AIR PROGRESS

AIR TRAILS ANNUAL

1941

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8 COLOR PAGES ★ 10 WARPLANE PLANS ★ 32 PHOTO FEATURES

ARTICLES • INFORMATION • PICTORIAL CHARTS

INTRODUCTION

Aviation is unpredictable. To attempt to chart its future trends and accomplishments is presumptuous; therefore we present the accomplishments of the past year that you may use them as a yardstick for gauging future progress and achievement. As the last World War was a great stimulus to aviation, so too has been the European conflict of recent months. Under the pressure of conflict the pace of development has been stepped up to an unbelievable degree, and from production lines roll new aviation products, months ahead of peacetime debuts. Dreadful in purpose for the time being, these same developments will but hasten peace-time aviation's greater safety and efficiency. Future generations will smile at 1940's transports, war planes and private aircraft, even as we smile at those of the First World War, but THEIR achievements will in turn be but other steps in the air progress of the future. In this, Air Trails' third annual, we give the outstanding highlights of the past few months as presented through our pages.

C. B. Colby

EDITOR OF AIR TRAILS

AIR PROGRESS

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INTRODUCTION

ARTICLES

FEATURES

COLOR PAGES

THREE-VIEW DRAWINGS OF FIGHTING PLANES

MODELS TO BUILD

THIRTY-ONE PICTORIAL FEATURES

C. B. COLBY, EDITOR ● ALEX D. SNIFFEN, ART EDITOR

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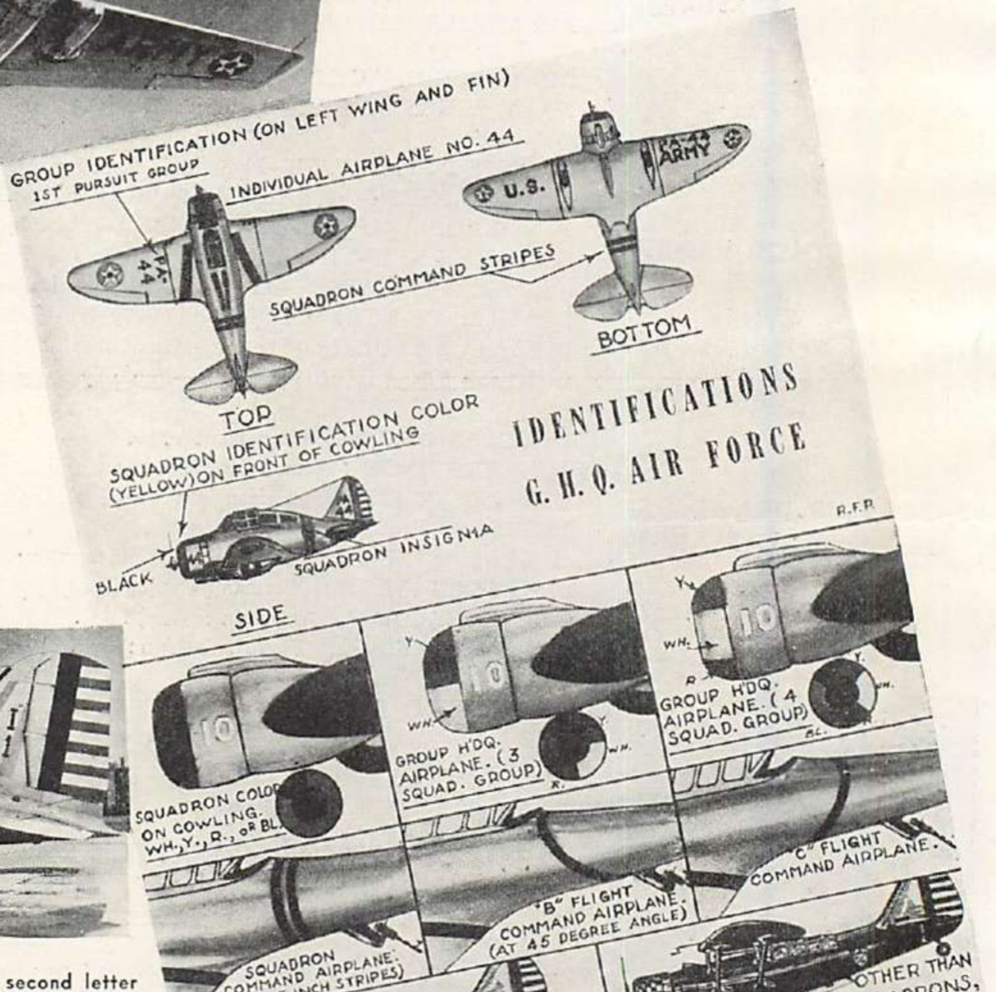
FULL-COLOR COVER PHOTOGRAPH OF CURTISS P-40 BY RUDY ARNOLD

This illustrates three-color marking in yellow, white and red on cowling of a group headquarters ship.

The U. S. army planes bear this identification on lower wings.



Interpreting "BI-21": B, second letter of alphabet, means "2nd Wing." I, ninth letter—"9th Group," and 21—ship of "1st Bombardment Group."

These two stripes about the wing of this B-17 mean it is a squadron command airplane of GHQ.

Some squadrons go in for fancy painted cowls as on these Douglas B-18As.

This P-36A bears PA-71, which translated means First Pursuit Group. P, pursuit; A, first group. Plane No. 71.

IDENTIFICATION OF ARMY AIRCRAFT

BY ROGER F. PARKHILL—20th Observation Squadron

DURING the late summer and fall of 1937, many air enthusiasts, civilian and military alike, were mystified to see strange new markings upon the surfaces of army air corps airplanes.

Each airplane of the GHQ air force is identified by two distinctive letters and a number forming an identification group. The two letters identify the purpose and the organization of the airplane. The number identifies the airplane itself. Distinctive examples of this identification are as follows:

AC-18—No. 18 airplane of the third attack group. ("A" for attack, "C" for third.)
BG-1—No. 1 airplane of the seventh bombardment squadron.
PA-44—No. 44 airplane of the first pursuit squadron.

For tactical squadrons not a part of a group, the group letters are omitted, and a certain block of numbers is assigned to the squadron for identification.

The complete identification groups for units of the GHQ air force are as follows:

Unit	No.
Headquarters, GHQ Air Force	HQ1 to HQ-*
1st Wing	WA1 to WA-
2nd Wing	WB1 to WB-
3rd Wing	WC1 to WC-
3rd Attack Group	AC1 to AC-
17th Attack Group	AQ1 to AQ-
2nd Bombardment Group	BB1 to BB-
7th Bombardment Group	BG1 to BG-
9th Bombardment Group	BI1 to BI-
19th Bombardment Group	BS1 to BS-
1st Pursuit Group	PA1 to PA-
8th Pursuit Group (Includes 37th Atk. Sq.)	PH1 to PH-
20th Pursuit Group	PT1 to PT-
1st Air Base Squadron	KA1 to KA-
2nd Air Base Squadron	KB1 to KB-
3rd Air Base Squadron	KC1 to KC-
4th Air Base Squadron	KD1 to KD-
5th Air Base Squadron	KE1 to KE-
6th Air Base Squadron	KF1 to KF-
18th Reconnaissance Squadron	R1 to R15
21st Reconnaissance Squadron	R16 to R30
38th Reconnaissance Squadron	R31 to R45
41st Reconnaissance Squadron	R46 to R60
88th Reconnaissance Squadron	R61 to R75
89th Reconnaissance Squadron	R76 to R90

* These numbers have not been fully allotted to their respective squadrons or group.

Following are examples of the assignment of airplane numbers to organizations, as represented by those at Mitchel Field:

Base Headquarters and 2nd Air Base Squadron, GHQ Air Force	1 to 10
Headquarters and Headquarters Squadrons, 9th Bombardment Squadron, GHQ Air Force	11 to 19
1st Bombardment Squadron, GHQ Air Force	20 to 39
5th Bombardment Squadron, GHQ Air Force	40 to 59
99th Bombardment Squadron, GHQ Air Force	60 to 79
18th Reconnaissance Squadron, GHQ Air Force	80 to 100
97th Observation Squadron, (Corps and Army) Air Corps	101 to 120
Reserve Section	121 to 140

(Turn to page 91)

SLINGSHOT AVIATORS

Standing by for take-off. Two catapult planes are poised for the signal.

Land catapult. The British have a catapult for small fields to aid fast rise.

This shows the arresting gear which stops the cradle upon which the seaplane rests during ride.

—And then comes the moment when your catapult plane is shot forward and into the air by a charge of powder.

BY WILLIAM HERBERT RANDALL

HAVE you ever been fired from a cannon? No? Well, very few people have. But quite a number of navy pilots—those assigned to duty aboard battleships and cruisers—have similar experiences daily. These are the pilots who depend upon catapults to put them into the air quickly.

Catapults that were formerly operated by compressed air are now propelled by gunpowder, heightening the effect of being fired from a cannon. From a dead start the catapulted plane attains a speed of sixty knots in the amazingly short distance of sixty feet.

The principle of catapulting is similar to that of the slingshot. Forward motion holds and propels the plane by means of the grip on the pontoon step.

Satisfied with his inspection, the pilot climbs into the cockpit and dons his radio helmet. He leaves the hatch covers open just in case. The heavy gun turret, on top of which the catapult is mounted, swings to the beam in order to catapult the plane well clear of the warship. The pilot starts the motor and warms it to thirty degrees centigrade. If he is satisfied with his ship and is ready to be catapulted, he idles the motor and claps his hands over his head in signal to the catapult officer.

Seamen start hosing the deck with sea water in case of fire as the deck officer awaits the "go-ahead" signal from the bridge. The signal comes at last and the catapult officer holds up five fingers and punches his stop watch. In exactly five minutes the charge in the catapult driving cylinder will *(Turn to page 96)*

One of our slingshot missiles. This SOC-1 warms up before the trip down the short track begins.

At the end of the track the cradle is stopped by the bumpers and the freed ship soars away.

POWER PLANE PILOTS SHOULD SOAR

Why? Because "many fatal accidents could have been avoided if the pilots had known soaring," says this famous Golden "C" pilot.

BY LEWIN BARRINGER

The author, experienced in the handling of many types of power planes, takes a spin in an army Douglas O-38.

With the aid of a towline and winch, this sailplane is launched on a 212-mile record flight by Lewin Barringer.

FOR some months the idea of this article has been buzzing around in my brain. Although sure that the subject was both important and timely, I hesitated to put it on paper. The reason for this was that it is addressed not only to the general public, including the fast-growing ranks of private pilots, but also to the seasoned veterans of many thousands of hours in the air now piloting our airliners and military aircraft or engaged in miscellaneous commercial flying. Many of these men are my personal friends, and what I have to say may seem like presumption on my part and result in a heaping of coals upon my head.

Why should I, with less than 2,000 hours in the air, spread over ten years, presume to advise men who have 8,000 to 10,000 hours and twenty-five years of flying? It is for the simple reason that close to 200 of my hours have been spent in the cockpits of sailplanes flying without power. To succeed in this type of flying, I have had to learn facts about the behavior of this ocean of air in which we live that would be valuable to any pilot.

For the past six years I have been trying to sell my airplane-pilot friends on the advantages as well as the fun of glider flying. The general skepticism has been discouraging but understandable. Too many of them remembered the many crack-ups—most of them by experienced airplane pilots—in primary gliders around 1928-30. That left a bad impression which it has been hard to overcome. The trouble could usually be traced to complete overconfidence in flying something "so light that it should be a cinch." The result was that they had no feel of the ship and forgot that it did have a stalling speed, although this was as low as twenty-two miles per hour, with the inevitable result of falling off and sometimes spinning it. Without protection in an entirely open cockpit, some of them got hurt.

Now the picture has changed. Although we may still occasionally hear of an isolated case where an overconfident and careless pilot has spun in with a modern, stable sailplane, the average pilot today realizes that a sailplane is not a toy or "fragile craft," but a very refined aircraft capable of remarkable things. He is beginning to realize, too, that it is not hard to fly one, but that he must go through a short check-out period to get used to the different feel, slow flying speed, extremely flat glide and level landing on one wheel.

To get back to our original premise, why should these thousands of capable airplane pilots take up soaring? The answer is simple. *There have been too many fatal accidents that could have been and would have been avoided had the pilots had a background of soaring experience.* I'll be specific, but first let me say that I would be the last person to knock our air lines on which I frequently fly, and that I have an equally high regard for our military air services, having flown army planes for six years.

My first shock at a pilot's lack of what I regard as fundamental knowledge came some years back. While making preparations for a distance *(Turn to page 91)*


Aeronca 50


Beechcraft 17


Beechcraft 18


Bellanca Pacemaker Sr.


Boeing Clipper


Cub J-3 Sport


Consolidated PBY


Curtiss Hawk 75-A


Northrop Attack


Douglas DC-3

WHAT SHIP IS THAT?

Here's a chance to learn to identify planes in flight by looking for certain distinctive characteristics.

BY FRANK TINSLEY

THE ability to identify aircraft in flight is not easily acquired. It is the result of experience and is based upon two essentials. The first is a comprehensive knowledge of airplane designs. The second is the knack, born of long practice, of picking out design features at a distance. This latter requirement is more difficult than you might think, for a moving plane, viewed by an observer on the ground, is seen at a constantly changing angle. These unusual angles can do queer things to the outlines of aircraft. When viewed in silhouette, for instance, the lower wings of an oncoming biplane overlap its tail surfaces, and at certain angles it is hard to say whether the approaching ship is a biplane or a high-wing monoplane. At certain other angles, those same lower wings of our biplane mask the wheel gear and give the ship the appearance of a seaplane.

The ever-increasing use of retractable landing gear also helps to confuse the observer. The fuselage contour of an airplane with tucked-up wheels closely resembles that of a flying-boat hull, and until an accurate sense of distance is developed it is hard for the tyro to distinguish between a comparatively small land plane and a larger, more distant flying boat. If the nearby ship is a biplane, the possibility of error is even greater, for at one side angle, when viewed from below, the lower wing tips of the double-decker resemble the partially visible outlines of a flying boat's wing-tip pontoons.

When passing directly overhead, a monoplane presents the observer with an unexpected puzzle. What type is it? Is it a low-wing, high, or midwing job? Like Mike and Ike, they all look alike when *(Turn to page 92)*


Fairchild 24


Grumman G-21A


Grumman J2F-1


Lockheed Electra


Monocoupe 110 Special


No. American


Ryan S-T


Seversky P-35


Stinson Reliant


Waco C

WHAT HAPPENS TO OLD ARMY SHIPS?

Northrop A-13, forerunner of A-17's.

How long before this Bell Airacobra joins the others?

Curtiss A-8 attack, known as Shrike.

An old-timer, Thomas Morse O-19E.

Martin B-10, still used to small extent.

The O-43A observation is still in use.

Curtiss P-1, first of long pursuit line.

World War DeHavilland.

Can civilians buy them? Are they used for training? Listen to a man who knows, and tells you.

BY LIEUT. THOMAS B. SUMMERS

ON August 2, 1909, the Wright Brothers successfully flew an airplane that was capable of carrying a pilot and one passenger; could attain a speed of forty miles per hour; carried sufficient fuel for a 125-mile trip; could fly at least ten miles across country; and could be carried on an army transport wagon.

And what has become of all those ships that have gone by the wayside down through the cavalcade of time? The DeHavilland, Jenny, Spad, Curtiss P-1, Curtiss P-6, P-12, Boeing P-26, Martin bombers and all of the others that gave way to the mighty ships of today such as the B-15, Flying Fortress, Curtiss P-36, the Curtiss A-18 and the North American O-47? What was done with them and what is being done today as they reach the point that they are out of date and no longer useful to a tactical unit?

Perhaps you remember the post-War days when Jennys were stacked high at the Boston airport and burned. If so, you might have the opinion that *(Turn to page 93)*

The Boeing P-26A, long our best pursuit.

