BLM National Aviation Office

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EADS CASA CN-235

Preliminary Aircraft Evaluation for SASEB

Index

Introduction

- The EADS CASA CN-235-300 is a high-wing twin turboprop tactical transport aircraft capable of operating from short, unpaved runways. It can carry a maximum payload of 5,950 kg and the maximum cruising speed is 245 knots (455 km/h). Relative to earlier CXN-235 versions, the new CN-235-300 by EADS CASA offers improved hot-and-high performance, higher rated pressurization and an advanced state-of-the-art integrated avionics system.

- The EADS-CASA CN-235 is the most widely sold aircraft in its category, as more than 30 different operators from 23 different countries have selected this broadly known platform. The EADS CASA versions of the CN-235 have gained civil certification by the FAA in the USA, the European JAA and Australian CAA.

- The large cargo hold and in-flight operable rear ramp allow easy loading of bulky cargo, including standard 88˝x108˝ pallets, light vehicles or combat aircraft engines. The CN-235 can airdrop loads, using low altitude (LAPES) or high altitude delivery (HAD) techniques. Up to 51 paratroopers can be carried, and dropping is effected in a short time through the two rear side doors or the rear ramp. For medical evacuation missions, it accommodates up to 21 NATO standard stretchers, with four attendants.

- The ample cabin allows a great flexibility, providing an optimum platform for a wide variety of special application versions, such as Maritime Patrol, Electronic Warfare (ESM/ECM and ELINT/COMINT), navigator training or aerial survey.

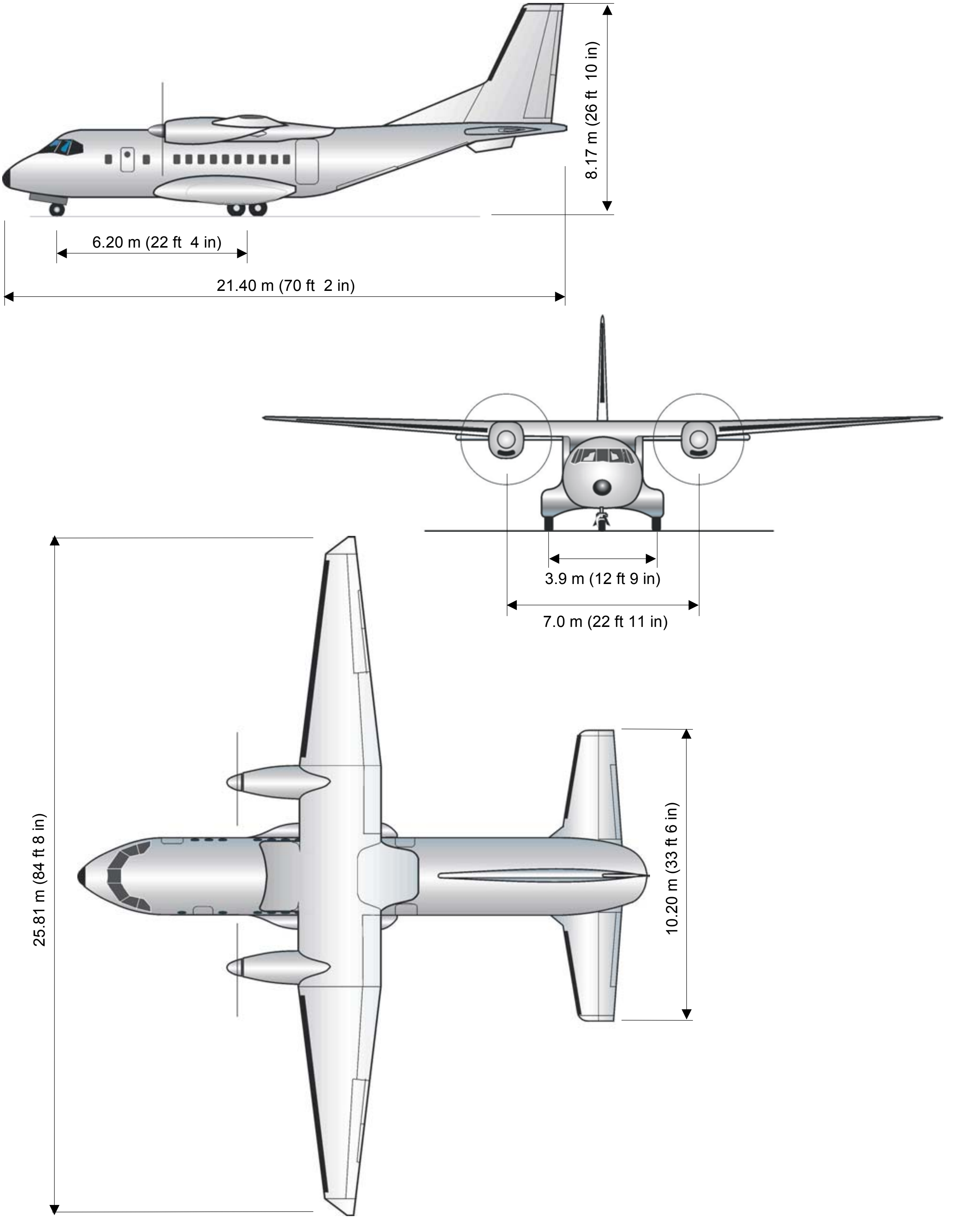
- The CN-235 can routinely operate from short runways that are simply inaccessible to C-130 class airlifters.

- The CN-235 is the undisputed leader in its class, with over 245 aircraft sold. It enjoys an excellent reputation for mission versatility, minimal support requirements, safe and reliable operation in all kinds of environments and low operating costs. Operating experience to date is in excess of 600,000 flight hours.

The CN-235 in Numbers

Overall Length	21.40 m	70 ft 2''
Overall Height	8.17 m	26 ft 10''
Gross Wing Area	59.1 m^2	636 sq ft
Wing Span	25.81 m	84 ft 8''
Wing Aspect Ratio	10.156	
Wheel Track	3.9 m	12 ft 9''
Wheel Base	6.2 m	22 ft 4''
Cabin Length (exc. ramp)	9.65 m	31 ft 8''
Ramp Length	3.04 m	9 ft 11''
Cargo Hold Height	1.90 m	6 ft 3''
Cargo Hold Max Width	2.70 m	8 ft 10''
Gross Cargo Hold Volume	45.22 m^3	1597 cu ft
Maximum Take Off Weight	16,500 kg	36,380 lb
Maximum Landing Weight	16,500 kg	36,380 lb
Maximum Zero Fuel Weight	15,400 kg	33,950 lb
Maximum Payload	5,950 kg	13,120 lb
Fuel Capacity	5220 liters	1380 US gal
Maximum Cruise Speed	452 km/h	245 ktas
Maximum Operating Altitude	7620 m	25000 ft
Range with maximum fuel	4135 km	2233 nm
Ferry Range	5055 km	2730 nm
Take-off Run (ISA/SL)	404 m	1325 ft
Landing Roll (ISA/SL)	378 m	1240 ft

Three View Drawing



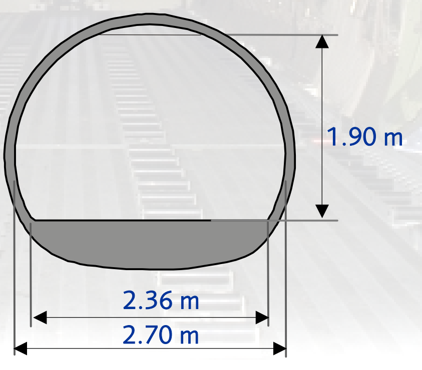
Cargo Cabin

- The CN-235-300 cargo cabin dimensions have been conceived to optimise the number and type of loads carried, ranging from passengers or paratroopers to light vehicles or aircraft engines. The cargo cabin is specifically configured to fulfil each required mission, with a system that permits a rapid change from one configuration to another, with a high degree of versatility.

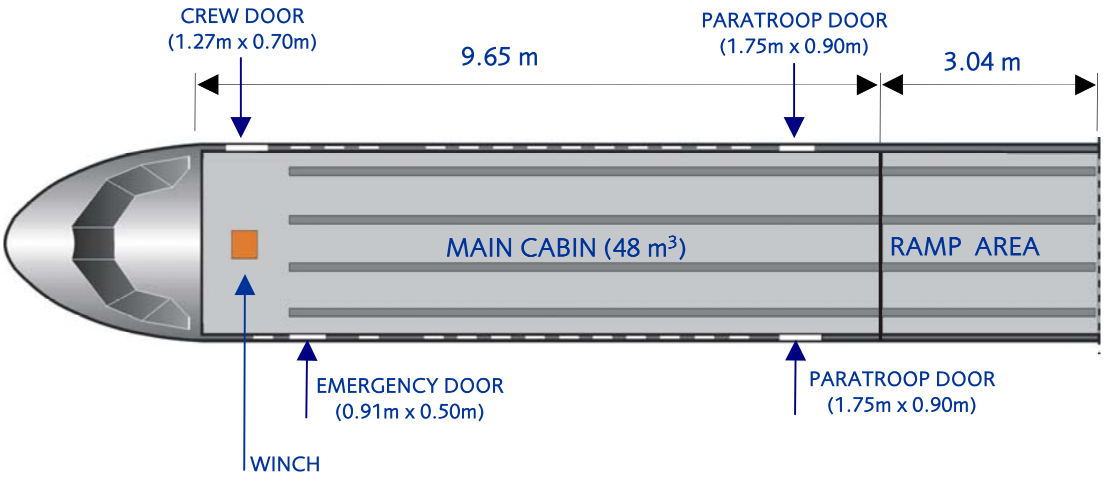
- The cargo/passenger cabin is provided with a lining covering the entire interior to ensure thermo-acoustical insulation and a comfortable interior finish. The interior furnishing matches the inner contour of the fuselage structure and covers the control cables, the air conditioning and the other systems to protect them against damage from cargo or passengers.

- The CN-235-300 is equipped with two main doors, a crew door, an emergency door and the ramp door located in the aft part of the fuselage.

- The following role configurations are available, among others:
  - Non palletised cargo
  - Palletised cargo transport
  - Vehicle transport
  - Troop transport
  - Paratroops dropping operations
  - Cargo Air Delivery operations
  - Medical evacuation (MEDEVAC)



Constant Cross Section along the Cabin



Basic Cargo Cabin Configuration

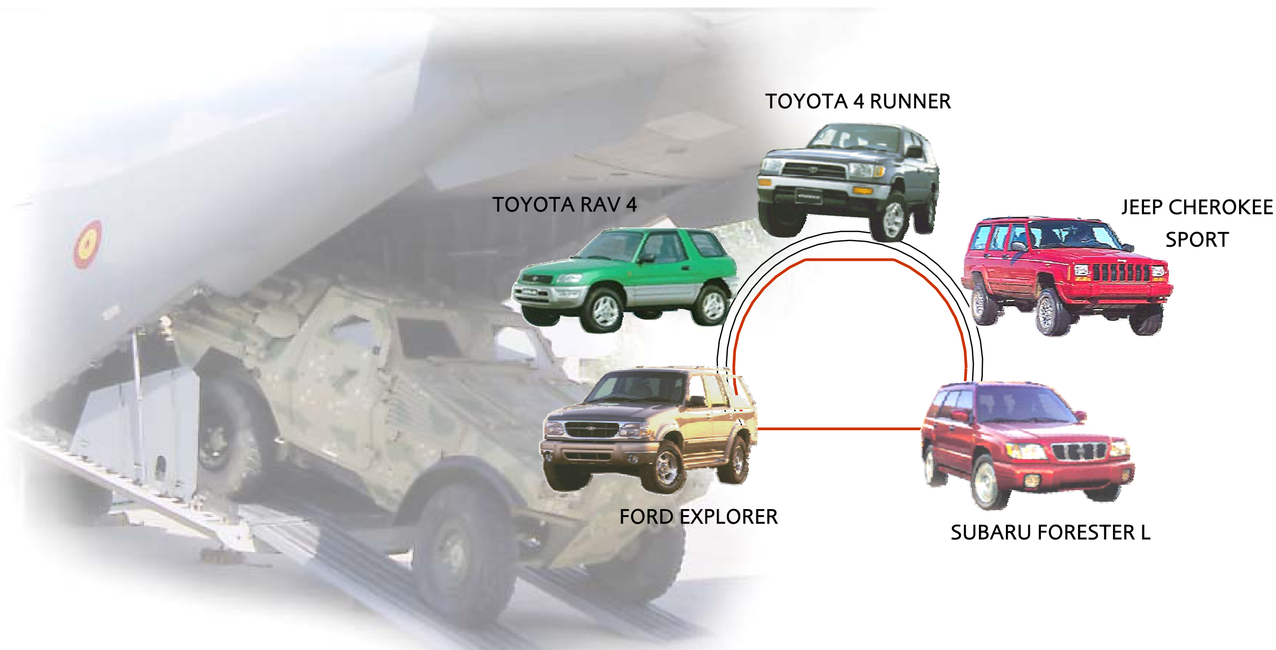
- In the basic cargo configuration, the CN-235-300 can transport general cargo or bulky loads such as wheeled vehicles, fighter engines or artillery.
- In the case of transporting vehicles, they are secured to hard points on the floor structure by means of cargo straps and cargo chains, with no need for floor shoring. The maximum wheeled vehicle weight per axle is 2100 kg which allows the carriage of most of the vehicles in common use by the Air Forces.

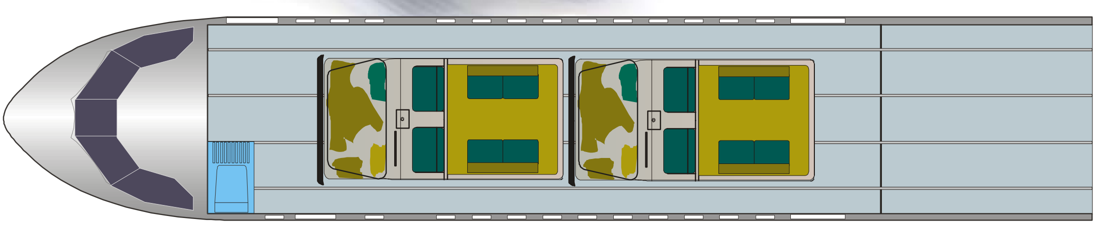
PANHARD VBL

VAMTAC URO

LAND ROVER DEFENDER 110

NISSAN ML - 6

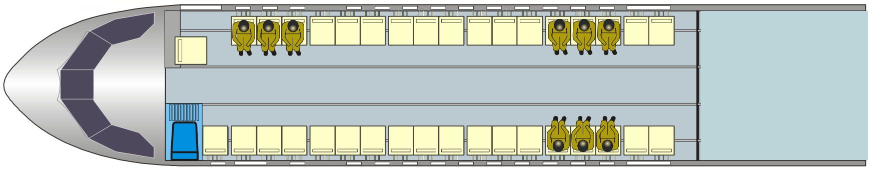




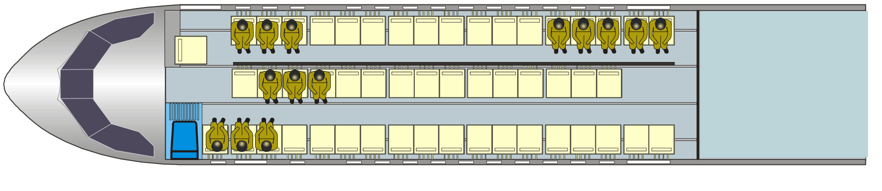
Troop Transport Configuration

- The CN-235 can transport 51 troops in high density configuration using a central seat row. Additionally, an optional four-place ramp seat is available, providing a maximum capability of 55 seats. When the central row is not used, the aircraft carries up to 36 troops.
- The lateral seats are attached to the aircraft structure by a sidewall seat track and are folded against the cabin sidewalls when not in use.
- The rear side doors can be equipped with easily foldable double seats as an option; these seats do not interfere with the door operation.
- The central row is secured through two points, one in the cabin ceiling and the other in the floor hard points. These seats are stowed under the floor in compartments accessible by quick release panel fasteners

36 Fully Equipped Troops



51 Training Troops

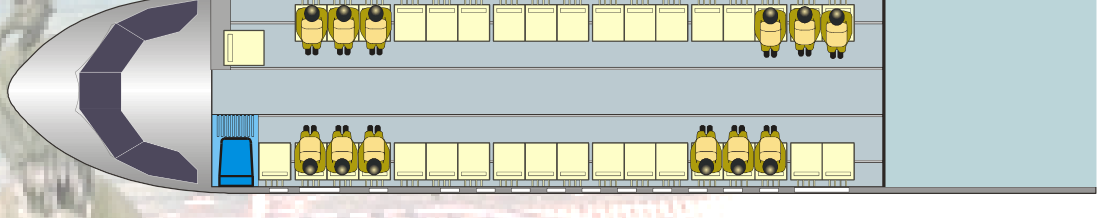


Paratroops Dropping Configuration

- The CN-235-300 is capable of air transport and drop up to 36 fully equipped paratroopers accommodated on sidewall seats or up to 51 training parachutists using the central row seats.

