U. S. DRIVERS AGAINST THE WORLD

POPULAR MECHANICS
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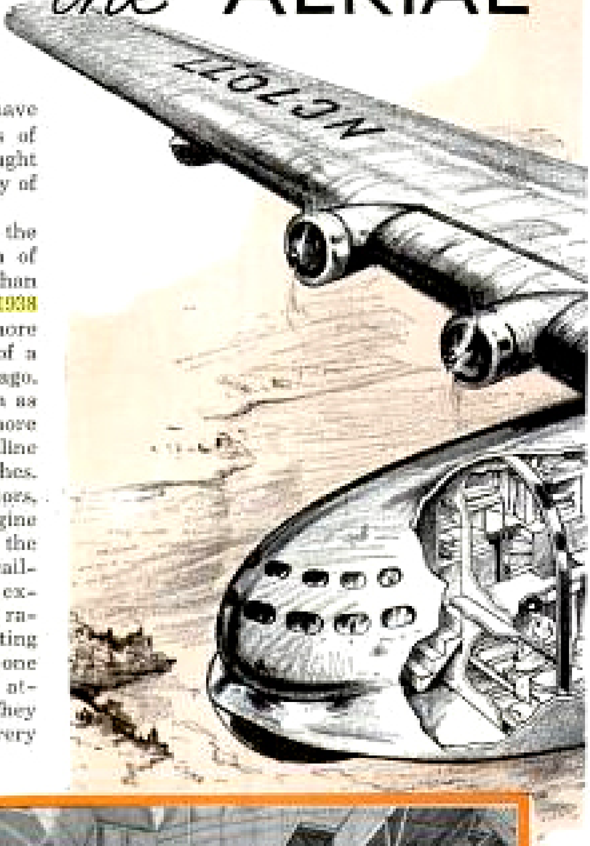
AGE *of the* AERIAL



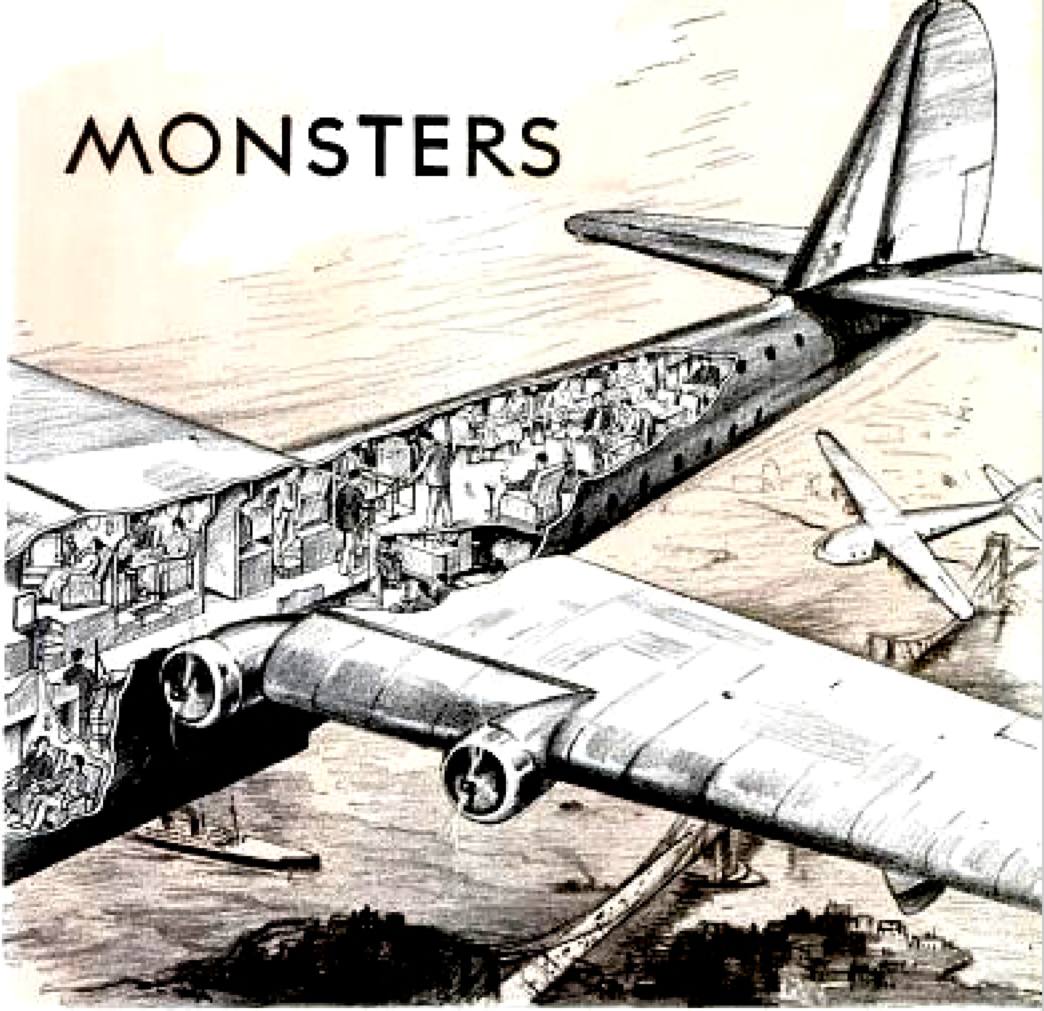
FOR years aviation engineers have been discussing giant airplanes of the future. This year they have caught up with their prophecies and the day of the aerial monsters is here.

