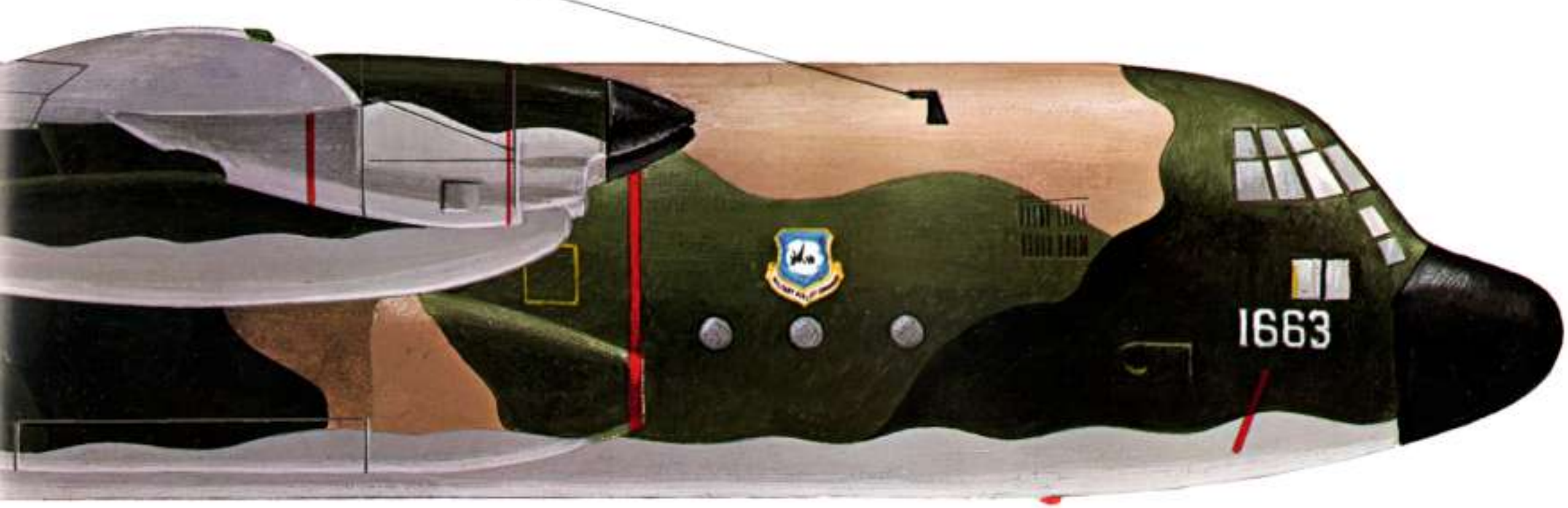
Hercules

World's Most Versatile Airlifter




ROYAL
68

The Legendary C-130

- Cargo Carrier
- Personnel Transport
- Aerial Delivery
- Missile Tracking & Recovery
- Medical Evacuation
- Unpaved Airfield Operations
- Ski Operations
- World Wide Communications Station
- Aircraft Carrier Deck Operations
- Inflight Refueling
- Airborne Drone Launcher
- Helicopter Inflight Refueler
- Surface To Air Rescue
- Medical Supply Pack Airdrops
- Aerial Photography & Mapping
- Lounge PAC Passenger Operations
- Search Rescue & Recovery
- Weather Reconnaissance
- Forest Fire Fighter
- Maritime Patrol
- Earth Resources Survey

Foreword

Mighty airtruck—the timeless C-130 Hercules—for the past two decades has forged a reputation around the world. Rugged, hard working, dependable—and versatile, it flies to the very eye of a hurricane—it refuels a jet fighter a thousand miles at sea—lifts a bulldozer over the Andes—relocates the homeless from cyclone-devastated Darwin.

A Hercules can patrol the coastline, extinguish a forest fire, rescue the stranded, evacuate the injured, and drop food to the famished.

It can carry 44,000 pounds of heavy equipment into a dirt airstrip—drop half a hundred paratroops into a hotspot.

The Hercules can ski to a stop on ice-laden Antarctic snow runways—photograph topography—carry a Caterpillar tractor or a herd of livestock.

It is, at times, a flying hospital or a troop carrier. No stranger to mountain peaks or polar ice...jungle or desert...it operates smoothly and efficiently from hacked-out dusty runways with the same ease it visits a busy metropolitan airport.

Lockheed Hercules fly the flags of 36 nations. The global fleet has earned an enviable reputation for building up more than 10-million flight hours everywhere, doing different jobs in different climates a hundred ways better.


Australia


Belgium


Brazil


Canada


Chile


Colombia


Indonesia


Iran


Israel


Italy


Jordan


Kuwait


New Zealand


Nigeria


Norway


Pakistan


Peru


Philippines


Sweden


Turkey


Uganda


United Kingdom


Venezuela


Zaire

Newer and Better

The Hercules is ageless. One delivered today does not differ much in appearance from ship No. 1 at rollout. So successful, so functional has been the Hercules in 20 years of service, that, in response to continually more demanding user requirements, Lockheed has retained the working airframe and efficient propjet design, and concentrated on new and important improvements to its internal systems, power and performance.

- When more powerful engines became available, the Hercules got them.
- When a better auxiliary power unit was designed, it was added.
- When more efficient brakes were developed, the Hercules switched to them.
- When more effective air conditioning and pressurization was called for, Lockheed added it.

Virtually every part of every system has been strengthened—modernized—improved. Fuselage skin, wing panels, wing structure, landing gear, engines, propellers, hydraulic systems, electrical systems, fuel system, radios, instruments, environmental systems, and other components have been systematically updated to make today's C-130H the best tactical airlifter the world has ever known.

The result is that the Hercules of today, although similar in outward appearance to the hundreds produced at Marietta, Georgia, is a vastly improved, essentially all-new cargo carrier.

This book tells about a few of these improvements and how they work to make the Hercules a better, more capable aircraft.

A Host of Improvements

Because of Lockheed's continuing pledge of product improvement, it is always alert to new, practical ways to upgrade and update the Hercules... ways to make a good airplane even better.

The C-130 has undergone continuous upgrading since its introduction to service. In twenty years of operation, over thirty significant technological advances have been incorporated or planned for today's modern Hercules fleets. As a result of this never-ending program of monitoring, testing, and incorporating new improvements, the C-130H of today requires fewer maintenance man-hours per flight hour, and has reached new levels of dependability and capability.

Reliability is the byword; reliability coupled with cost effectiveness. In every case, time between overhaul or replacement of parts has been so greatly extended ...or maintenance time so drastically reduced... that dependability, reliability, maintainability, and in turn, operational costs have been improved for operators of all size fleets.

Results of Improvements

Meanwhile, important airframe upgrading has been accomplished as well. Due to the continued growth in load carrying capability, speed, and range, it has been necessary to add strength in the affected areas. The center wing section box beam is redesigned and strengthened, and the outer wings are also of added structural strength and fatigue life.

Structural improvements to the Hercules have increased life expectancy of the "E" model to 20,000 flight hours, and today's "H" model to 28,000 hours—double that of the first airplane.

