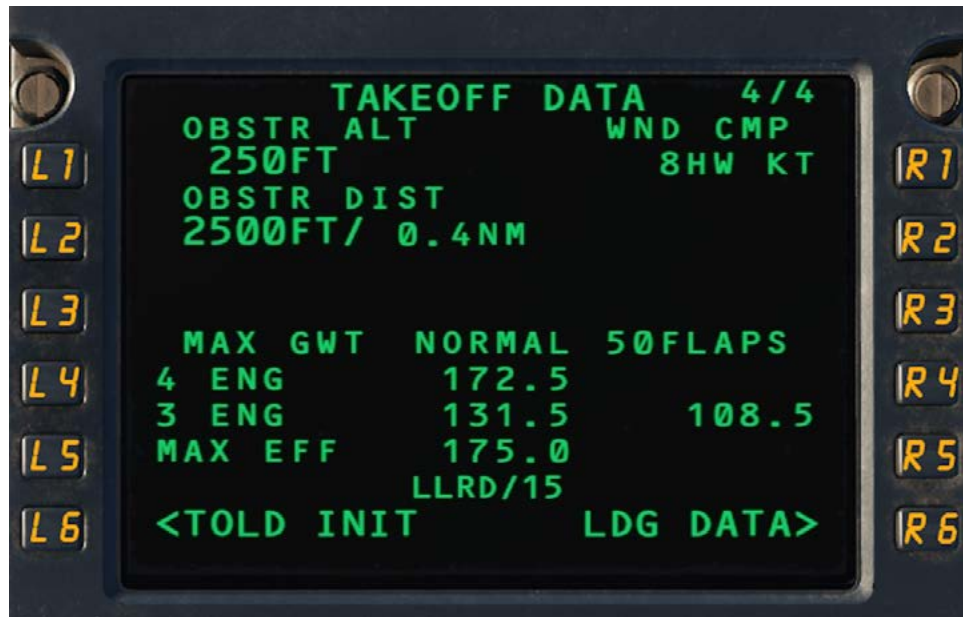
**R5:**

**R6:** Branches to LANDING DATA 1/2.



## TAKEOFF DATA 4/4

Used when a known obstruction/obstacle exists beyond the departure end of the runway. By defining the obstruction's altitude and distance from the beginning of the runway, the CNI will provide the maximum gross weight for various configurations that will guarantee clearance.



**L1:** Defines the obstruction's altitude, in MSL.

**L2:** Defines the obstruction's distance.

**L3:** Blank.

**L4:**

**L5:**

**L6:** Branches to TOLD INIT 1/2.

**R1:** Displays the calculated takeoff wind component. Headwinds are denoted with a "HW" suffix, while tailwinds use "TW". The default value can be overridden by using the "XXH" format for headwind entries, and "TXT" for tailwinds. The maximum wind component entry is 99 knots.

**R2-R4:** Blank.

**R5:**

**R6:** Branches to LANDING DATA 1/2.



## LANDING DATA 1/2

Displays landing speeds for different flap configurations.



**L1:** Blank.

**L2:** Displays the approach speed for different flap configurations.

**L3:** Displays the threshold speed for different flap configurations.

**L4:** Displays the touchdown speed for different flap configurations.

**L5:** Displays the current gross weight.

**L6:** Branches to TOLD INIT 1/2.

**R1:** Selects which flap setting is intended for use on landing. When a flap setting is selected, all of the associated speeds are shown in inverse video. MAX is unable to be selected using R1; AMAX or MAX must be selected as the TOLD type on TOLD INIT 2/2 in order for the speeds to be in inverse video.

If AMAX or MAX has been selected on TOLD INIT 2/2, R1 will not be operational and the flap selection will be locked to MAX.

**R2-R4:** Blank.

**R5:** Allows for entry of the current surface winds.

**R6:** Branches to TAKEOFF DATA 1/2.



## LANDING DATA 2/2

Displays landing speeds and crosswind values for the landing runway.



