NEW PLANE FOR PHOTOGRAPHIC MAPPING IN THE STRATOSPHERE

By Talbert Abrams

The comparatively new but rapidly growing industry of mapping from the air received a new contribution on November 20, 1937 when "The Explorer," the first plane built especially for aerial photography, performed successfully on its initial test flight from Brooke Field, Marshall, Michigan, preliminary to Department of Commerce tests to be carried out at an early date. This new craft, so unique in design as to resemble the mythical creation of a "Buck Rogers" Space Ship of the year 2040, differs radically from conventional types in many of its more important features. Careful planning and ten months of actual construction were directed with one goal in view; to produce an airplane capable of more efficient and economical photographic mapping. The prerequisites of such a plane were considered to be the following qualities: perfect forward and downward visibility for the pilot, ability to ascend rapidly to high altitudes, high cruising speed, stability, at least an eight-hour fuel supply, super-charged motors, and arrangements for supplying oxygen to the photographic crew at high altitudes.

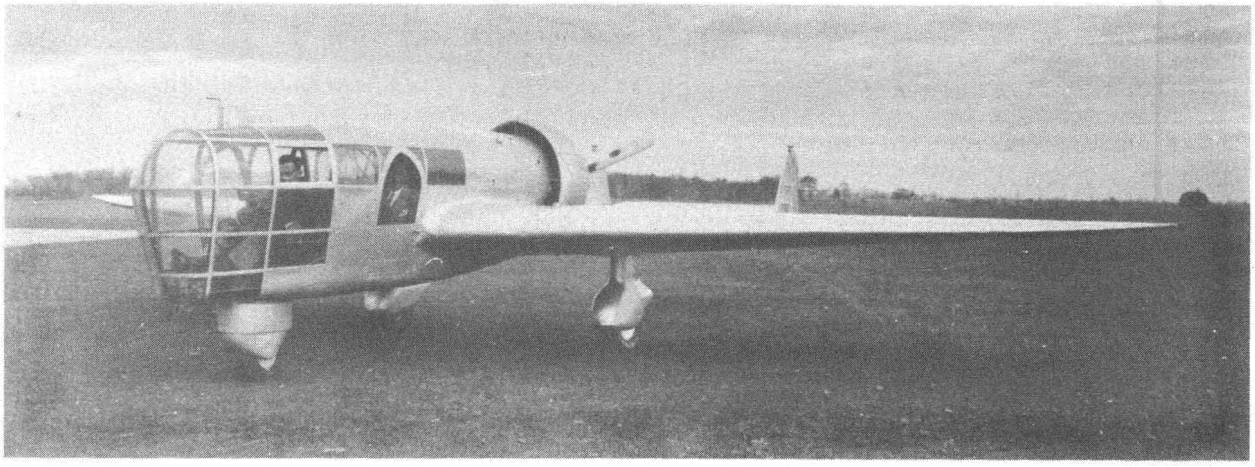
To gain these objectives, conventional types were reversed and the pilot's compartment was located in front in a glass-enclosed gondola and the motor was put in the rear. This particular unconventional shift in design allows the pilot perfect forward and downward visibility absolutely impossible in ordinary airplanes, and of utmost necessity in flying an airplane on photographic mapping. From high altitudes the pilot must see the flight lines and locations he is to map if he is to do a precise job of location flying.

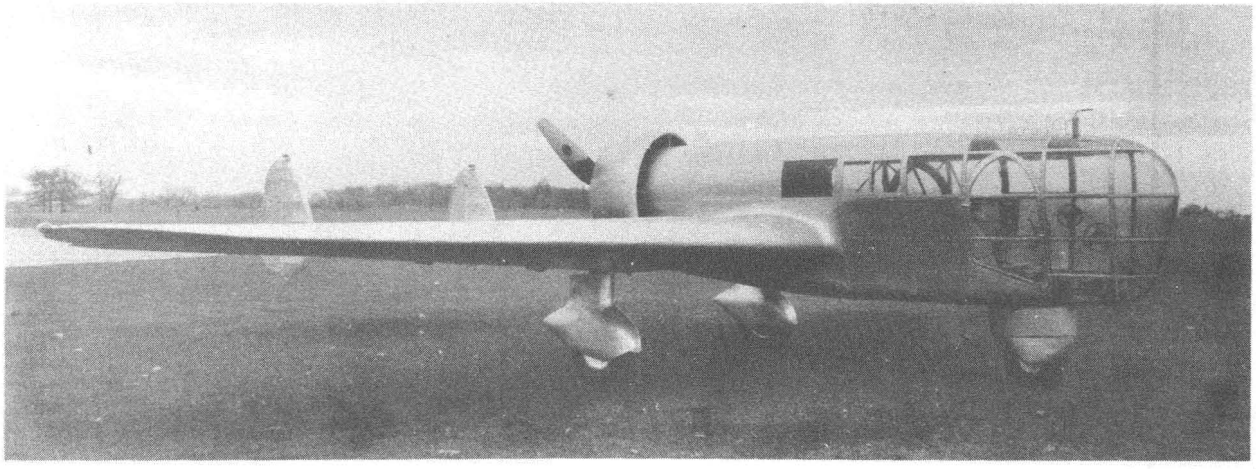
The Strato-Plane embodies many features of the first Wright Brothers and Curtiss pusher planes which are still considered by aeronautical engineers as being inherently more stable and possessing a degree of visibility not found in most commercial planes of today. The principal features borrowed from the early Wright and Curtiss pusher planes are the forward seating arrangement for the pilot, the pusher type motor, outriggers or booms for connecting the tail and control surfaces and the three wheel undercarriage for safety in alighting after a flight. The most modern type of construction has been used, such as a welded steel tube gondola covered with a stressed aluminum covering and a full cantilever wing of the new monospar steel tube construction, together with two monocoque stressed dural booms and double rudders.