One thing that has helped make the dream come true is the perfection of aviation engines far more powerful than any of the past. One engine of a 1938 four-motored airplane develops more power than the total horsepower of a tri-motored transport of ten years ago. Four such engines provide as much as 6,000 horsepower for take-offs, more power than is required by a streamline engine to pull twelve railroad coaches.

These tremendous air-cooled motors, the latest developments of the engine manufacturing companies, are on the "military secret" list and are not available to everyone, nor may they be exported abroad. They are twin-row radials of improved design, consisting essentially of two radial engines, one placed right behind the other, and attached to a common crankshaft. They develop one horsepower for every pound and a quarter of weight.

Bottom, view of workmen busy on giant fuselage and wings of Douglas transport, DC-4. The scaffolding forms a sort of dry dock in which the plane was assembled like a ship

MONSTERS

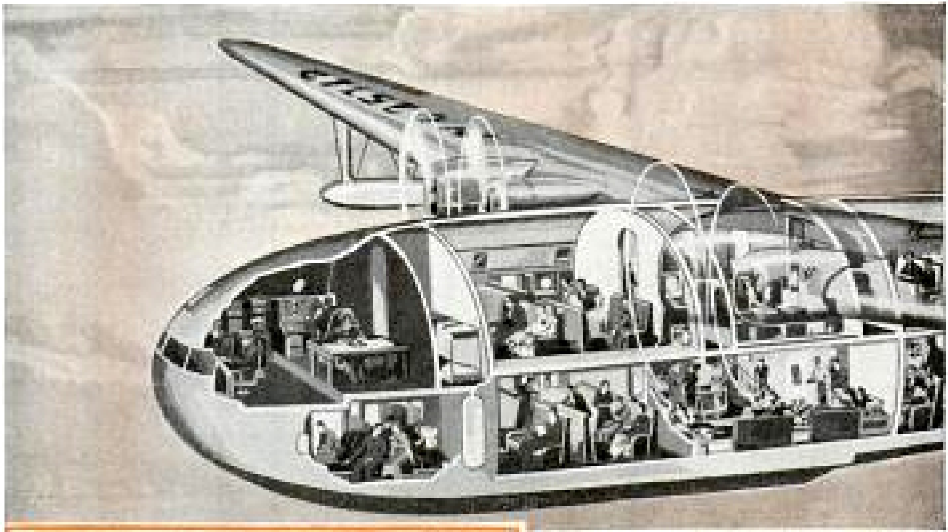


Drawing of interior of Consolidated's version of transoceanic air liner. Note the double-deck arrangement and luxurious accommodations, very similar to those of ocean liners

The new airplanes made possible by these engines actually dwarf the present giants of the airways. The new DC-4, to be launched soon by the Douglas Airplane company, was assembled like a ship, in a sort of dry dock.