- There are two static anchor cables along the cabin, allowing jumping through the rear ramp and the side doors. Two retrieval rods stored in the ramp area allow easy and safe retrieval in case of a parachutist is hung up.

- The CN-235-300 has also the capability to drop paratroops by free fall, by both the cargo ramp or the side doors.



Palletised Cargo Transport Configuration

- The CN-235 can transport palletised cargo with a Cargo Handling Aerial Delivery System (CHADS) completely compatible with the 463L cargo pallet system which is widely used in the C-130 and other airlifters.

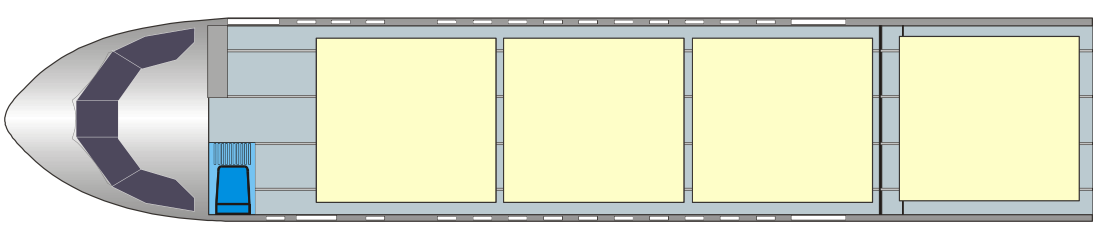
- This configuration allows the transport of up to:
    - Four 88"x108" pallets (one on the ramp), or
    - Eight 88" x 54" pallets (two on the ramp).

- The Cargo Handling Aerial Delivery System includes:
    - Two side rail rows, to provide upward and lateral restraint, equipped with manual and automatic locks that provide the forward and rearward restraint
    - Four roller tray rows, located all along the main cabin and cargo ramp and attached to the seat track by quick release devices.
    - Ramp transport kit, consisting of four locks fitted to the ramp side rails which allows transport of pallets on the ramp roller trays; the locks can be easily removed without tooling and stowed in the ramp side rails if clear side rails are required for platform delivery.

- Six manual lock devices are installed in the left rail that fit any cargo pallet combination. The locks are controlled by a lever installed at the front end of the left rail, that opens the locks sequentially starting from the one closest to the ramp. It is possible to open locks individually.

- Six automatic locks, installed in the right rail to provide parachute extraction aerial deliveries, have three positions: "full lock", "automatic lock" and "full release".

- The rails, manual control boxes and related subsystems can be permanently installed in the cabin without any interference with other systems.



Cargo Air Delivery Configuration

The cargo cabin can be configured for Cargo Air Delivery missions with CHADS and the addition of two anchor cables, a tow plate assembly and a pendulum release assembly.

This configuration allows the following cargo dropping modes:

- EXTRACTION using either HAD (Heavy Drop Altitude) or LAPES (Low Altitude Parachute Extraction System):
  - Up to three 8 feet x 88 inch platforms,
  - Up to two 12 feet x 88 inch platforms, or
  - One 16 feet x 88 inch platform by extraction,
- GRAVITY or CDS (Containers Delivery System):
  - Up to seven 48 inch x 53.5 inch A-22 containers

The Tow Plate, used in LAPES to transfer the force of a drogue chute to deploy the main extraction chutes, is located on the floor just forward the ramp hinge and it is secured by quick release devices and is actuated from the cockpit by an electrical switch. It also has a mechanical backup release mechanism available to the loadmaster in the cargo cabin area.

The Pendulum Release is used to release an extraction parachute in HAD or a drogue parachute in LAPES drops. Its release actuation may be done by either an electrical switch in the cockpit or by a mechanical backup release in the forward cargo area.

Medevac Configuration

- The basic cargo cabin can be configured for Medevac missions. Structural provisions are permanently installed in both the sidewall and the ceiling. The fittings are compatible with standard NATO litters.

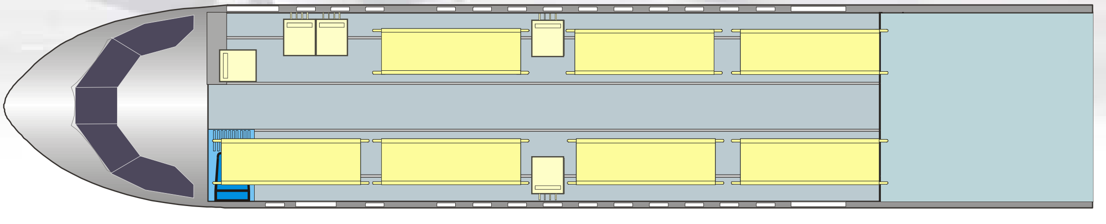
- The aircraft can accommodate up to 21 NATO standard stretchers located at seven stations, each one with a capacity of three stretchers; moreover, up to four seated medical attendants can be accommodated.

- Electrical outputs and oxygen regulators are provided in the cabin in order to guarantee the mission requirements.

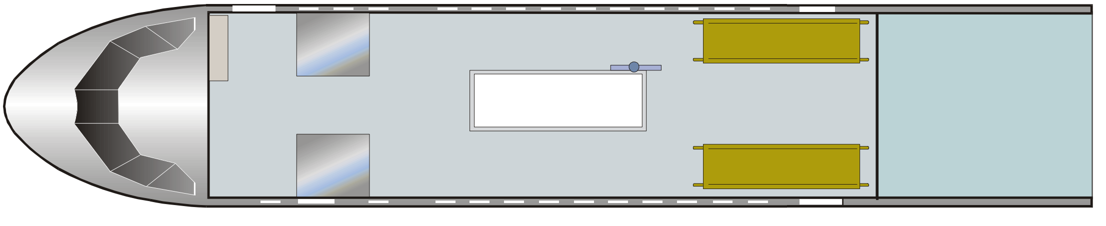
- The Medevac kit, which allows the reconfiguration of the basic cargo cabin for medical evacuation, includes the sidewall hook supports, floor fittings supports and harnesses.

- As a further option, the cabin can be reconfigured as an Intensive Care Unit or as an Operating Theatre.

21 Stretchers



Operating Theatre



Flight Deck

- The CN-235-300 cockpit allows all types of operations to be performed by a crew of two. Pilot workload has been reduced by the use of an advanced avionics system with five multifunctional displays. A foldable observer seat can be provided in case a third member should be required.

- The cockpit controls and displays are distributed in the main instrument panel, the left and right consoles, the central pedestal panel and in the overhead panels.

- The Electronic Flight Instrumentation System (EFIS) comprises five displays, two acting as Primary Flight Displays (PFD), two as Navigation Displays (ND) and the fifth as a Multifunctional display. In addition to the EFIS, the main instrument panel incorporates the Standby Flight Instrumentation, Powerplant indicators, Warnings, Landing Gear Lever, Communications and Flight Guidance panel.

- The Integrated Electronic Standby Instrument (IESI) provides all the information required for a safe recovery when flying under IFR conditions, in the case of failure of primary flight instruments. The IESI is installed on the instrument panel so that both pilots can monitor it.

- The Integrated Engine Display System (IEDS) processes and displays engine and general systems operating parameters, and provides warning and caution messages to the crew. This information is displayed to the crew on two Active Matrix Liquid Crystal Displays located on the central instrument panel.

- The crew is alerted to the presence of a warning or caution message by means of flashing master lights (red for warning messages, amber for caution messages). An aural master warning is provided when each warning message is detected. Some warnings use a specific audio tone which is generated following the aural master warning.

- The engine quadrant is located in the central area of the pedestal panel. The remaining forward and rear areas provide locations for various avionics control panels (FMS, VOR, ADF and HF). Other controls and panels related to Flight Control system are arranged on the pedestal panel.

- The Audio Control panel, Oxygen and miscellaneous panels including nose wheel steering, windshield wipers, Airborne Data Loader, Crypto panel and Flight Data Recorder controls are arranged on the left and right side consoles.

- The overhead panel contains the General Systems panels including Fuel, Ice Protection, Electric, Hydraulics, Air Conditioning, Engine Fire, Engine Start, Pressurisation, Internal and External Lighting controls.

Visibility and Comfort

- The field of view for crewmembers is a parameter of vital importance in a tactical transport. The design of the cockpit of the CN-235-300 fulfils the most stringent requirements in this respect.

  • The flight crew has clear and unobstructed external vision through the windshield and side windows to safely perform any maneuvers within the aircraft limits. Two of the side windows can be opened from inside and can be used as emergency exits.

• The distance between crew and aircraft centerline allows good accessibility and visibility to the pedestal and overhead panel for both pilots.

• All displays, indicators, control units and switches are placed within easy reach and full visibility of the pilots.

• Instruments and controls are normally duplicated for the pilot and copilot, except for those instruments and controls which can be viewed and reached easily by both pilots from their normal seating positions.

• The cockpit is equipped with smoke goggles, full face masks, portable oxygen bottle, portable extinguishers of Halon type, portable spotlight and lifejackets.

Communications system

- The Communications System has been designed to support present and future communication and surveillance requirements for operations in civil and military environments.
- The Communications System provides two-way voice communications over UHF, VHF and HF bands and supports secure voice and data communications. The system provides aircraft identification and surveillance by civil ATC services and friend-foe identification in military operations. The TCAS collision avoidance system enhances aircraft safety when operating in areas with dense traffic, and provides formation flight and rendezvous capability.
- The communications system also performs audio distribution, providing intercommunication among all aircraft crewmembers and with ground crew, and public address messages to personnel in the main cabin. The aircraft is also equipped with a Cockpit Voice Recorder (CVR) and an Emergency Locator Beacon (ELT).
- The Communications System utilises Commercial-on-the-Self (COTS) equipment, providing high reliability and performance in a cost effective solution. The System offers growth potential as new equipment can be added if required. The following Communications System description applies to typical CN-235-300 configurations.

COMMUNICATIONS SYSTEM EQUIPMENT (Typical)

Equipment	Model	Manufacturer
U/VHF	AN/ARC-210	Rockwell-Collins
HF	HF-9000	Rockwell-Collins
IFF	APX-100	Raytheon
Transponder	TDR-94	Rockwell-Collins
TCAS	TCAS-94D	Rockwell-Collins
Interphone	DADS	AVTECH
Public Address	PACIS	AVTECH
CVR	SSCVR	Allied Signal
ELT	A06	CEIS

U/VHF Communications

- V/UHF communications is provided by a single or dual AN/ARC-210 Rockwell-Collins radio system operating throughout the standard frequency ranges, from 30 to 88 MHz, 108-174 MHz, 225-400 MHz and the 156-173.975 MHz maritime band. In the ATC band, from 118 to 137 MHz, channel spacing is 8.33 kHz.
- The VHF and UHF minimum guaranteed omnidirectional range is greater than 100 NM.
- Each receiver/transmitter is capable of scanning four channels and a dedicated guard receiver module enables monitoring and transmission on the 121.5 and 243 MHz emergency channels.
- Each receiver/transmitter contains embedded ECCM circuitry to provide HAVE QUICK and HAVE QUICK II anti-jam capability.

HF Communications

- A single HF-9000D Rockwell Collins radio system provides HF communications using either simplex or half-duplex operation in Upper Side-Band (USB), Lower Side-Band (LSB), Amplitude Modulation Equivalent (AME) and Continuous Wave (CW). The system operates with either voice or data in the USB, LSB and AME modes.
- Each receiver/transmitter can utilize 99 user-programmable preset channels covering the 2.0000 to 29.9999 MHz frequency range in 100 Hz steps.

Identify Friend or Foe (IFF)

- Identification is provided by one Raytheon AN/APX-100 IFF system. The system replies to IFF interrogation modes 1, 2, 3/A, C, 4 and S. The transponder system is interrogated on a frequency of 1030 MHz by radar pulses received from ATC ground stations, IFF interrogators and TCAS II processor, and automatically replies on 1090 MHz frequency.
- Mode 4 is provided by an independent card which is Government Furnished Equipment.
- The diversity transponder receives interrogations on two antennas and transmits the reply on the antenna on which the strongest signal was received.

Transponder

- The aircraft is equipped with one transponder TDR-94D, manufactured by Rockwell-Collins, controlled by a single control unit. The transponder provides replies to Air Traffic Control radar beacon system interrogations in modes A, C and S.
- The transponder is interrogated on a frequency of 1030 MHz by radar pulses received from ATC ground stations, IFF interrogations and TCAS II processor and automatically replies on a frequency of 1090 MHz with the codes corresponding to the interrogation mode.

Traffic Alert and Collision Avoidance System (TCAS)

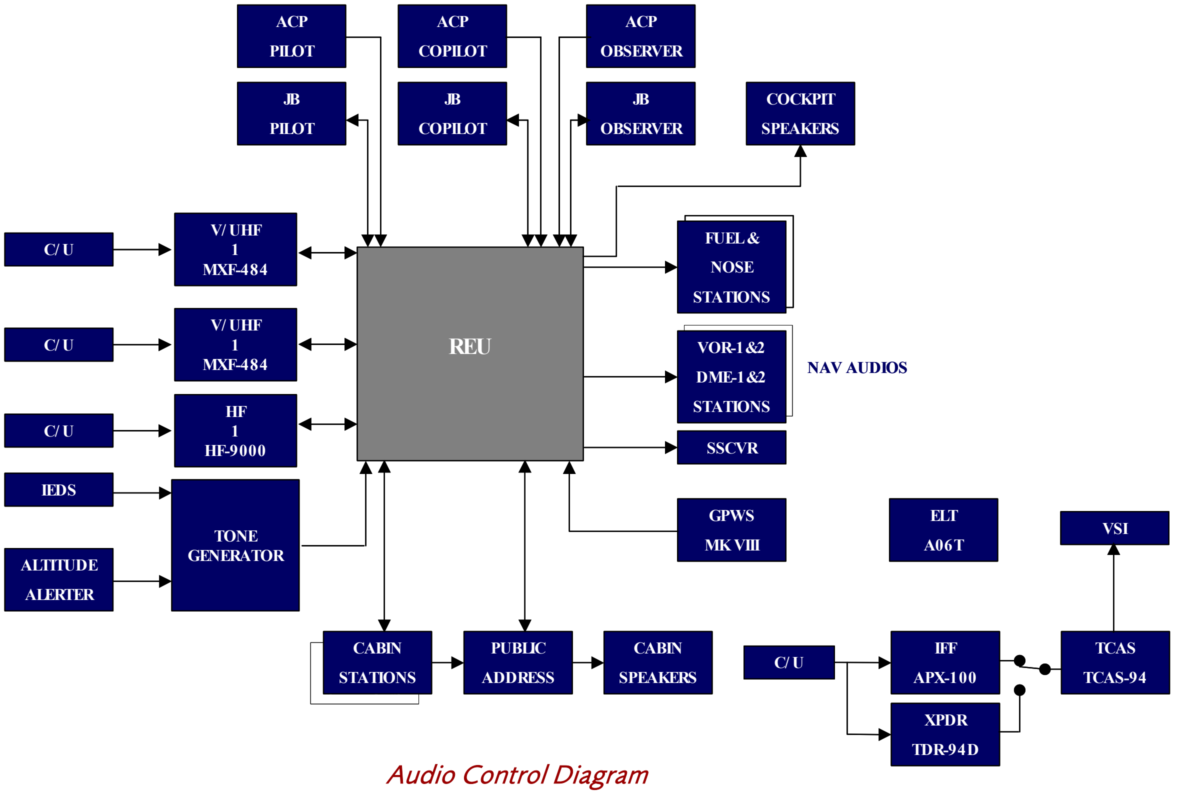
- Potential aircraft traffic conflicts are detected by the Rockwell-Collins TCAS-94D system. The system provides warnings when the proximity of another aircraft is determined to be a threat (standard TCAS II function) and also provides formation flight and rendezvous capability (enhanced TCAS II capability). The TCAS performs the following functions:
    - Surveillance: tracks up to 30 aircraft within a range of 14 nm.
    - Tracking: tracks the flight path of surrounding aircraft using the data obtained from their transponders.
    - Threat detection: provides the following warnings depending on threat levels:
        - Traffic Advisory (TA)
        - Preventive Resolution Advisory (PA)
        - Corrective Resolution Advisory (RA)
        - Threat Resolution
        - Communication and Co-ordination
    - Threat Resolution: calculates the point of maximum aircraft proximity and, if there is a collision threat, triggers the warning sequence .
    - Formation Flight and Rendezvous: provides tracking of those aircraft selected as formation members or for rendezvous .