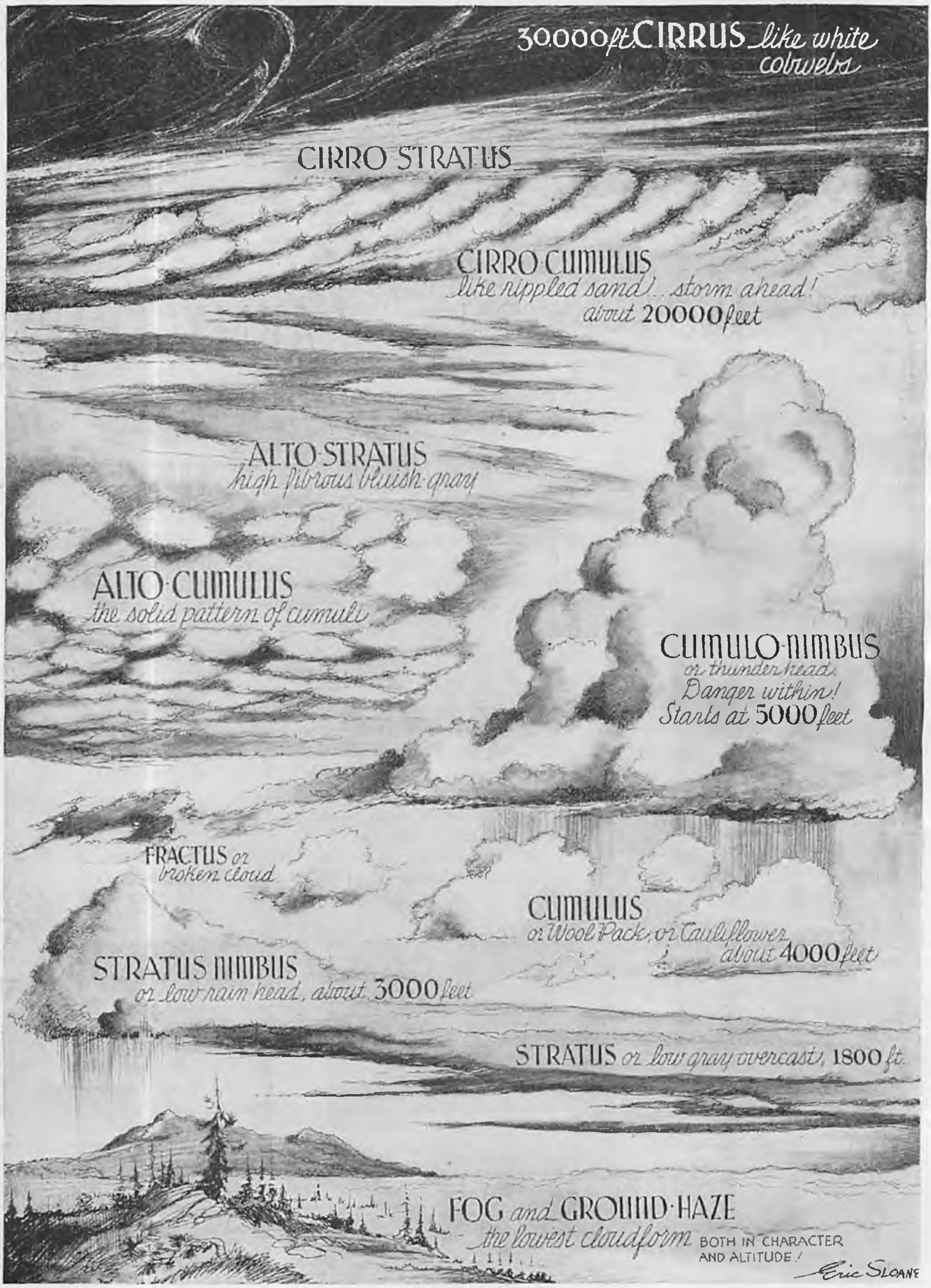
The O-24, another fine ship left behind.

The A-12, developed from the A-8.

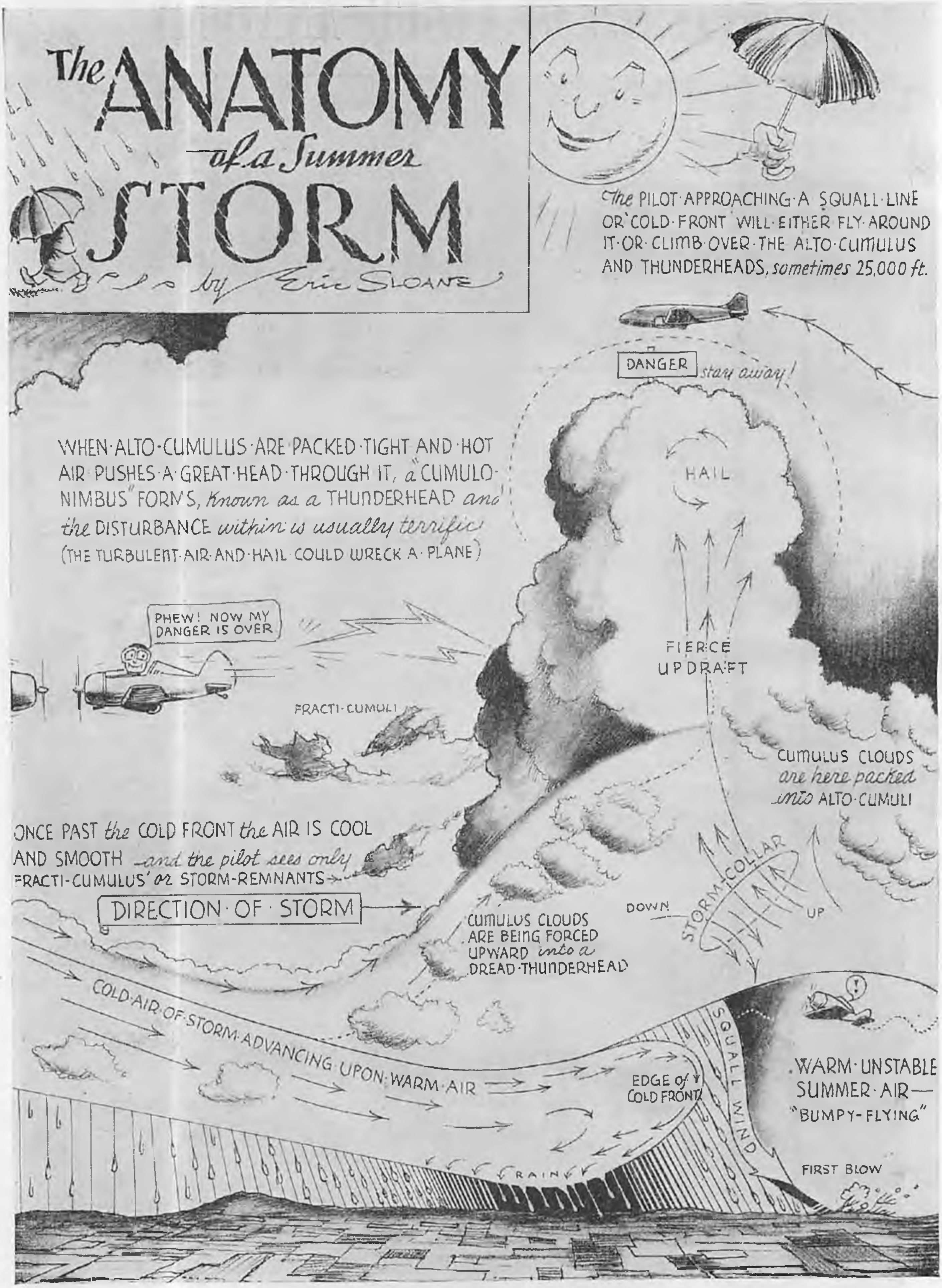
The BT-2B, now for instrument training.

The O-25, famous as observation ship.

CLOUD CHART

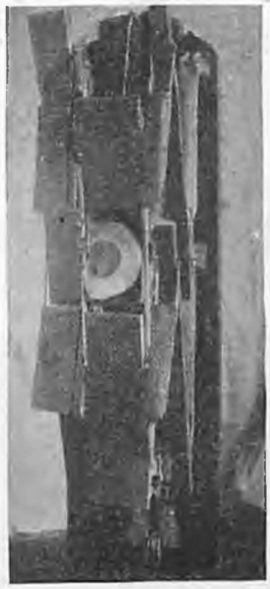

30000ft. CIRRUS like white cobwebs
CIRRO STRATUS
CIRRO-CUMULUS like rippled sand!... storm ahead! about 20000 feet
ALTO-STRATUS high fibrous bluish-gray
ALTO-CUMULUS the solid pattern of cumuli
CUMULO-NIMBUS or thunder head. Danger within! Starts at 5000 feet
FRACTUS or broken cloud
CUMULUS or Wool Pack, or Cauliflower about 4000 feet
STRATUS NIMBUS or low rain head, about 3000 feet
STRATUS or low gray overcast, 1800 ft.
FOG and GROUND-HAZE the lowest cloudform BOTH IN CHARACTER AND ALTITUDE!
Eric Sloane

SKETCHES OF CLOUD ANATOMY

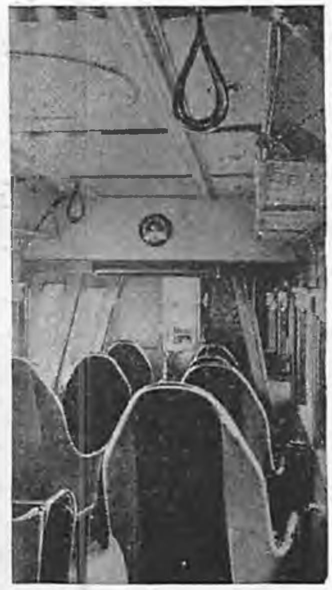


The ANATOMY of a Summer STORM
by Eric Sloane
The PILOT APPROACHING A SQUALL LINE OR COLD FRONT WILL EITHER FLY AROUND IT OR CLIMB OVER THE ALTO CUMULUS AND THUNDERHEADS, sometimes 25,000 ft.
DANGER stay away!
WHEN ALTO-CUMULUS ARE PACKED TIGHT AND HOT AIR PUSHES A GREAT HEAD THROUGH IT, a "CUMULO-NIMBUS" FORMS, known as a THUNDERHEAD and the DISTURBANCE within is usually terrific (THE TURBULENT AIR AND HAIL COULD WRECK A PLANE)
HAIL
PHEW! NOW MY DANGER IS OVER
FIERCE UPDRAFT
FRACTI-CUMULI
CUMULUS CLOUDS are here packed into ALTO-CUMULI
ONCE PAST the COLD FRONT the AIR IS COOL AND SMOOTH and the pilot sees only FRACTI-CUMULUS or STORM-REMNANTS
DIRECTION OF STORM
CUMULUS CLOUDS ARE BEING FORCED UPWARD into a DREAD THUNDERHEAD
DOWN
STORM COLLAR
UP
COLD AIR OF STORM ADVANCING UPON WARM AIR
SQUALL WIND
EDGE of Y COLD FRONT
WARM UNSTABLE SUMMER AIR— "BUMPY-FLYING"
RAIN
FIRST BLOW

Once again we present some early birds.



Aviation folds up! This plane folded up by touching a button. Sometimes without pushing a button.

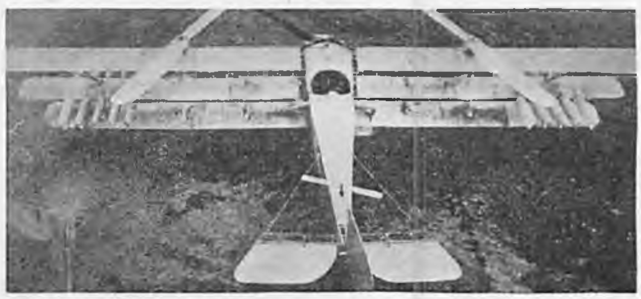


Sky subway car complete with strap-hanger equipment. Note that altimeter, you modern manufacturers. Good idea!

You auto see the one that got away! This was made by "using body of an automobile and shape of plane slipped over it."

This German inventor built a sailplane with a motor, but unfortunately it flew, spoiling speculation as to whether it would.

The caption says it's a "plane-dirigible." We say it's plain— To carry 500 passengers from here to there in eighty hours.



An early helicopter with an assortment of wings and props. We think this should be able to go in at least one direction.

Here's a nice fresh model, just picked. Note stem. This beautiful Razbury 2-U is being pushed off where no one will see it.

One thing about this little number: You can always climb up to the top and see how it would seem if you had really taken off.

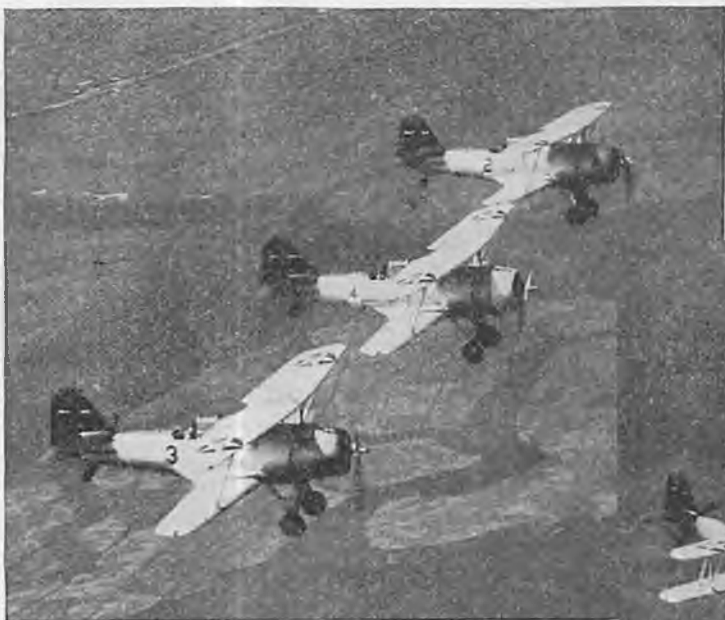
FROM TOYS TO TACTICS

Right echelon of section V's shown with toys by Lt. Commdr. Don F. Smith, Reserve Base, Floyd Bennett.

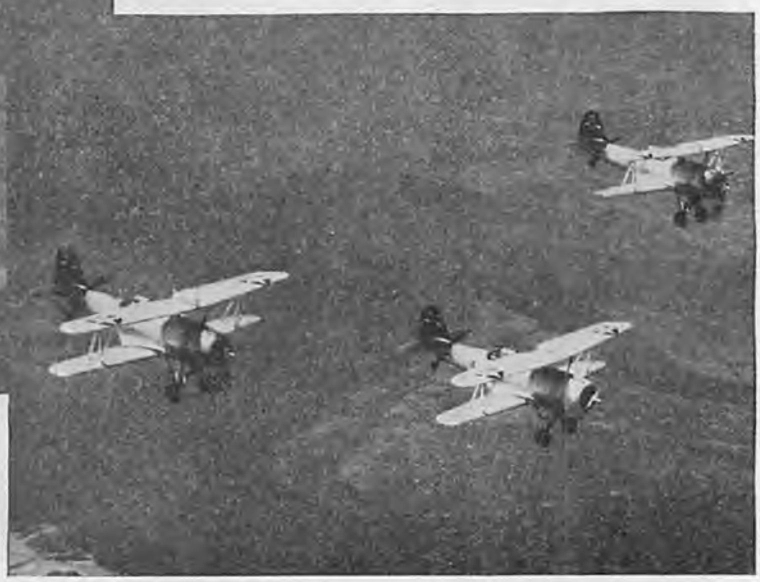
Now the formation is shifted to a right echelon of echelons while flying cadets watch change take place.

The toys in what is known as a line of sections, sections in opposite echelon. Each division leader always maintains position on the group squadron leader's plane.

From toy planes these future navy pilots learn the fundamentals of intricate maneuvers, then



Students go aloft to practice what toys have preached. Flying about 20 feet apart, they watch the center man.

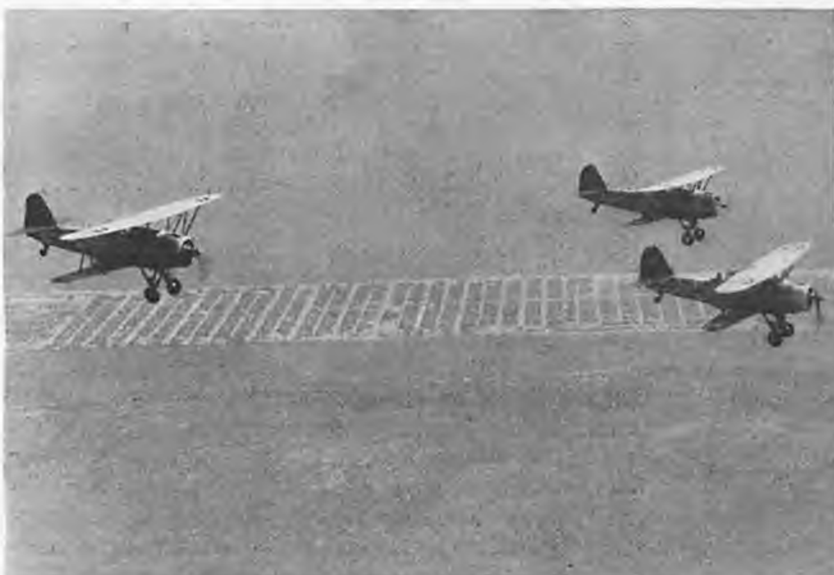


Upon a signal from leader in center plane bearing stripe of section leader about the fuselage, they assume a V, keeping above and behind for safety.

By a swift shift of toy planes we now have a close compact bombing formation which offers a small target and at same time results in an effective compact coverage by a bombing salvo.