**L1:** Blank.

**L2:** Displays the landing distance over a 50-foot obstacle for different flap configurations.

**L3:** Displays the landing ground roll distance.

**L4:** Displays the maximum recommended crosswind component for landing.

**L5:** Displays the maximum landing gross weight limited by brake energy, and the maximum gross weight for landing considering the most limiting TOLD factor.

A 3-character label is displayed to the right of the maximum landing gross weight, which indicates which TOLD factor is limiting the gross weight. The following labels can be displayed:

Label	Limiting TOLD Factor
B/E	Landing Brake Energy
PLE	Power Lever Transition Speed
LGR	Landing Ground Run
L50	Landing Distance over a 50 Foot Obstacle

Below the MAX GWT field, the airport/runway combination being used for TOLD calculations is displayed. Whenever an input is made that requires TOLD to be recomputed, the airport/runway combination is shown in inverse video while calculations are occurring. During this time, no entries may be made.



**L6:** Branches to TOLD INIT 1/2.

**R1:** Selects which flap setting is intended for use on landing. When a flap setting is selected, all of the associated landing distances are shown in inverse video. MAX is unable to be selected using R1; MAX must be selected as the TOLD type on TOLD INIT 2/2 in order for the distances to be in inverse video.

If AMAX or MAX has been selected on TOLD INIT 2/2, R1 will not be operational and the flap selection will be locked to MAX.

**R2-R4:** Displays the crosswind component. When surface winds have not been entered on TOLD INIT 1/2 or LANDING DATA 1/2, the field will display dashes.

**R5:** Displays the current gross weight.

**R6:** Branches to TAKEOFF DATA 1/2.



A	Answer	CAPS	Coordinated Aircraft Positioning System
A-PATH	Along Path	CAS	Calibrated Airspeed
A/I	Anti-Ice	CAT	Category
A/T	Auto Throttle	CCP	Cursor Control Panel
AC	Alternating Current, Air Conditioning	CDI	Course Deviation Indicator
ACAWS	Advisory Caution Warning System	CDM	Climb Dive Marker
ACFT	Aircraft	CDS	Container Delivery System
ACT	Active	CFIT	Controlled Flight Into Terrain
AD	Airdrop	CFP	Cooler Flap Position
ADC	Air Data Computer	CGO	Cargo
ADF	Automatic Direction Finding	CHF	Chaff
ADP	Aerial Delivery Panel	CMD	Command
ADS	Aerial Delivery System	CMD5	Countermeasure Dispensing System
AHD	Ahead	CNBP	Communication/Navigation/Breaker Panel
ALT	Altitude	CNI-MU	Communication/Navigation/Identification Management Unit
AM	Amplitude Modulation	CNTL	Control
AMAX	Adjusted Maximum Effort Takeoff	CNTRL	Control
AMU	Avionics Management Unit	CP	Copilot, Curved Path
APP	Approach	CRS	Course
APU	Auxiliary Power Unit	CRSR	Cursor
ASC	Airplane Simulation Company	CVR	Cockpit Voice Recorder
ATC	Air Traffic Control/Controller	CW	Continuous Wave
ATCS	Automatic Thrust Control System	DADS	Distributed Air Data System
ATS	Air Turbine Starter	DBS	Doppler Beam Sharpening
AUD	Audio	DC	Direct Current
AUTO	Automatic	DCS	Digital Combat Simulator
AUX	Auxiliary	DECR	Decrease
AUW	All Up Weight	DEF	Defensive, Defined
AV	Avionics	DFDR	Digital Flight Data Recorder
BA/ECS	Bleed Air/Environmental Control System	DN	Down
BAL	Ballistic, Balance	DIF	Differential
BARO	Barometer	DISCH	Discharge
BAT	Battery	DSDT5	Dual Slotted Data Transfer System
BDL-OTH	Training Bundle-Other	DSNG	Disengage
BHD	Behind	DTC	Data Transfer Cartridge
BIT	Built-in Test	DZ	Drop Zone
BLK	Black	EAT	Exit At Time
BOT	Bottle	ECB	Electronic Circuit Breaker
BRT	Bright	ECM	Electronic Countermeasures
BSTR	Booster	EGI	Embedded GPS/Inertial Navigation System
BYP	Bypass		
CAB	Cabin		
CALC	Calculated		