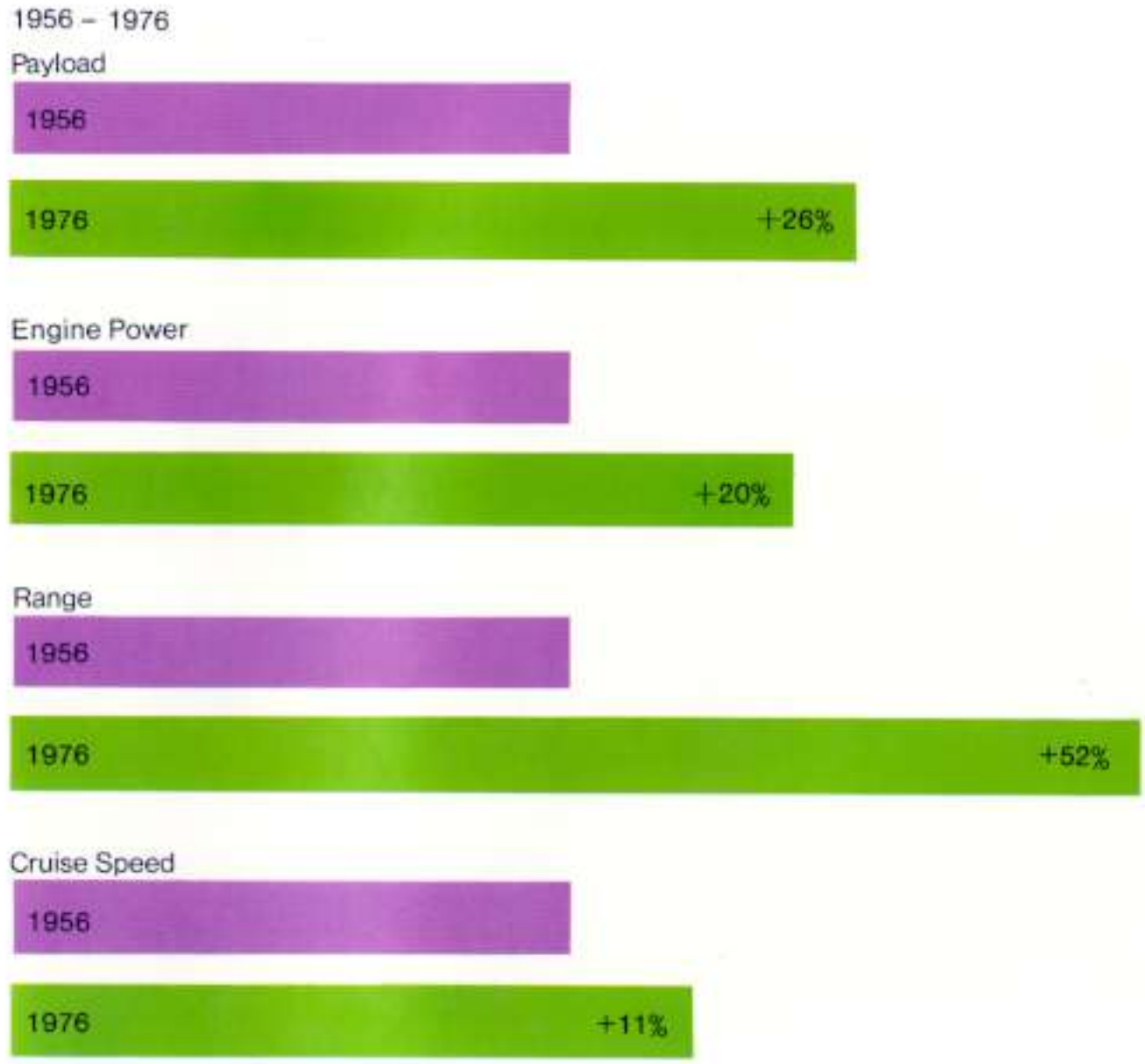
The new "H" models now being delivered have a life expectancy that extends beyond the end of the century based on 600-700 hours a year utilization.

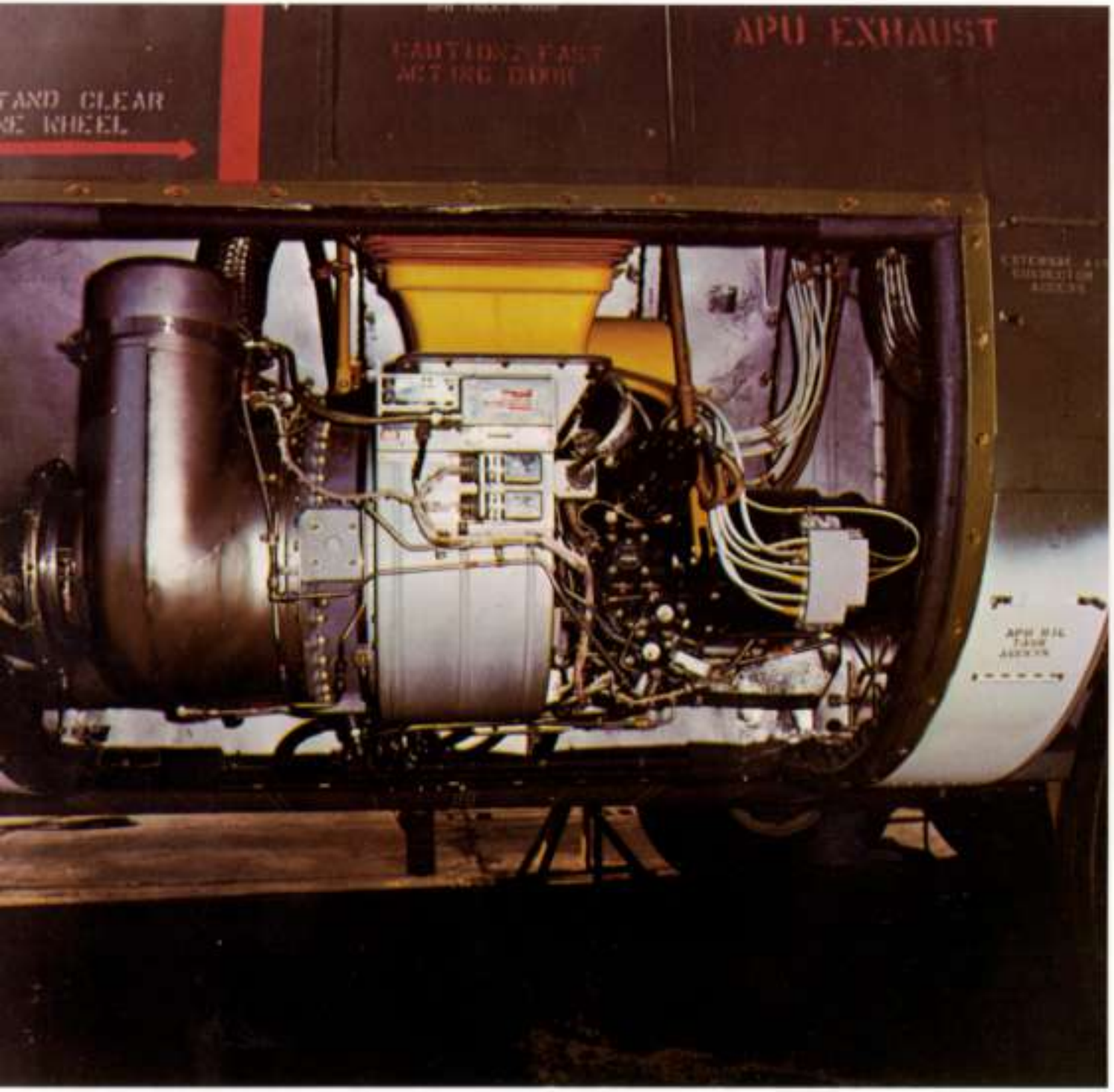
Not only is the "H" hardier, but it does much more. The current model C-130 has seen changes which result in:

26% more payload
20% more engine power
52% greater range
11% faster cruise speed

Between models A and H, the Hercules has realized a 57% increase in fuel capacity.