The DC-4 has nearly three times the gross weight of the big Douglas transports now in service. The four-motored plane has a wing spread of 139 feet. Its fuselage is ninety-seven feet long and it stands twenty-four feet high. It will carry forty-two passengers and a crew of five, as well as three and a half tons of mail and express. The plane will have a top speed of around 237 miles per hour at 8,000 feet, a cruising radius of 2,200 miles, and a service ceiling of around 23,000 feet. The plane weighs 65,000 pounds fully loaded and will be able to cross the continent with only one stop. Research, engineering, and construction costs on this first giant amount to one and a half million dollars. The plane was built at the joint order of the five leading domestic air lines. The idea of this united action is to develop a standard type of super-transport.

Instead of settling down on a tail wheel in landing, the DC-4 will land level with the ground with its tail remaining in the air. The plane uses a retractable tricycle type of landing gear that employs a nose



Top, nose of Martin's concept of transatlantic air liner. Bottom, mock-up of DC-4 passenger compartment

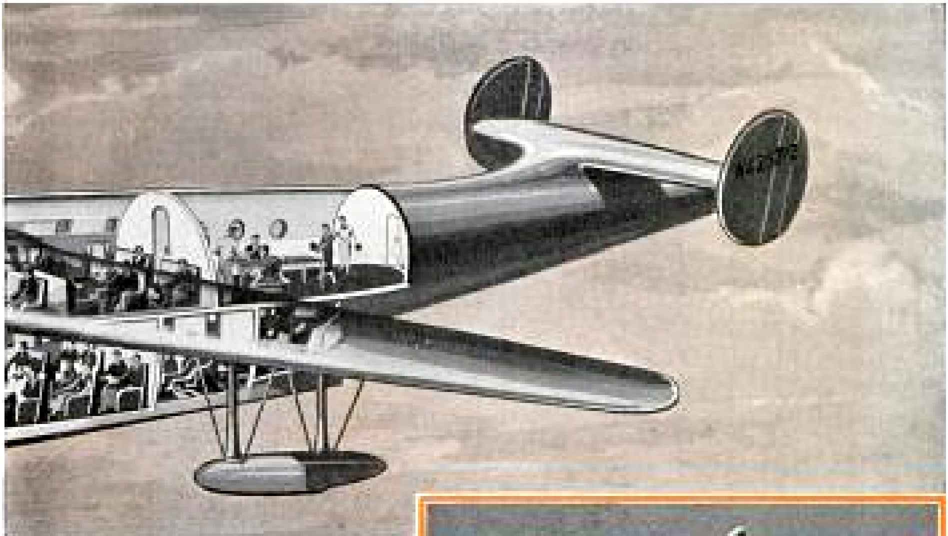
wheel instead of a tail wheel. The two huge main landing wheels are twenty-six feet apart.

Instead of a conventional tail the plane has triple vertical tail surfaces. The new arrangement allows better control with half the power plants not operating. The horizontal airfoil surface of the tail group is about the size of the wing of a small bomber. Control surfaces are so large that manual control by the pilot is augmented by hydraulic booster pumps. Some of the control cables are nearly one-half inch in diameter. For the first time in a large airplane, flat flush-type rivets are used in fastening the outer metal skin, materially reducing resistance.