Emergency Locator Transmitter (ELT)

- Search and rescue beacon functions are provided by the Ceis A06T ELT system. When activated, the system transmits through standard VHF and UHF distress transmissions as well as 406 MHz distress signals to COSPAS/SARSAT satellites. It also transmits 121.5 and 243 MHz signals to facilitate the final approach in an emergency. The ELT is powered by internal batteries which provide 48 hours of continuous operation.

Cockpit Voice Recorder (CVR)

- The voice recording function is provided by a solid state CVR (SSCVR) system. The CVR records four audio channels simultaneously in a crash-survivable solid state memory. The recording time is 30 minutes of cockpit crew voice and cabin area audio.



Audio Control Diagram

Audio Control

- Cockpit and cabin/cargo compartment audio control is provided by the DADS Interphone system, by AVTECH. The system provides the aircraft crew with the following functions:
  - Selectable intercommunication among all flight crew audio stations and with ground personnel
  - Communications using V/UHF and HF systems
  - Reception of the aural identification signals from the navigation systems
  - Reception of audio warnings and alerts of the general systems in the aircraft
  - Announcements via the Public Address system.

Passenger Address

- Aircraft crew can make announcements from the audio control system via a set of loudspeakers located in the cargo cabin through an AVTECH PACIS system.

Navigation system

- The navigation system has been designed to support present and future navigation and surveillance requirements to operate in either civil or military environments.
- The Navigation System uses Commercial-on-the-Self (COTS) equipment providing high reliability and performance in a cost effective solution. Adequate growth provisions have been made to allow addition of new systems and new functions that may be required in the future. The following Navigation System description applies to typical CN-235-300 configurations.

NAVIGATION SYSTEM EQUIPMENT (Typical)

Equipment	Model	Manufacturer
Air Data Computer	90040	B&D
Attitude Heading Reference	332D-11T	Rockwell-Collins
	MCS-65	Rockwell-Collins
EFIS	EFIS-85 B14	Rockwell-Collins
FMS	UNS-1C	Universal
IRS	LTN-101	Litton
WXR Radar	WXR-350	Rockwell-Collins
RADALT	ALT-55B	Rockwell-Collins
VOR/ILS/MB	VIR-32	Rockwell-Collins
DME	DME-42	Rockwell-Collins
ADF	ADF-462	Rockwell-Collins
TACAN	TCN-500	Rockwell-Collins
GPWS	MARK VIII	Honeywell
FDR	SSFDR	Allied Signal
Autopilot	APS-65F	Rockwell-Collins

Air Data System (ADS)

- The ADS is made up of a dual 90004 system, manufactured by B&D, containing two air data computers which convert pneumatic inputs from the aircraft pitot-static system into an ARINC 429 format.
- Each Air Data Computer has provision for self-monitoring.

Gyro Systems

- Aircraft gyro system is made up of a dual Rockwell-Collins MCS-65 magnetic compass system, containing two directional gyros and two magnetic flux detectors, and a dual 332D-11T vertical gyro system.
- Two control and compensating units are used to set the DG operational mode and DG slew. Magnetic compass data is displayed on the pilot and copilot EFIS Navigation Displays. Heading is displayed on the Radio Magnetic Indicator (RMI) along with VOR and/or ADF bearing . Vertical gyro attitude data is displayed on the EFIS Primary Flight Displays.

Inertial Reference System (IRS)

- The CN-235 is equipped with two Northorp-Grumman LTN-101 IRS systems (formerly Litton). The IRS provides inertial velocity vectors, the aircraft position and the true heading data to the FMS
- The IRS is made up of two Inertial Reference Unit (GNIRU), which contain the three laser gyros and the accelerometers and two Mode Selector Unit (MSU), which control the IRS mode of operation.

VOR/ILS/MB

- The VOR bearing, localizer & glideslope and marker beacon functions are provided by a dual VIR-32 system, manufactured by Rockwell-Collins.
- Up to four preset frequencies can be stored in the non-volatile memory of each control unit. The FMS uses the VOR/ILS/MB data for navigation calculations.

DME

- DME functions are provided by a dual DME-42 system, by Rockwell-Collins. The DME transceivers can simultaneously track and provide complete information from any of the 252 channels available. This scanning capability provides simultaneous distance data to the selected VOR stations and allows the FMS to establish the aircraft position when within range of enough beacons. Up to four preset frequencies can be stored.
- Data output from DME transceivers is displayed on EFIS displays.

ADF

- Relative bearing between the aircraft and the selected AM transmitters is provided by a single Rockwell-Collins ADF-462 system, which operates throughout the standard 190 to 1799.5 kHz frequency ranges or the 2179 to 2185 kHz extended frequency range in 50 Hz steps.

TACAN

- TACAN functions are provided by a TCN-500 system manufactured by Rockwell-Collins. All 126 X and 126 Y channels are available when operating with standard VORTAC ground stations or suitably equipped aircraft. The system transmits on the 1025-1150 MHz frequency range and receives on the 962-1213 MHz frequency range, with 1 MHz increments.

Weather Radar

- Adverse weather conditions are detected by a WXR-350 radar system, manufactured by Rockwell-Collins. The system can also be used for ground mapping to display prominent landmarks such as rivers or coastlines.
- Weather and Map detection operates within a range from 10 to 300 NM from the aircraft.

Radio Altimeter

- Radio altitude above ground level is provided by a single ALT-55B system, manufactured by Rockwell-Collins. The range of the system is from 0 to 2,500 ft.

GPWS

- Mark VIII EGPWS, from Honeywell, provides warnings to prevent controlled flight into terrain (CFIT) accidents. The system provides the basic GPWS modes (basic ground proximity modes, altitude call-outs and bank angle alerts) as well as Enhanced Modes (terrain awareness function, obstacle awareness function, terrain clearance floor function and envelope modulation function).
- The system contains three databases: envelope modulations database, terrain database and obstacle database. The system allows uploading all databases. Terrain database already provides universal coverage.

FDR

- Flight Data Acquisition Unit (FDAU) collects flight data in ARINC 573 format for recording by the Flight Data Recorder (FDR). Up to 25 hours of flight data are stored in a non-volatile flash EEPROM memory.
- Data can be retrieved from the FDR to a portable download unit (DLU). The DLU is a ground based equipment which does not form part of the aircraft system.

Electronic Flight Instrumentation System (EFIS)

- Flight information is displayed on five EFIS-85B screens, manufactured by Rockwell-Collins. Two screens, located in the pilot and copilot seats, are used as PFD (Primary Flight Display), two screens (pilot & copilot), are used as ND (Navigation Display) and the fifth screen, for both pilots, is used as MFD (Multi Functional Display) .
- The PFD displays include attitude, FCS commands and annunciators, lateral and vertical deviation, decision height and other data. The ND displays include heading, bearing, course and ground speed. Weather radar information, flight plans, information pages and bearing are presented on the MFD.
- EFIS screens are controlled from three processor units, two for the PFD's and the ND's and a third for the MFD. Different settings are selected using two Displays Control Panels and one Course Heading Panel.

Flight Management System (FMS)

- Flight Management is provided by a dual Universal UNS-1C system. The FMS is a fully integrated navigation and flight management system which provides centralized control of the aircraft navigation sensors, computer based flight planning and fuel management. Each UNS-1S system includes a high resolution 5-inch active matrix liquid crystal display (AMLCD), an alphanumeric/function keyboard and a master computer in a single panel-mounted Control and Display Unit (CDU).
- The system captures and holds preselected lateral tracks and provides lateral steering commands directly to the flight control system during the enroute phase of flight. During approaches the system captures and holds preselected lateral and vertical tracks and provides vertical and lateral guidance to the flight control system.
- Navaids, airports, NDB's, enroute waypoints, intersections, airways, SID's, STAR's, approaches and runways are stored in a non-volatile memory. In addition to this world wide navigation database, the FMS can store up to 200 pilot defined locations, 200 pilot defined routes and 100 pilot defined alignment points, airports, approaches and runways. Data bases are updated via the data transfer unit (DTU).
- As well as the normal civil holding patterns, a multi-mission management function provides the capability to automatically steer along different search patterns such as rising ladder, border patrol or expanding square.
- The aircraft fuel flow sensors provide the system with the inputs necessary to integrate real time fuel management data with the navigation functions. During flight, the FMS updates the fuel-on-board gross weight and provides continuous EFO (Estimated Fuel on Board) parameter for the programmed flight plan based upon fuel flow and ground speed.

Flight Director and Autopilot System (FD&APS)

- The Rockwell-Collins APS-65 AFCS (Automatic Flight Control System) equipping the aircraft is a digitall integrated and versatile 3-axis Autopilot and Flight Guidance System including elevator trim automatic control and certified for ILS Cat I and FMS GPS approaches for automatic or manual operations.
- The AFCS performs the functions of autopilot computation and flight control servo control, flight director computation, flight director indicator control and system monitoring through the inputs received from various aircraft sensors (Air Data System, Compass System, Attitude Reference System, Radalt, FMS and DME/VOR/ILS).
- The system includes two panels, one for controlling the autopilot and the other for selecting the flight director operating modes and one altitude preselector.
- The FD&APS System processes the outputs from various aircraft sensors (VOR/ILS/MB; VG; DG; Radio altimeter) and any pilot initiated commands (HSI) or mode selections, to provide flight guidance commands for the ADIs command bars and to automatically position the aircraft control surfaces.
- The system provides the pilots with the following features:
    - Attitude hold mode with synchronized steering
    - Heading mode
    - Navigation mode (VOR or localizer)
    - Approach mode with automatic glideslope capture and track
    - Back course localizer mode
    - All angle adaptive capture for VOR; LOC and REV LOC
    - Altitude hold mode
    - Indicated airspeed hold mode
    - Vertical speed hold mode
    - Soft-ride (turbulence) mode
    - Half-bank mode
    - Computed steering display outputs
    - Mode selection controls and indicator
    - System integrity warning flag outputs
    - Go-around mode.

Flight controls

The CN-235 Flight Control System is a conventional mechanical system. The primary control surfaces are mechanically operated by means of push-pull rods and closed-loop cables.

The separation of the Control System into redundant control paths minimises the probability of failure from the same cause. There is also routing segregation between the Primary Flight Controls and the Trim Controls.

- Longitudinal control: dual interconnected mechanical control paths move both elevators. Each elevator surface is provided with an electrically operated trim tab and a geared tab.

- Lateral Control: dual interconnected mechanical control paths move both ailerons. Each aileron has an electrically operated trim tab and a geared tab.

- Directional Control: a single control chain moves the rudder from the pilot and copilot pedals. The rudder has a geared tab and an electrically powered trim tab.

- Flap Control System: there are two flap surfaces on each wing; each flap panel is supported on two tracks attached to the wing structure by two carriages.

The flaps actuation system includes a hydraulically powered drive unit in the aircraft centerline, with mechanical transmission to the four flap panels through transverse shafting along the wing span.

The flap setting is achieved by selecting one of four predetermined positions on the Flap Control Lever.

- Ground Gust Lock System: a gust lock lever in the cockpit controls three locking devices for the control chains of elevators, ailerons and rudder through a cable circuit and, when engaged, prevents also power lever motion. This system will prevent damage of the flight controls system, when the aircraft is on the ground.

The system when engaged does not prevent ground handling of the aircraft.

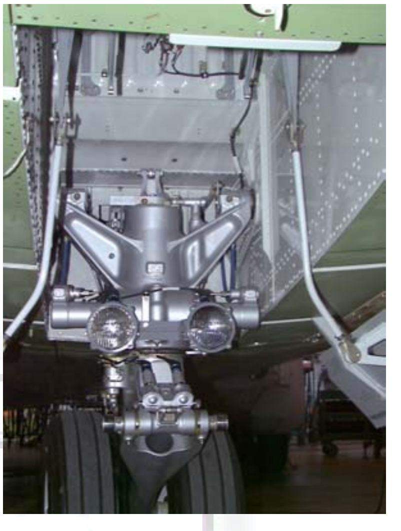
Landing Gear

- The CN-235-300 landing gear allows operation from unprepared runways with soft surfaces. The landing gear has a fatigue life of 30,000 landings and has been designed for easy maintenance .

- The main landing gear has two legs in tandem configuration on each side of the fuselage. Each leg has an independent oleo-pneumatic type shock absorber. Both legs are interconnected so that extension and retraction is accomplished by means of a single hydraulic actuator. Each main landing gear leg has one wheel equipped with a hydraulically actuated disk brake. The gear is stowed in the fuselage nacelle with no doors to close this bay.

- The nose landing gear is located in a non-pressurised wheel bay under the cockpit and is equipped with a single wheel levered type with oleo-pneumatic shock absorber. The gear is retracted and extended by means of a double-acting actuator. Two mechanical operated doors, linked to the gear strut, close the gear bay.

- Optionally, the nose landing gear can be equipped with a double wheel in order to improve the operation from unpaved fields.



- In case of hydraulic system malfunction, the undercarriage can be extended by gravity once the uplocks are released mechanically by the pilot selecting a control lever.

- The normal braking system is a conventional pilot and copilot brake control through brake metering control valves operated by foot pedals. The normal braking system incorporates an ON/OFF damped antiskid control system. An independent emergency/park brake system is powered by an hydraulic accumulator and hand operated through a lever.

Engine

The CN-235-300 is powered by two General Electric CT7-9C3 turboprop engines, driving Hamilton Standard 14 RF-37 four bladed propellers.

The General Electric CT7-9C3 turboprop engine is a derivative of the CT7-9C model in service with previous versions of the CN-235. Performance ratings are adjusted to increase take-off power in high temperature conditions.

FAA type certification of the engine was granted in 1998. The CT7 engines have proven their reliability in over 10 millions flight hours.

The engine is capable of continuous operation, free from stall, surge or handling restrictions, particularly in relation to throttle operations, in all parts of the CN-235 operating envelope.

The CT7-9C3 engine provides a nominal take-off power of 1,750 shp at sea level up to an ambient temperature of 38.5 ºC and, with 0,455 lb/ehp-hr, the best fuel economy in its class.

In the event of engine failure during take-off, the integral Automatic Power Reserve (APR) increases the power of the remaining engine to 1,870 shp, also at sea level up to an airfield ambient temperature of 38.5 ºC.