Each step of the way in this evolution, the airplanes became improved in maintainability, reliability, productivity, mission capability, versatility—and they are destined to get even better.





Improved Auxiliary Power Unit

The new APU operates a shaft driven 40 KVA alternator which is interchangeable with the engine driven alternator. This installation eliminates the air turbine motor and increases the mean time between unscheduled removal of APU components from 200 hours to over 1500 hours! Other gains:

- 34% increase in air supply
- 7% increase in pressure
- 100% increase in ground air conditioning flow
- Improved engine start time
- Auxiliary power doubled

Improved Air Conditioning

An improved, more reliable air conditioning system has been made possible as a result of the increased capacity APU. It is comprised of two units with 70 pounds per minute flow each instead of one 70 PPM unit and a smaller 30 PPM unit.

Design features include the use of long-life materials, and lower, less critical turbine operating speed—thus increasing the mean time between unscheduled removal of both the flight station and cargo compartment units from 300 hours to 2000 hours. Close matching of the new system to the APU has yielded the following benefits:

- Improved cooling on the ground and at low altitude
- Increased ventilation at low altitude
- Better pressurization with one unit inoperative
- Capability to transfer conditioned air between flight station and cargo compartment
- Water separator anti-iced
- Interchangeability of components

Improved Automatic Flight Control System

New generations of automatic flight control systems have become more reliable, more versatile, lighter in weight, and lower in price than the original autopilot which was adapted to and installed in the C-130.

The new C-130H comes off the assembly line equipped with the Collins AP-105 autopilot. Advantages derived over the previous equipment are many:

- 400% improvement in reliability through solid state components and modular design
- Predicted 85% reduction in logistic support cost
- Reduced size and weight—111 pounds lighter
- Compatible with existing C-130 avionics system—encoding altimeter and FD 109 Flight Director
- Precision computation meets FAA low approach performance requirements
- Turn coordination and lift compensation
- Automatic all angle radio beam capture and cross-wind correction

Improved Radar

The AN/APQ-122(V)5 Radar is another example of new generation, modular design, solid-state equipment with increased performance and reliability. Range is increased up to two times by increased power output, antenna gain and receiver sensitivity. A new high resolution cathode ray tube provides more than twice the viewing area while decreased pulsewidth and bandwidth as well as other improvements yield a considerable increase in mapping resolution. All solid state except for displays, RF power, and modulator tubes gives field reliability three and one-half times greater than the previous radar. The mean time before failure is 260 hours as compared to 50 hours.

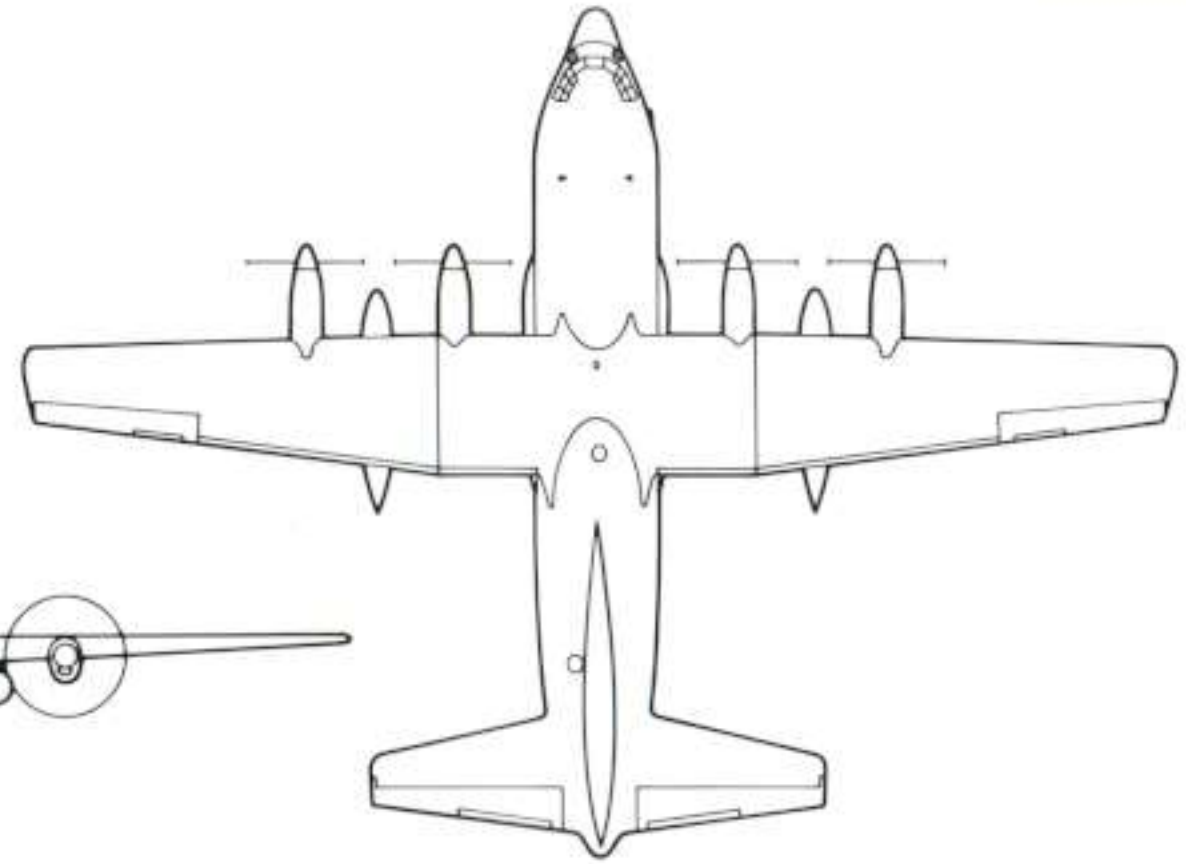
Improved Brakes

New high-energy Goodyear multi-disk tri-metallic brakes replace the older single-disk brakes on early Hercules. They provide 60% more kinetic energy capacity—stopping power—yet are only 30% heavier. They have greater torque and give faster stops for a heavier Hercules with less fading. The operating temperature limit for the new brakes is 60% higher than that of the former single-disk brake, so they last longer. There is less maintenance simply because the brakes do not require overhaul as often. Many operators are reporting ten times as many landings between wear-parts replacement.

The system incorporates an improved Hytrol Mark II anti-skid arrangement for higher energy absorption and higher hydraulic operating pressures. These combine to allow more braking to be applied.

C-130H General Description

Wing Span 132.6'
Length 97.7'
Height 38.0' (Approx)



Specifications

This version of the C-130 is not normally equipped with external tanks, but pylon mounted tanks may be included if so desired. The weights shown below are without tanks.

