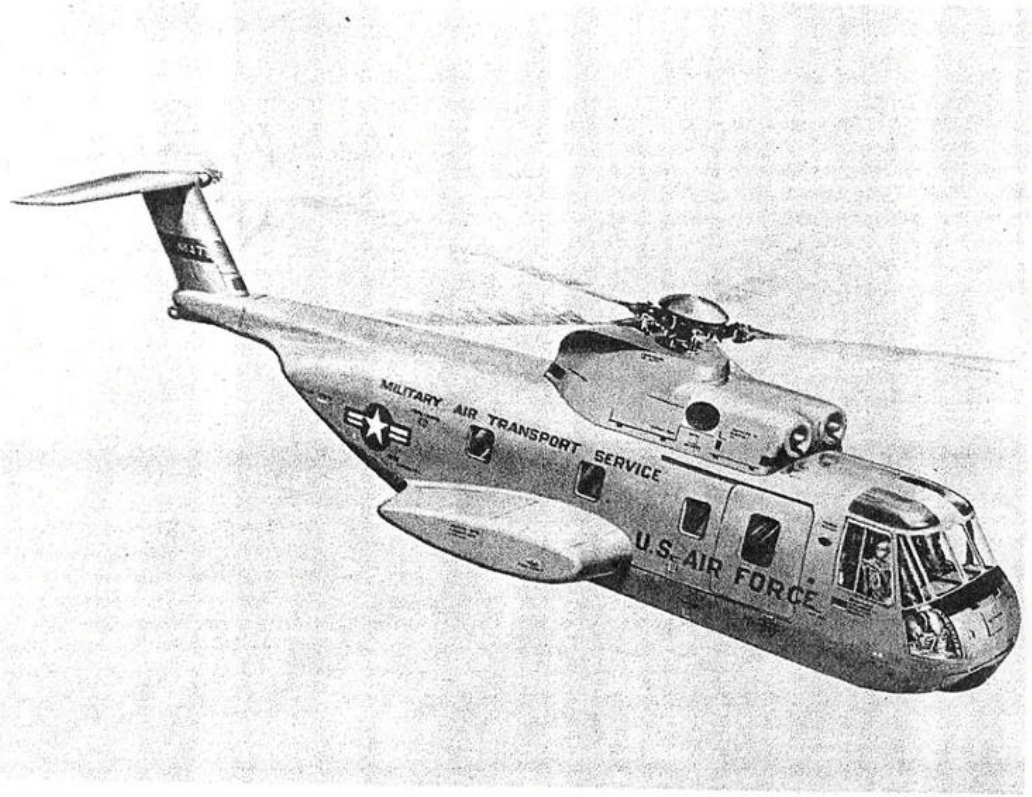
Soon to take its place in the MATS aircraft inventory is the new CH-3C helicopter being built by the Sikorsky Aircraft Division of United Aircraft Corporation. This article details the construction and performance of this versatile airlift vehicle.

COMING CARGO COPTER: The CH-3C



THE CH-3C is a long range, general purpose helicopter for transport of cargo, personnel or litter patients, and the recovery of aerial targets. Although the "C" is a new production model, previous models have a proven performance and reliability record. Its predecessors, the CH-3B and the Navy's SH-3A (formally the HSS-2), have been in service with Naval units since March 1959. Over 140 of these aircraft have logged more than 50,000 hours flight time. The HSS-2 presently holds five international speed records.