The arm signals as used by flight leader to denote changes in formation in flight. Above, change to echelon. Right, change to V formation. Rocking wings gives same signal. Below, signal for line formation of planes.

go aloft and put them in practice.



The V now begins to form an echelon. The plane to right of leader leaves V and swings to left of and above other two planes. Right—The completed right echelon with leader at bottom. They fly so that upper planes may see any signal.

SAND and SPINACH

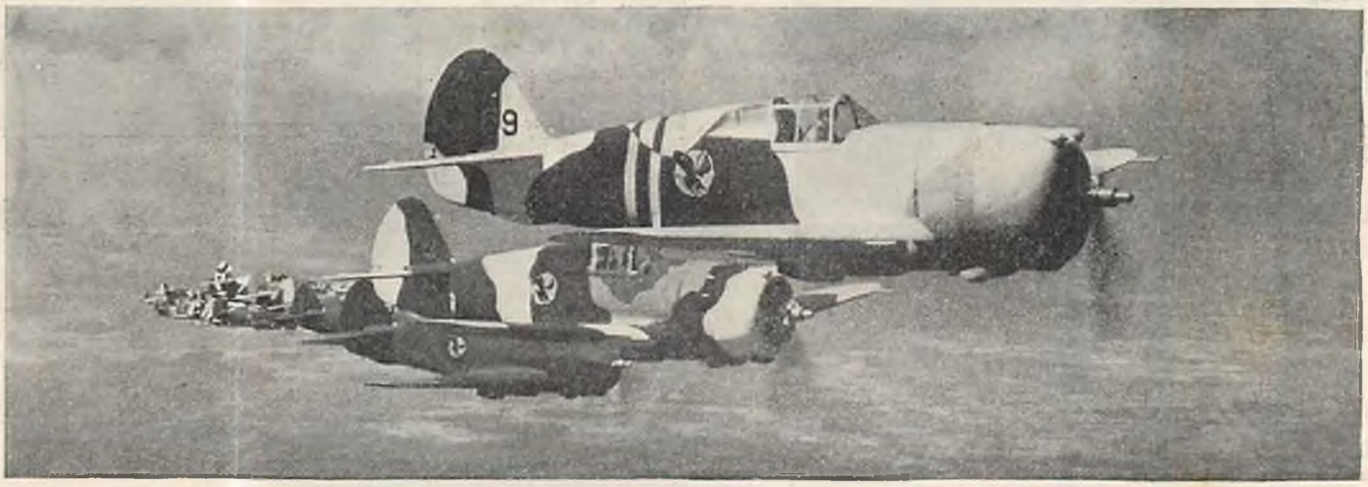
Camouflage runs into queer problems when applied to aircraft—here's how it's done.

BY FRANK TINSLEY

"CAMOUFLAGE?" says John Public. "Oh, yeah; that's the trick of painting cannons and things with crazy stripes of color, so you can't see them. It started during the World War, didn't it?"

The answer is no, John. Camouflage is merely a modern term for a tactical device as old as war itself. It has been employed in one form or another in almost every conflict since history began. The use of colors and broken patterns to imitate the effects of light and shade in nature, for the purpose of deceiving the enemy, has been well-nigh universal.

Protective coloration as applied to army aircraft appeared late in 1916. The Germans seem to have been



Believe it or not, there are fifteen planes in this group of P-36s!

the first to use it, and their Halberstadts, L. V. G.'s and Albatrosses shed their bright colors and replaced them with the dull, crazy-quilt tints of camouflage. Various arrangements of design and color were tried, ranging from regular, geometric patterns applied at the factory, to the wildest sort of daubs executed by field mechanics.

Allied air units quickly followed suit, displaying a tendency toward the irregular, stripe designs of ground camouflage. The prevailing colors used by both sides were tones of green, yellow and brown, with occasional flecks of red. Long-range night bombers were either given an overall coat of dull black or finished with drab tops and sides and dull-black bottom surfaces. Many of the English fighter squadrons adopted the practice of painting the under surfaces of wings and fuselage a pale sky-blue color. In all cases, both Allied and German, recognition colors and symbols were, of course, retained.

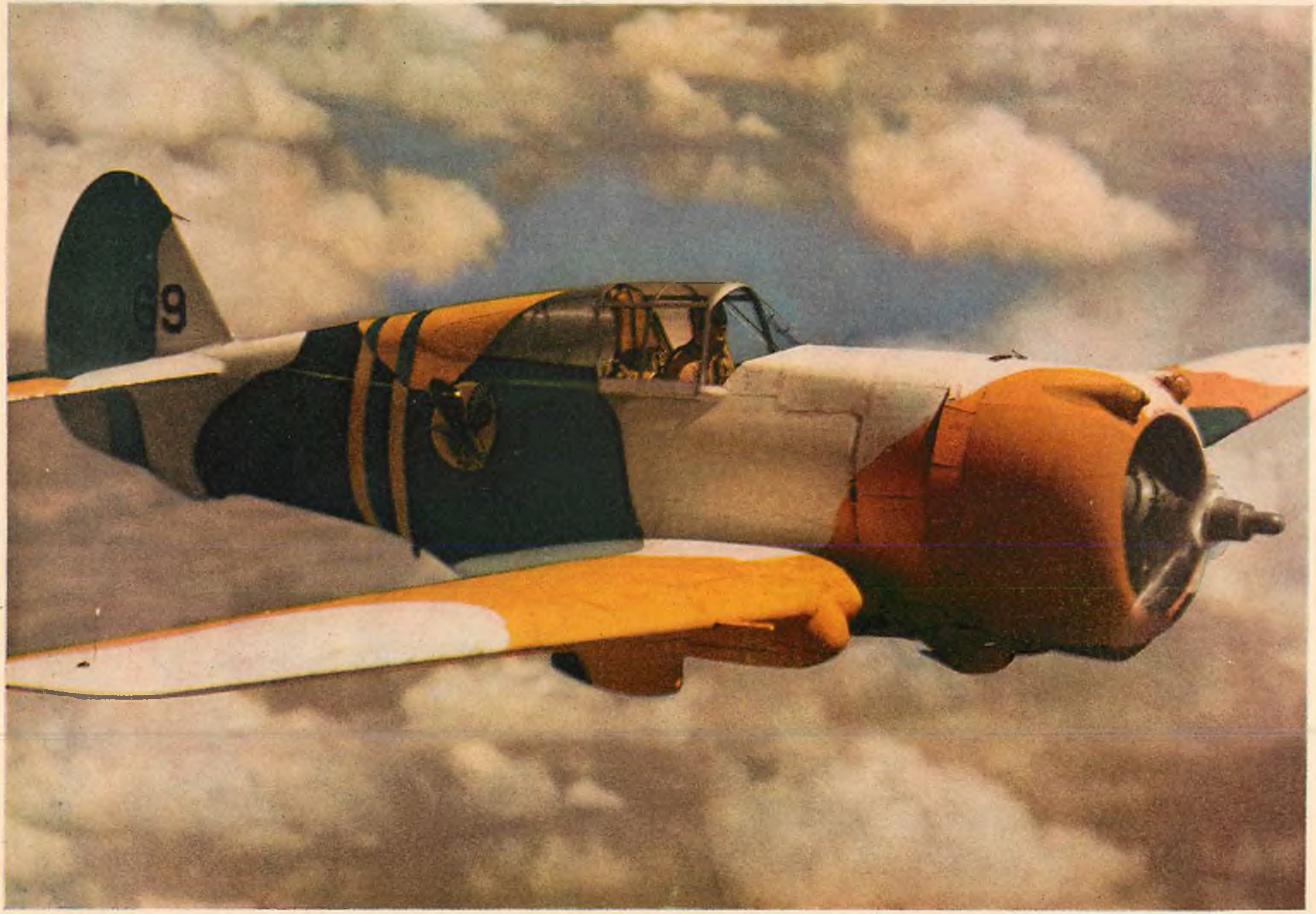
During the years following the Armistice, the use of camouflage for aircraft was discontinued. With the revival of dress uniforms for the personnel of post-war armies, peace-time color schemes were created for military airplanes. The standard national insignia were augmented by varicolored identification stripes and numerals, together with squadron crests and mottoes.

Then the continued crises in various parts of the world had the effect of placing almost every great air force upon a war basis and this automatically reinstated camouflage as a regulation finish. Practically all protective coloration used today follows standardized patterns, scientifically developed for each particular type and model. They are put on at the factory, leaving only the individual identification markings to be applied by the unit to which the machine is assigned.

In working out these standard colors *(Turn to page 94)*

This shows relative visibility of ship with and without camouflage.

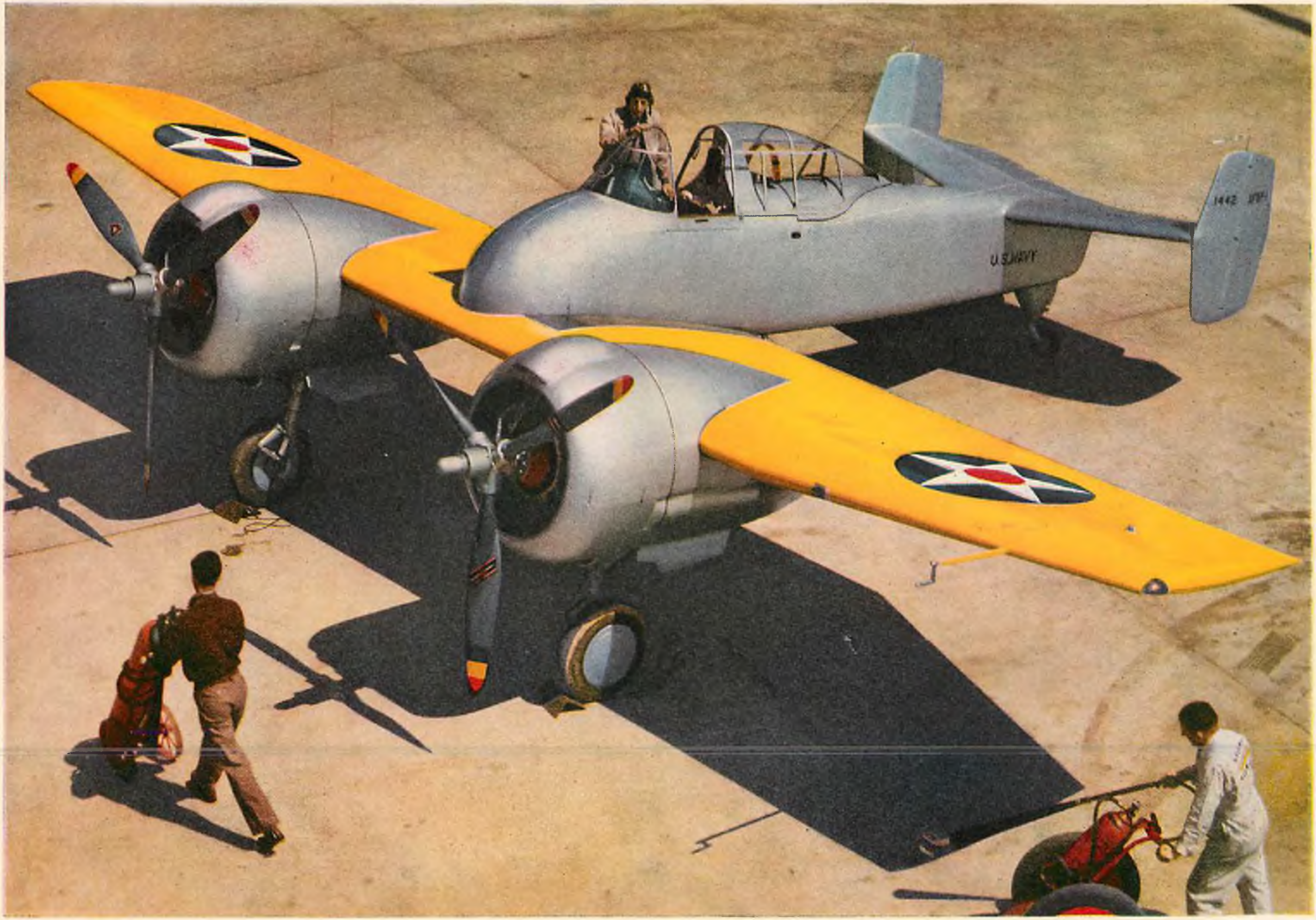
An example of how "sand and spinach" blends with cloud forms.



CURTISS P-36 PURSUIT

STEARMAN PT13-A TRAINER

NORTHROP A-17A ATTACK



GRUMMAN XF4F-1 INTERCEPTOR

FLYING SCHOOL ON WHEELS

It's the last word in intimate contact between student and school, this rolling classroom at Floyd Bennett Field. Baxter, noted operator, pioneers.

Baxter leaves his rolling school to direct student activity.

Panel with removable tags enables the instructor to check the students' time.

This portable gas wagon is carried to service the Cubs directly on the flying line.

Full equipment is carried in this ingenious "office" to make repairs right on the field.

Interoffice phone connections are maintained with the administration building.

A short-wave radio keeps instructors informed as to weather and traffic conditions.

Lining up for their day's flying program. Here the school, in the middle of things, enables Baxter to keep in intimate touch with all.

Above—Alert for distress signals, this Curtiss SOC-4 seaplane of the coast guard drones over the Olympic Mountains. Left—A coast guard Grumman JF-2 takes off from Port Angeles harbor on regular patrol flight over region.

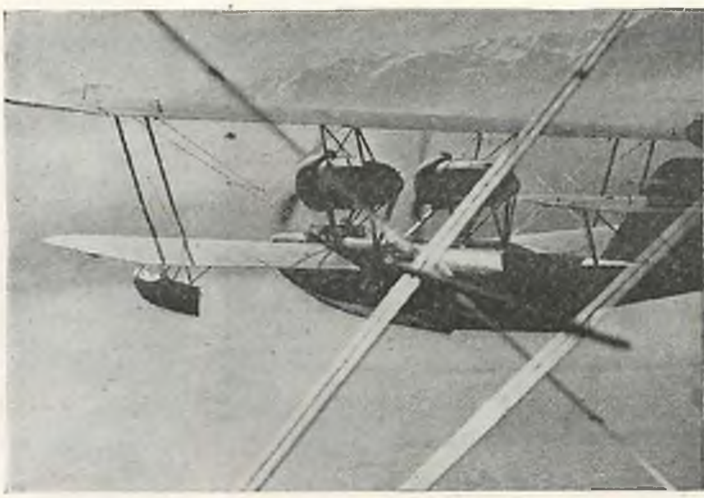
WATCHDOGS OF THE NORTHWEST

BY GORDON SEAR WILLIAMS

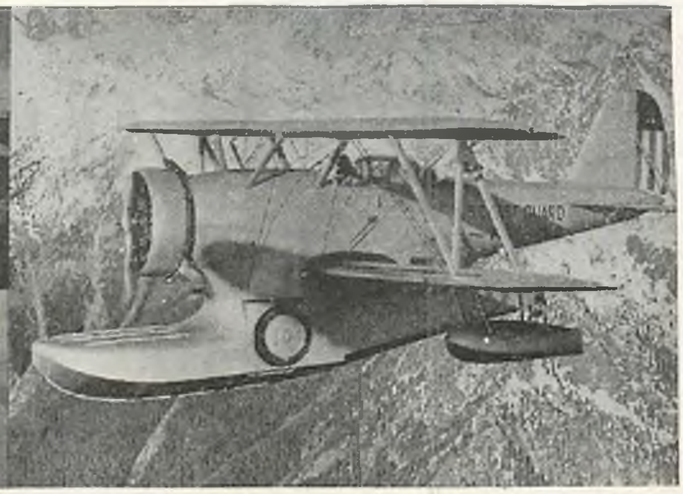
SEARCHING for strayed log booms in the Strait of Juan de Fuca, or for lost hunters and hikers in the almost inaccessible Olympic Mountains, may not sound like duties of the U. S. coast guard, a supposedly sea-going force, but even stranger duties than these are undertaken by the Port Angeles Air Station, located in the northwestern corner of Washington State.

The Port Angeles Air Station. This base is located on the tip of Ediz Hook, a long sandspit that forms a natural breakwater for the harbor. On it are aircraft shops, barracks housing 35 men. Complete photographic equipment is a special feature.

Tatoosh Island, the most northwesterly weather station in U. S. This barren, flat-topped rock is less than a mile offshore, but so wild are the storms and tides that sometimes it is cut off for weeks at a time. Buildings are anchored by guy wires.



Although somewhat archaic-looking, the Hall PH-2 has proved to be perhaps the best rough-water flying boat in service. Its great range of nearly 2,000 miles non-stop makes it doubly valuable for bad-weather patrolling when a reserve of fuel is important.



A tough place for a forced landing! This Grumman JF-2 amphibian, carries out regular patrols over the wild Olympic Mountains on the lookout for lost or marooned parties. This type of ship is also used for routine sea and coast work.