Weights	U.S.	Metric
Operating weight empty	75,381 lb	34,190 kg
Maximum payload	43,761 lb	19,850 kg
Maximum takeoff weight	153,390 lb	69,580 kg
Maximum landing weight—9 fps	130,000 lb	58,970 kg

Power Plants

Engines—Four Allison T56-A-15, flat-rated at 4508 eshp @35°C at sea level
Propellers—Four-blade Hamilton Standard hydromatic Diameter: 13.5 ft (4.11 m)
Auxiliary Power—The APU supplies air for engine starting, ground air conditioning, and an auxiliary AC generator

Fuel

Internal tank capacity	6,960 gal	26,340 liters
External tank capacity (optional)	2,720 gal	10,300 liters
Total fuel capacity	9,680 gal	36,640 liters
Single point refuel rate	600 gal/min	2,270 liters/min
Jettison rate	500 gal/min	2,080 liters/min

Pressurization/Air-conditioning

Maximum normal pressure differential of 7.5 psi; cabin altitude of 8000 feet (2440 m) with airplane at 35,000 feet (10,690 m)

Cargo Compartment	U.S.	Metric
Total volume	4,500 cu ft	128 m^3
Width	10.0 ft	3.0 m
Height	9.0 ft	2.7 m
Length excluding ramp	41.0 ft	12.5 m
Floor height above ground	3.4 ft	1.0 m

Personnel Capacity

Crew	5
Troops	92
Paratroops	64
Litters	74

Landing Gear

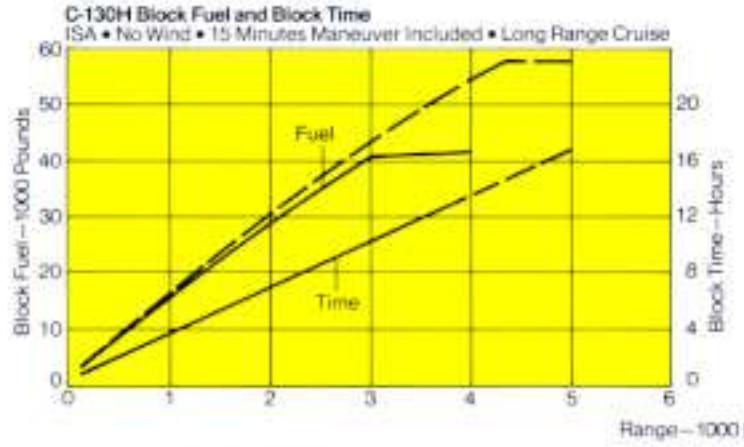
Nose landing gear	Dual	
Main landing gear	Tandem	
Tread, MLG	14.3 ft	4.3 meters
Wheel base	32.1 ft	9.8 meters
Nose gear turn radius	37.0 ft	11.3 meters

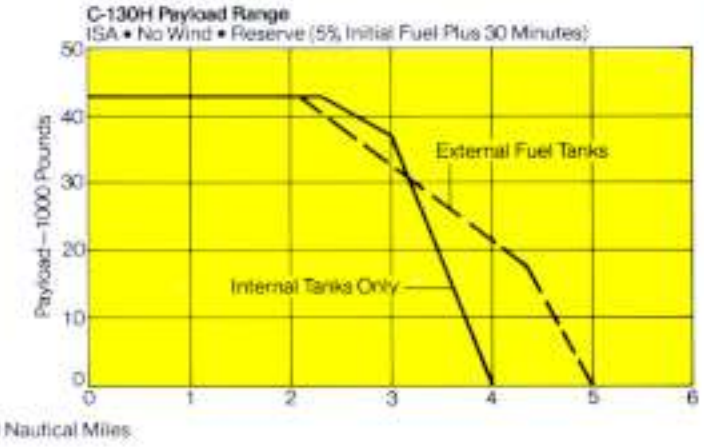
Top Performance . . . A Hercules Trademark

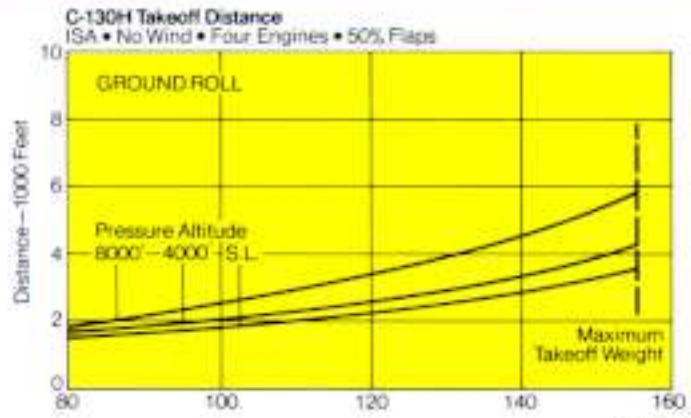
With four powerful new propjet engines, Hercules now climbs higher and cruises farther—at faster speeds—than ever before. Yet fuel economy has not been sacrificed.

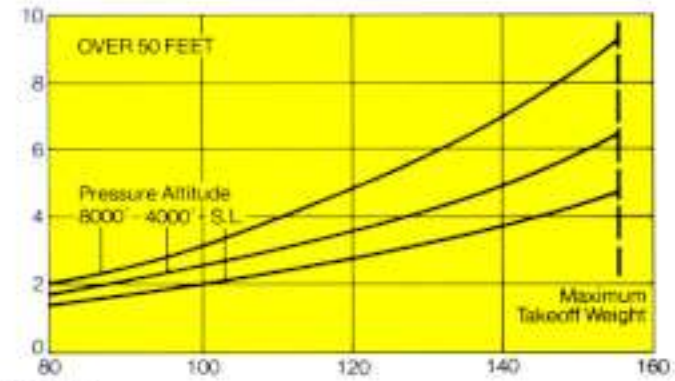
Short fields offer little obstacle. Landings at gross weights of 100,000 pounds (45,360 kilograms) require as little as 1200 feet (366 meters) of ground roll. And takeoffs can be made from spaces as confined as the deck of an aircraft carrier.

Nor is it restricted to paved runways. Strips of grass, dirt or sand—even beaches and pastures—are potential destinations. A heavy duty landing gear, and big, low pressure tires combine to make operations in these out-of-the-way places routine.