AIRPLANE GENERAL

The CH-3C is a modification of the B model to provide rear ram

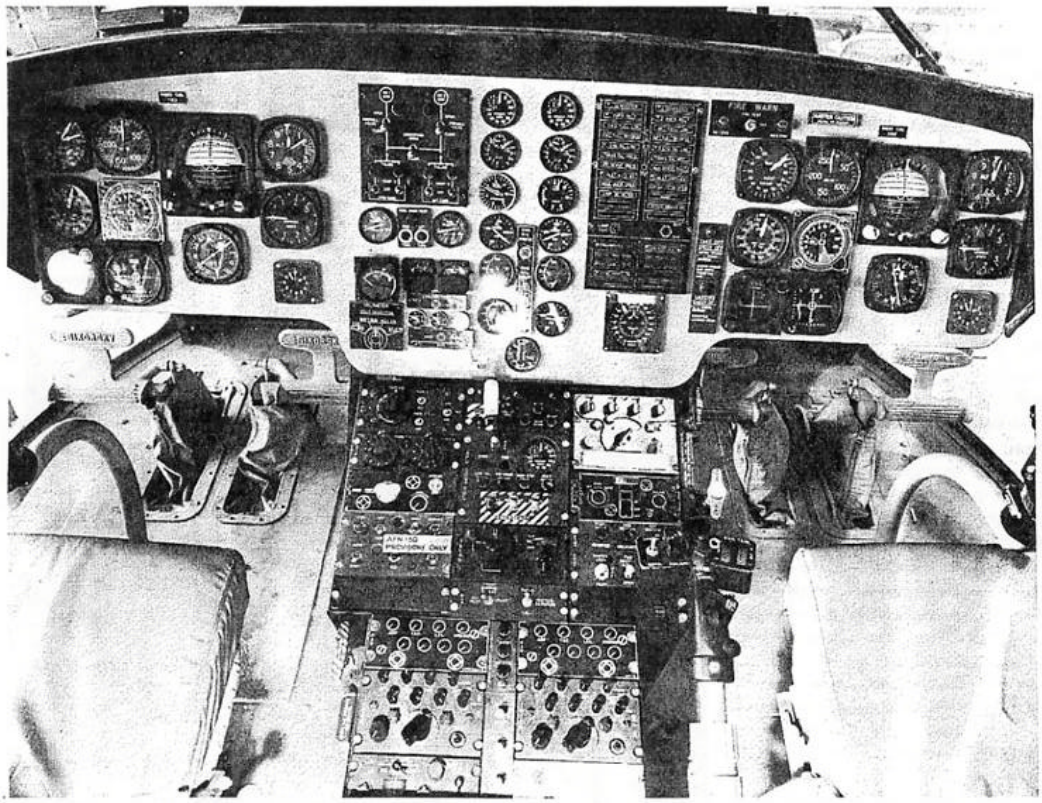
loading. Externally the distinguishing features of the C model, in addition to the rear ramp doors, are the aft located sponsons and the sliding cargo door just aft of the crew compartment on the right side of the fuselage.

The aircraft has an overall length of 72 feet 10 inches. The fuselage length is 60 feet 11 inches from the nose to the rear tip of the tail rotor. Overall height to the top of the tail rotor is 18 feet 1¼ inches. Maximum span with the main rotor blades rotating is 62 feet. The width of the fuselage is 17 feet three inches.

Three crew positions are provided in the cockpit. The pilots are seated side by side with the aircraft commander on the right and the copilot on the left. A folding jump seat for the flight mechanic is provided in the cockpit entry, directly behind and between the pilots' seats.

The aircraft is fully equipped for instrument flight, including the flight director instrument system. The panel is mounted high in the cockpit, near the pilots' normal line of vision. Further, the panel is located close to the pilot so that good over-the-nose visibility is maintained. The cockpit provides a 236 degree lateral visibility field for either pilot. Overhead and floor plexiglass panels provide a 216 degree field of view vertically. The center forward windshield is heated to provide unrestricted forward visibility during icing conditions.

The cabin measures 25 feet 10 inches in length, 6 feet at its minimum height, and 6 feet 6 inches at its maximum width. It will accommodate 25 troop seats or 15 litters, and can be readily converted to either of these from the basic cargo configuration. The sliding cargo door on the forward right side measures 5 feet 4½ inches high by 4 feet wide. This sliding door incorporates positive locking to preclude inadvertent opening in flight. The rear ramp door will have a maximum opening of 87 inches high by 6 feet wide. It can be opened in



A far cry from earlier concepts of helicopter flying! The CH-3C, as indicated by this cockpit mockup, is fully equipped for instrument flight. It includes a flight director instrument system, and an automatic flight control system which operates throughout the chopper's entire speed and altitude range. The AFCS can even maintain the aircraft in a hover.

flight, on the ground or on the water.

The basic cargo compartment is 20 feet 2½ inches long with the additional 5 feet 8 inches of split floor ramp which can serve as a utility flooring for light cargo. The flooring is wear resistant and anti-skid, capable of supporting wheeled vehicles such as ground power units or jeeps. An internal, electrically powered cargo-handling winch is capable of lifting up to 2000 pounds dead-weight loads.

Eight windows are provided in the cabin, one of which is a jettisonable emergency escape hatch on the left side. The other ground or water emergency exits are the rear ramp door, the sliding cargo door and the cockpit side windows.

A 200,000 BTU heating system provides heating, ventilation and air conditioning for both the cockpit and the cabin. This system can be operated by the auxiliary power plant or by an external power unit when the aircraft engines are not running.

Attachments are incorporated for an external sling designed to carry up to a 10,000 pound cargo load. Normal electrical and emergency mechanical release controls are provided in the cockpit.