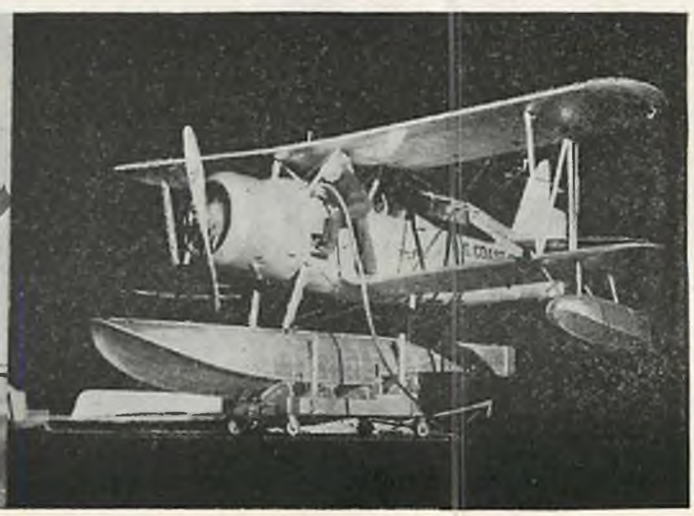
These aerial coast guardsmen fly over living glaciers and vast snow fields in the Vancouver range and the white-and-green Olympics, over Indian reservations, bays filled with salmon fishermen, gale-swept coastal islands—as rugged and picturesque a territory as can be found in the country. It is also a section where assistance and service from aloft are of unusual value. Crews of the giant planes drop storm warnings or special messages to small fishing craft far out at sea, pick up emergency cases requiring speedy hospitalization. They patrol mountains for the forest service, do many other things.

Last year more than fifty general-assistance flights were carried out, many after dark and in bad weather. The Pacific Northwest is well served by the U. S. coast guard!

Lieut. D. B. MacDiarmid at the controls of a Douglas RD-4 Dolphin. All officers and enlisted pilots are required to practice night landings on water.

One of the RD-4s, powered with two 450 h.p. Wasps. This powerful ship is used along with the rest for narcotic smuggling patrol work, inspection of salmon fishing fleets, checking up on foreign shipping activity. Ships are thoroughly washed with fresh water.

The planes are gassed up and serviced immediately after landing regardless of time or weather, for it's never known when they will be called out at a moment's notice for an emergency. This Curtiss SOC-4 is convertible to either wheels or floats.



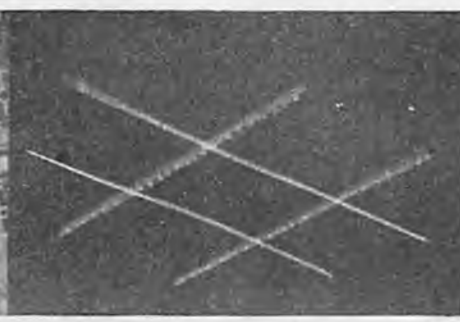
Andy Stinis, left, and Dave de Blasio, right, decide to try "Tic-tac-toe" aloft.

SKYWRITER'S HOLIDAY

Skywriters go the old postman one better for pastime on a day off!

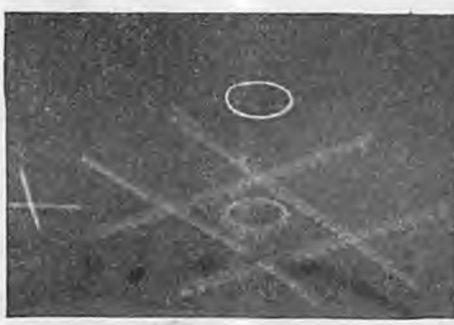
They take off in their speedy sky buggies, testing their chemical smoke.

Dave traces the first line of the game as seen from Andy's ship a bit above.



Here we have the Tic-tac-toe game ready for players to begin their aerial battle.

Here we go! Andy makes an "O" and Dave comes right back with an "X." Tie!



Aha, Andy slaps in his second "O." All right, Dave, what will you do?

All over but the shouting as Dave makes his second "X" in corner. Andy wins!

Back on earth they still battle on, but Andy points as proof to evidence.

LUSCOMBE LIKES METAL

This line-up of Luscombes is composed of twenty that took part in the light-plane cavalcade making pilgrimage to Orlando, Florida.

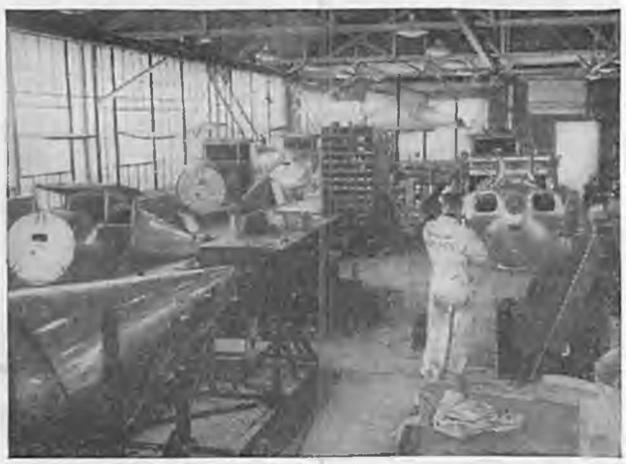
Unique in light-plane manufacturing, the Luscombe dares to be different and comes out in metal. Here are several glimpses of factory.

With a top speed of 107 m.p.h. from a 50 h.p. Continental engine, the Luscombe has a landing speed of 37 m.p.h.

No wood, no glue, no fooling! Continuing Luscombe's all-metal plan, here we see the wing structure as they build it.

The next chapter of our tale deals with just that. These metal stabilizers are being covered in their jigs by expert craftsmen.

Simplicity and strength are riveted together by experts. Here the metal skin is riveted to the metal fuselage bulkheads.



The production line gathers the various parts and unites them into a complete ship. Luscombe's at West Trenton, N. J.

EDUCATION and AVIATION

BY

JOHN W. STUDEBAKER

U. S. COMMISSIONER OF EDUCATION

Dr. John W. Studebaker at his desk.

This address to the First National Congress of the National Aëronautic Association sheds much light on how schools fit into national aviation.

By introducing the building of simple models in the lower grade schools, the basic fundamentals of aviation are easily instilled.

Career bound. These graduates of Manhattan High School of Aviation Trades, New York City, are trained as expert mechanics.

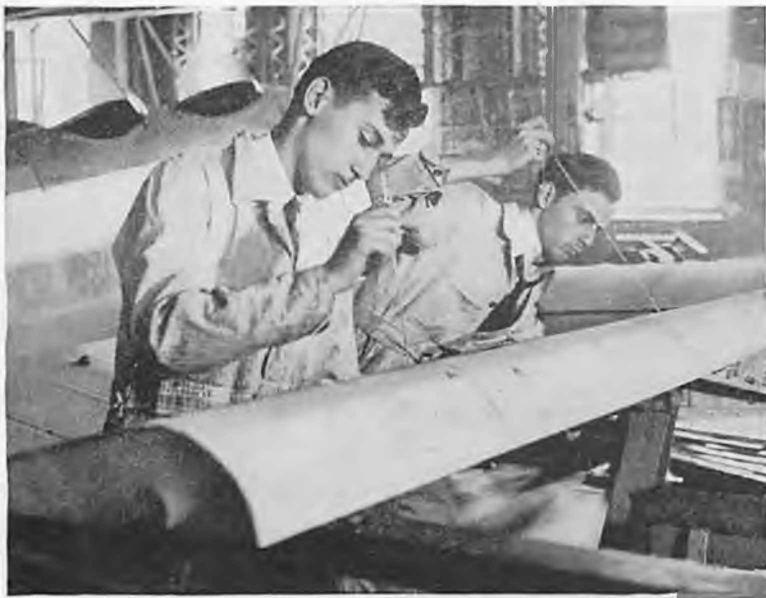
WE are in a national emergency. All the rights that the common man has fought for in a thousand years are grimly menaced. One democracy after another crumbles under the mechanized columns of the dictators. A life-and-death struggle is in progress for every principle we cherish in America, for freedom of speech, of religion, of the ballot, and for every other freedom which upholds the dignity of the human spirit.

America is fully resolved to keep the war away from the Western Hemisphere. We are prepared to spend any amount of treasure necessary for building up our navy, our army, and our air force. Public opinion is beginning to realize that preparedness will also involve the organization of our manpower. Many of our young men may soon be put in uniform, and for the duration of the emergency industry and labor will be harnessed to preparation for military defense.

Our traditional policy, developed through more than 150 years of national history, is to regard the defense of the nation as residing not in a gigantic military organization sapping the resources of the people in time of peace but rather in a strong and soundly equipped citizenry; a citizenry trained in the arts of peace and at the same time capable of rising to the requirements of a national emergency. Time is always of the essence in any emergency. It is so today. Industrial mobilization cannot be attained in a day or a month. The engrossing question in the mind of everyone is: How can we move most rapidly to prepare the United States to resist any aggressor?

In this connection, then, I propose to discuss with you today first of all the question: What part can the schools play in the development of aviation in the present emergency? And, second, to raise the further question: What are the long-time contributions which education can make to the development of aviation in the United States?

If we have learned any military lesson from the present European war, it is that air power in modern military defense is of crucial importance.



In many schools such trades as wing covering may be taught to boys and girls, as both engage in this work.

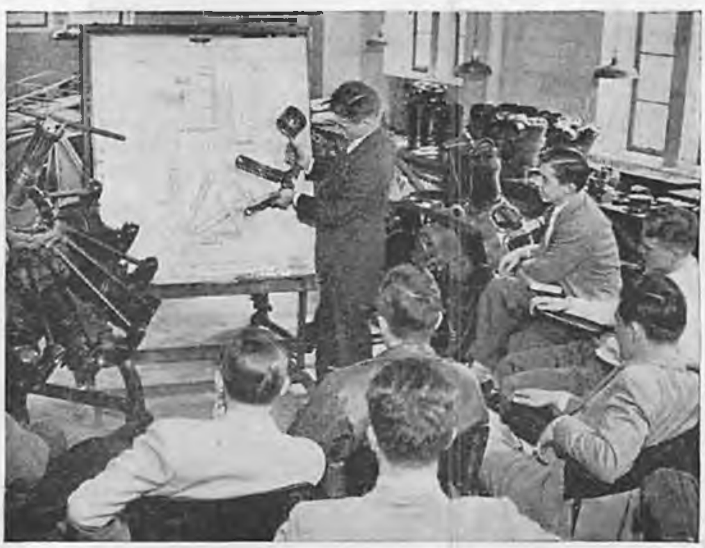
Measuring the lift of a certain airfoil section. Many schools already include aviation material and subjects in physics research classes.

I need not rehearse to this audience the evidence of our awakening to the paramount necessity of expanding our air forces. The goal of 50,000 military planes set forth recently by the president has readily been accepted by the public, and a program to achieve this goal is already well started. It is perfectly obvious that this program will require not alone that 50,000 planes be designed, constructed, powered, and equipped, but that they be flown and serviced as well. How can the schools contribute to meeting both of these requirements?

Immediate construction of thousands of airplanes involves, of course, a tremendous and rapid expansion of the aircraft industry. If this expansion is to take place rapidly and smoothly, bottlenecks in raw materials, in transport, and in supply of trained workers must be eliminated. If this is to be done, a very great increase in the supply of skilled labor must quickly be made available. We are dependent upon the manual dexterity of our manpower both for the production of war equipment and for the intelligent operation of planes, tanks, guns, and all of the modern engines of war. It is here especially that the educational system of the nation fits in.

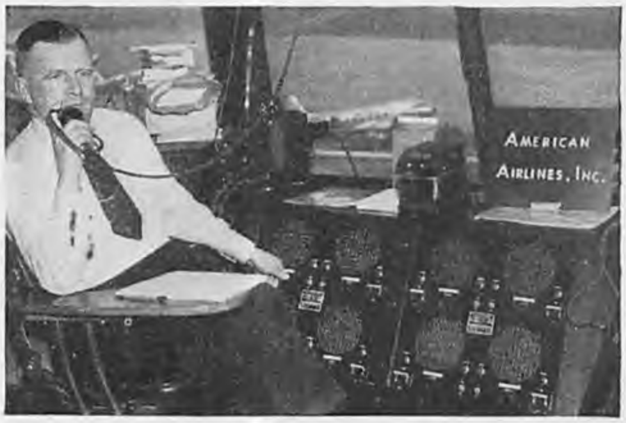
As early as last December it was estimated from orders then in hand that the aircraft industry would require an increased labor force of approximately 100,000 workmen to meet the enlarged program of our own military and naval forces and the greatly expanded foreign orders which had been received. Since that time, of course, the expansion in the aircraft construction industry has been greatly accelerated and the problem of securing trained workmen greatly increased. There are tested methods by which new recruits for the industries of the nation can be trained or retrained to give them the necessary production skills. These methods are:

1. The more or less unorganized trial-and-error breaking in of new workers by foremen and lead men in the plants themselves. *(Turn to page 88)*



The real thing and the chart. Ground-school subjects and actual flying instruction may eventually become routine educational subjects.

Air photo of La Guardia Field shows location of field's traffic tower.



No place for "mike fright." George Hamilton, tower man, is instructing DC-3 as to runway to use, wind direction, etc.

TALKING TOWER

From this glass-inclosed vantage point come the air traffic directions for La Guardia Field, New York.

Above—Hamilton explains the instruments to an air-line pilot. The runway map of the field between them indicates electrically which runway to use for correct upwind take-off. Below—Light signal-gun to direct ships that have no radio.

Behind the scenes of the Talking Tower are many unseen instruments and men. Here we see part of the teletype message room.

For Heaven's sake, Roscoe, that won't cure a sore throat. The now famous Col. Turner, away back.

EARLY DAREDEVILS

Back in the days when aviators were crazy. They earned their laurels!

So far so good—or is it? Sgt. C. B. Buton, famous early daredevil, hangs by his knee.

And now we have a dash of hangover. Sgt. Buton hooking his trusty feet into the wires.

Floyd Parsons changing from speed boat to plane at 50 m.p.h. for first time in history.

He just got bored with bucking broncs. "Kinx" Jenkins, famous cowboy, goes up.

Harold McCracken, the ace news cameraman, went after his movies in a big way.

Charles Godefroy, the French pilot, flew through the Arc de Triomphe in Nieuport.

In the first photo we see a pilot about to make a landing in the water. He unfastens the chest and leg straps.

Now, arms folded to keep himself from falling from harness, he waits until 'chute has almost reached the water.

As he is about to be dunked, he raises his arms and, straightening his legs, slides into water, free of the 'chute.

If you have to, here's how you get out of a 'chute in a water landing.

Down to the Sea in 'Chutes

Screwball Bomber

Special to Air Trails! Pilot "Baron" Eddie Wormald presents newest pocketbook bomber! 5th columnists please note!

The "Baron" believes in preparedness, and so he checks his bean-shooter. Note two-way air screw for going downward and also backward.

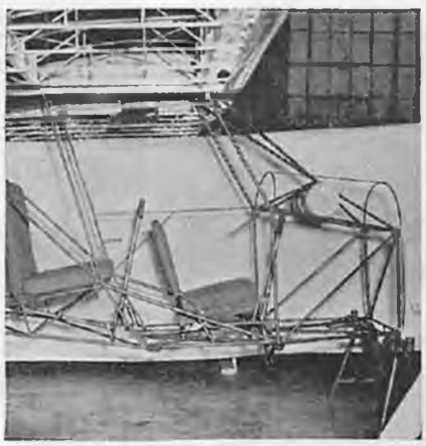
We only hope some spy copies this charming little number, as presented by the leader of the "Nitwitzkrieg" Battalion who claims he will fight for beer-bottle caps, marbles, peanuts or ten cents. (No stamps, please.)

This shows tail-gun assembly. Ingenious bomb release consists of scythe on pole to hack away the bomb ropes. The staggering strategic part of the mess is that "pocket battleship" target is carried along with it.

NOW AERONCA'S TANDEM

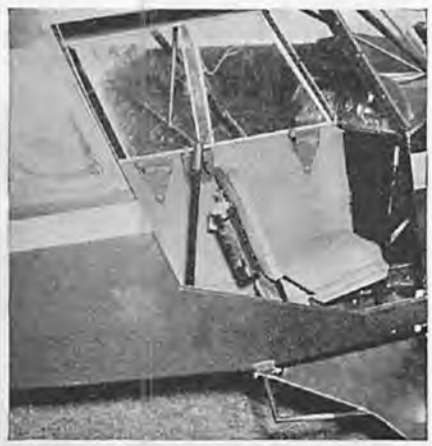
With the co-operation of instructors using this type of equipment, Aeronca produces a sleek new trainer with many interesting features.

This tandem trainer presents a new silhouette under famous trade-mark as compared with the usual models.