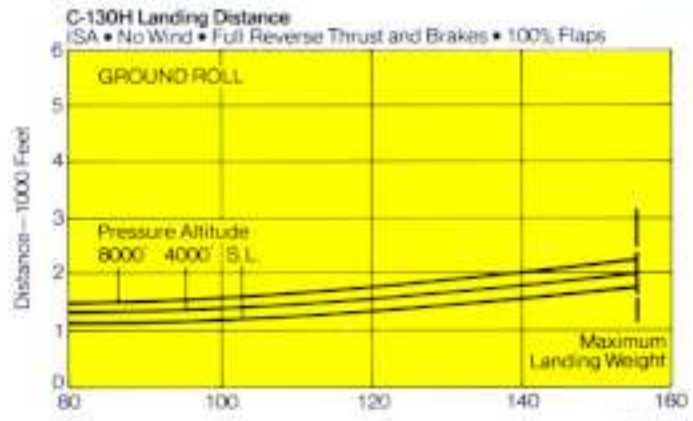


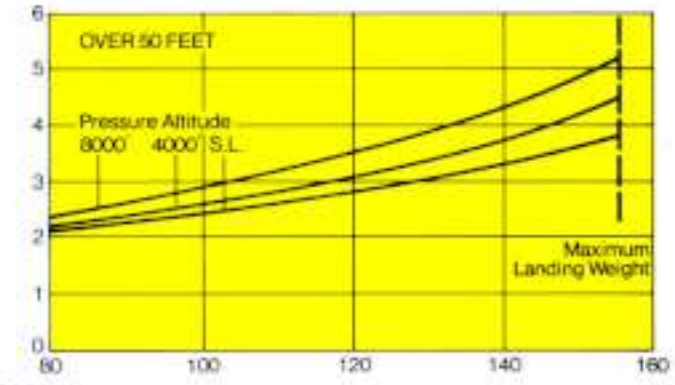






Gross Weight—1000 Pounds





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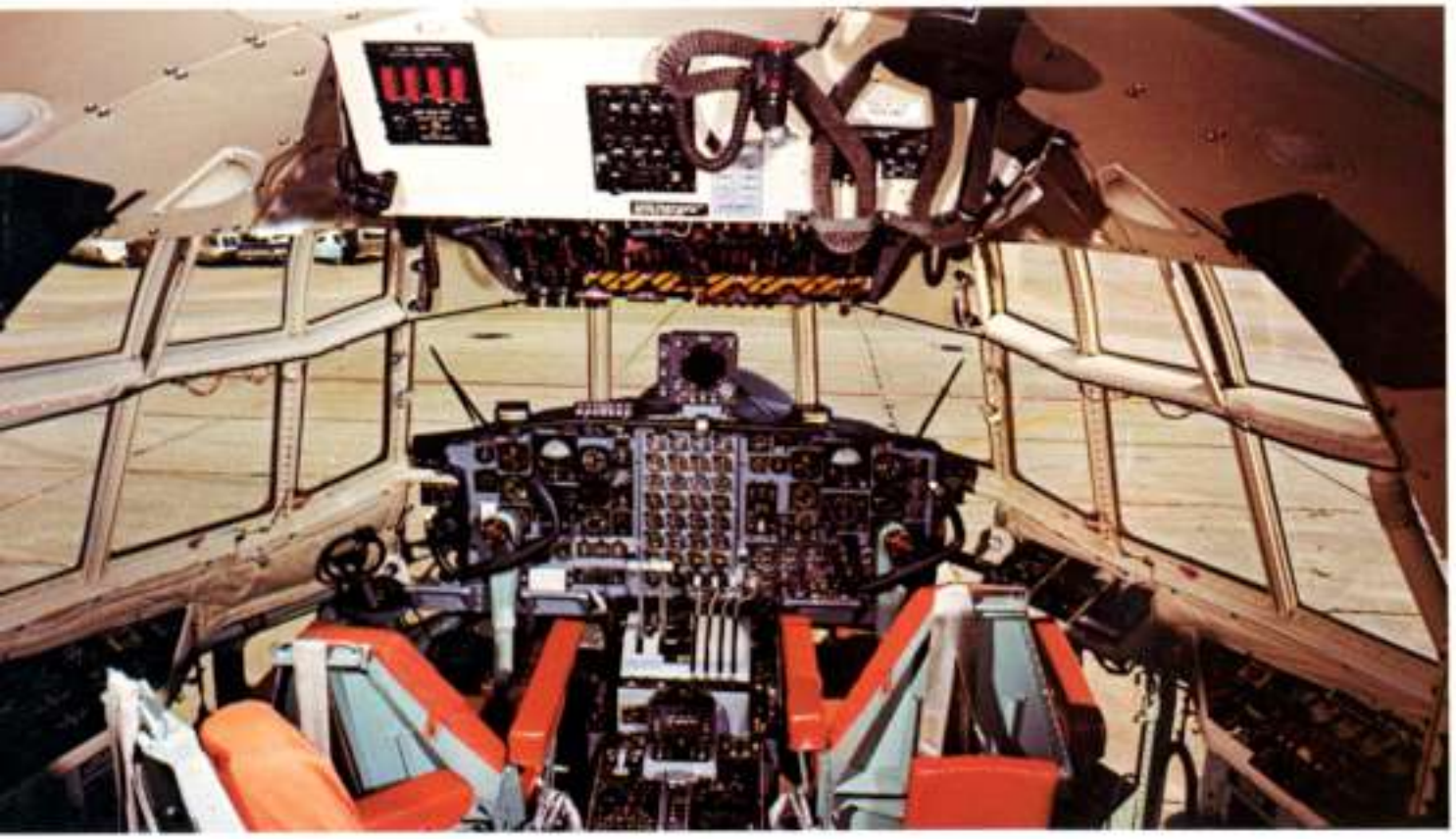


Flight Station

The Hercules "Front Office" emphasizes spaciousness, comfortable seating and convenient grouping of instruments and controls.

Nearly 40 square feet (3.7 square meters) of window area afford excellent vision for air-drop and rescue missions, formation flying or landings in tight places. And the Nesa glass windshield assures maximum visibility under any icing condition.

Relief crew sleeping space is provided, as well as facilities for preparing meals during long flights.

Cargo Compartment

A job-sized cargo compartment plus a loadable ramp 10 feet (3.0 meters) wide provide 4500 cubic feet (128 cubic meters) of usable cargo space—all pressurized and air conditioned.

The multi-position aft ramp lowers to ground level for drive-in loading of trucks, tractors and other wheeled vehicles or adjusts to various truck bed and loading dock heights for straight-in handling of other cargo.

Hercules' high strength cargo floor invites heavy outsized items such as the large engine required by today's superjets. Tie-down fittings for stabilizing these bulky loads are systematically located throughout the compartment.

An optional, removable, rail-roller conveyor system extending the full length of the cargo floor allows containers or pallets as wide as 118 inches (299.72 centimeters) to roll directly from transporter into the cargo hold.

Systems

Power Plants—The C-130H is powered by four Allison T56-A-15 propjets, each generating 4508 eshp. Compared with earlier Hercules power plants, this advanced engine provides increased takeoff power (as much as 24 percent more on hot days), 4000 hours between engine overhauls and lower specific fuel consumption.

Four-blade, reversible pitch Hamilton Standard propellers with full feathering capabilities are installed on each engine. In flight, the propellers operate at constant speed, providing instantaneous response to any flight requirement. On the ground, reverse thrust capability enables the plane actually to back-up under its own power.

Hydraulics—Three separate hydraulic systems are provided. Utility and booster systems are powered by engine-driven hydraulic pumps, while an auxiliary system operates from an electric motor-driven pump —with a hand pump available for emergencies.

All hydraulic reservoirs are in the main cargo compartment, and may be refilled in flight. Most control valves can be reached for manual positioning if electric power is lost.

Fuel—Six wing tanks have a total capacity of 6960 gallons (26,340 liters). Two optional external tanks hold an additional 2720 gallons (10,300 liters). Special fuel is not required. All grades of jet fuel can be used, as well as aviation gasoline in an emergency.