LANDING GEAR

The tricycle landing gear is fully retractable. Hydraulically operated, it will retract within 10 seconds and extend within 8 seconds. A safety lock prevents retraction while the aircraft is on the ground. A mechanically actuated, pneumatically operated system is provided for emergency gear extension.

The brakes provided on the main wheels are of the hydraulic, single-disc type. They are actuated by differential toe pedals provided for both the pilot and the copilot.

The CH-3C can operate on inland waterways with the landing gear retracted. Sponsons are installed to provide lateral stability for water taxiing, takeoff and landing. This helicopter will withstand 40 knot, 90 degree crosswinds in sheltered water with the rotors stopped. There have been several cases of CH-3B crews making emergency open sea landings, repairing the aircraft and taking off again.

POWER PLANT

The CH-3C is powered by two General Electric T58-GS-8B turboshaft engines mounted above the cabin compartment in a side by side arrangement. The T58 engines have a military power rating of 1250 shaft horsepower and a normal (continuous cruise) rating of 1050 SHP at 19,500 rpm. General Electric is presently engaged in a growth engine program to develop an engine with 1400 SHP at military power and a normal rating of 1250 SHP. This engine is programmed to be available in the first quarter of 1964. Development of a 1600 SHP engine is being considered at this time. The airframe installation of the CH-3C is completely compatible with either of these proposed engines.

An auxiliary power plant is installed as an integral part of the aircraft. It provides power for ground operation of all electrical and hydraulic systems, power for engine starting, and engine anti-icing in flight.

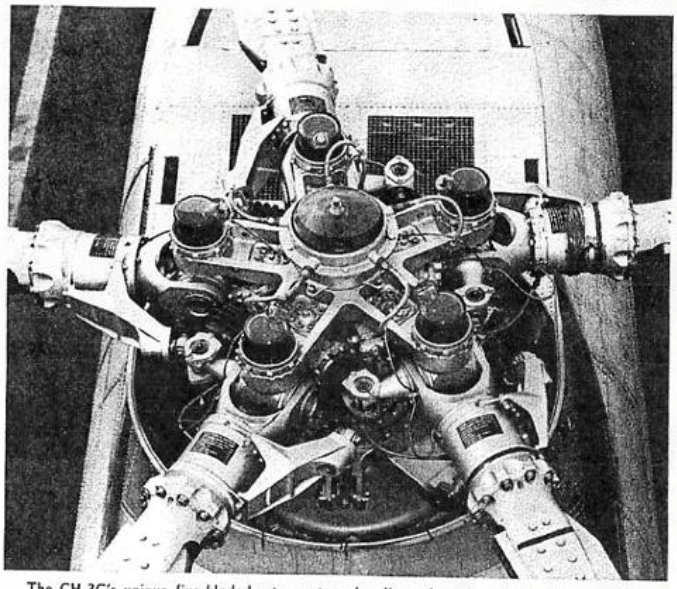
Both engines and the auxiliary power plant are protected by a fire detection system. Independent high rate discharge bromotrifluoromethane (CE_3Br) extinguishing systems are provided for each engine. The engines also incorporate a chip detector warning system.

Both main and tail rotors are five bladed. All rotor blades have anti-icing protection through a contrahesive tape affixed to the blade leading edge. This tape surface reduces ice adhesion to the point where this ice is shed by centrifugal force.

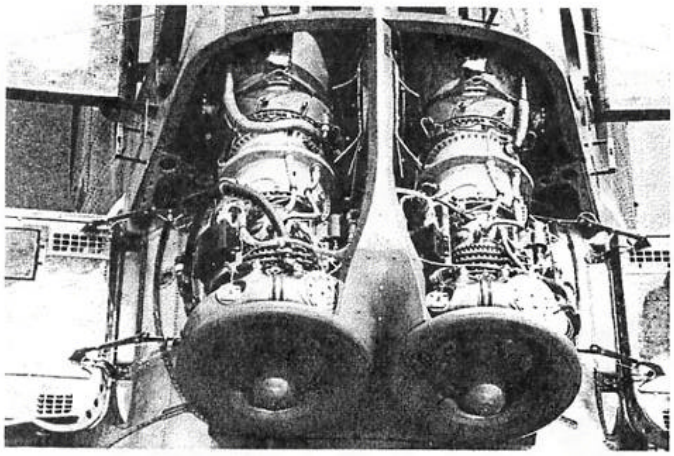
A Blade Inspection Method (BIM) system developed by Sikorsky is incorporated in the main rotor blades. The blade spar is sealed and pressurized to 10 psi. If the blade is damaged the indicator will show a pressure drop which will provide warning to the flight crew.