Engine Performance Ratings

The installed General Electric engine model CT7-9C3, has guaranteed performances for Sea Level, Static, 100% propeller rpm and ISA conditions, summarised in the following table:

Engine rating	SHP	Up to ambient temperature of
• APR	1870	38.5ºC
• Takeoff	1750	38.5ºC
• Maximum continuous	1750	41ºC
• Maximum cruise	1700	15ºC

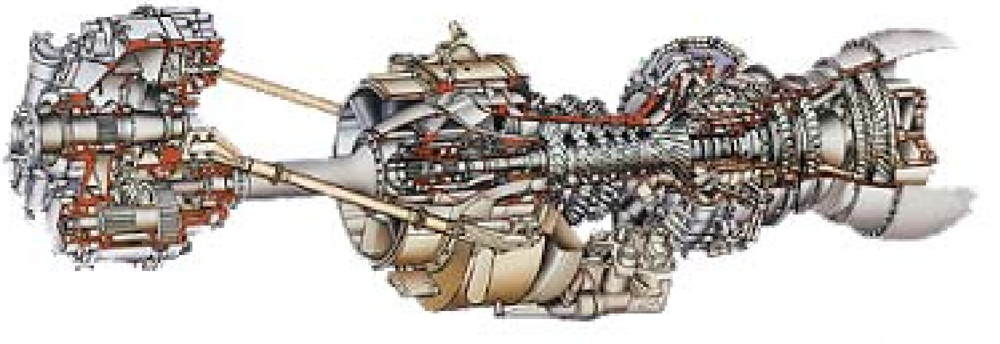
Maximum continuous power is the maximum power approved for continuous operation under emergency conditions. Maximum cruise power is the maximum power approved for normal continuous operation.

- The CT7-9C3 engine incorporates modular construction. Each engine is made up of two main assemblies: the Power Unit Assembly or Gas Generator and the Propeller Gearbox.

- The Gas Generator has three main modules: the Core, the Power Turbine and the Accessories Section.

- The single-spool Gas Generator Core consists of a five-stage axial compressor, single stage centrifugal compressor, through-flow annular combustion chamber and two-stage axial flow turbine. A two-stage free Power Turbine drives the compound idler propeller gearbox.

- The Propeller Gearbox consists of the following modules:
  - Propeller Gear Train and Case,
  - Propeller Gearbox Accessory Drive Sections,
  - Propeller Gear Box Drive Shaft, Drive Shaft Housing, Struts and Attaching Hardware.



FOD

- The engine inlet has an "S" shaped air intake duct, with an Inlet Protection Device (IPD) inertial separator at the bend. The IPD captures and traps foreign objects before they can get to the engine compressor inlet. The smaller particles are discharged outboard through a port at the bottom.

APU Mode

- The left engine is fitted with a propeller brake, to allow the use of the engine gas generator as an Auxiliary Power Unit, for ground operation only, with the propeller stopped. This APU mode delivers DC electrical power and bleed air for the aircraft systems.

Propeller

- The propellers installed on the aircraft are Hamilton Standard Type 14RF-37 four-bladed assemblies with hydraulically controlled variable pitch, feathering and reverse capability. The propellers have a diameter of 3.66 meters.

- The pitch changing mechanism is double acting and provides constant speed operation, full feathering and unfeathering and direct blade control for approach, reversing and ground handling. Maximum propeller speed is 1,384 rpm. A synchrophaser system is provided in order to reduce cabin noise and vibration.

- Each blade is made of a solid aluminium alloy spar with an composite airfoil bonded to the spar. The leading and trailing edges of the airfoil are filled with low-density polyurethane foam. Electrical heater mats are bonded to the leading edge of the inner half of each blade for de-icing. The leading edge of the outer half is protected from erosion by a nickel sheath.

- The rotation of the left-hand side propeller can be stopped with the engine running, on ground only, in order to use the engine's gas generator machinery as an APU, to obtain bleed air for air conditioning, and electrical power by means of the starter generator.

- The propeller brake unit is installed on the left hand engine propeller gearbox. Hydraulic supply from the main hydraulic system for brake actuation is controlled by an electrical system.

Fuel System

The fuel is carried in four integral tanks in the wings: two main tanks in the central wing and two auxiliary tanks in the outer wings. The usable fuel capacity of each tank is:

- Each inboard cell (Main): 1020 litres
- Each outboard cell (Auxiliary): 1590 litres
- Total fuel: 5220 litres

The structure of the tanks has been designed to provide baffling for fuel movement, to ensure sufficient passages for the fuel and to prevent lightning strike penetration to the tanks. A protective treatment against corrosion and biological contamination is applied to all tank interior surfaces.

Ground Refuelling and defuelling

The filling of all four tanks is accomplished from the pressure refuelling station located on the right main landing gear fairing, consisting in a standard fuel coupling and a refuel control panel. The fuel flows through mechanically operated refuelling valves to the main tanks and from these to the auxiliary tanks through the pressure refuelling lines. Differential pressures controlled by a servo line to the level control valves operate the refuelling valves.

At the nominal refuelling pressure of 50 psi the time required to refuel the main tanks is 5.5 minutes and to refuel all four tanks 13.5 minutes. The tanks can also be filled by gravity through a lightning safe cap on each tank.

Forced defuelling is accomplished by using the submerged electrical pumps and disconnecting the hose that feed the engines. Gravity defuelling is also possible by means of the pressure relief valves and using a defuelling adapter, which is part of the ground equipment supplied with the aircraft.

Fuel feed and transfer

In normal conditions, each engine draws fuel from its associated wing tank via its engine driven pump. The submerged electrical pumps are used only for transfer, in the event of engine's pumps failure and for cross feeding through the crossfeed valve, which is electrically operated from the cockpit.

Hydraulic System

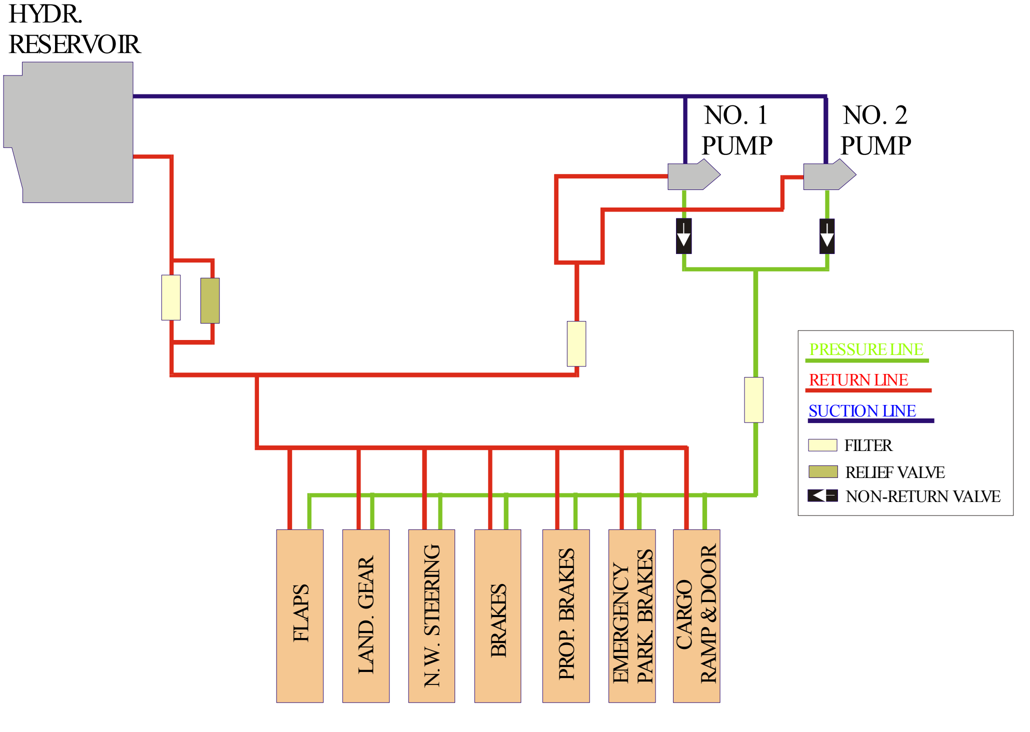
The Hydraulic System has been designed with general criteria of simplicity, ease of maintenance and utilisation economy. It is a closed centre, airless type capable of operating without restrictions at those altitudes and temperatures covered by the aircraft flight envelope.

The hydraulic system powers to the following subsystems:

- Wing Flaps
- Landing Gear normal extraction and retraction.
- Brakes (Normal and Emergency/Parking Brake)
- Nose Wheel Steering
- Rear Ramp
- Propeller Brake

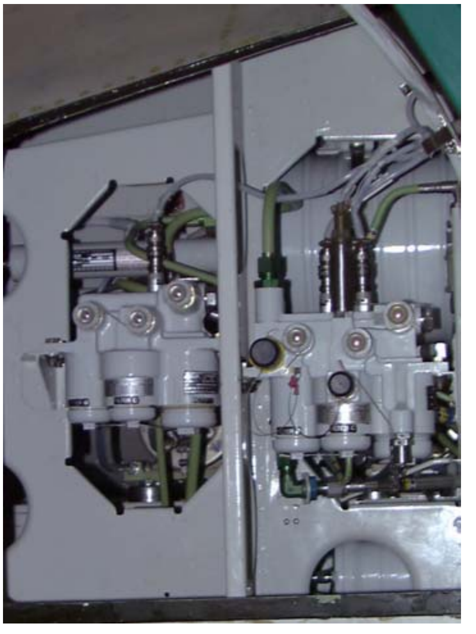
Hydraulic fluid is stored in a bootstrap type reservoir with a capacity of 10 litres at a nominal working pressure of 50 psi. The reservoir is fitted with an overboard relief valve, a manual bleed valve, a fluid quantity transducer, a mechanical indicator and a temperature switch.

Two DC Electrical Motor Pumps supply hydraulic fluid at 207 bar (3000 psi) to the hydraulically operated aircraft subsystems. Power can be also obtained from an external Ground Power Unit or from a Hydraulic Ground Cart when the aircraft is on ground.



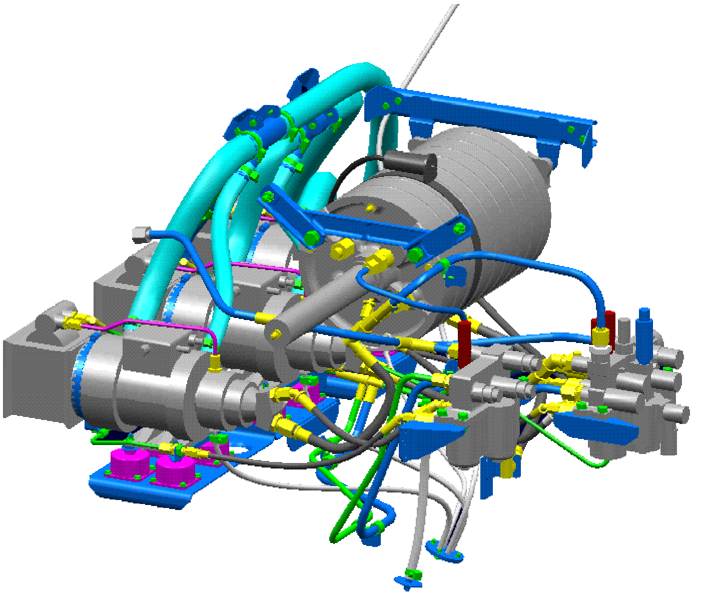
- Fluid in the pressure line from the pumps, before distribution to the subsystems, is passed through the high-pressure sections of the filter package. A relief valve within the filter package protects the system against damage due to abnormal high pressures. Return fluid from the subsystems is also passed through the Modular Power Unit low pressure 5 µ filters prior completion of the circuit at the reservoir.

- In case of pump failure, pump motoring is prevented by means of a non-return valve installed on each pump pressure line. The remaining pump will provide pressure system services.



- Two hydraulic accumulators provide pressure to the brakes in case of hydraulic power failure.

- One accumulator is used for the normal brake system, actuated through the pilot´s pedals. A second accumulator is provided for the independent emergency and parking brake system. This system is actuated through a hand-lever in the cockpit and it applies pressure to all four main wheels simultaneously for emergency braking or as a parking brake.



Electrical System

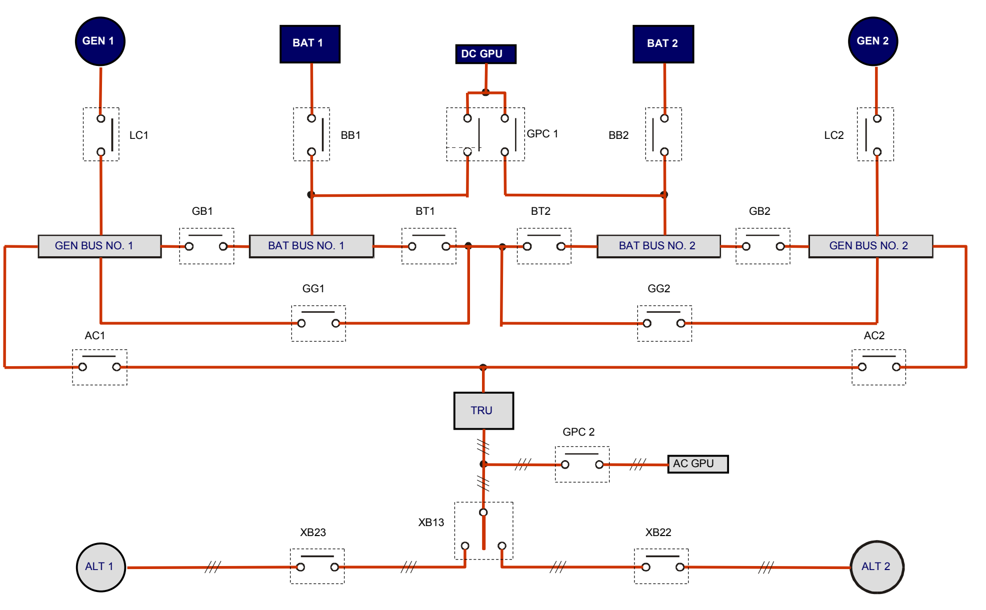
Primary electrical power for the CN-235 is provided by two DC starter-generators. Two DC driven inverters provide single-phase AC constant frequency power. A wild frequency AC system powered by two engine driven generators supplies the engine air intakes anti-icing electrical loads and provides, in case of emergency, supplementary DC power through a Transformer Rectifier Unit (TRU).

The CN-235 is equipped with a DC ground power connector, located in the right landing gear fairing.

DC System

The main generation system consists of two engine-driven DC 28V, 400 A starter-generators. In case of failure of both generators, it is possible to obtain 28 V DC, 300 A from the AC generators, through the TRU.

Two 24 V, 37 AH Ni-Cad batteries are provided for limited ground use, engine starting on the ground or in flight, and as source of DC power in emergency conditions.



DC Generation subsystem architecture

AC System

- The aircraft is equipped with two fully independent AC systems:
    - The constant frequency system
    - The wild frequency system

- Three solid-state static inverters powered by the DC system provide single phase constant frequency AC. Each inverter produces 115/26 V, 350 VA AC at 400 Hz constant frequency. Two inverters are required as the source of energy, and the other remains in stand-by mode.

- The Wild frequency AC is provided by two generators, one driven by each engine. The output of each generator is 115/200 V, 26kVA, 3 phase with variable frequency related to engine speed. This system provides power for the engine air intake anti-icing system and supplementary DC power up to 300 A at 28 V through a Transformer Rectifier Unit (TRU).

Abnormal flight conditions

- During normal operation each DC starter-generator functions independently and supplies electrical power to the corresponding bus bars. When one DC generator fails, all bus bars are powered from the remaining DC generator.

If a second failure occurs, such as an engine shut-down, the batteries maintain the aircraft system powered until the crew selects the alternate DC power source which comes from the AC generator through the TRU.

- When the normal inverter fails, it is automatically disconnected from the buses; the stand-by inverter must be manually connected to energise the distribution buses.

- In APU mode, all busbars are powered by the operating generator.