The Hercules fuel system is a modified manifold-flow type featuring single point refueling/defueling. Crossfeed capability enables fuel to be supplied to any engine from any combination of tanks.

Electrical Power—Primary power sources are four engine-driven, 40 KVA, a-c alternators. An auxiliary 40 KVA alternator is also available. Four transformer-rectifiers convert alternating current into direct current for systems requiring d-c power.

Landing Gear—The Hercules landing gear is a steerable, tricycle type with tandem main wheels and dual nose wheels. Nose wheel steering capability, when combined with forward or reverse thrust from any engine, permits ground turns to be made in a surprisingly small radius.

For extra structural efficiency, the main gear is mounted in fuselage wells directly below the payload. Two pairs of low pressure tires, 20 inches (50.8 centimeters) wide and 56 inches (142.24 centimeters) in diameter, absorb heavy shock loads and allow Hercules to ride easily over any reasonably firm surface.

Multiple disc, hydraulically actuated brakes, and a fully modulating anti-skid system are mounted on the main gear wheels.

Avionics—Advanced avionics including flight director; HF, VHF and UHF command radios; weather avoidance and search radar; LORAN; TACAN; doppler navigation system; automatic radio compass and omni-directional range receiver give Hercules an all-weather, around-the-clock operational capability.

An interphone system is provided for in-flight communications between flight crew members, and a public address system is installed in the cargo compartment.

Environmental System—For crew and passenger comfort as well as for protection of delicate cargo, the entire fuselage is both air conditioned and pressurized.

A liquid oxygen system designed to operate for 96 manhours without replenishment is also provided.

Anti-ice provisions are included for all leading edges, engine inlets, prop blades, the nose radome and forward windshields.

Designed For Maintainability

Much of the Hercules fleet's dependability is derived from the number of easy-to-maintain features designed into the aircraft.

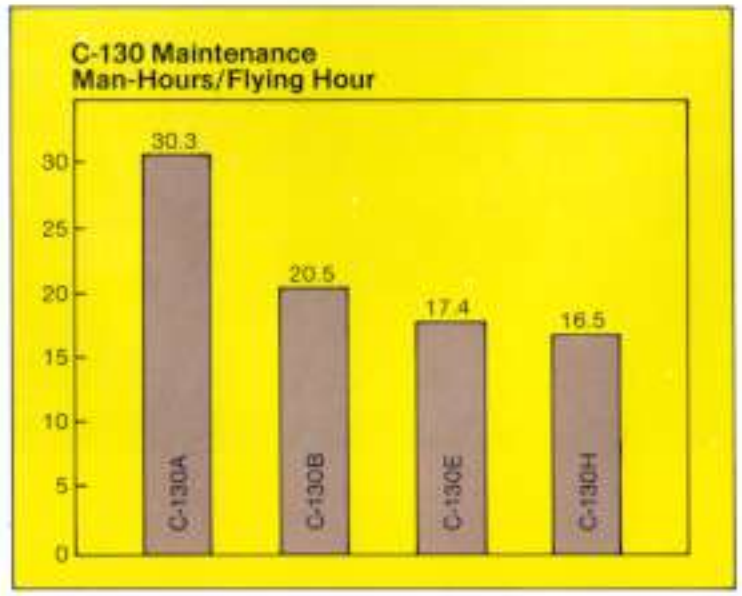
Hydraulic centers are grouped conveniently in the cargo compartment. They are easy to reach and are in-flight serviceable. New avionics feature advanced solid state electronics, newly located in a compartment that's temperature controlled, pressurized, accessible.

On nacelles, engine access panels are numerous and designed for efficient service. Major engine components and many smaller parts are interchangeable for easy replacement. Few special tools are needed. Such component design allows interchange of compressors, turbine units, torquemeters, or reduction gear assemblies with no requirement for test stand running.

Fueling the Hercules is easily accomplished through a single port at chest-high level.

The radome nose is hinged for quick access.

Much routine servicing is easily accomplished without elaborate workstands or complicated ground servicing equipment. The Hercules is virtually self-sustaining for easy operation into remote airfields which lack service facilities. The maintenance man-hours per flying hour have decreased with each improvement.



Lockheed Support

New Hercules operators, regardless of their geographic location or type operation, have at their disposal the complete services of Lockheed's world-wide product support team.

A modern, rapid response spares provisioning program, comprehensive maintenance and flight crew training and expert technical assistance are among the wide variety of support services available.

Spares Support—Even before a Hercules is delivered, Lockheed's Spares Provisioning organization analyzes customer spares requirements and recommends initial stock levels. After delivery, support continues—on a 24 hour-a-day, seven day-a-week basis.

A large parts inventory controlled by data processing, a highly mechanized distribution system and skilled supply specialists ensure immediate response to requests for routine replenishment of parts or emergency shipments of critical items.

Training—An intensive training program tailored to fit individual customer needs is available for both maintenance personnel and flight crews.

Maintenance training is conducted by experienced instructors in modern classroom facilities convenient to the Hercules production area and maintenance shops. Classes are designed to provide students with a thorough understanding of Hercules systems and maintenance techniques. Visual aids ranging from actual system components to closed circuit television are used extensively to make training as realistic as possible.

Pilots, navigators, flight engineers and loadmasters can participate in comprehensive ground school and flight transition training designed to qualify them for safe and efficient operation of the Hercules.

Technical Representation—Technical help on a personalized basis is available through experienced service representatives having a comprehensive knowledge of the Hercules and each of its systems. Representing a technical link between the operator and a factory based team of engineering, manufacturing and quality control experts, the service representative is qualified to advise on technical matters affecting the aircraft, perform troubleshooting activities, assist with line maintenance and conduct classroom or on-the-job training.

L-100 Hercules: Commercialized, Improved, Stretched

Another major step in Lockheed's modernization of the Hercules is evident in the non-military L-100. It was barely ten years ago when airlines and commercial operators saw the great advantages of utilizing Hercules' tremendous versatility in commercial cargo service.

And why not? It could transport so many things that had been turned away by the limitations of passenger converted freighters. It was efficient and quick-and-easy to load, accepted all types of cargo containers, and was known for quick turnarounds which could increase utilization and profits. And it could carry over-size loads which wouldn't fit in the belly holds of passenger airliners.

Lockheed-Georgia engineers began by removing military equipment (aerial delivery systems, litter stanchions, navigator stations) and then increased the maximum payload and commercialized the electronics and loading systems.

The Hercules was FAA type-certificated in 1965 and was immediately pressed into service transporting oil drilling equipment, prefabricated housing components, foodstuffs, electronics, and general cargo on transcontinental airline routes.

Since then, the commercial Hercules L-100 has been upped in power and performance, stretched two times (100 inches and 180 inches), its cubic capacity increased by 35% and its payload boosted to 51,685 pounds. The latest version carries eight commercial pallets as opposed to six for the original L-100.

Over fifty L-100's are in service around the world performing charter cargo haul and flying commercial cargo airline routes.