A skeleton too good for closet. Note raised rear seat, simplicity, reserve tank.

Rugged simplicity is engine mount. The Lycoming "50" may be removed quickly.



These seats of Bedford whipcord are fully adjustable and are of Paratex.

The open door of safety swings wide for tandem's passengers. Note stout struts.

Taken from rear seat in take-off position, this shows instrument board and visibility.

The new tandem can take it. Although not advocated, this demonstrates its strength.

RACKET BUSTER

Is this the solution to the old problem of silencing plane engines?

Meet the inventor. Eddy Latulippe, of Montreal, Canada, points out the new and potentially sensational exhaust silencer for planes. This represents 11 years' research.

This shows the automatic trap door that opens in case of backfire, preventing exhaust blowout. May be opened by pilot as cutout. "Silencer" does not cause back-pressure.

Heel-operated cutout lever. The advantages of a silent exhaust for military planes are tremendous as can be readily seen, and have been subject of many experiments.

NEW ANTIAIRCRAFT AIDS

With research come these new designs for death via antiaircraft.

One of our latest antiaircraft "fly swatters" in action at Fort Tilden testing ground. Man seated at right receives aiming instructions from men stationed at computers.

They're in the movies now. Shells bursting about sleeve target are photographed in slow motion for later check and study. This leads to greater accuracy in aiming.

This does the dirty work. This new army antiaircraft fire computer collects all the range data, unscrambles it and gives correct firing data to gun crew via electric cables.

Out in Oklahoma where coyotes are plentiful, a home-built plane and self-taught pilot team up with a gunner for sport and profit.

The gunner, R. E. Frid, and Pilot Bomhoff.

1 There he is; let's get him! The dodging coyote is sighted and the chase begins across the prairie.

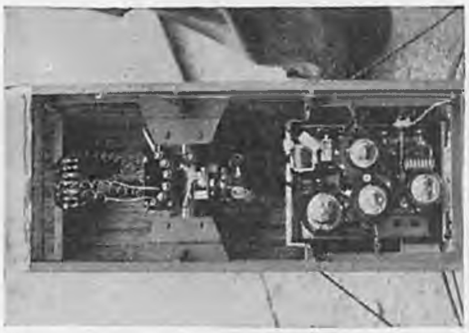
2 You got him! The zig-zagging plane finally overtakes the animal and gunner Frid goes to work.

3 Back to Bomhoff's home-built plane with trophy. Ship has paid for itself in coyote bounties and pelts.

4 Canade County, Okla., pays off well for good piloting and good marksmanship. Nice hunting!

MODEL PLANE OBEYS RADIO

This latest wrinkle is of international use for antiaircraft gunnery practice on flying model.



Left—Model built by Joe Raspante, of Brooklyn, N. Y., shown testing receiving set. Heavy-duty batteries used for testing preserve the plane's own.

Middle—Close-up of receiver and selector units. The receiving set weighs 15 ounces. Right—Tuning the receiver to the 5-meter ground transmitter.

Left—Tail assembly is provided with control wires, co-ordinated with selector unit in nose. Engine and rudder controls are all that control plane.

Middle—These batteries energize magnets that control ship. Right—Ground control to maneuver plane actuates six different aerial maneuvers.

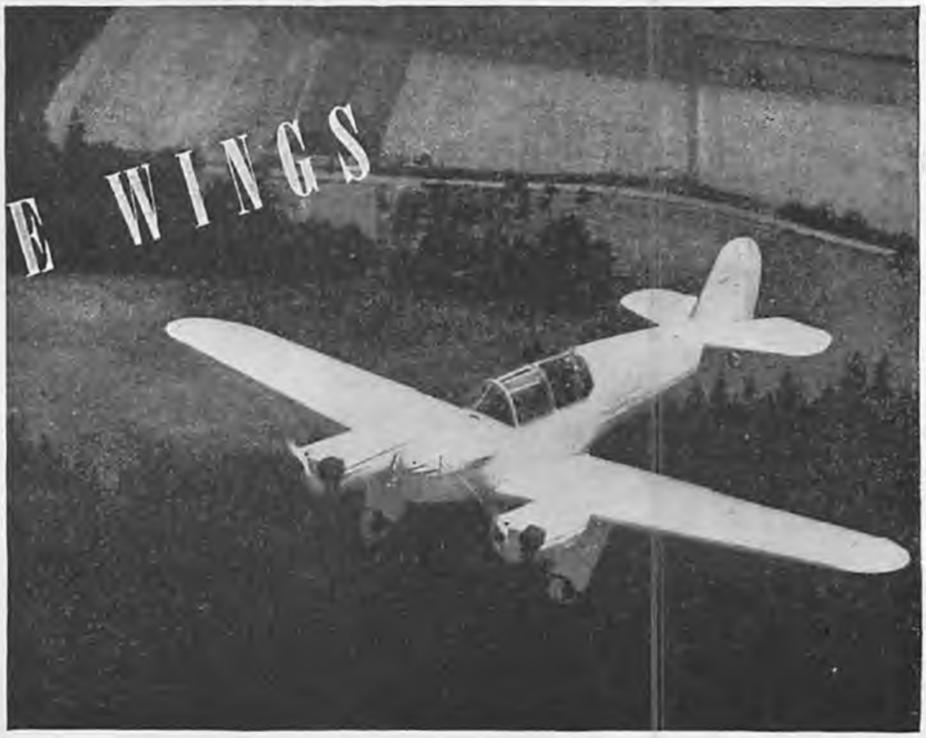
Setting up the control units. Transmitter is in the center, ground-control selector right. Latter does the actual controlling.

They even build the engines for some. This one has no gas lines; takes gas directly through crankcase.

Above—Built from "Student Prince" plans, this biplane of Jimmy Gaston's is a splendid performer. Left—Giving the impression of sitting with legs and feet through the bottom, Myron Buzwell warms up "Wimpy," another home-built job, for a trial hop.

HOMEMADE WINGS

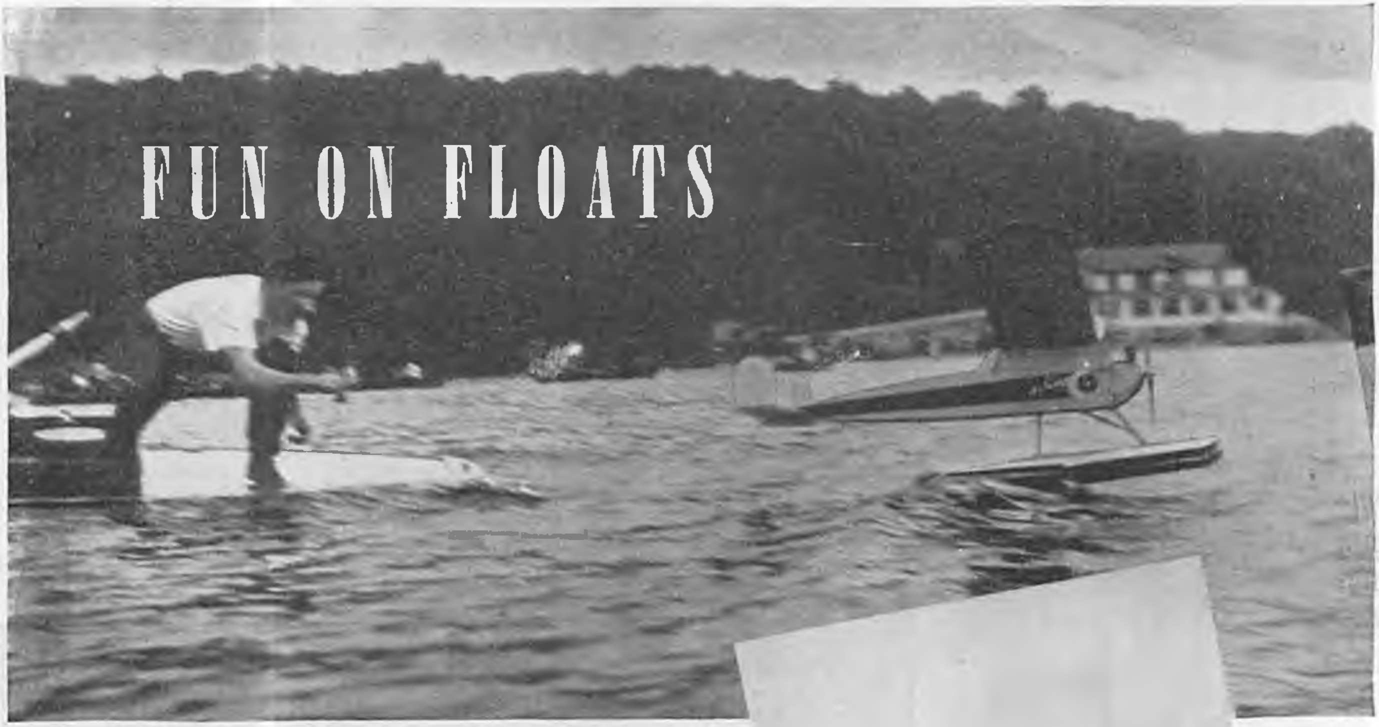
Presenting unique Beaverton Airport near Portland, Oregon — a fliers' club for "home-builders" only.



Above—They even build twin-engine jobs. This twin-engined monoplane built by George Yates, dean of the club, has many interesting details. Below—Having trouble? Gaston and Bigelow work on the latter's plane. When problem gets tough all pitch in.

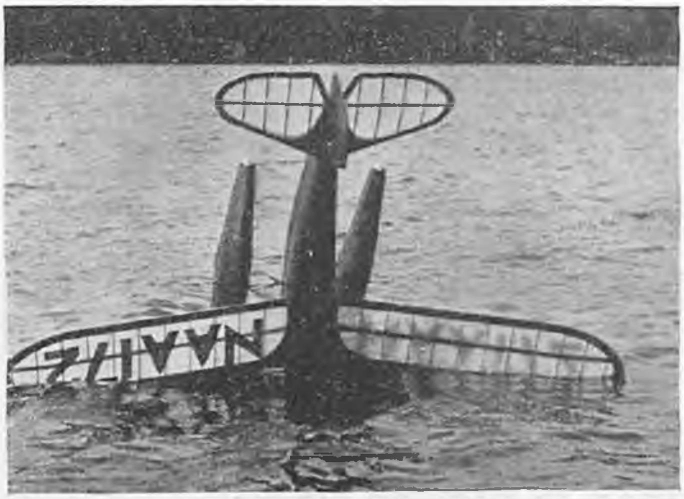
Walter Ruppert and the "Ruppert Special." Walt built this single-seater to be powered with a French motor. Note Oregon State license plate 6 on fuselage. Only State issuing licenses.

FUN ON FLOATS



Above—Planing for the take-off, ship seems to be getting off to a flying start. Take-offs proved difficult. Models were ducked frequently, builders not infrequently. Below—Everyone agreed on plenty of rudder area.

Right—Taibi's winning model putting in one of its three flights. And no delayed flights, either. Below—Looks like a float in the Tournament of Roses' parade. Everybody had a swell time, especially the spectators.



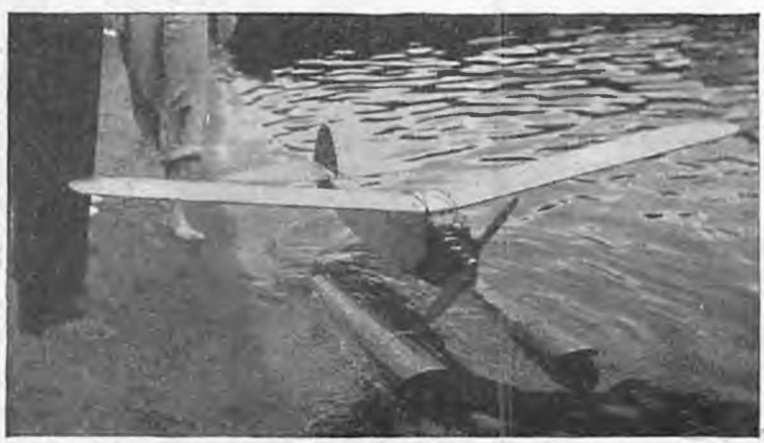
Characteristic pose. Once the boys got the hang of it, things just "sailed" along. It was like the old days. If it flies you're good.

The idea is to dunk the model without soaking the engine. Rocketeer demonstrates the technique.

A line-up of sea-going put-puts before contest. If names meant anything Clipper in foreground should have been right at home.

Here's one Zipper that didn't zip. Floats are a great equalizer. Wrong floats, no take-off.

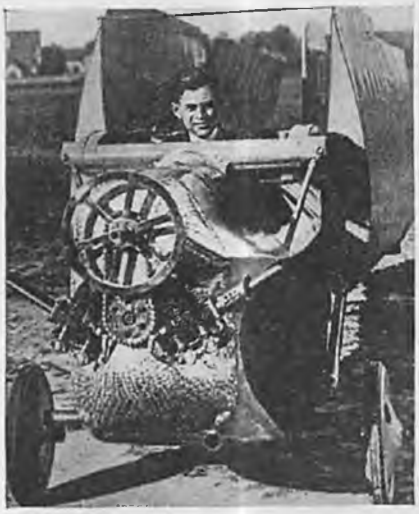
Seaplane contest at Lake Hopatcong, N. J., proved a natural. In fact, it was more of a picnic than contest.



Winning model, by Taibi. Floats are similar to one described in "Have You Tried Pontoons?" Taibi's consistency proved practicability of these floats.

from the FAMILY ALBUM

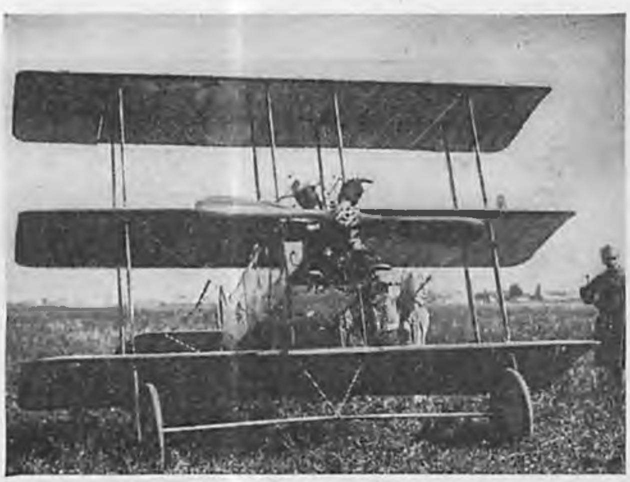
come these interesting and even astonishing early flying machines, brave foundation layers of our present-day aviation.



This little number was designed to drive through street traffic, or stone walls, when not being used for grinding coffee.

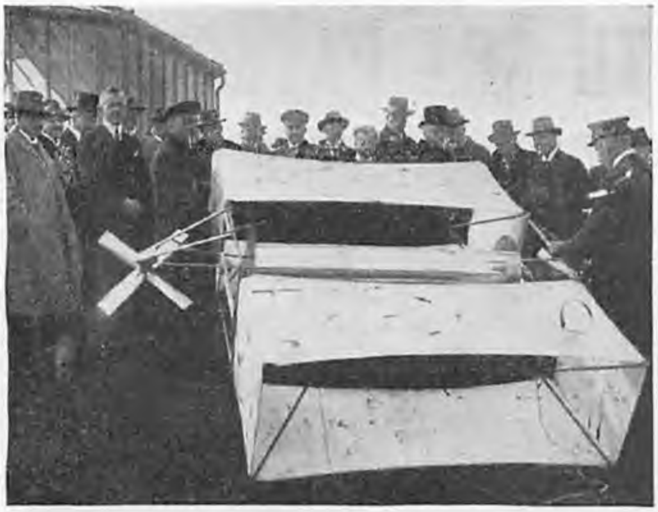
Stand back, you cad, you cannot touch my plane, or what? Another folding-wing type just a wee bit knock-kneed.

Flying over the Alps is quite a refreshing summer sport. So says the caption on this. We'll take a DC-3 transport, thanks.



This is not a trophy-winning model but the winner of an early Italian small-ship competition. This ship with a wing span of 13 feet was 15 feet long, made the amazing speed of 106 m.p.h.

Literally a screwy design if there ever was one. This twin-screw airliner for twenty-five passengers was designed for speeds up to 500 m.p.h., with a 498 m.p.h. tail wind built in.