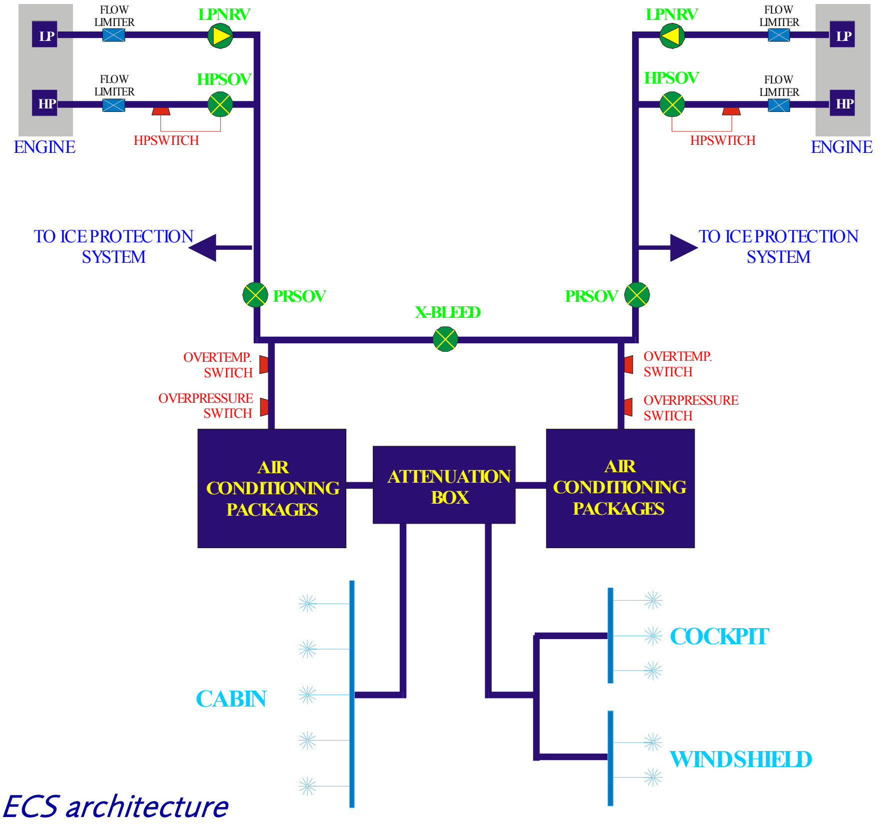
Environmental Control System and Pressurisation

- The Environmental Control System provides temperature control in the flight deck area, the main cabin and the avionics bays.

The conditioned air is ducted to exit throughout the passenger cabin and cockpit, with independent temperature control for each area. Air is extracted from the cockpit underfloor through an axial fan to provide cooling and ventilation to the avionics racks. Two ventilation fans provide cooling air for the avionics equipment in the unpressurised area below the cockpit floor.

- Compressor bleed air is obtained from high pressure and low pressure ports in each engine. A shut-off valve allows the possibility of a crossfeed from either engine to both refrigeration units. When the aircraft is on the ground, air conditioning can be provided by the left engine operating in APU mode, with the propeller braked.

- Additional ECS functions include:
    - Provide engine bleed air for operation of the ice protection system
    - Allow cross bleed for APU mode.
    - Shut off air conditioning bleed air supply during engine starting.



ECS architecture

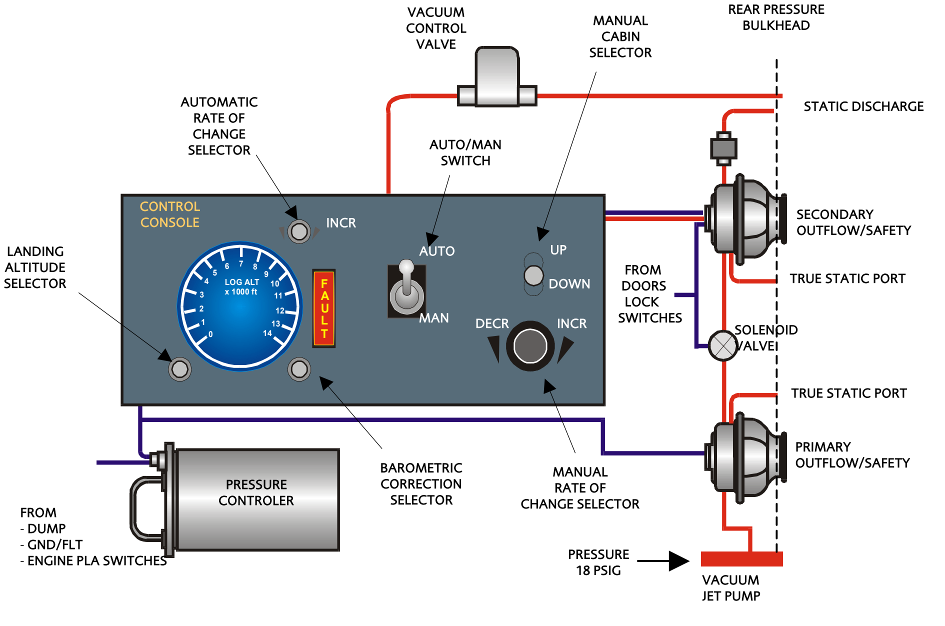
Pressurisation System

- The pressurisation system is able to maintain a positive differential pressure of 5.5 psi corresponding to a cabin altitude of 7,900 ft with aircraft flying at 25,000 ft altitude.

- The system is of electro-pneumatic type, digitally controlled by means of microprocessors. Basically, the system consists of a cabin pressure selector, a digital cabin pressure controller and two outflow relief valves. The system can work either in automatic or manual mode.

- The two valves are located in the rear door and are pneumatically linked to work in tandem. They are actuated by pressure controller and may operate under positive or negative pressure conditions as relief valves.

- The Digital Cabin Pressure Controller is located in the cockpit equipment bay and is linked to the Air Data System to perform the cabin pressure control computations according to the aircraft altitude and cabin altitude rate of change. The controller generates the outflow valve drive signal for determining the valve opening, hence providing automatic cabin pressure regulation. The pressure selector has a manual control to be used in case of failure of automatic control and a switch for pressure dump in an emergency.



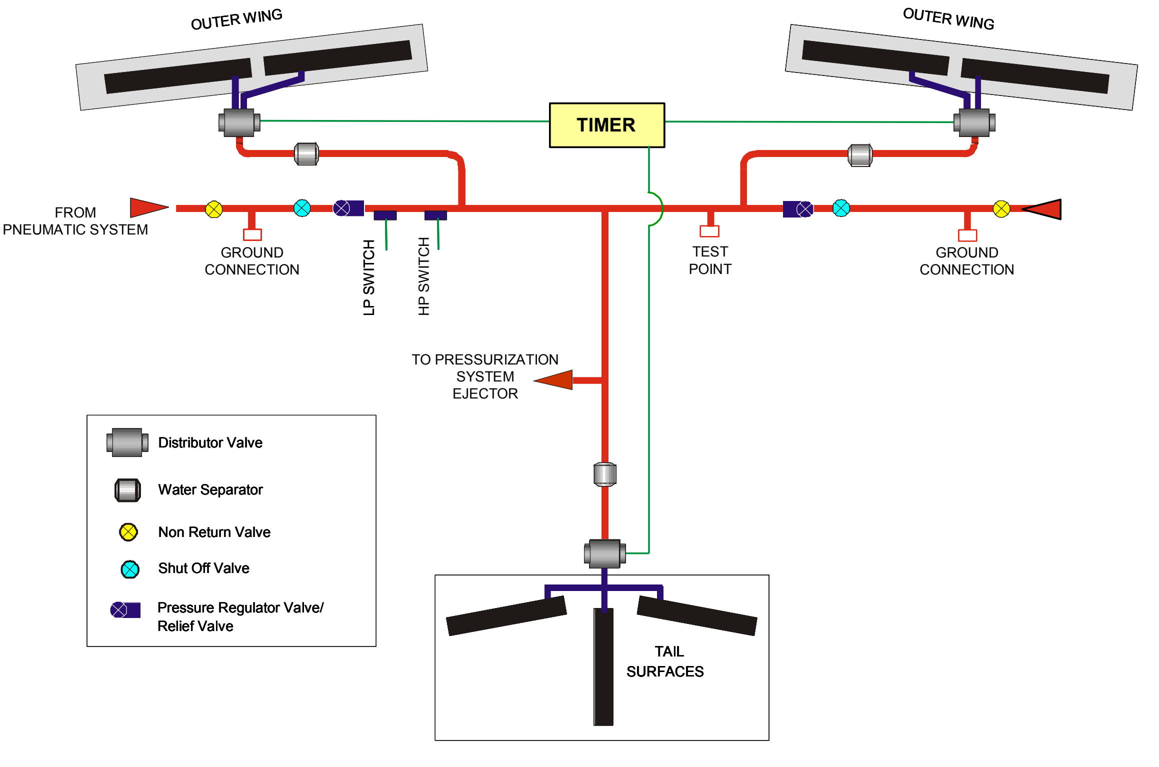
Ice Protection System

- The Ice Protection System complies with FAR25 certification requirements. It can be used in any flight conditions and engine power range, from takeoff to landing.

Aerodynamic Surfaces

- The Ice Protection System for the Aerodynamic Surfaces is of the pneumatic boot de-icer type, bonded along the external wing leading edge, the horizontal stabiliser leading edge and the vertical fin leading edge. A total of seven de-icer boots are installed on the aircraft: two boots in each wing and one in each tail surface

- The system operates with air pressure bled from the engine compressors, regulated, and distributed to the inflatable rubber de-icing boots. The boots are inflated and deflated cyclically causing the ice layer to break away.



Propellers

- Each propeller blade is provided with electrically heated de-icers, integrally mounted into its leading edge and protected by a layer of fibreglass, with no disruption of the airfoil surface.
- The de-icers are connected through a system consisting of a slip ring assembly, brushes and a brush holder to a power supply, all being regulated by an electronic control.

Engine Air Intake

- The engine air intake protection is based on an evaporative anti-icing system consisting of heater mats, installed on all the air intake internal surfaces where ice accretion could take place. Two thermal controllers, one per intake, and an ice detector regulate the operation of the system.

Air Data Sensors

- The three pitot probes and the two Angle of attack (AOA) sensors installed in the nose section of the aircraft are electrically heated to prevent ice formation. The heaters are activated by five individual push buttons located on the overhead panel of the flying deck.

Windshield

- Windscreens are protected against ice accumulation by an electrical heating system, which has two regulators, one per windshield.
- Warm air from the Environmental Control System is also available to prevent fogging of the internal surfaces of the windscreen and window panels.

Ice Detection System

- The CN-235 is equipped with an ice detector, located outside the aircraft. It is a rotating cylinder type, consisting of a small electrically driven cylinder with a knife cutter located very close to the cylinder surface. Under icing conditions, ice accreting over the cylinder surface interferes with the cutter, increasing torque required to maintain the cylinder rotation, and providing a signal to a caution light in the cockpit.

EADS CASA

Fire Protection System

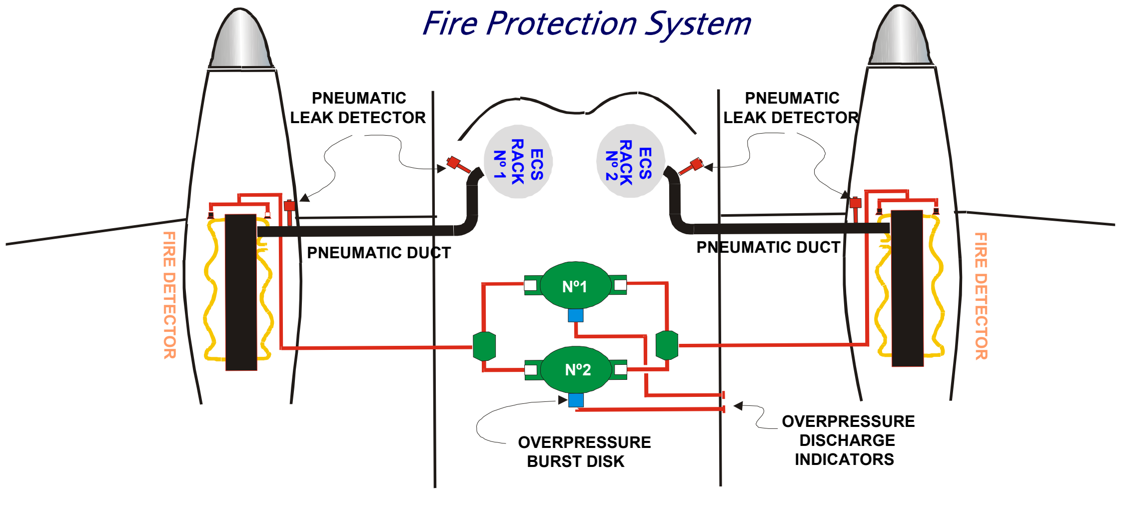
The Fire Protection System is designed to reduce the consequences of fire on board, by detecting the fire or smoke at an early stage and neutralising the hazard as soon as possible.

Passive fire protection is obtained through design procedures aimed at eliminating or minimising the risks and effects of a fire on the aircraft. These procedures range from the selection of suitable materials for liners, cowls or firewalls to detailed design precautions to reduce the risk of flammable fluid spills coming in contact with ignition sources such as electrical sparks or hot air.

Active protection is provided by the Fire Protection System, which includes the following subsystems:

- **Engine Fire/Overheat Detection System** to provide full fire/overheat detection capability in engine bays
- **Engine Fire Extinguishing Subsystem** to provide fire suppression in the engine bays
- **Cabin Protection Subsystem** to provide an adequate degree of protection against all the cabin aircraft fires, in cockpit and cargo compartments.
- **Leak Detection Subsystem**, for pneumatic ducts to provide an adequate degree of protection against leakage of hot bleed air.
- **Control and Monitoring Subsystem** to manage the whole Fire Protection System from the cockpit.

Fire Protection System



Power Plant

- The fire detection system in each engine is of the resistive type requiring the sensing of both, resistive and capacitive properties of the sensing elements to activate the warning signal. The system is formed by a control unit and a continuous sensor routed to cover the whole fire zone of the nacelle. The system generates a visual warning signal in the cockpit when a fire is started or an overtemperature is reached.

- The extinguishing system consists of a fixed installation with an independently dischargeable extinguisher for each engine. The system is a high rate discharge type, using Halon 1301. "Second shot" facilities are also provided, allowing two discharges per engine. Two fire handles situated on the overhead panel of the flight deck control the activation of the system. To prevent an overpressure condition in the extinguishing system, the bottles have a safety device, which dumps pressure overboard through a discharge indicator located on the right side of the fuselage.

Cabin

- The cabin fire protection is provided by two Halon 1211 hand extinguishers, one in the cockpit and another in the cargo compartment, and one water hand held fire extinguisher.

Oxygen System

- The oxygen system includes a fixed installation for the crew and three portable oxygen bottles for use by the passengers.

- The fixed oxygen system for the flight deck crewmembers is a high pressure gaseous type (1,850 psi) with pressure reducer and diluter demand regulation. The oxygen is stored in two interconnected pressure cylinders, which are installed under the floor behind the cockpit. Both cylinders are filled from a single connector located in an external receptacle on the right side of the fuselage. The oxygen system is connected to the supply line, the external discharge indicator, the manometer in the cockpit and the oxygen filler valve.

- The fixed system is designed to satisfy the requirements of three cockpit crewmembers, and up to three additional fixed stations in the cargo cabin. Each station is provided with a quick-donning oxygen mask incorporating a diluter demand control and a dynamic microphone. There are smoke goggles for each crewmember and a full-face smoke mask for use in case of fire.

- The three portable oxygen bottles have a capacity of 2.4 liters. Each bottle is equipped with a full-face mask.

Lighting System

The CN-235-300 Lighting System provides the required external and internal illumination for all flight/ground environments, including night operations with use of Night Vision Goggles.

External Lighting

The exterior lighting subsystem consists of the Navigation Lights; Anti-collision Lights; Wing Inspection Lights; Landing/Taxi Lights; Runway Turn-Off Lights and Emergency Lights.

Navigation lights

Standard navigation lights are installed: one green light on the right wing tip, one red light on the left wing tip and two white lights at the end of the rear fuselage tail cone.

Anti-collision lights

The aircraft is provided with two stroboscopic, white anti-collision lights, one each on the lower forward part of the fuselage and on top of the vertical fin.

Wing Inspection Lights

Two lights, one on each side of the front fuselage, illuminate the wing leading edge, engine air intake and propeller in order to allow visual inspection for ice built-up on these elements.