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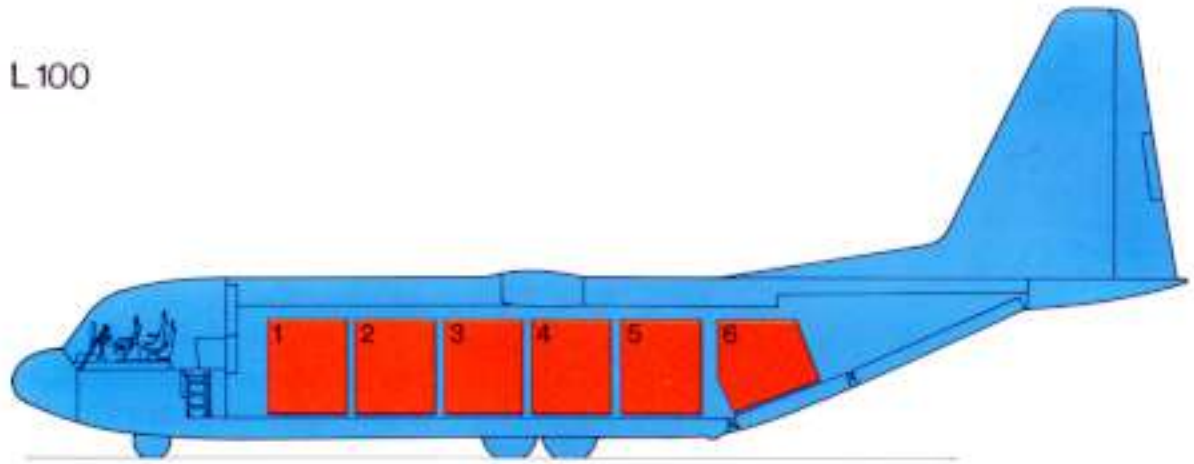

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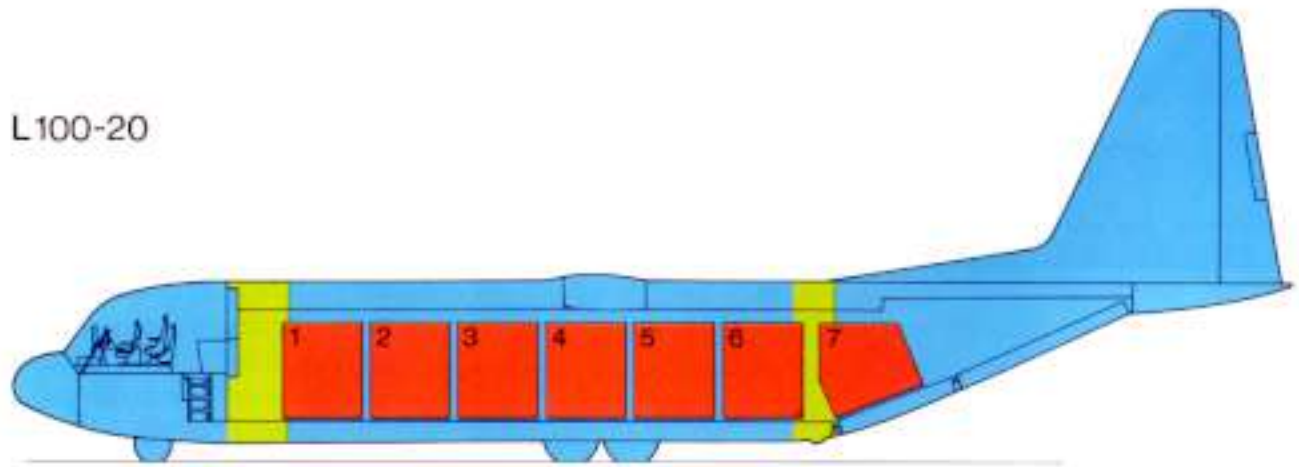

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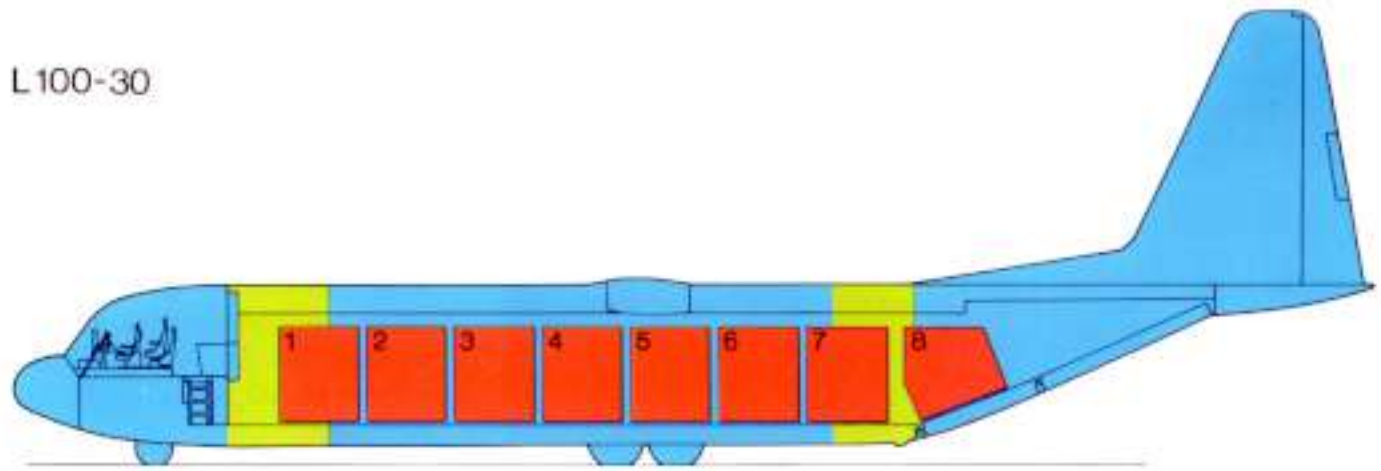


The Ideal Airlifter

The Hercules was first conceived as an economical airplane to do the best cargo hauling job possible at the least cost. Essential to that objective were quick and easy loadability, good takeoff performance, and flexible range/speed/altitude/payload.

The lessons of earlier years added another ingredient to the final specification for the C-130. That was the concept of optimum unit sizes. Virtually every vehicle in existence today has been experimented with until an optimum or ideal size was hit upon. We have had 2-passenger cars and 12-passenger jitneys; we've had 100-passenger buses and tandem bicycles. But eventually, as an industry matures, it finds an optimum package size—whether it is the standard railroad freight car, the 64-passenger bus or 6-passenger auto. Other specialized types are required and are built, but in smaller numbers for more specialized applications. The optimum size also changes through the years, but it is an evolutionary, not revolutionary, development.

The C-130 incorporates these lessons. It is an approach to an ideal unit size—a unit large enough to handle the great bulk of freight moved by surface transport today—either by truck, rail or ship.

In the days of swept-wing jets and widebody airliners, is a propjet incongruous? Users from thirty-six nations think not.

The propjet-powered Hercules offered the best combination of characteristics to meet all these requirements. For one thing, the Hercules has much lower fuel consumption than a fanjet. A modern high-by-pass-ratio fanjet engine burns about half again as much fuel per pound of thrust as the T-56 of the Hercules.

The combusters in the T56-A-15 engines are designed to keep exhaust emissions of smoke, unburned hydrocarbons, and oxides of carbon and nitrogen to the very minimum. In broad terms, atmospheric pollution bears a direct relationship to fuel consumption and degree of combustion. Since the Hercules burns up to 20% less fuel per ton-mile than a four-engine turbojet transport, it not only uses less of the world's energy resources in transporting a ton of material, but also contributes less environmental pollution in terms of particulates, gasses, and noise.