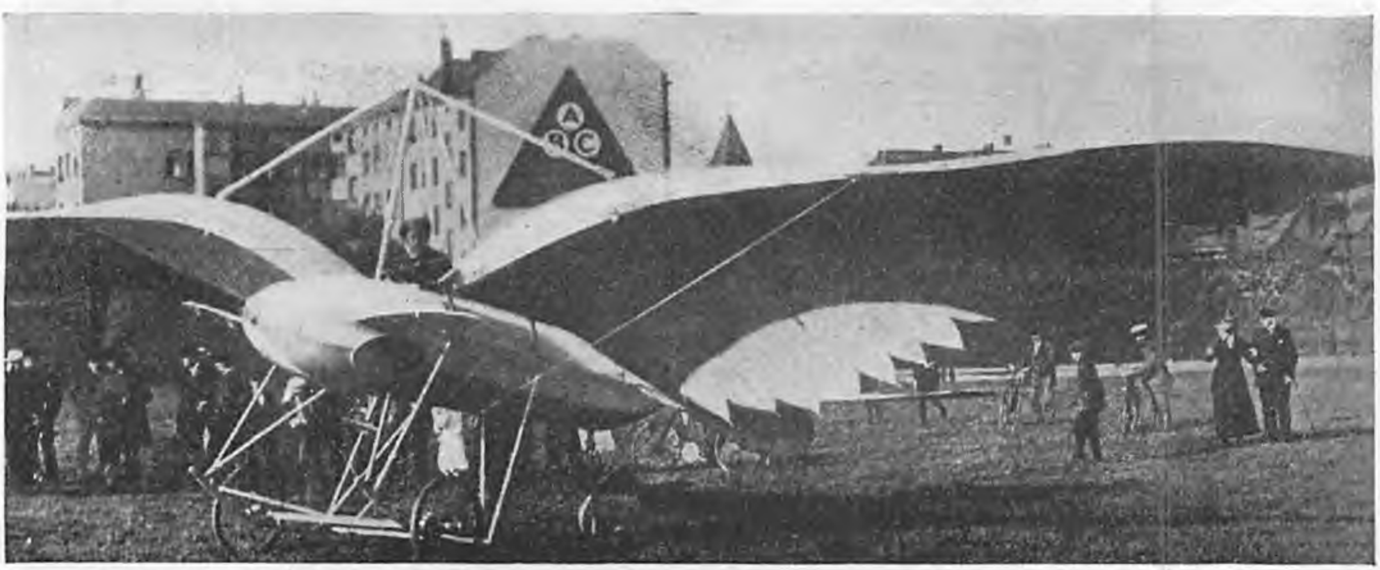


Built for kiting around your country estate in windy weather, this experimental prop-driven box kite appeared in Germany.

All this chap ever got out of aviation was some good lame legs and a ticket for "flying" in a Paris park, Le Bois de Bologne.

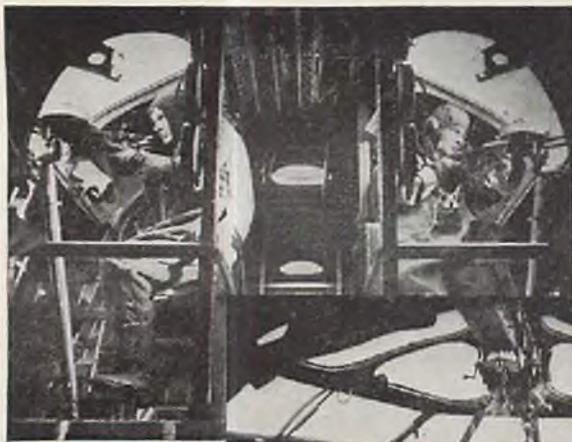
More kites! This one with its charming pilot was designed for war observation work. It actually lifted loads of 186 pounds.

A new helicopter "perfected by the U. S. air service at Mc-Cook Field" made a flight of two minutes and forty seconds.

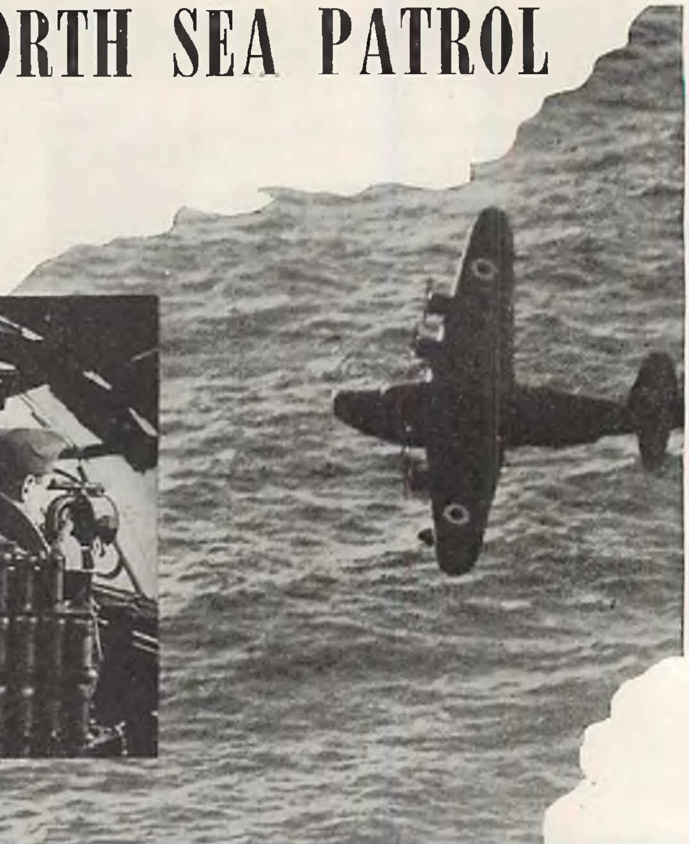


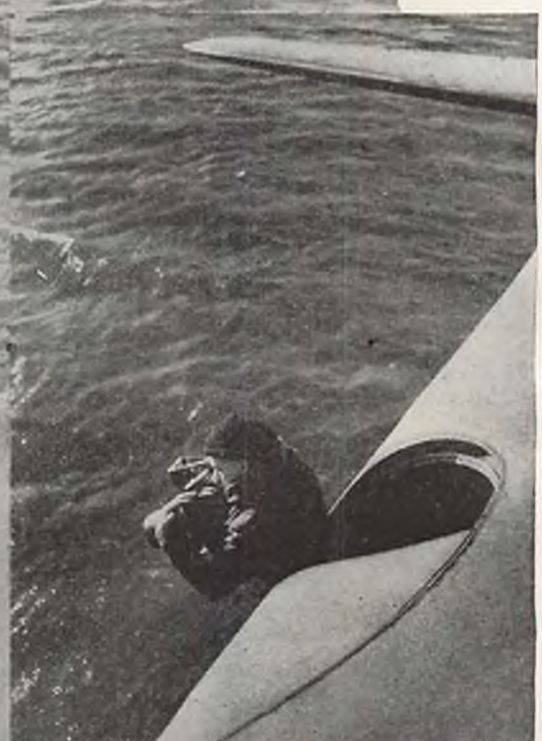
The caption says this, er, flying machine was able to rise to a height of 150 feet but could not make any headway. Tsk!

NORTH SEA PATROL



Right—Copilot, right, using flash lamp in place of radio to prevent interception of messages. Above—Side machine gunners in Sunderland flying boat keep a constant watch.





Right—Tale's end, and that, too, of whoever comes close. The four-gun threat of the tail turret of the huge four-engined North Sea Patrol boat. Just before take-off.

Above—With a safety cord about his neck just in case the camera slips, this R. A. F. photographer "shoots" a lone vessel for the record. Planes keep a constant vigil.

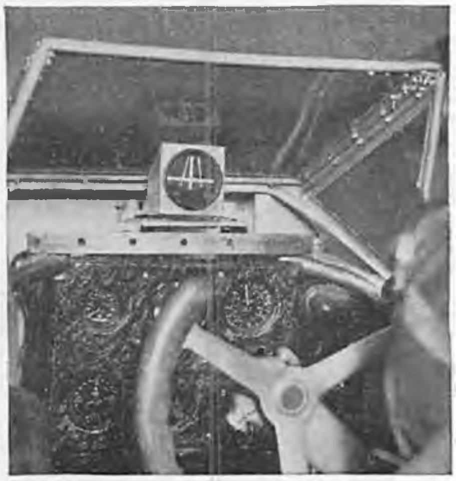
THE PASSENGER LISTENS IN!

What next? The latest innovation for aerial entertainment has been installed by T. W. A. for the air passengers.

Individual receivers covered with sponge rubber are slipped under passengers' pillows, bringing them popular programs from below. Center—Hostess Frances Ice tunes in, checking with own Husha-tone receiver. Right—Capt. Weaver breaks in with flight data.

MAGNETIC LANDING

Drawn as by a magnet to the field no longer fiction, for the navy's new magnetic-beam landing system does just that.



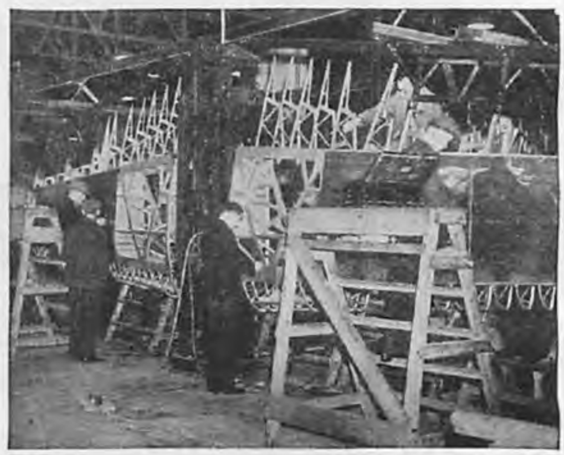
The man-behind-the-beam adjusts the control panel that sends the current into the cables buried under the runway. These beams set up a magnetic field effective over 9,000 feet in all directions. Center—The apex of the cables buried underground, unaffected by weather conditions. Buried cable at right goes to power panel. Right—Beam indicator in cockpit shows pilot position of runway.

British Hurricane does 335 m.p.h. Left—Fuselages on the assembly line reveal old-fashioned construction. Much covering is of fabric.

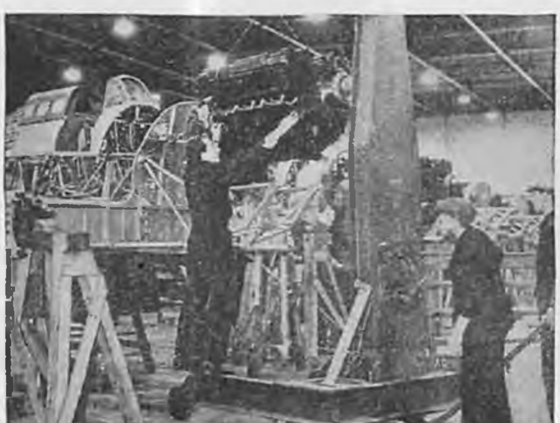
Hurricane, eight-gun interceptor, combines old and new types of construction.

HAWKER'S NEST

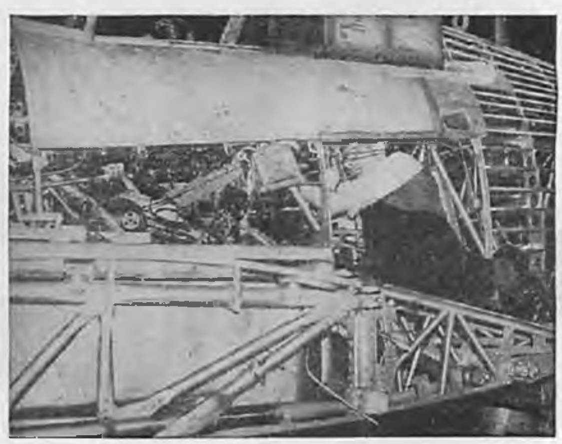
Turtleback is made of wood formers. Fuselage, aft of the cockpit, is fabric-covered. Bullets make a clean exit.



Assembling wing in its jig. Metal-skin covering forward of rear spar. Hurricane is large, spanning 40 feet.



Famous Rolls-Royce engine is lowered into place by crane. A fine engine, the Merlin develops 1,050 h.p.



Headaches galore. Production is limited by number of men able to squeeze into tight spots like this.

CALLING ALL LIGHT PLANES

And there are plenty of them to answer with safe, economical flight for John Q. Pilot's family.

The 1940 Piper Cub Coupe is helping to make sport flying more popular than ever.

The Stinson 105 may be had in either 75 or 80 h.p. and features new luxury interior.

Louise Thaden stands beside the sleek Porterfield Collegiate Trainer, Model 50.

Who else but Roscoe Turner could pose so well beside the Taylorcraft he sells.

Presenting one of the new light planes, the Culver, featuring retractable wheels.

New 75 h.p. light plane is the Funk with its inverted four-cylinder in-line engine.

Another low-wing light plane appears in the form of this sleek Jensen sport plane.

The all-metal Luscombe is adapted to floats quickly attached and makes a fine seaplane.

The Brown L-5 presents an interesting light plane design for use in the "Flying 40s."

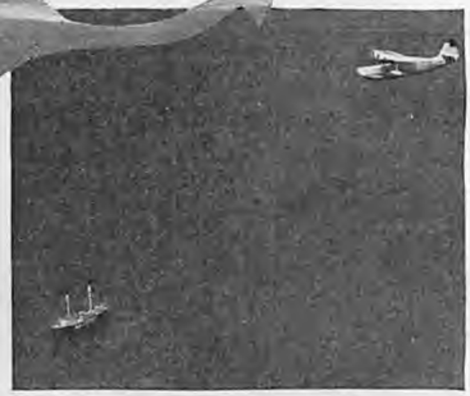
Another newcomer to the light-plane field is product of Aircraft Corp., Laporte, Ind.

COAST PATROL

150th anniversary of Coast Guard sees it on special duty in the air.

Lieut. Watson A. Burton, Commander, Floyd Bennett station; Lieut. McCue, patrol plane pilot, chart course of flight.

Over New York harbor on way out to sea. The Coast Guard is charged with law enforcement on waters adjacent to the United States.



Ambrose Lightship, actual point of departure. These lightships serve as "radio beacons" for direction-finding bearings in flight.

Scanning the ocean, mechanic keeps lookout for suspicious surface vessels.

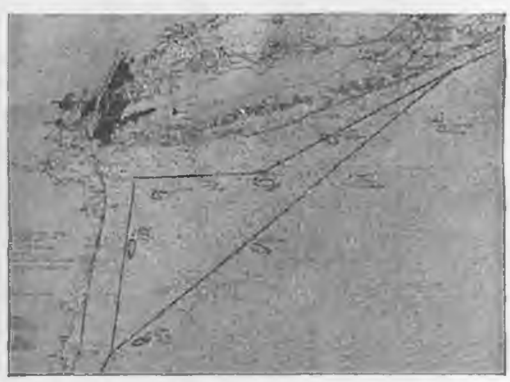
Off shore 60 miles, the plane passes a merchantman. Photo was taken to rear under tail.

Plane approaches vessel into wind in case emergency landing on water is necessary.

The boat's position is noted on navigation chart. Because of the heavy shipping in the area, patrol plane flies at 500 feet altitude.

Suspicious activities of sighted shipping are radioed back to District Divisional Headquarters. Plane gives its own position every 15 minutes.

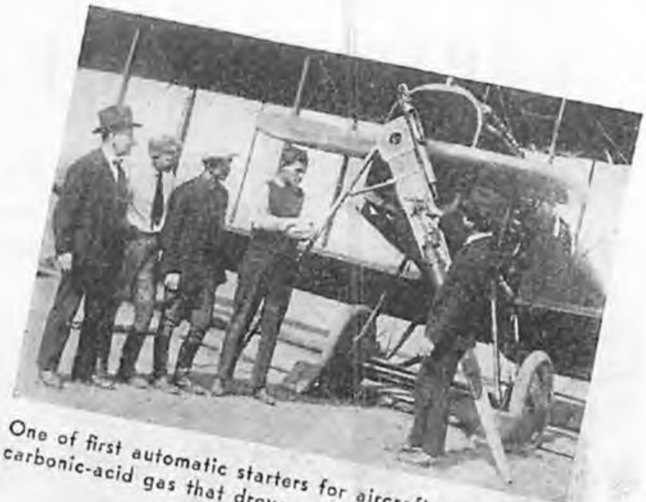
Patrol over, mechanic lowers wheels. Out three hours, plane covered 3,600 square miles.



"Track chart" drawn after return records everything sighted. Chart shows U. S. submarine, blimp, wreckage, empty lifeboat, merchantmen.

FLYING FIRSTS

There always has to be a FIRST of anything. Here are several of aviation's.



One of first automatic starters for aircraft engines used carbonic-acid gas that drove a tripod-mounted plunger.

The brave beginning of a modern miracle, the automatic pilot. This early version, built by Robert Mitton, proved merit of instrument later developed.

Another first. Anthony Fokker and Engineer Seekatz on first flight with passenger in motorless craft. Seekatz made first photos from glider.

The first slotted-wing plane to come to America was this de Havilland Moth flown by James Taylor. One of the smallest planes built, it featured stall-preventing slots perfected by Handley Page.