EGT	Exhaust Gas Temperature	HDD	Heads Down Display
ELEV	Elevation, Elevator	HE	Heavy Equipment
ELT	Emergency Locator Transmitter	HF	High Frequency
EMER	Emergency	HP	Horsepower
EMMU	External Mass Memory Unit	HSGI	High Speed Ground Idle
EMP	Empenage	HSI	Horizontal Situation Indicator
ENT	Enter, Entered	HT	Height
ENG	Engine	HUD	Heads Up Display
ERO	Engine Running Onload/Offload	HW	Headwind
ETA	Estimated Time of Arrival	Hz	Hertz
ETE	Estimated Time Enroute	I/B	Inboard
EXT	External, Exterior, Extinguish	IAF	Initial Approach Fix
F/ODS	Fire/Overheat Detection System	IAS	Indicated Airspeed
FADEC	Full Authority Digital Electronic Control	IF	Initial Fix
FAF	Final Approach Fix	IFA	In-Flight Alignment
FAN	Fan, Fan Beam	IFF	Identification Friend or Foe
FAQ	Frequency Asked Question	ILS	Instrument Landing System
FCRS	Front Course	IMC	Instrument Meteorological Conditions
FCV	Flow Control Valve	INAV	Integrated Navigation
FD	Flight Director	INCR	Increase
FF	Fuel Flow	INDX	Index
FIC	FADEC in Control	InHg	Inches of Mercury
FLCV	Fuel Level Control Valve	INIT	Initialization
FLR	Flare	INOP	Inoperative
FLT	Flight	INSTLD	Installed
FM	Frequency Modulation	INTF	Interface
FMA	Flight Mode Annunciator	IP	Initial Point
FMC	Fuel Management Controller	IPRA	Integrated Precision Radar Approach
FORM	Formation	IR	Infrared
FOM	Figure of Merit	IRCM	Infrared Countermeasures
FOV	Field of View	ISOL	Isolate
FPA	Flight Path Angle	JMR	Jammer
FPM	Feet per Minute, Flight Path Marker	KCAS	Knots Calibrated Airspeed
FRZ	Freeze	KHz	Kilohertz
FS	Flight Station	KIAS	Knots Indicated Airspeed
FTI	Flight Test Instrumentation	L	Left
GC	Gyro Compass	LAIRCM	Large Aircraft Infrared Countermeasures
GCAS	Ground Collision Avoidance System	lb(s)	Pound(s)
GCU	Generator Control Unit	LCD	Liquid Crystal Display
GDNC	Guidance	LDI	Lateral Deviation Indicator
GND	Ground	LE	Leading Edge
GOV	Governor	LG	Long
GS	Groundspeed, Glide Slope	LL	Latitude/Longitude
GWT	Gross Weight	LO	Low