The Hercules has excellent noise characteristics. It has demonstrated compliance with FAR Part 36 by a margin of 10 EPNdB on takeoff sideline and 5 EPNdB on approach flyover. It also complies with international noise certification standards specified in ICAO Annex 16 and all known airport noise restrictions. At maximum takeoff and landing weights, the 90 EPNdB noise foot print covers only seven square miles.

As for design, the capacious cargo-designed fuselage hugs the ground where it is easy to load; the wing is high, out of the way of loading and servicing operations. Fast turn-arounds, which are important to all operators, are routine for the Hercules.

Operational Improvements and Future Development

Hercules engineers are studying alternate approaches to retaining all the advantages of the C-130H while increasing its capability.

C-130SS (Stretch STOL) This projected Hercules could meet the payload requirements of the Advanced Medium STOL Transport (AMST) on a 400-mile radius mission, land on 1500 feet of dirt strip hacked from jungle terrain, and return to base without refueling.

Design studies show that structural strengthening in the wing and landing gear, plus other changes, will result in an improved Hercules to land in a shorter distance at a higher sink rate. For normal operations, this improved Hercules would have a significantly greater payload than the C-130H with a minimal increase in gross weight. The fuselage would be stretched to accommodate 20 more combat equipped troops or one additional pallet. The addition of a standard inflight refueling receptacle could double the range or endurance with each hookup.

Such a C-130 would incorporate extensive changes to result in even better airfield performance. A new double slotted wing flap would be added along with roll control spoilers, new horsal fins, and the areas of dorsal fin and rudder would be increased. These changes would improve slow flight controllability and allow slower approach and landing speeds. Installation of higher energy brakes would further decrease landing distance. All this with the same big-capability Hercules cargo design: the wide aft-door, easy-loading opening with the multi-position ramp.

As versatile as the Hercules has proven to be, there is apparently no limit to its future possibilities.

L-100-50 On the drawing board is an L-100 commercial Hercules stretched 35 feet longer than the C-130H. Its 75-foot cargo floor would carry a 54,000 pound palletized revenue payload. Its cavernous cargo compartment swallows up ten pallets for a palletized volume of 6,600 cubic feet.

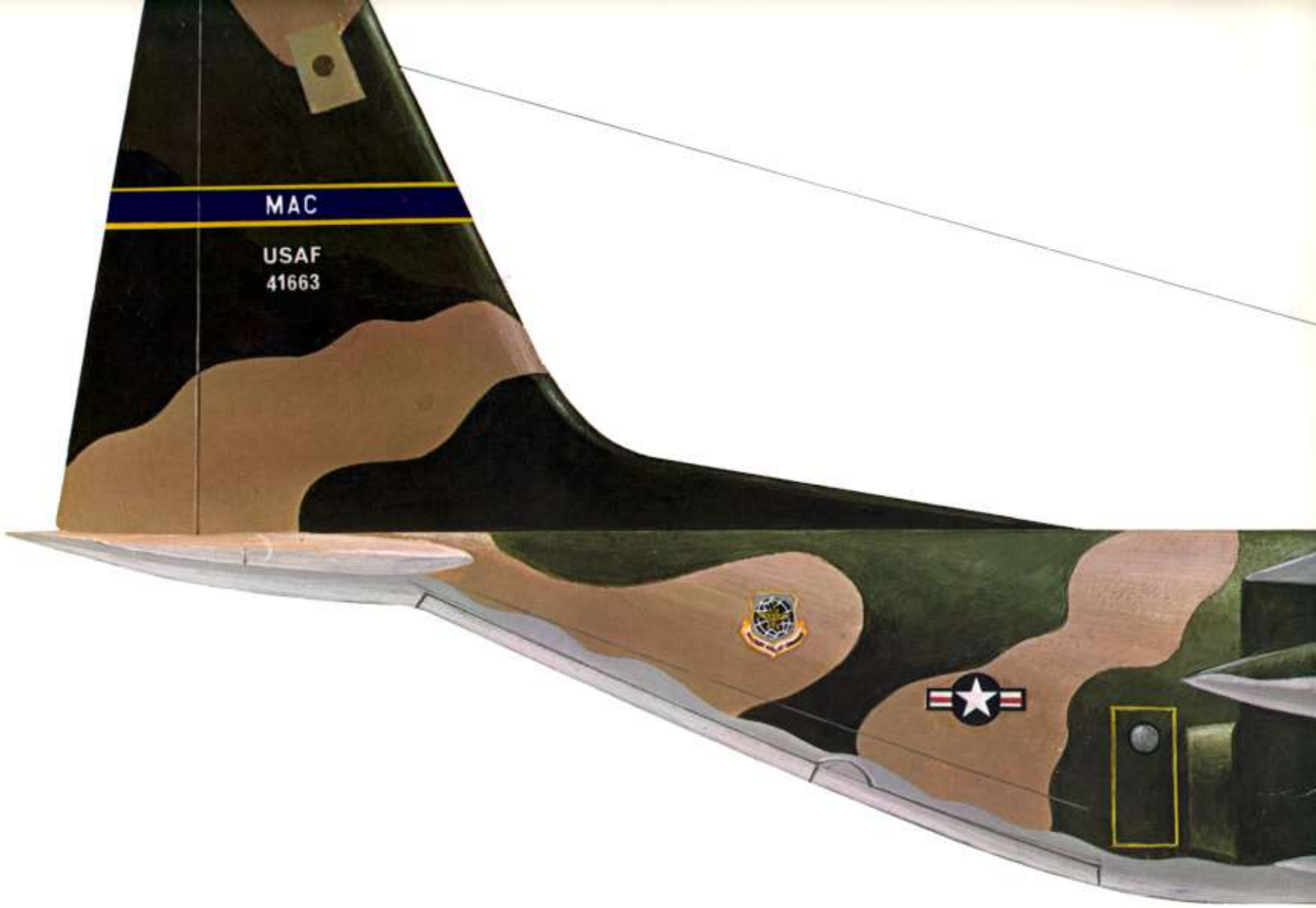
Air Cushion Landing System The ACLS is designed to replace conventional landing gear. This system utilizes a cushion of air to support the weight of the aircraft during takeoff, landing, and ground operations. It operates effectively on mud, water, ice, snow, grass, concrete and mixed surfaces. The C-130 is the logical choice for tactical transport ACLS application.

L-400 Twin Hercules This proposed two-engine derivative of the classic C-130 would be designed specifically to provide a simple and versatile cargo aircraft incorporating turboprop economy. Large cargo compartment, rear end truck-bed level loading, unpaved runway capability, and unique compatability with existing C-130 fleet make the Twin Hercules a logical choice to fulfill light transport requirements.

Hercules Amphibian The Naval Air Systems Command has been investigating the airworthiness, seaworthiness and mission capabilities of the C-130 Amphibian concept. To support the analytical efforts, a 1/16th dynamically scaled radio-controlled model was built and tested. Studies currently underway by the Navy require factual, experimental data from a full-scale, large Amphibian incorporating modern technology. The C-130 Amphibian will satisfy this requirement.


LOCKHEED


HOW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