America's first all-metal plane, the J.L.-6 carried 6 passengers 120 miles in 59 minutes. Some speed! Note fashions in vogue.

Looking slightly airsick already, the world's first air stewards prepare to look after the wants of the cash customers.

Erected in Hounslow, England, first "lighthouse for airmen" was run by acetylene gas. On its tower is apparent skeptic.

J. E. Carroll, inventor of the first reversible-pitch propeller, pauses for a few puffs while adjusting the gears before a trial.

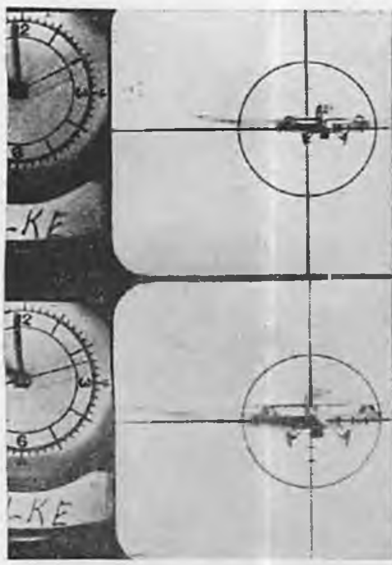
GADGETS A LA SWASTIKA

What the well-equipped German war flier carries. Here are some of the devices and accessories employed to aid him in his work.

German naval flier blows up. This seaplane pilot tests his rubber life preserver. These are inflated with gas, in emergency breath-inflated.

German officer points to bullet holes in gadget to test machine guns. These guns are syncronized to fire through blades of propeller. This shows where the bullets hit the disk.

A new slant on German bombing technique. These diagonal lines painted upon fuselage side are to aid the bombardier. Note plane is light below and dark above.



Two seconds to live. This photo-shooting of his target shows that within two seconds the pilot's aim was perfect, at least in training.

Camera gun used to train pilots in aerial murder. This takes the pictures shown at left. The pilot is lining up his camera gun before take-off. After flight pictures are checked.

Down to the sea in tin cans go these emergency radio sets. Sealed in moisture-proof tin containers, they are carried by bombers in case of crash sea landings.

WHERE'S THAT HORIZON?

"It must be fun to stunt in a sailplane." Then climb aboard with Emil Lehecka, sailplane aerobatic expert and 1938 National champion. He's going for a ride!

Inside the two-place Schweizer. Flight cards are filled out for Emil. Photos from rear seat.

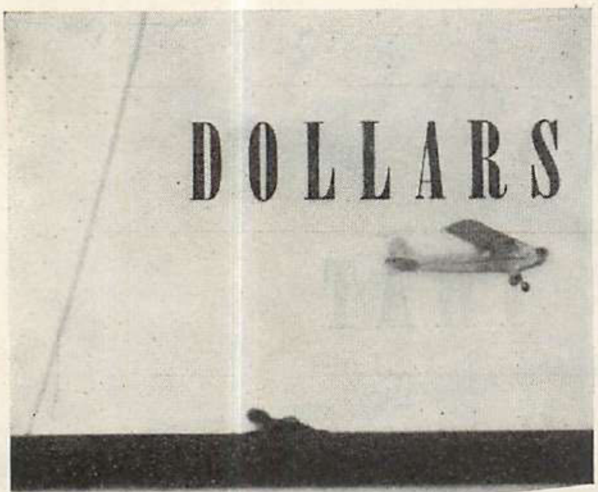
Climbing to a stunting altitude; usually over 2,000 feet, which leaves a good safety margin.

Here we are—now for a loop! John Robinson's "Robin" above moves over in clear.

Oh-h-h, what's the earth up there for? Note the horizon through transparent cowling.

Now a spin! Those are parked cars above, er, below. Well, anyway, there are cars!

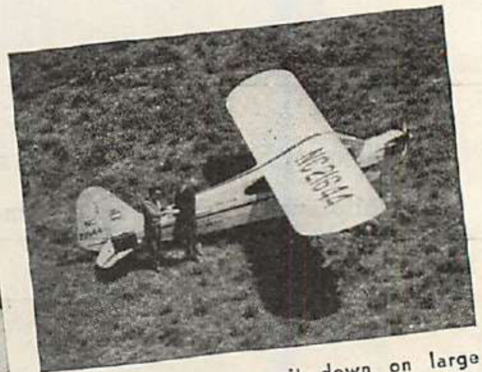
We slip in for a landing upon Harris Hill, Elmira, N. Y., from which we took off.



DOLLARS FROM HEAVEN

Archie Baxter of Floyd Bennett Field cashes in on his ingenuity and Piper Cub for big profits.

One original source of income for Archie is his flat rate to local camera clubs for trips over New York or the New York World's Fair.

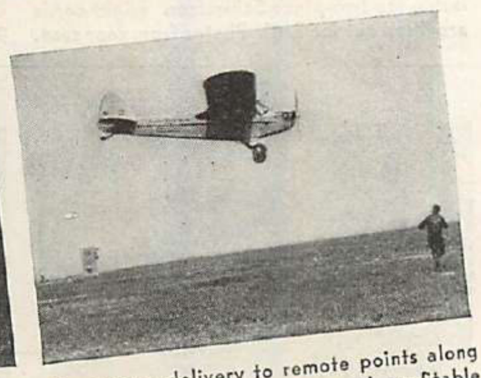


His light plane can sit down on large estates, farms or almost anywhere his many rural "fares" care to get to in a hurry.

The delivery of spare parts by light plane not only saves time, but often enables the parts to be delivered directly to the stranded ship.

The comparatively slow light plane makes coverage of various races possible for radio announcer and profitable for Baxter.

Aerial signs $10 an hour, farewell messages to departing passengers on ships, are made with special gummed tape easily peeled off.

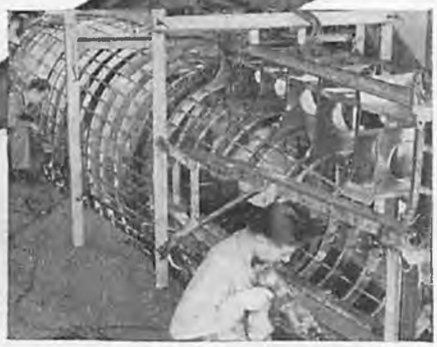


Newspaper delivery to remote points along the coast proved a happy and profitable thought. Now, then, what do you suggest?

BIRTH OF A SUPER "B" LINER

Manufacturer and purchaser check every detail of the ship from plan to completed plane.

The first step in building a "B" Liner is the agreement on plans and details. H. W. Beals, Braniff's factory representative, and Dan Gillmore, project engineer, consult.



The various parts are placed in the jig and riveted in place. This shows fuselage cabin being assembled and riveted together. All the rivets are hand-drilled.

After the fuselage has been assembled the metal skin is riveted on over the forming strips. Such construction assures strength much greater than ever needed.

The cabin is given wings. These have been built and covered, or "skinned," in another part of the factory and moved up with cranes. Now come the load tests.

Here we begin to recognize the wagon as the line's name and insignia are applied with air brush and stencil to the shiny metal sides of the giant Douglas transport.

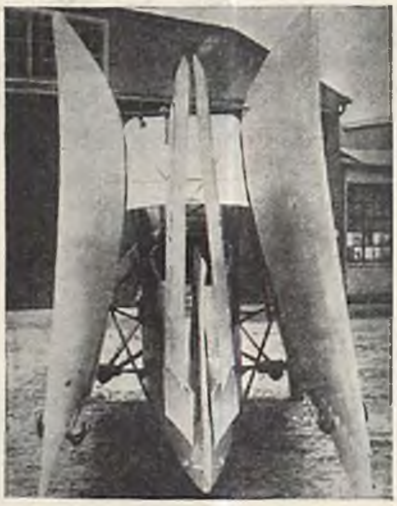
Now, if you'll step inside. Here we have Beals and Gillmore discussing the liner's interior appointments. Notice the photomurals in front of "B" Liner's cabin.

Like a jockey before a race, the liners are weighed in before the test flights. They must check with the weight figures planned for in the original design of huge transport.

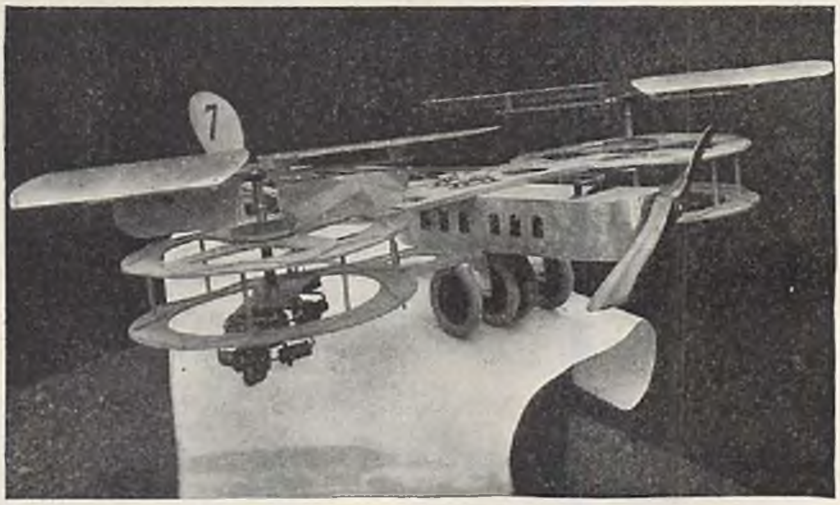
Ready for flight, the Super "B" Liner emerges from the factory. At last the test flights and final acceptance into Braniff Airways service, another link in our airways.

from the FAMILY ALBUM

come these further pictures in our interesting series showing early flying machines—actual, projected, and unexpected. All forerunners of our present planes.

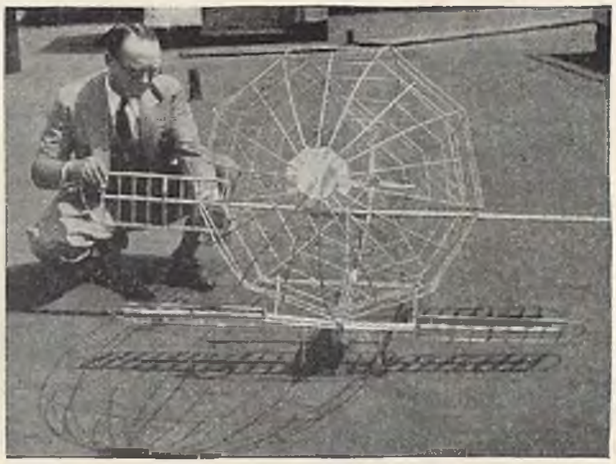


Don't look now but this is, or was, the smallest collapsible plane built. In flight it collapsed to an even smaller size.



According to the caption, "The machine is designed on the planetary system, the central axis of the lifting surfaces representing the sun and the motors and traction wheels the satellites." Apparently there was a total eclipse of the entire system.

Capable of grinding for either drip or percolator, this little model created quite a sensation; that of sitting on the ground while your head was frantically fanned by a winged totem pole.

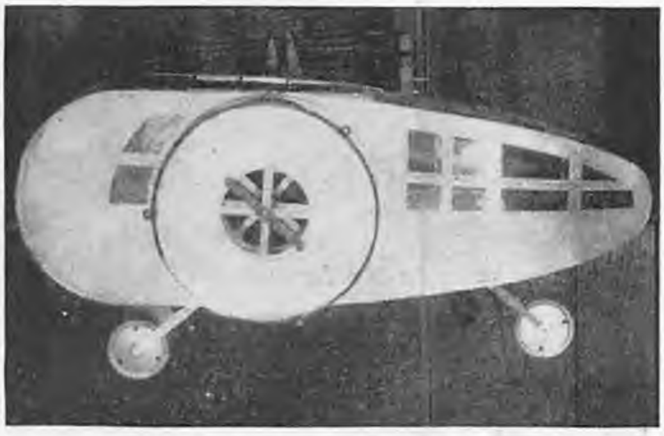


Stand back, spies! This flying-spiderweb-appearing dohicky is a model of a winged dirigible, a super-airship with many possibilities. The wings were intended to aid in vertical ascent.

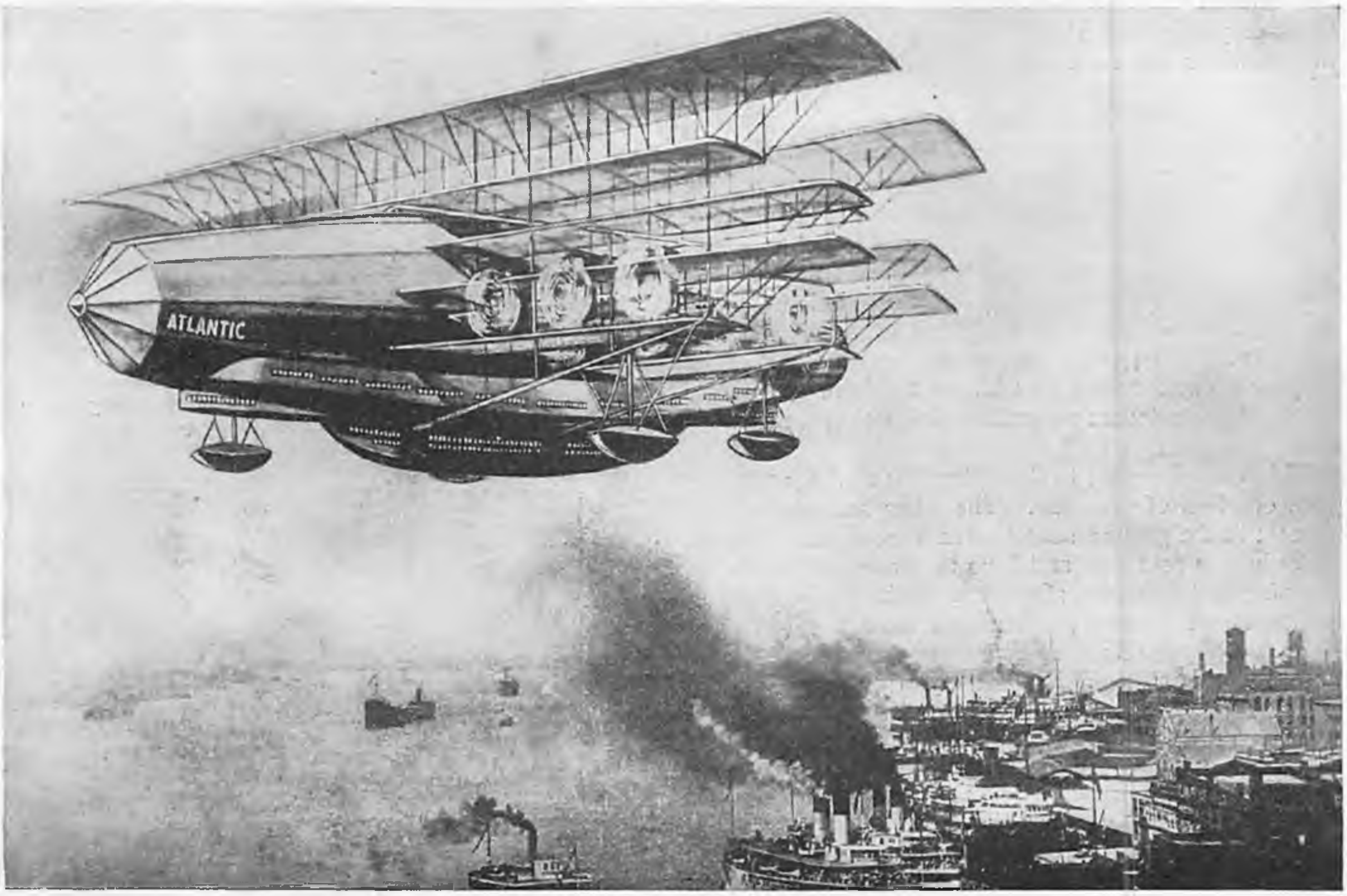
When is a plane not a plane? When it's a submarine. They foxed us on this one and combined the two. Wheels would allow the pilot to cruise along the bottom in perfect safety.

The 1940 trimotor Foozle. By turning the outboard engines down you went up, like a rocket. By turning them up you went down, for the last time. By turning one up and one down. . . .

This is what happens when engineers can't agree as to where to put the wing. All four engineers won! It had accommodations for 100 passengers, and the little man who wasn't there.



You've got something there, Willie! Unfortunately we don't just know what. This flying slot machine with the built-in jackpot and paddle wheels created lots of talk but no lift.



See your oculist twice a year. This drawing was made under the expert supervision of the inventor and an equally poor light.

FLYING CADET'S DAY

A letter home to the family pictures cadet life at Kelly.

BY LIEUTENANT ROBERT J. BRUTON

Against a background of Curtiss P-36s, included as part of advance training at Kelly, grins a typical cadet.