LOX	Liquid Oxygen	P-P	Point to Point
LPCR	Low Power Color Radar	PCU	Pitch Control Unit
LSGI	Low Speed Ground Idle	PEN	Pencil Beam
LSK	Line Select Key	PER	Personnel
LT	Light	PF	Pilot Flying
LV	Lower Sideband	PFD	Primary Flight Display
LWR	Lower	PI	Point of Impact
LWS	Laser Warning System	PLA	Power Lever Angle
MAC	Mean Aerodynamic Chord	PMA	Permanent Magnetic Alternator
MAN	Manual	POS	Position
MAP	Missed Approach Point	PPOS	Present Position
MB	Millibars	PRF	Pulse Repetition Frequency
MCP	Maximum Continuous Power	PRGMS	Programs
ME	Maximum Effort	POS	Position
MFP	Mission Function Parameter	PRI	Primary, Priority
MGM	Monopulse Ground Map	PRL	Parallel
MGN	Magenta	PRMTR	Parameter
MGT	Measured Gas Temperature, Management	PROG	Progress
		PROP	Propeller
MHz	Megahertz	Q	Question
MINS	Minimums	QTY	Quantity
MOM	Moment	R	Right
MSL	Mean Sea Level, Missile	RAD	Radar
MSN	Mission	RAD ALT	Radar Altitude, Radar Altimeter
MWS	Missile Warning System	REF	Reference
NAV	Navigation	REV	Reverse
NAC	Nacelle	RNDZ	Rendezvous
NDB	Non-Directional Beacon	RNG	Range
NEG	Negative	ROT	Radius of Turn
NESA	Non-Electrostatic Shield Formulation A	RPM	Revolutions per Minute
NG	Gas Generator	RUD	Rudder
NIU	Nacelle Interface Unit	RWR	Radar Warning Receiver
NM	Nautical Mile	SD	Slow Down
NP	Power Turbine	SEN	Sensed
NVG	Night Vision Goggles	SEP	Separate
NVIS	Night Vision Imaging System	SFC	Surface
O/B	Outboard	SH	Short
O/S	Offside	SKE	Station Keeping Equipment
OAP	Offset Aim Point	SME	Subject Matter Expert
OFS	Offset	SOLN	Solution
OPR	Operate	SP	Skin Paint, Signal Processor, Soft Panel
OVRD	Override	SPD	Speed
P	Pilot	SQL	Squelch
PA	Pressure Altitude, Public Address	SRCH	Search



STBY	Standby	$V_{OBS}$	Obstacle Clearance Speed
STOL	Short Takeoff and Landing	$V_R$	Rotation Speed
SWS	Sideslip Warning System, Stall Warning System	$V_{RA}$	Recommended Speed for Turbulence Penetration
SYS	System	$V_{REF}$	Approach Reference Speed, Decision Speed
T/O	Takeoff	$V_S$	Stall Speed, Vertical Speed
TACAN	Tactical Air Navigation	VHF	Very High Frequency
TACT	Tactical	VIS	Visual
TAS	True Airspeed	VLV	Valve
TAW	Total Aircraft Weight	VOR	Very High Frequency Omnidirectional Range
TAWS	Terrain Awareness and Warning System	W/V	Wind Direction and Velocity
TCF	Terrain Clearance Floor	WG	Wing
TCN	Tactical Air Navigation	WHT	White
TD	Touchdown	WOW	Weight on Wheels
TE	Trailing Edge	WPT	Waypoint
TGS	Target Groundspeed	WT	Weight
TGT	Target	XMIT	Transmit
THR	Threshold	X-PATH	Cross Path
THROT	Throttle	XSHP	Cross Ship
TJ	Towplate Jettison, Troop Jump	XTK	Cross Track
TK	Tank, Track	YEL	Yellow
TNL	Tunnel		
TP	Turn Point		
TR	Transformer Rectifier		
TRANS	Transition		
TSPD	Target Speed		
TTG	Time to Go		
TW	Tailwind		
UFLR	Underfloor		
UHF	Ultra High Frequency		
UNCG	Uncage		
UNK	Unknown		
UTIL	Utility		
UV	Upper Sideband		
$V_D$	Design Dive Speed		
$V_H$	Horizontal Flight Maximum Speed		
$V_{MCA}$	4-Engine Minimum Control Speed in Air		
$V_{MCA3}$	3-Engine Minimum Control Speed in Air		
$V_{MCA2}$	2-Engine Minimum Control Speed in Air		
$V_{MCG}$	Minimum Control Speed on Ground		
$V_{MPR}$	Minimum Power Restoration Speed		