Landing Lights

Two landing lights are installed in the landing gear nacelles (one on each side of the aircraft).

Taxi Lights

Two taxi lights are installed on the nose landing gear.

Turn-off Lights

Illumination of flight crew field of vision during night runway turn-off manoeuvres is provided by two turn-off lights, one in each landing gear nacelle.

Emergency Lights

Exterior emergency lights are installed next to each door in order to provide illumination and evacuation guidance in an emergency situation to passengers and crew.

Internal Lighting

- The cockpit is provided with two lights placed on the ceiling, one floodlight on each side, and two wander lights. All instruments installed in the cockpit, as well as indicators, control panels, instrument panel lettering, fuse panels and circuit breakers on the upper and console panels, have lighting permanently available.

- All the lights installed in the cockpit are compatible with Night Vision Goggles.

- The Interior Lighting Subsystem consists of:
    - Cockpit lighting,
    - Auxiliary Cockpit Lights,
    - Instruments and Panel Lighting,
    - Emergency Cockpit Lighting,
    - Cabin Lighting,
    - Passenger Compartment general illumination,
    - Cargo Compartment Lights,
    - Paratroops/Dispatch Lights,
    - Emergency Cabin Lighting.

- The aircraft is provided with internal lights throughout the cabin, as follows:
    - White/red light infinitely dimmable from full bright to off,
    - Two dome entrance lights,
    - Toilet light,
    - One NON SMOKING / FASTEN SEAT BELT signal,
    - Two exterior cargo lights,
    - One adjustable beam direction light in the rear loading area ,
    - Four sets of red and green paratrooper jump/dispatch lights, located at the two paratroop side doors and above the rear door.

- The emergency lighting system includes:
    - Four emergency lights along the ceiling aisle,
    - Four EXIT location signs in the upper part of each door,
    - Four exterior lights, one by each exit door.

Survivability

- Survivability enhancing options available in the CN-235-300 include a Radar Warning Receiver and a Counter-Measures Dispenser System.

- The Radar Warning Receiver (RWR) and the Counter Measures Dispenser System (CMDS) detect, identify, classify automatically, and provide protection and warning against radio frequency and Infrared threats. These functions are fully integrated in order to provide a rapid and effective response to any hostile threat detected by the RWR; integration with other aircraft systems such as navigation and communications is also provided, to optimise the self-protection capabilities of the aircraft.

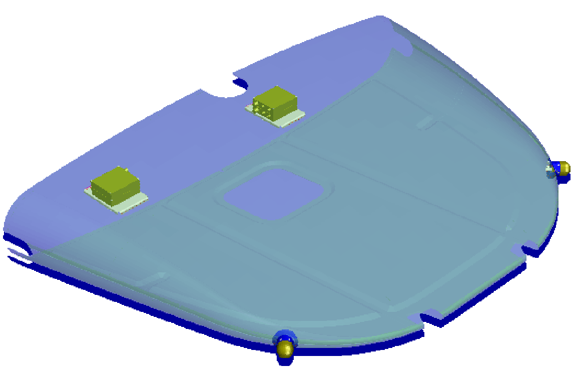
Radar Warning Receiver (Optional)

- The ALR-300(V2)R Radar Warning Receiver system receives, identifies and classifies Radar emissions in a dense electronic environment; the frequency range coverage extends from 0.5 GHz to 18 GHz.

The RWR installation includes a C/D Band antenna to receive emissions from 0.5 to 2 GHz and four E/J Band antennas to receive the emissions in the range from 2 to 18 GHz.

- RF signals received by the RWR are identified in accordance with the threats library. The system sends this information to the CMDS through the Mil-1553B bus. An azimuth indicator placed in the cockpit gives information about the threat and a warning tone is generated.

An interface box receives the blanking signals of the onboard emitter systems and inhibits the RWR to avoid a CDMS answer to these RF emissions.



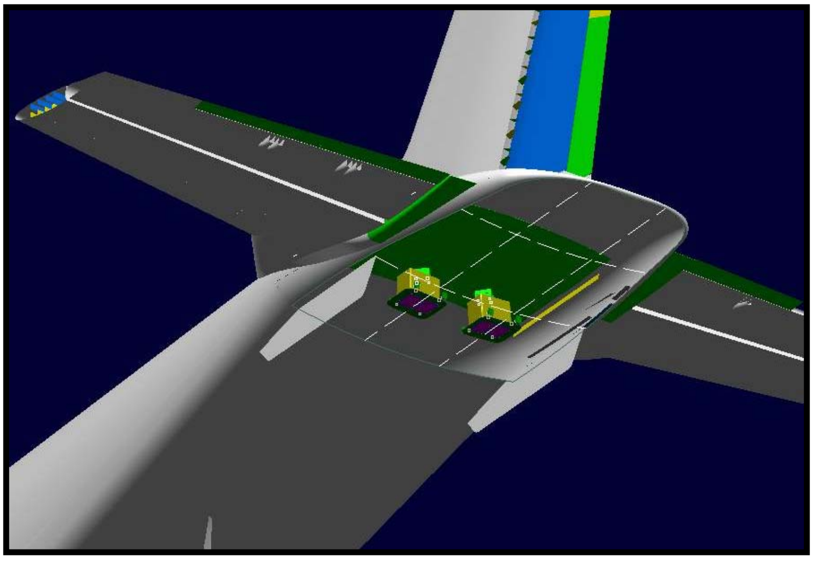
Tailcone E/J Band antennas

Counter-Measures Dispenser System (Optional)

- The ALE-47 Counter Measures Dispenser System is capable of dispensing expendable countermeasure decoys such as chaff, flares and others to enhance the aircraft survivability against radar-directed anti-aircraft artillery (AAA), radar command-guided missiles, radar homing guided missiles and infrared (IR) guided missiles.

- The chaffs and flares are stored in four magazines which are held in dispensers located in the rear part of the aircraft. Each dispenser may be loaded with interchangeable chaff or flare magazines. Each magazine may contain up to 30 of 1"x1" chaff or flare cartridges, or up to 15 of 1"x2" flares. However the ALE-47 system allows growth capability for up to 32 dispensers management.

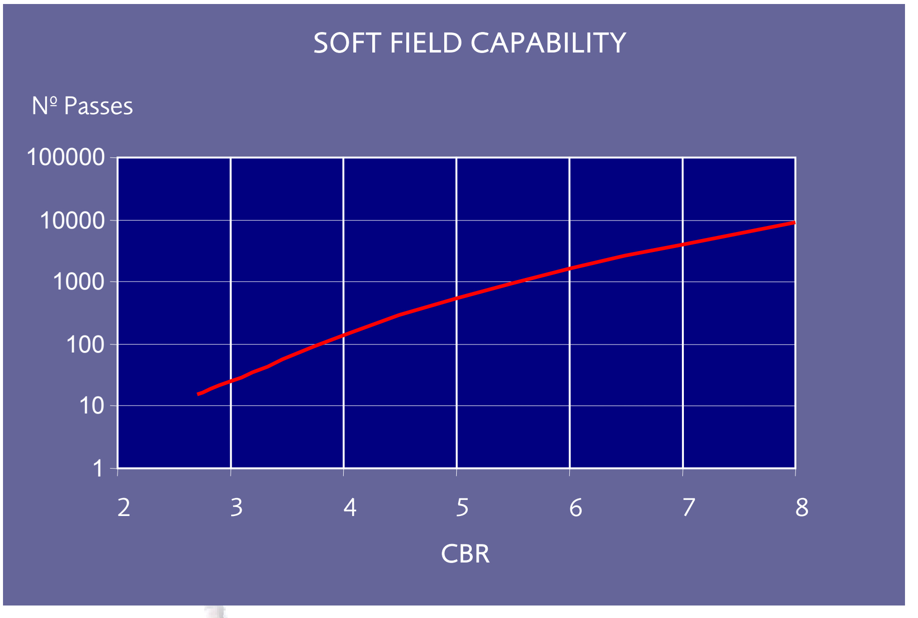
- The CN-235 CDMS is controlled by a digital control unit, placed in the pedestal cockpit panel, with two different modes of operation. In manual mode the pilot or copilot program a sequence of decoys release while in automatic or semi-automatic mode, the system uses information from the RWR and the flight data parameters to determine an optimised dispense response.



Chaff/Flares dispensers location

Soft Field Capability

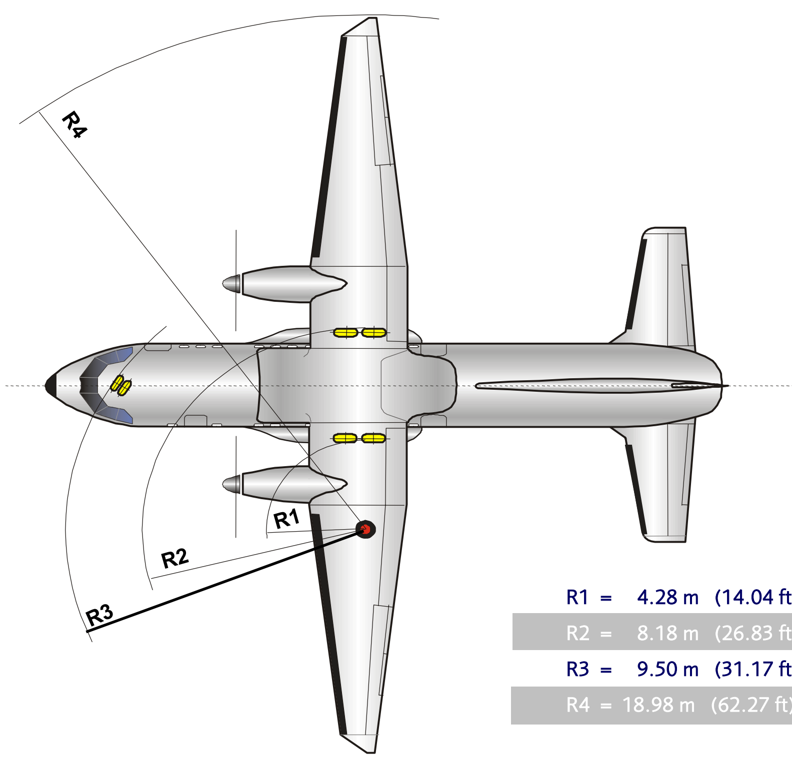
- Excellent performance on the ground is mandatory in a military aircraft conceived to operate in austere and remote environments. The CN-235-300 has an impressively strong airframe and high flotation landing gear, allowing operations from soft surfaces, with CBR 3 or lower.



Maneuverability

- Excellent handling qualities, fast engine response times and outstanding maneuverability allow safe operations at very low level close to the ground. The sustained turn radius of the CN-235-300 is 380 meters (at MTOW = 16,500 kg, 160 Kts).

- Small undercarriage turn radius allows a high degree of ground maneuverability for operations from airfields with restricted runway and apron space.



R1 =	4.28 m	(14.04 ft)
R2 =	8.18 m	(26.83 ft)
R3 =	9.50 m	(31.17 ft)
R4 =	18.98 m	(62.27 ft)

Ground Performance

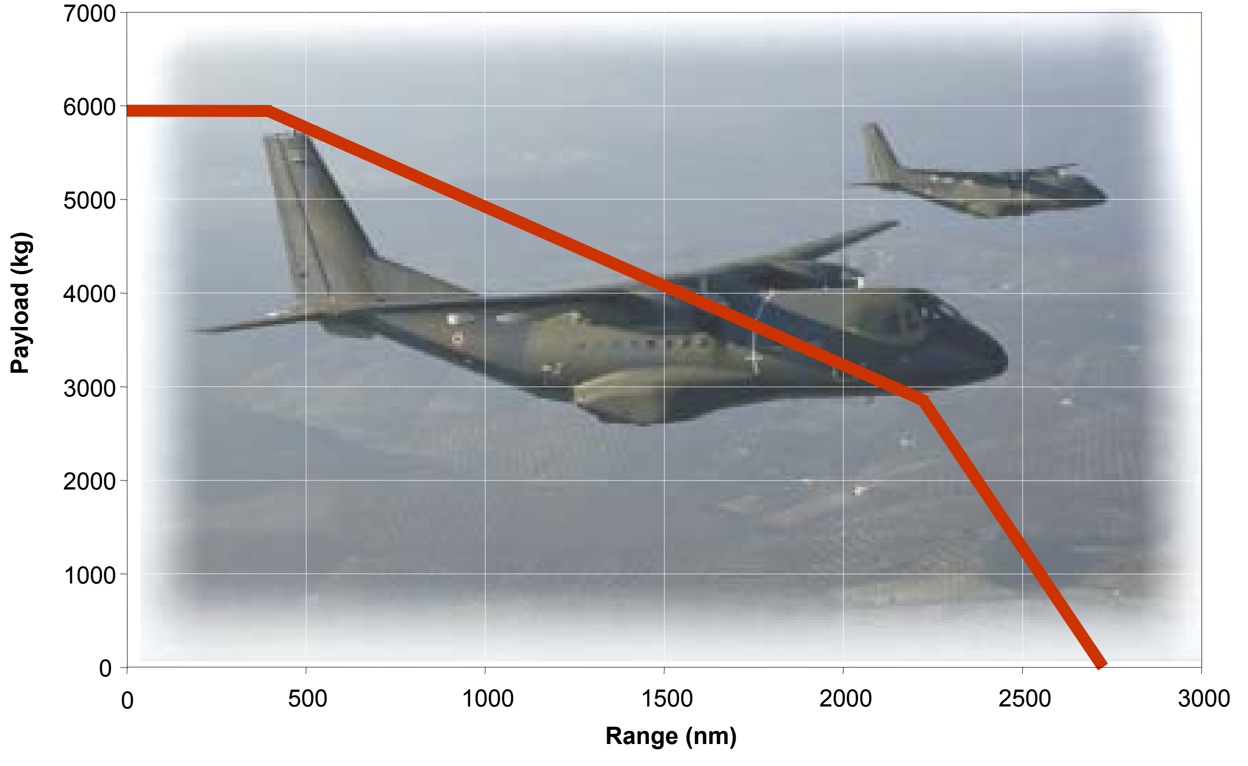
TAKE-OFF at MTOW (16,500 kg)
Short Field Technique

LANDING at MLW (16,500 kg)
Short Field Technique

Payload-Range

- The diagram below shows the payload-range capabily for a logistic mission, assuming a Long Range profile at optimum cruise conditions, with fuel reserve for 45 minutes holding at 5000 ft.
- The maximum take off weight for logistic missions is 16500 kg; the corresponding load factor limit is 2.5 g.
- With for a payload of 4,000 kg, the CN-235-300 has a range of over 1550 nm (2,870 km)

PAYLOAD RANGE – LOGISTIC MISSION



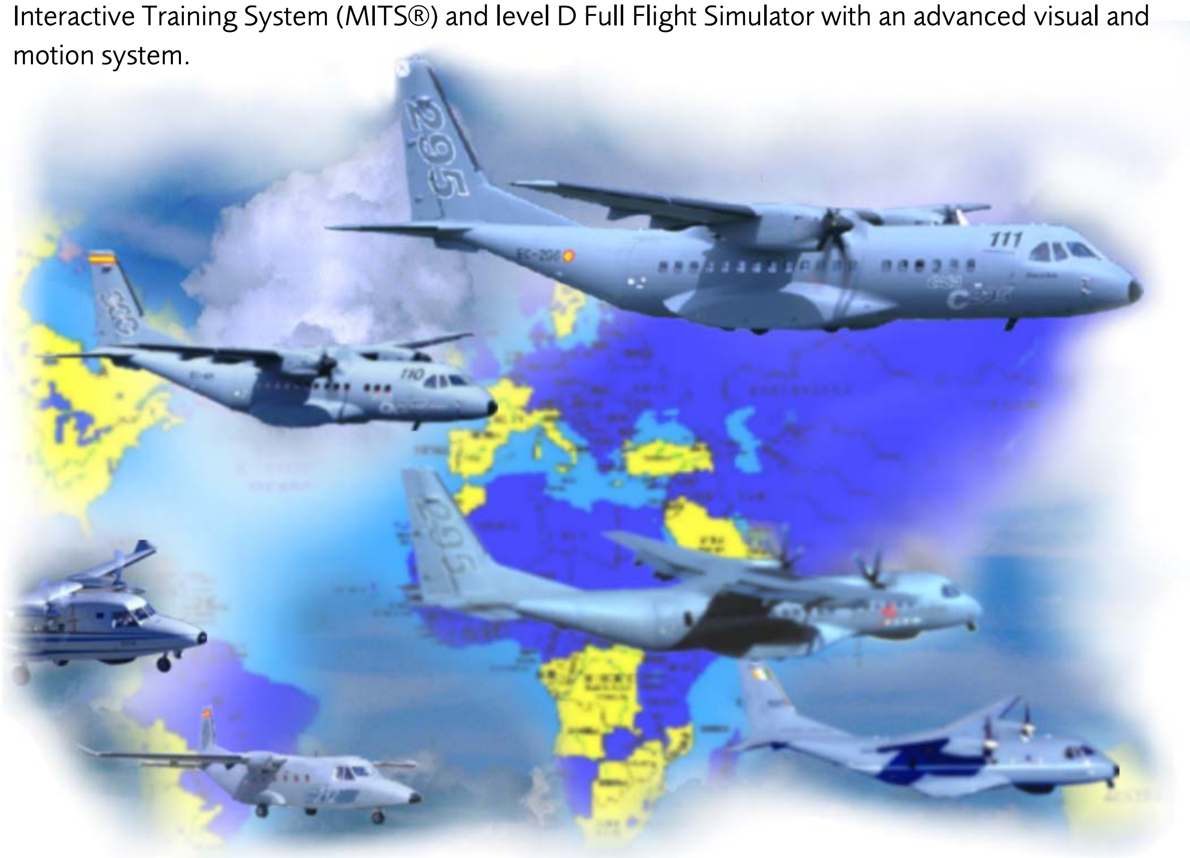
EADS CASA Integrated Customer Services

- Operators of more than 800 CASA aircraft in 50 countries benefit from the EADS CASA Integrated Customer Services: a guarantee of timely and comprehensive service, adapted to our customer requirements to ensure they obtain the best operational results. More than 25 years of experience supporting over 100 world-wide operators have provided EADS CASA with the expertise and resources to offer a whole range of Integrated Logistic Support options in order to obtain the maximum efficiency at minimum cost for the whole life cycle.