To make sure their calculations provide the needed safety factors Douglas engineers performed more than 300 major physical tests and approximately 1,000 minor tests before construction really started. Hundreds of thousands of dollars were spent on building up vital parts of the plane and then testing them to destruction. The special anti-frost laminated glass for the cockpit windows was subjected to temperatures of forty degrees below zero to make certain that it remain transparent under extreme conditions.

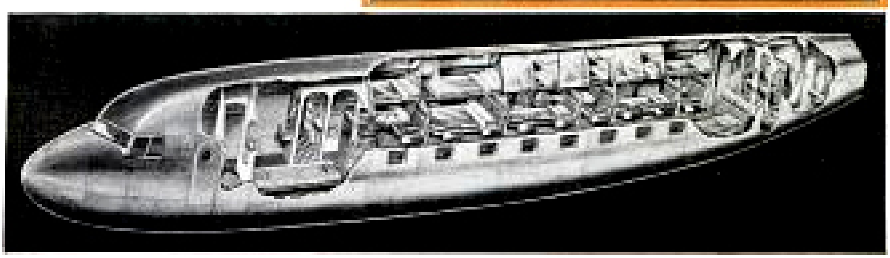
Approximately 20,000 pieces of metal, fittings, and sheets, exclusive of rivets, were used to build the plane and inspectors stationed in the dry dock approved every part before it could be added to the structure.

The lighting and other secondary power requirements are so heavy that auxiliary engines instead of batteries are used for the circuits. These air-cooled auxiliary engines drive alternators furnishing enough 800-cycle 110-volt current to light a huge office building. They also operate vacuum pumps for instrument-operating vacuum, provide pressure for the de-icers, run a hydraulic pump for the autopilot, and furnish pressure for the main hydraulic system that operates the air flaps, landing gear, and the minor hydraulic units. The



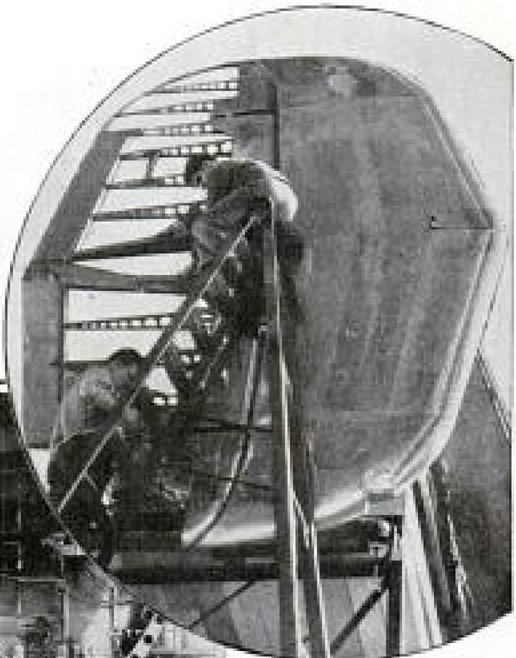
exhaust systems of these engines pass into the exhaust pipes of the propelling engines, being located so as to pass through steam boilers for cabin heating, making heat for the boilers available even when the plane is standing on the ground with the main propelling engines not operating.

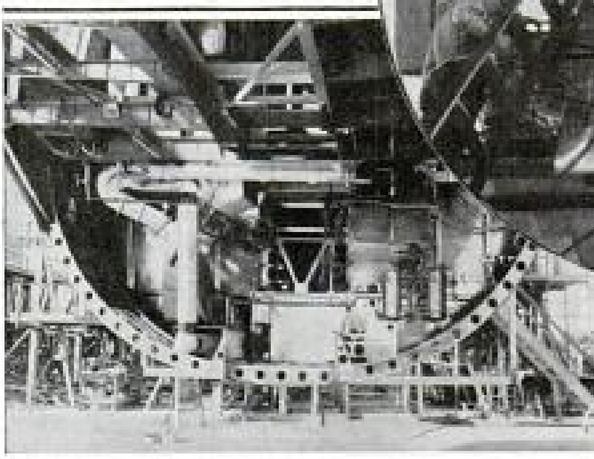
Inside the huge cabin various arrangements of comfortable lounge chairs, reclining chairs, or sleeping berths are to be installed according to the desires of the different air lines. The different plans all include dressing rooms and a large galley under the care of a steward and stewardess. There are thirty-two windows in the