SYSTEMS

Two independent engine driven hydraulic systems are provided for operation of the flight control servo units. A third hydraulic system supplies pressure for the operation of th rotor brake, main wheel brakes, land-



The CH-3C's unique five bladed rotor system. Leading edge of each blade has anti-ice system operated through contrahesive tape. Blade Inspection Method system provides safety feature by warning flight crew of any rotor damage.



CH-3C's twin engine reliability is furnished by two T58-GS-8B turboshaft engines mounted side by side above the cabin. Single engine performance provides a 100 foot per minute rate of climb at design gross weight.

ing gear retraction mechanism and rear ramp doors.

The flight controls are the conventional helicopter cyclic stick for controlling lateral and longitudinal flight, the collective pitch control lever for ascent or descent, and the rudder pedals for directional control. A primary hydraulic servo system, with a backup secondary system, operates the blade collective and cyclic pitch change mechanisms in the main rotor and introduces backup automatic flight control signals to the AFCS. Dual controls are provided, although the collective pitch locking device is not incorporated into the copilot's controls. The automatic flight control system is capable of operating throughout the helicopter's entire speed range, including hovering, and throughout its altitude range. It will maintain altitude within a plus or minus 25 feet in straight and level, unaccelerated flight or when hovering out of ground effect.

Electrical power is supplied by two 20 KVA, 115 volt, three phase, 400 cycle, self-cooled, brushless generators. A portion of this power is converted to 28 volt DC by an unregulated transformer-rectifier. Each generator provides sufficient power to operate all equipment essential for night instrument flight. Failure of either generator will initiate automatic switching to disconnect the non-essential bus from the electrical distribution system. The generators are mounted on the accessory gear box so that loss of one or both engines will not result in any electrical power loss.

Two non-self-sealing bladder tanks provide a capacity for 700 gallons of JP-4 fuel. There will be a maximum of seven gallons trapped or unusable fuel in any attitude the aircraft is capable of sustaining. In an emergency, the T58 engines can be operated on automotive or aviation gasolines for a maximum period of five hours. Auxiliary fuel tanks can be installed in the cabin for long range missions.

The aircraft is furnished with a full set of command and navigation electronic equipment, including:

AN/ARC-34B UHF radio
TR-4A UHF backup radio
AN/ARA-25 UHF/DF
AN/ARN-65 TACAN
AN/ARN-58 ILS receiver
AN/ARN-59 LF ADF receiver
AN/AIC-18 Interphone
AN/AIC-13 Public Address System
AN/APX-46 IFF/SIF
AN/APN-150 Altimeter

In addition to the above, a Doppler Navigation system will be installed in the aircraft delivered to APCS units. All aircraft will have provisions for the installation of a Collins HF-103 single side band radio and a Collins VHF-101 radio.

PERFORMANCE

Basic design gross weight is 19,320 pounds with an emergency capability of 22,000 pounds. The positive limit load factor is 2.5 Gs at basic design gross weight, with a limit sinking speed of eight feet per second. The empty weight with standard equipment is 11,248 pounds, providing a useful load capacity of 8072 pounds.

Top speed at sea level (at design gross weight) is 143 knots at military power and 137 knots at normal power. Limit diving speed is 162 knots. The maximum range at design gross weight is 425 nautical miles at 126 knots airspeed. This range includes a 10 per cent fuel reserve at destination and excludes auxiliary tank fuel. The maximum rate of climb at sea level is 1970 feet per minute, with single engine rate of climb of 100 fpm at military power. Hovering ceiling is 3700 feet, or 6200 feet in ground effect. The aircraft service ceiling is 12,000 feet.

As stated earlier, the CH-3C's predecessor holds five *Federation Aeronautique Internationale* records:

198.8 mph over a 3 Kilometer open course.
210.65 mph over a 15-25 Kilometer open course.
182.8 mph over a 100 Kilometer closed course.
179.5 mph over a 500 Kilometer closed course.
173.3 mph over a 1000 Kilometer closed course.

Production aircraft for MATS units will be delivered between November 1963 and August 1964. The planned use of these new MATS aircraft will be in Air Weather Service's balloon recovery program and in Air Photographic and Charting Service's HIRAN ground station support mission. In both of these missions the aircraft will be used in a cargo carrying support capacity.

The CH-3C appears to be the versatile performer required for many of the unique missions of the MATS airlift force. It has the growth potential for future requirements. With proper operation it should add an increased safety margin to these operations.