- For Customers requiring advanced support concepts, EADS CASA offers complete Full In-Service Support at fixed price and "Pay-by-the-hour" packages. This can be extended to include the Customer warehouse management, components repair, maintenance for different levels (from Operational to Depot) and a wide scope of possibilities that enable the Operator to simply concentrate on flying.

- For Customers who prefer traditional procedures, EADS CASA Integrated Logistic Support provides an extensive range of services: material support, components repair, a 24 hours seven days a week A.O.G. desk, rapid production and distribution of technical documentation, full engineering and field service support, aircraft overhaul, major repairs and modifications.

- Particular attention is paid to operation and maintenance training. The EADS CASA Training Centre at Seville has available a full range of advanced training aids such as the Multimedia Interactive Training System (MITS®) and level D Full Flight Simulator with an advanced visual and motion system.



Compliance with SASEB Requirements.

1. FAA Certified as a Normal or Transport Category Aircraft.

CN-235 is FAA certified in the Transport Category.

2. FAA approved to fly with the jumper exit door removed.

CN-235 is approved to fly with the jumper door opened. The design of the door does enable the operation without the need to remove the door.

3. Airspeed at 1.3 V stall (jump configuration) not to exceed 115 Kts.

CN-235 with 20 jumpers and fuel to fly for five hours has a Stall Speed, in jumping configuration, of 82 Kts. That means 1.3 V stall (jump configuration) is 106.6 Kts.

4. Jumper exit door at least 25 inches wide and 36 inches high.

There are two Jumping doors at the rear of the cabin (35,43 inches wide and 67 inches high) and also jumping may be perform through the rear ramp (93 inches wide and 67 inches high)

Multi-engine Aircraft

1. 1 to achieve a single engine (critical engine inoperative) rate of climb of 50 feet per minute (fpm) at 9,000 feet density altitude.

With 95 % of MTOW , the CN-235 has a single engine rate of climb of 291 fpm

2. Ability to achieve a single engine climb capability of +.6 percent ……

In these conditions, CN-235 has a rate of climb of 386 fpm

Administrative Considerations The "Sponsor's Report" needs to provide agency managers with information needed to make an informed judgment about the prospects for the proposed aircraft to fulfilling agency needs at an acceptable cost. Successful completion of this part of the report will generally require the skills of both experienced aviators and smokejumpers.

1. Support the need for the aircraft. Why are you proposing that this aircraft be evaluated? Why do you want to use this particular aircraft? What are the perceived advantages over aircraft already on the approved list? How many aircraft of this type do you propose to use, and how soon? Note: Careful reasoning here will help preclude the expenditure of time and money for aircraft that may "look good" but for which there is no real identifiable need.

2. Number of aircraft potentially available for smokejumper use? This information is necessary to determine whether there will likely be a "payoff" following an aircraft evaluation. The candidate aircraft may Offer excellent performance and an optimum configuration for smoke jumping. But if it is not available for smoke jumping contracts, or is too expensive, the costs of conducting an evaluation will be wasted.

3. Versatility of the aircraft; multi-use capabilities (i.e., crew and/or cargo haul, administrative use, etc. Describe how the aircraft can be effectively used for non-smokejumping missions and indicate if this was a consideration in your decision to sponsor the aircraft.

4. Payload capabilities - Smokejumper/pax crew and cargo haul ….

CN-235-300 Weights (FAR 25)

Maximum Ramp/Taxi weight: 34,940 lb

Maximum Take-Off weight: 34,830 lb

Maximum Landing weight: 34,390 lb

Maximum Zero Fuel Weight: 31,080 lb

Operating Empty Weight for the basic CN-235 is 20,850 lb. It includes engine oil, unusable fuel, two pilots, miscellaneous aircraft equipment (manuals, covers, tool bag, emergency equipment and some allowance for other optional items, including static lines).

All items specifically related to the Smoke Jumper role will be referred to as “payload” – even those that will be permanently installed in the aircraft.

Maximum number of smokejumpers

The Spanish AF routinely operates with 28 paratroops, but the actual capability of the CN-235 is well over 30.

The military style side seats that EADS CASA offers as standard are 18 inches wide. These seats are easily foldable against the sidewalls.

PAYLOAD CASES

Three different payload cases will be considered for the performance calculations:

Case 1. Eight Jumpers

Case 2. Twenty jumpers

Case 3. Maximum Payload (Transport mission)

The weight of the seats will be taken as 495 lb: 11 SIMLA seats at 45 lb each, providing a seat capacity of 22. This weight has also been considered for Case 1 (8 jumpers).

The provided table “Fire Load and Weights” shows a weight of 2430 lb, including the spotter and 6 jumpers at 250 lb each. Without the jumpers the weight would be 970 lb, which has been rounded to 1,000 lb.

Case 1 Eight Jumpers

Payload:	1,000 lb	(Fire load, Spotter, Equipment)
	495 lb	(11 SIMLA seats)
	2,240 lb	(8 jumpers at 280 lb each)
Total :	3,735 lb	payload

Case 2 Twenty Jumpers

Payload:	1,000 lb	(Fire load, Spotter, Equipment)
	495 lb	(11 SIMLA seats)
	5,600 lb	(20 jumpers at 280 lb each)
Total:	7,095 lb	payload

Case 3 Maximum Payload, limited by MFFW is 10,230 lb

5. Range and cruise speeds with operational loads.

Case 1:

8 jumpers, ISA, SL

Max. Cruise	Range (nm)	KTAS	Time (hrs)
FL 20	1,387	234	6.21
FL 120	1,792	236	7.83
FL 200	2,165	244	9.34

Normal Cruise			
FL 20	1,449	229	6.62
FL 120	1,794	239	7.76
FL 200	2,156	244	9.30

Long Range Cruise			
FL 20	1,761	179	10.19
FL 120	2,202	184	12.09
FL 200	2508	202	12.82

8 jumpers, ISA, 5,000 ft

Max. Cruise	Range (nm)	KTAS	Time (hrs)
FL 70	1,580	239	6.94
FL 120	1,801	237	7.84
FL 200	2,177	244	9.37

Normal Cruise			
FL 70	1,593	240	6.95
FL 120	1,803	239	7.78
FL 200	2,168	244	9.33

Long Range Cruise			
FL 70	1,996	182	11.31
FL 120	2,214	184	12.13
FL 200	2,522	202	12.87

Case 2:

20 jumpers, ISA, SL

Max. Cruise	Range (nm)	KTAS	Time (hrs)
FL 20	934	234	4.28
FL 120	1,203	236	5.39
FL 200	1,441	242	6.40

Normal Cruise			
FL 20	975	229	4.55
FL 120	1,204	239	5.34
FL 200	1,436	243	6.38

Long Range Cruise			
FL 20	1,171	179	6.84
FL 120	1,442	188	7.87
FL 200	1,617	207	8.22

20 jumpers, ISA, 5,000 ft

Max. Cruise	Range (nm)	KTAS	Time (hrs)
FL 70	1,065	238	4.78
FL 120	1,212	236	5.40
FL 200	1,454	242	6.43

Normal Cruise			
FL 70	1,074	240	4.79
FL 120	1,213	239	5.36
FL 200	1,449	243	6.40

Long Range Cruise			
FL 70	1,322	184	7.48
FL 120	1,454	188	7.91
FL 200	1,632	207	8.27

Case 3:

10,230 lb of payload, ISA, SL

Max. Cruise	Range (nm)	KTAS	Time (hrs)
FL 20	456	234	2.24
FL 120	583	236	2.80
FL 200	688	240	4.29

Normal Cruise			
FL 20	476	229	2.37
FL 120	584	238	2.78
FL 200	686	241	3.28

Long Range Cruise			
FL 20	565	180	3.43
FL 120	682	192	3.83
FL 200	748	210	3.93

10,230 lb of payload, ISA, 5,000 ft

Max. Cruise	Range (nm)	KTAS	Time (hrs)
FL 70	523	238	2.50
FL 120	592	236	2.82
FL 200	701	240	3.32

Normal Cruise			
FL 70	527	239	2.50
FL 120	593	238	2.80
FL 200	699	241	3.31

Long Range Cruise			
FL 70	638	187	3.70
FL 120	694	192	3.88
FL 200	763	210	

	Take-off Weight (lb) (MTOW: 34,830 lb)	
Airport	ISA	ISA+15
Grand Junction Colorado	34,830	34,510
Durango Colorado	34,172	32,100
Telluride Colorado	32,430	30,360
Carson City Nevada	34,830	34,690
Boise Idaho	34,830	34,830

6. Landing field requirements.

MLW: 34,390 lb	ISA, SL	ISA, 5000 ft	84ºF, 5000 ft
Landing Distante(ft)	2,251	2,473	2,389
Landing Field Length (ft)	3,752	4,122	3,982

7. Total aircraft purchase cost. List the cost to acquire this aircraft. If new, show equipped price with IFR avionics, seats, and "other normal and required equipment". If used, show the range of prices for aircraft in the age class and equipment range that you would contract.

The catalogue price for a basic CN-235-300 brand new aircraft is $17.085 M (E.C. 2003).

Estimated Fleet (Gov owned) rate:

- - Rate per hour

- -Daily availability

- -Other costs

Estimated contract rate:

- - Rate per hour

- -Daily availability

- -Other costs

Note: Maintenance Aircraft Contracting Officer may be able to suggest techniques that help estimate a contract rate.

8. Date of certification date and last manufacture.

FAA certification: December 3, 1986.

CN-235 is currently in production

9. Maintenance/support requirements.

The initial scheduled maintenance program for the CN-235-300 is based on the Maintenance Review Board (MRB) procedure outlined in the FAA Advisory Circular 121-22A.

The program minimises scheduled maintenance requirements and maximises aircraft availability without degrading flight safety or reliability. It is focused to prevent deterioration of inherent design reliability and safety of the equipment and to accomplish this at a minimum cost.

The aircraft will be maintained basically "on condition" by means of maintenance tasks that determine the condition of systems, subsystems or components and ascertain whether the equipment involved can continue to operate satisfactorily until the next scheduled inspection.

A complementary Zonal Inspection program will assure that all systems, components, installation contained in a Zone receive adequate surveillance to determine security of installation and general condition. It provides a package of general visual tasks generated against Maintenance Significant Items into one or more Zonal surveillance tasks.

PERIODIC INSPECTION	FREQUENCY
1. Servicing	72 hours (elapsed time)
2. "A" Check	200 flight hours
3. "C" Check	2,000 flight hours
4. "Y" Check	Every year

	ON AIRCRAFT		OFF AIRCRAFT	
	SCHEDULED	UNSCHEDULED	SCHEDULED	UNSCHEDULED
LEVEL "0"	PF/TR "D" "S"	-Failure investigation until LRU level (Troubleshooting). -LRU Removal/Replace		
LEVEL "I"	"A"	- Corrective actions exceeding maintenance level "0". - Minor Structural Repair. - Minor Modifications/SB.	-Batteries	-Battery -Wheels -Brakes -Components repair (up to the level defined).

LEVEL "D"	"C" "Y" Structural Inspections	- Major Modifications /SB. - Major Structural Repairs	-Components Overhaul.	-Components Repair

10. Single pilot certification. Is the aircraft certificated for single pilot?

CN-235 is not certified for single pilot.

Flight Performance Data This section is designed to compile as much relevant information as possible from the Aircraft Flight Manual. Along with the informed provided by operators or the aircraft's manufacturer, this should enable a judgement as to the suitability of the aircraft's flight performance characteristics as these relate to the smokejumper mission.

1. General performance envelope (all calculations made with aircraft at maximum gross weight).

Performance data is presented for two weight conditions:

a) 34,830 lb (MTOW)

b) 31,350 lb (90% MTOW)

The MTOW case (34,830 lb) is more relevant for the use of the CN-235 as a transport aircraft than for its use as a smokejumper platform. In fact, even the most demanding smokejumper missions would normally use considerably lower weights. The performance data for 31,350 lb is given as reference: this weight would allow for 20 smokejumpers and 6885 lb of fuel (more than 5 hours).

Stall Speed (knots)	MTOW	90 % MTOW (*)
Clean	99	94
Landing configuration (Flaps 23°)	79	75
Jumping configuration (Flaps 10°)	86	82

(*) 20 smokejumpers + 5 hours fuel

Rate of Climb (fpm)	MTOW	90 % MTOW
AEO Sea Level ISA conditions	1,450	1,700
AEO 5,000 ft ISA + 25 C (OAT= 30 C)	800	1,050

Critical engine out, Sea Level, ISA	500	680
Critical engine out, 5,000 ft ISA + 25 C	260	400

Service Ceiling, all engines (ft) (100 fpm residual climb)	MTOW	90 % MTOW
ISA	25,200	27,700
ISA+20 C	21,800	24,400

Critical engine out ceiling (ft)	MTOW	90 % MTOW
ISA, residual 100 fpm climb	11,500	14,700
ISA+20 C, residual 100 fpm climb	7,400	11,200

Note: CN-235 AFM has no ceiling data for 50 fpm climb

Landing Distance, 50 ft obstacle (ft)	MLW	90 % MTOW
Sea Level, ISA	2,250 ft @ 34,390 lb	2,130 ft @ 31,350 lb
5,000 ft airport elevation, ISA + 25 C	2,370 ft @ 32,190 lb	2,340 ft @ 31,350 lb

Notes: The required Landing Runway Length (FAR25 definition) can be obtained by applying a factor of 1.66 to the Landing Distance values of the table.

34,390 lb is the FAA certified Maximum Landing Weight (structural);
32,190 lb is the maximum allowable landing weight for 5,000 ft/ISA+25, as limited by the FAR25 requirement of 2.1° climb gradient in approach configuration with critical engine out.