Top, interior of Martin plane shows passengers at play. Center, model of the DC-4. Bottom, interior arrangement of DC-4, showing deep, comfortable berths for traveling at night main cabin space, sixteen upper skylights, and two portholes. Space beneath the cabin floor is used for baggage and express, providing more room than is available in many large sized trucks. Provisions are to be made for installing air-compressing gear and for sealing the cabin and cockpit for substratosphere flying.

In the cockpit the pilot and co-pilot sit farther apart than in present transports, the space between them being taken up by a wide control stand upon which





At the left is a view of the "basement" of a super-airliner. Here, under the floor, may be seen in process of completion the maze of controls, heating, electric and ventilating systems. Above is the rudder

are mounted all engine operating levers. Throttles are duplicated on each side of this pedestal so that it is not necessary for either man to reach across it. A third seat behind the pilots is provided for a flight engineer, who also has access to all engine controls and who thus can relieve the flying crew of all engine operating problems.

Four single engine fuel systems are provided, each engine having its own 100-gallon tank of high octane take-off fuel and its own 300-gallon tank of cruising fuel. One main selector switch on the engine pedestal changes over all the tanks in one motion. In addition, supplemental by-pass levers make it possible to route fuel from any of the tanks to any of the engines. Engine-driven fuel pumps are supplemented by hand pumps in the cockpit. To make certain that this large fuel-delivery system is foolproof in every respect, the engineers conducted comprehensive tests with a full-scale mock-up. They even had to make allowances for such conditions as the rearward acceleration of fluid in the fore and aft fuel lines during take-off, which in some systems results in a temporary drop in fuel pressure at the carburetors.

One problem magnified by the size of the plane had to do with the engine control system arrangement. Each of the outboard engines is seventy feet away from the cockpit, yet it must respond to control adjustments as rapidly and easily as if it were only a few feet away. A combination of push-pull rods at each end, connected by cables stretching through the wing, was found to be the answer. In cases where

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Age of the Aerial Monsters

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automatic controls are used in the engines, manual over-ride controls are attached for possible use from the cockpit in emergencies.

The power of aviation engines has been climbing upward for years. In 1930 the Pratt & Whitney Wasp was rated at 420 horsepower but today the same engine delivers 600 horsepower with hardly any change in size. The increased output is due to improvements that include refinement of cylinder design and higher compression ratios and supercharging. These last two improvements are possible because of the better fuels that are available today and in turn permit a higher number of engine revolutions per minute, which results in greater horsepower.

Other engine improvements include hollow valves filled with sodium to promote cooling, tougher alloys that are better able to withstand the higher crank speeds, and redesigned fins on the air-cooled cylinders which together with pressure baffles that force the air to circulate between the fins result in better control of engine temperatures.

The trend in engine design seems to be toward more and smaller cylinders, providing a smoother flow of power with less vibration. The two-row radial engines are a development of this trend, as well as an answer to the cry for greater horsepower. The new R-2180 Twin Hornet, made by Pratt & Whitney, is a fourteen-cylinder twin-row radial with a displacement of 2,180 cubic inches. Four of these are installed in the new Douglas DC-4.

Even more powerful than the Twin Hornets are the new 1,500-horsepower Wright Cyclones of similar radial type that are being used to power the new Boeing four-engined flying boats that carry seventy-two passengers.

Today the engine manufacturers are working on engines of even larger horsepower. The day of the 2,500-horsepower aircraft engine is almost in sight and when such power plants are available larger aircraft than ever will be possible.

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