A special safety feature is the three wheel undercarriage equipped with combination oil and spring hydraulic shock absorbers and Goodyear brakes. This type of undercarriage allows easy cross-wind take-offs, prevents noseing over on landings and, with brakes on the rear wheels and a steerable swiveling front wheel, it is both safe and comfortable to taxi around on the ground at a high speed.

The new ship has been carefully streamlined from nose tip to tail, even the motor being enclosed in the latest N.A.C.A. cowling or speed ring. Streamlining of the latest metal formed type is provided for undercarriage, wheels, and struts, and the same outline curve which gives the nose a modernistic touch is carried out in the wing tips, rudder and wheel streamlining. The wings slope back and away from the gondola, allowing both the pilot and cameraman an unobstructed view of the ground in a turn, and these wings of full cantilever monospar steel tube construction carry in their trailing edge not only the balance type of ailerons, but special flaps which are partially lowered on the take-off to increase the lift of the wing and are fully lowered to act as a drag and reduce the speed of the plane in landing. By a special device both the flaps and the ailerons can be partially lowered for take-off, this being planned to increase the wing lift and reduce the take-off run. The gondola is so close to the ground that no steps are necessary to enter. One door is provided on each side and they open directly to either the pilot's

OR CAMERAMAN'S SEAT. STICK AND RUDDER CONTROLS ARE AVAILABLE FOR BOTH THE PILOT AND CAMERAMAN, AND CAN BE SEPARATELY OR SIMULTANEOUSLY OPERATED BY EITHER. A FULL SET OF INSTRUMENTS AND ENGINE CONTROLS ARE WITHIN SIGHT AND REACH OF BOTH PILOT AND CAMERAMAN.





"THE EXPLORER"

AN ADDITIONAL PHOTOGRAPHIC FEATURE IS THE DOOR WITHIN A DOOR WHICH ALLOWS THE CAMERAMAN TO SIT IN HIS REGULAR SEAT AND, WITHOUT OPENING THE MAIN OUTER DOOR BUT BY JUST OPENING THE INNER DOOR, TAKE PICTURES AT AN OBLIQUE AND FORWARD ANGLE. A SPECIAL MAPPING PORTHOLE WITH A SPECIAL CAMERA MOUNT IS PROVIDED FOR IN THE FLOOR OF THE GONDOLA AND THE ARRANGEMENT IS SUCH THAT PICTURES CAN BE TAKEN STRAIGHT DOWN THROUGH THIS HOLE, THE APERTURE BEING HERMETICALLY SEALED WHEN THE CAMERA IS IN PLACE. SUPER-CHARGING OF THE CABIN IS PROVIDED FOR BY SEALING IN THE SAFETY GLASS WHICH, BESIDES SERVING AS WINDOWS, ALSO SERVES AS THE OUTSIDE COVERING OF THE GONDOLA. THE OVERALL SIZE OF THE CABIN WAS REDUCED TO A MINIMUM SO THAT THE AREA TO BE SUPER-CHARGED WOULD BE AS SMALL AS POSSIBLE. COMPARED WITH MOST AIRPLANES, THE OVERALL SIZE IS SMALL AND THE INTERIOR ARRANGEMENTS ARE COMPACT. THE FIRST IMPRESSION MIGHT BE THAT THE PILOT'S AND CAMERAMAN'S QUARTERS WOULD BE SOMEWHAT CRAMPED, BUT ACTUALLY THERE IS PLENTY OF ROOM FOR AERIAL CAMERAS AND THE OPERATOR AND PILOT.