Takeoff Distance, 35 ft obstacle (ft)	MTOW	90 % MTOW

Sea Level, ISA	3,870 ft @ 34,830 lb	3,120 ft @ 31,350 lb
5,000 ft airport elevation, ISA + 25 C	5,420 ft @ 32,190 lb	4,950 ft @ 31,350 lb

Notes: The above AFM values are FAR25 TOD for 35ft obstacle clearance, with critical engine failure at V1.

32,190 lb is the maximum allowable takeoff weight for 5000 ft/ISA+25, as limited by FAR25 requirement of 2.4º climb gradient (critical engine out)

Approximate TODs for 50 ft obstacle, with critical engine failure at V1:

S/L ISA 34,830 lb 4,220 ft

S/L ISA 31,350 lb 3,395 ft

5000 ft/ISA+25, 32,190 lb 6,045 ft

5000 ft/ISA+25, 31,350 lb 5,495 ft

Maximum Cruise Speed (knots)	MTOW	90 % MTOW
15,000 ft cruise altitude, ISA	244	246
15,000 ft cruise altitude, ISA+10 C	238	241

Long Range Cruise Speed (knots)	MTOW	90 % MTOW
22,000 ft cruise altitude, ISA	214	210
22,000 ft cruise altitude, ISA+10 C	217	213

2. Stall and stall recovery characteristics.

Stall Warning System

Impending stall warning is provided by the illumination of the STALL annunciators and the simultaneous activation of the associated warning horn, when any AOA indication reaches the appropriate value.

Stall Characteristics in Different Configurations

With a clean configuration and idle power, stall is unattainable. With a pilot control wheel input of around 130 lbs, the aircraft engages in a high nose smooth descent that is easily recovered.

With 10° flaps and idle power, stall is attained with almost half the pilot control wheel input and with no buffeting. Audio and visual warnings appear 10 Kt before stall.

In all of the remaining configurations and power situations, the warnings activate at least 10 Kt before buffeting starts. Inputs get lower in proportion to "uncleanliness" and power, so that, with 23° flaps, and landing gear down and maximum power, only 5-10 lbs are required to attain stall.

NOTE

During stall, all flight controls remain effective, and recovery is obtained by smoothly lowering nose a few degrees and correcting A/C bank as required.

When the ball of the inclinometer has not been maintained in the centre, stall is accompanied by a wing drop (RH, generally) which is slight with a clean configuration and becomes proportional higher with flap deflection. When in landing configuration and powered, it will require a rapid bank correction order to avoid wing drops greater than 20°.

PRACTICE STALLS

Flight at or near the stall is not normally required in service. However, the procedure below is included for use in those cases in which it is desired to acquaint the users with the airplane flight handling characteristics which are present when effecting aircraft recovery from a stall.

Procedure

When intentional stalls are carried out the initial altitude should be 6 000 ft AGL, minimum. Furthermore, the following conditions must be met:

1. Autopilot / yaw damper, if fitted, to be disengaged.

2. Stall warning system to be operative.

3. Aerodynamic surfaces free from ice and, if fitted, the Stall Warning Shift System (SWSS) turned off.

4. Weather radar, if fitted, to be set at standby.

5. Synchrophaser off.

6. Ventral door closed.

7. Wing and tail de-icing system turned off.

Technique

The stalling technique is as follows:

1. Stalls must be performed with symmetrical power and condition levers at MAX RPM. Engine torque settings in power-on stalls should not exceed 41% TQ. Power, once set, should not be reduced during the approach to the stall and recovery.

2. The airplane should be trimmed at an airspeed approximately 1.3 VS in the appropriate configuration after setting the required power.

3. With wings held level throughout the approach to stall by appropriate use of roll control, and heading held fixed by appropriate use of rudder, airspeed should be reduced at not more than one knot per second. Do not retrim during manoeuvre. Any tendency to sideslip during the approach to stall should be corrected by normal use of rudder. Rapid

or violent movement of any control during the approach to the stall should be avoided, particularly at airspeeds below the operation of the impeding stall warning system.

Stalls with landing (23°) flaps at higher than normal (1kt/sec) entry rates may lead to wing drop values in excess of 20°.

4. When the stall is recognized, conventional positive recovery action should be taken. Stall recovery is prompt following relaxation of rearward pressure or application of gentle forward pressure on the control column until normal flight resumes. Any existing wing drop should be corrected by use of ailerons.

Characteristics

There is no clear distinctive natural warning or aerodynamic buffet prior to the stall; however, under certain flap/power setting configurations, a mild aerodynamic buffet may be noticeable. Impeding stall warning is artificially provided by an aural/visual warning system which is set to operate at 32 AOA units, corresponding to an indicated airspeed of 7% to 10% above the stalling speed.

The stall occurs smoothly, is docile and, when the airplane is in a clean configuration, is characterized by the high pilot forces required (with the longitudinal control reaching near maximum travel). With the flaps deflected, the stall is defined by a nose-down pitch accompanied by a moderate wing drop. Both the nose-down pitch and the wing drop become more marked as flap deflection increases, especially for the power-on, aft C.G., 23° flap configuration.

4. Slow flight characteristics and attitude. What type of slow flight characteristics do you anticipate from this aircraft? Is there a distinct “tail low” attitude in slow flight?

CN-235 has been certified under FAR 25 and JAR 25 Airworthiness Regulations showing in all flight conditions an excellent manoeuvring and controllability characteristics. Furthermore, CN-235 has been designed to operate for Military Mission where the flight characteristics out of normal civil flight envelope have to be guaranteed.

Comprehensive flight tests were conducted to demonstrate aircraft capability to successfully achieve this Military role, especially in the low speed missions:

- During Stall Tests in level and turning flight (30º bank), the aircraft remains controllable throughout the manoeuvre. The reduction of airspeed results in a progressive stick forces without any reversal or inversion. Normal use of rudder and aileron control allow to hold wings level/turning condition and maintain heading/zero sideslip while approaching the stall. In addition, elevator and aileron control remain effective during the post-stall phase making very easy the stall recovery, which is accomplished by relaxing rearward pressure on column and correcting bank angle by counteractive action on wheel control.

- Takeoff performance has been improved reducing rotation speed to 0.95 VS in order to lift off at VS (Short Field Takeoff Technique). Full elevator and aileron control was demonstrated at speed of 80 KIAS with light weight in order to guarantee the aircraft manoeuvrability during the initial climb. Nor pitch up neither wing drop tendency appear at this flight condition. The control effectiveness at this low speed (80 KIAS) provides full control of the aircraft allowing for turning, level, climb/dive manoeuvres and airspeed changes.

- Landing distance has been improved reducing the reference speed at 1.15 VS. The aircraft is able to follow the landing flight path, to perform offset landings and to achieve a precise touch-down point.

- In the Paratroops Airdropping role the aircraft is flown at 110 KIAS, FLAP TO (10º) with a pitch attitude always lower than 5º, even for the maximum logistic takeoff weight, to allow an easy paratroops exit. The aircraft exhibits full manoeuvrability to achieve the airdrooping zone, to stabilise at level flight and to perform the escape manoeuvre. During paratroops stand up, hook up and exit, the aircraft attitude is fully controllable with the elevator control preventing from a pitch up due to the rearward shift in airplane C.G.

5. Turning capability into dead critical engine at 1.3V for deep canyon get-away. Are there any indications of problems or concerns with the engine-out turning capabilities of this aircraft?

Engine-out turning capability was demonstrated during FAR and JAR certification test campaign.

The aircraft achieves more than 30º bank angle without stall warning appearance when trimmed at V2 (1.2VS), FLAP TO, one engine inoperative and the alive engine at MTP, as required by FAR/JAR Takeoff Manoeuvre Margin demonstration. In this condition, the excellent controllability of the aircraft allows to perform a ± 30º bank to bank (60º bank travel) in 6 seconds.

When aircraft is trimmed at 1.25 VS, FLAP UP, one engine inoperative and the alive engine at MCP (final takeoff configuration), more than 40º bank angle is achieved without stall warning appearance as required by FAR/JAR Takeoff Manoeuvre Margin demonstration. The aircraft proves to be controllable and manoeuvrable with normal use of controls without special pilot skill or losing control.

Finally, to exhibit the good engine-out turning capability at low speed, the aircraft is able to be rolled through an angle of 20º towards the operating engine in 5 seconds when it is trimmed at VMCL (about 80 KIAS), FLAP APP(15º) - LDN (23º), one engine inoperative and the alive engine at MTP.

6. Center of gravity limits ……
The CN-235-300 has a relatively wide center of gravity limits, from 16% to 30% of MAC. These limits are very unlikely to be exceeded for any reasonable distribution of smokejumper loads.

Only one condition might require some care: with medium payload (meaning some15 occupants for the CN-235) an excessive concentration of weight at the forward part of the cabin without any loads at the rear of the aircraft could cause an excess of the forward CG limit. This can be easily avoided with a more even distribution of occupants or payload.

7. Engine compatibility to a wide range of power settings and……

The aircraft is equipped with two General Electric CT7-9C3 turboprop engines driving a four-bladed Hamilton Standard 14RF-37 variable-pitch propeller.

Each engine provides a nominal power of 1750 SHP at sea level at up to a temperature of approximately 39°C. In the case of an engine failure during the takeoff, the integral APR (Automatic Power Reserve) system immediately increases the power of the remaining engine to about 1870 SHP.

The engine consists of a Gas Generator and a Free Turbine whose shaft passes through the inside of the Gas Generator to drive a Propeller Reduction Gear Box (PGB).

The Gas Generator - following the direction of the airflow - is made up of a six-stage compressor (five axial and one centrifugal), an annular combustion-chamber, and a two-stage turbine. After this is the two-stage Free Turbine, whose purpose is to drive the propeller through the propeller gearbox. The PGB is above the engine air-intake. It includes the reduction gear-train, the propeller pitch control components, various oil pumps, and an Alternator. This Alternator supplies the engine air-intake anti-icing heater-mats and acts as an alternative supply source to the aircraft electrical system. The RH engine PGB includes, in addition, a Hydraulic Propeller Brake. This allows the engine to be used in the APU mode on the ground in order to supply air conditioning and electric current to the aircraft, with the propeller stopped.

The PGB lubrication oil, which also serves as the pitch change control medium, is independent of the engine lubrication.

8. Trim change with speed and power variations and gear or flap deployment and retraction. Address the pitch changes associated with power changes and gear and flap deployment and retraction. Examine the trim response needed to deal with these changes, both manual and power trim (if applicable). Does the aircraft have any interconnect systems associated with the trim/flaps, and how will their function affect the pilot's feel for the aircraft and the workload?

Flight controls - particularly ailerons - require trimming in order to reduce the amount of force needed to move them.

Change of trim is slightly nose-down with increasing power; however, change of trim with landing gear extension is negligible. A significant nose-down change of trim is required as flaps are extended. Pitch trim is sensitive and should be applied in small increments, assessing the effect of each applicationin arriving at the desired setting.

When trimmed, the aircraft stability is very satisfactory along its three axis.

For aileron and stabilizer trimming it is required to push and move at the same time the required selector.

Bank control is very rapid, and yaw trimming, when applied, is immediate.

Turns with a bank above 30° or any power decrease originate a slight nose down attitude which is easily corrected.

During approach in turbulent conditions, bank forces are slightly above their normal values.

Rudder pedal displacements are asymmetrical, with a longer displacement for RH side pedal. Normal input strength on the rudder pedals is constant for RH foot pedal, from half travel onwards.

With one engine stopped - particularly RH engine - the control column will oscillate slightly forward and backwards with no aircraft movement.

Inflight Maneuvering

Aerobatic maneuvering is forbidden.

Normal maneuvering is performed with moderate effort input on flight controls.

During combat manoeuvering, remember that the maximum bank angle is 65°.

The minimum turning radius is with 15° of flap and IAS between 120 kt (weight less than 13,000 kg) and 130 kt (high weights).

For 10° of flap the recommended IAS is 140 kt. For clean aircraft the minimum turning radius is 160 kt at sea level (150 kt at 5,000 feet).

DIVING

Maintain VMO and VD limitations.

Avoid harsh recoveries at high speeds. The aircrafts response to its flight controls is excellent.

ABNORMAL FLIGHT CHARACTERISTICS

Single Engine: After engine failure oppose yaw and roll using rudder and aileron control in the normal way. The pedal forces required will be high at low speeds with high power settings. When steady flight has been regained, the airplane should be trimmed. In the event of port engine failure, a decrease in pedal force gradient will be apparent beyond mid-travel.
Critical Engine: The critical engine is the left engine (i.e., failure of such engine gives the critical asymmetric condition). More rudder control movement and force will have to be applied than with the opposite engine failed. Use of ailerons and bank has a significant effect on reducing rudder control force in asymmetric conditions. The rate of climb in the asymmetric condition with the left engine failed is similar to that with the opposite engine failed.

9. Straight forward and easy to manage systems. Look at the aircraft systems and evaluate them for ease of use and emergency procedures in relation to pilot workload, especially in single-pilot aircraft.

10. Gear retraction time and gear speeds. What is the gear retraction time, and what is the maximum air speed to extend and retract the gear? What is maximum speed with gear extended? Are these speeds compatible with using the gear as a drag device for cargo dropping?

The maximum speed at which it is safe to extend or retract the landing gear, VLO, and the maximum speed at which the airplane can be safely flown with the landing gear extended and locked, VLE, are the same: 150 KIAS.

Landing gear extension above 18 000 feet is prohibited

11. Door removed cruise speed? What are the penalties for in-flight performance with the smokejumper exit door removed? Are these penalties verified from the Aircraft Flight Manual, or as estimated?

The aircraft may be flown with either or both rear cabin parachute doors open.

The maximum speed at which the parachute doors can be opened or closed is 130 KIAS. With the doors open, the maximum permissible speed is 150 KIAS.

Smokejumper Functional Suitability Data Completing of this section will almost certainly require that the sponsor gain physical access to a representative aircraft.

1. Proximity of the horizontal stabilizer position to the jump and cargo door in slow flight at maximum forward CG. Is there a potential for tail strikes (either by jumpers or Paracargo)? Is there a possibility for parachutes to deploy over the top of the stabilizer or in the area of the elevator hinge? Is the distance from the anticipated primary static-line anchor location to the horizontal stabilizer compatible with the use of standard 15-foot static-lines?

2. Potential to deploy smokejumper personnel and cargo parachutes without damage to static-lines caused by contact with parts of the aircraft or exit door. Is the aircraft "clean" around the exit door and aft along the fuselage? If not, what would be required to "clean up" any conflict item or area? This is a critical safety issue which, if not resolvable, would be sufficient sole cause to reject an aircraft that might otherwise prove suitable.

3. Amenability of the aircraft to installation o fa functionally adequate smokejumper and cargo restraint system. What provisions exist, or can as a practical matter be arranged, to restrain smokejumpers and Paracargo? Is the aircraft compatible with installation of 42-inch smokejumper restraint benches? Or, are there raised bulkheads, etc., that would prevent their use? Are suitable alternatives to smokejumper restraint benches available for the aircraft?

4. Is the jumper exit door opening flush with the floor? If not, could a ramp be configured to level the opening in an acceptable fashion?

5. Flight and environmental characteristics with the exit door removed. Is a spoiler likely to be necessary? Are exhaust fumes in the cabin a likely possibility? If so, how sever a problem will they be, and during what phases of flight/ground operation will fumes be a problem?

6. Are the pilots and spotter's external field of view and overall visibility adequate for smokejumper/Paracargo operations?

7. Is the aircraft amenable for install a standard smokejumper communications package?

11. Are there any other factors (positive or negative), not addressed above, that would assist in making a case (for or against) adapting the aircraft for smokejumping?

12. Has the aircraft been used by the military for delivery of personnel equipment with static-line parachutes? If such history can be established, indicate where and by whom. Attempt to obtain operational information relating to this use.

SASEB Review the SASEB board will review the Sponsor's Report and recommend if the proposal to evaluate a candidate aircraft should be accepted or rejected. The SASEB will not recommend a formal evaluation if the "sponsor's report" does not provide the information needed.

The CN-235 is certified for Patratroops jumping. There are about 250 aircraft with 35 operators in the world. Among the different Air Forces that regularly utilise the CN-235 in Paratroops Configuration are: Spanish AF, French AF, South Korean AF, Turkey AF.