Upon close examination the utility of the plane for mapping purposes is immediately evident. The attention to details which has been worked into the overall design lends character and distinction, and the belief that here is really an airplane of utility for which many uses will be found not originally planned for by the designers. Ever since aerial mapping as a science took its place as an engineering service to those needing maps and aerial survey companies were formed to offer this service, the need for mapping planes has been evident because regular commercial planes could not be rebuilt advantageously for this type of work, nor were they economical to operate, nor could they be flown to advantage. This new Strato-Plane is no one's particular idea but is the result of a survey of those experienced in air mapping, and embodies all of the principal features deemed necessary to successfully carry on this type of work.

Assembly of all data on requirements and design were secured by the Abrams Aerial Survey Corporation of Lansing, Michigan from the leading aerial survey operators in the United States and some foreign countries. With all information available and with the aid of their own pilots, a basic design was adopted. Tests and research were then carried on over an extended period with the aid of recognized aeronautical engineers, universities, and the National Advisory Committee for Aeronautics.

Kenneth Ronan, Consulting Aeronautical Engineer, graduate of the first class in aeronautical engineering at the University of Michigan, for some time associated with the National Advisory Committee for Aeronautics at Langley Field and later with the Glen L. Martin Company, and then Chief Engineer of the Stinson Aircraft Company, was chosen as Chief Engineer of the project. To him and his chief assistant, A. Edward Kunzl, and a staff of eighteen technicians goes the credit for producing an unusual plane.

The first Strato-Plane for test purposes has been powered with one Wright J-6-9 E330 horsepower super-charged engine with adjustable steel propeller, and is expected to attain a maximum speed of well over 200 miles per hour at a ceiling of approximately 21,000 feet. However, "The Explorer" has been so designed as to operate safely with a supercharged motor of 450 horsepower, allowing for greater speeds at higher altitudes. As successive planes of a similar design are built, it is planned to use motors of 1000 or more horsepower to approach the ultimate in high ceilings and speeds.

The detailed specifications of the initial model of the new plane are as follows:

AREAS

Wings	191.00 Square Feet
Ailerons	18.40 Square Feet
Flaps	12.74 Square Feet
Stabilizers	20.70 Square Feet
Elevators	9.80 Square Feet
Fin	7.66 Square Feet
Rudder	6.86 Square Feet

WEIGHTS

Gross	3200 Pounds
Empty	1790 Pounds
Useful	1410 Pounds
Equipment	50 Pounds
Gas & Oil	800 Pounds
Crew	380 Pounds

PERFORMANCE

Maximum Speed (Sea Level)	185 Miles per hour
Maximum Speed (10,000 Feet)	200 Miles per hour
Cruising Speed 2,000 R.P.M.	165 Miles per hour
Landing Speed	66 Miles per hour
Rate of Climb	1,800 Ft. per minute
Service Ceiling	21,000 Ft.
Cruising Range	1,400 Miles

POWER PLANT

Engine Wright R975-E 330 H.P. at 2100 R.P.M.

Last week the Abrams Air Craft Corporation of Lansing, Michigan was formed to develop and manufacture the new type of aircraft described in this article, of which the officers are the following:

President: Talbert Abrams
Chief Engineer: Kenneth Ronan
Test Pilot: Walter Carr

A TIMBER SURVEY CONTROLLED BY AERIAL PHOTOGRAPHS

By Joseph G. Kelley, Jefferson National Forest

Ground surveys are necessary for the control and accurate use of aerial photographs, but it is only rarely that the requirements are reversed and the aerial photographs are used to control ground surveys. Photographs have been successfully used to control a timber survey.

On forest lands where timber management plans are to be initiated, it is essential to have an accurate knowledge of the present resources of the forests and sufficient data to anticipate future yields. For this purpose it is necessary to take an inventory of the present resources of the forest lands - that is, a timber survey.

Obviously, it is impossible to measure the height and diameter of every tree, so compass lines, called strip lines, are run parallel at regular intervals and sample plots are taken at specified points along the strip lines. The volume and the species of the timber are measured accurately in these sample plots and factors such as drainage, condition of the soil and presence of fungi and insects are noted. From a compilation of the sample plots, an accurate picture of the area may be drawn and future prospects closely anticipated.

It is necessary to have some method of controlling the strip lines. The practice in the past has been to use compass and tape traverses to determine the position of control points for the strip lines. These traverses are run between control points of a higher order and are run along the ridge tops which form the boundaries between logging units. At intervals of about ten chains, trees are blazed and scribed with an identifying number so that the crews running the strip lines may tie into them. The control work is done by a five-man crew and progress of the work is delayed by the necessity of cutting brush, so that two and a half to three miles of traverse is considered an excellent day's work.

In order to substitute an aerial photograph method of control for the compass method, it was necessary for the aerial method to show a decrease in