DEAR DAD: Since becoming a Flying Cadet at Kelly Field, I find that I have not written to you as regularly as I should have. I hope, however, that you will forgive my past misdemeanors, as this time I plan to write you a really long letter. I plan to answer all the questions you have been asking me as to what I do with myself throughout the day.

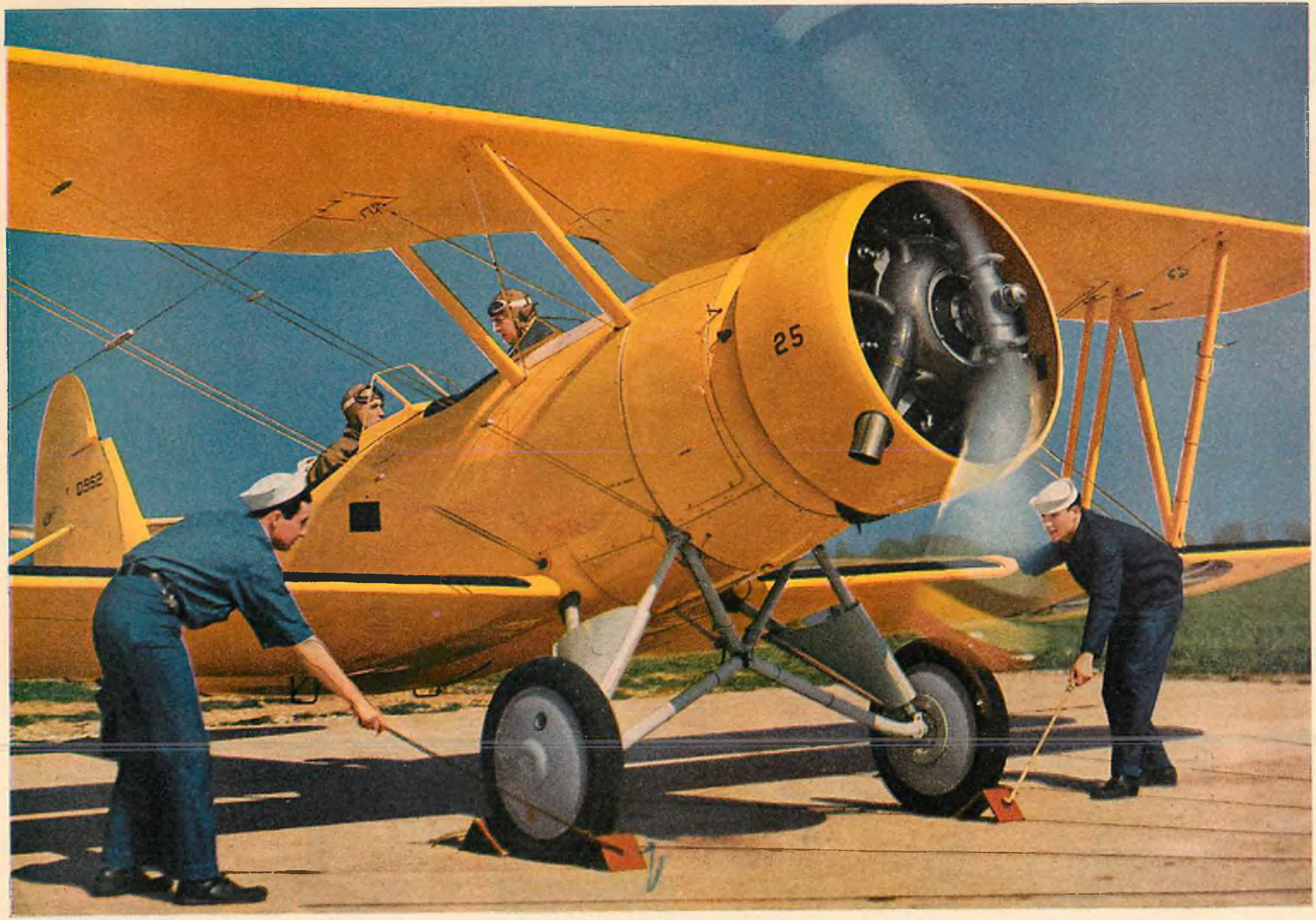
As you already know, we live in one long building divided into ten bays, each bay accommodating twenty-four cadets. Picture if you can the turmoil that takes place at 5:30 every morning—reveille. At that time we dress, make up our beds, and perform all the other necessary duties, such as sweeping around our cots, putting our clothes away, and making ourselves presentable for the day's work. At 6:15 we fall in ranks to march to breakfast. The government allows each Flying Cadet a dollar a day for food, in addition to his regular salary of seventy-five dollars a month, which means we eat very well.

This week I report to the flying line at 7 a. m., along with one half of my class. The other half of the class reports to the ground school. Next week, however, the procedure is reversed, and I go to ground school in the morning and fly in the afternoon. Before going further, I should explain the organization on the flying line. Our class is divided into four equal parts, according to the alphabet, the first alphabetical quarter making up the First Section, the second quarter making up the Second Section, et cetera.

Being assigned to the First Section, at 7 o'clock I report down to the section where I meet my instructor. He may take this opportunity to point out to us the mistakes we have been making in our flying and how best to correct them. In addition, if we are to begin some new phase of flying that morning, he will *(Turn to page 95)*

Gosh, I hope everything's O. K. The weekly inspection of cadets and their equipment takes place Saturday morning.

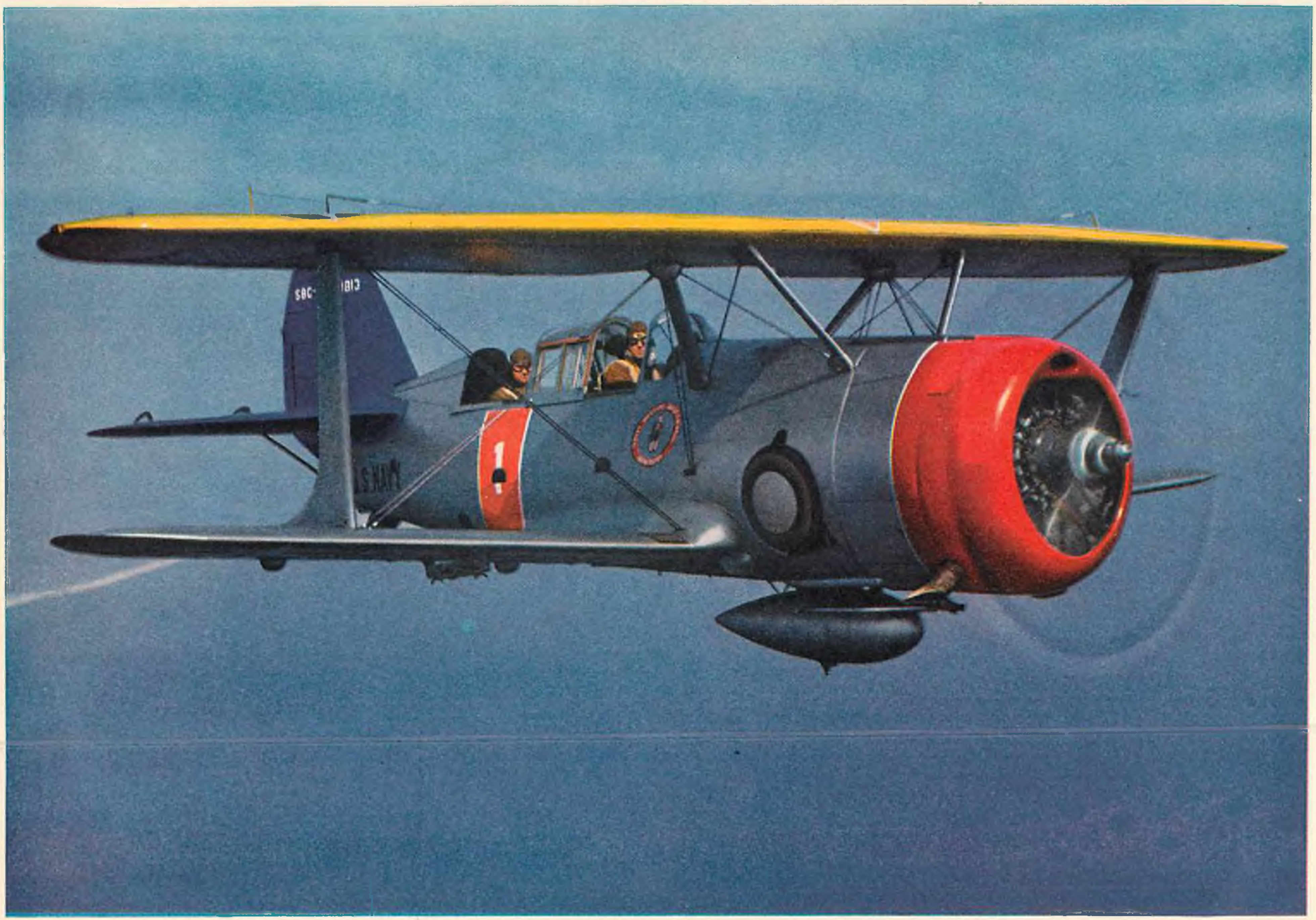
The "buzzer room" where code is taught. The instructor, right, sends code with "bug" to the cadets.



NAVY N3N-1 TRAINER

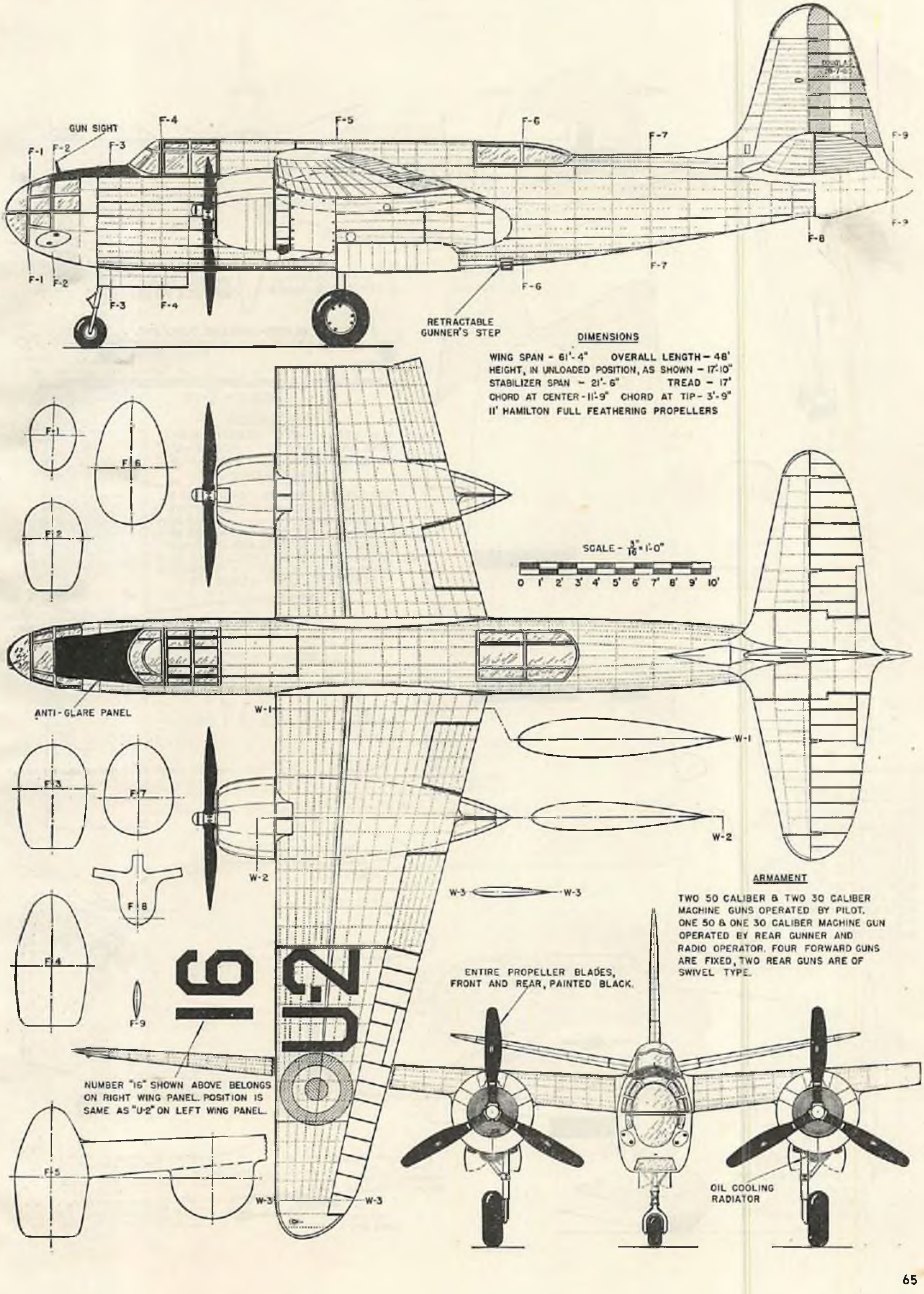
DOUGLAS DC-3 TRANSPORT

PIPER CRUISER

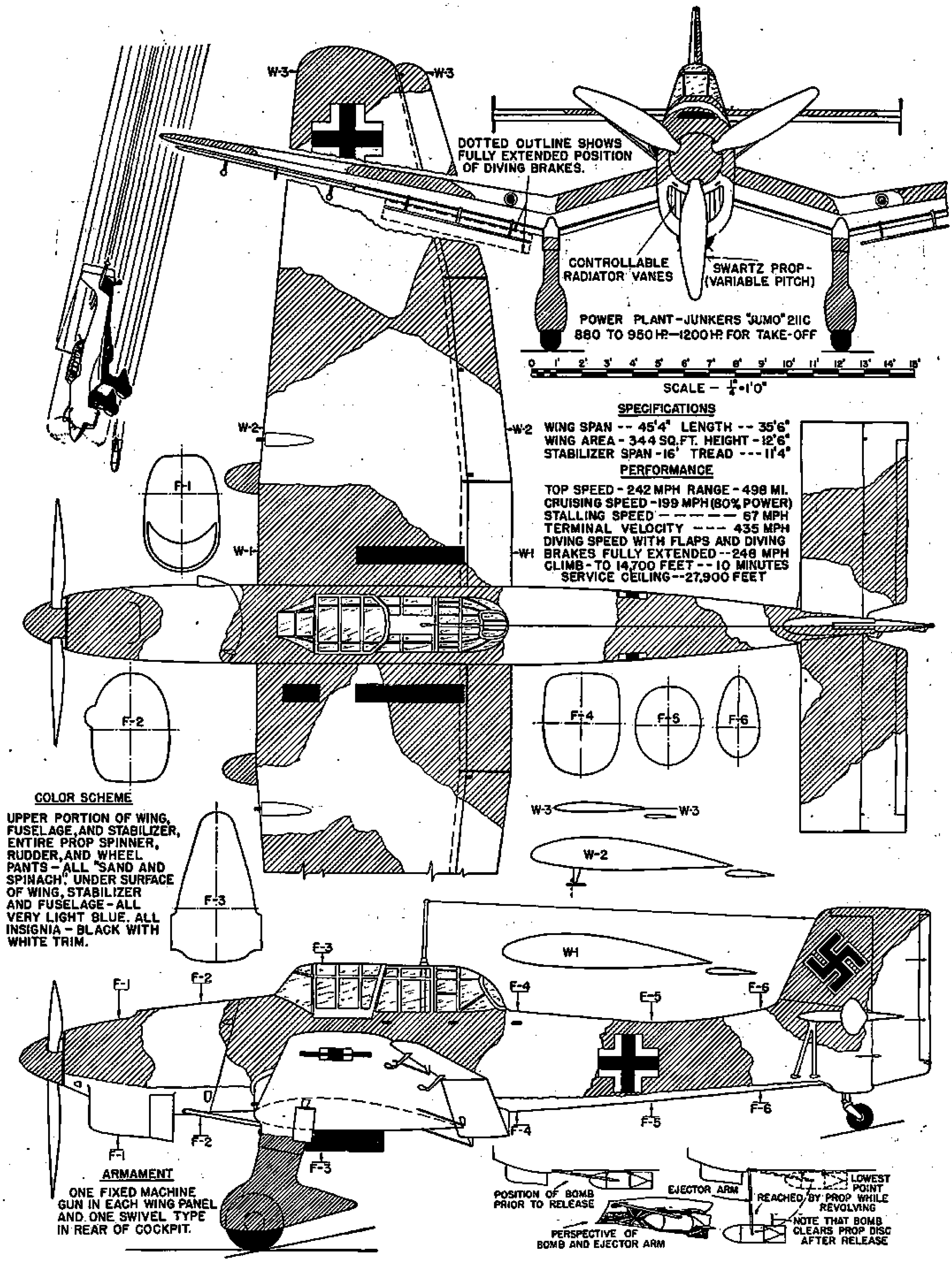


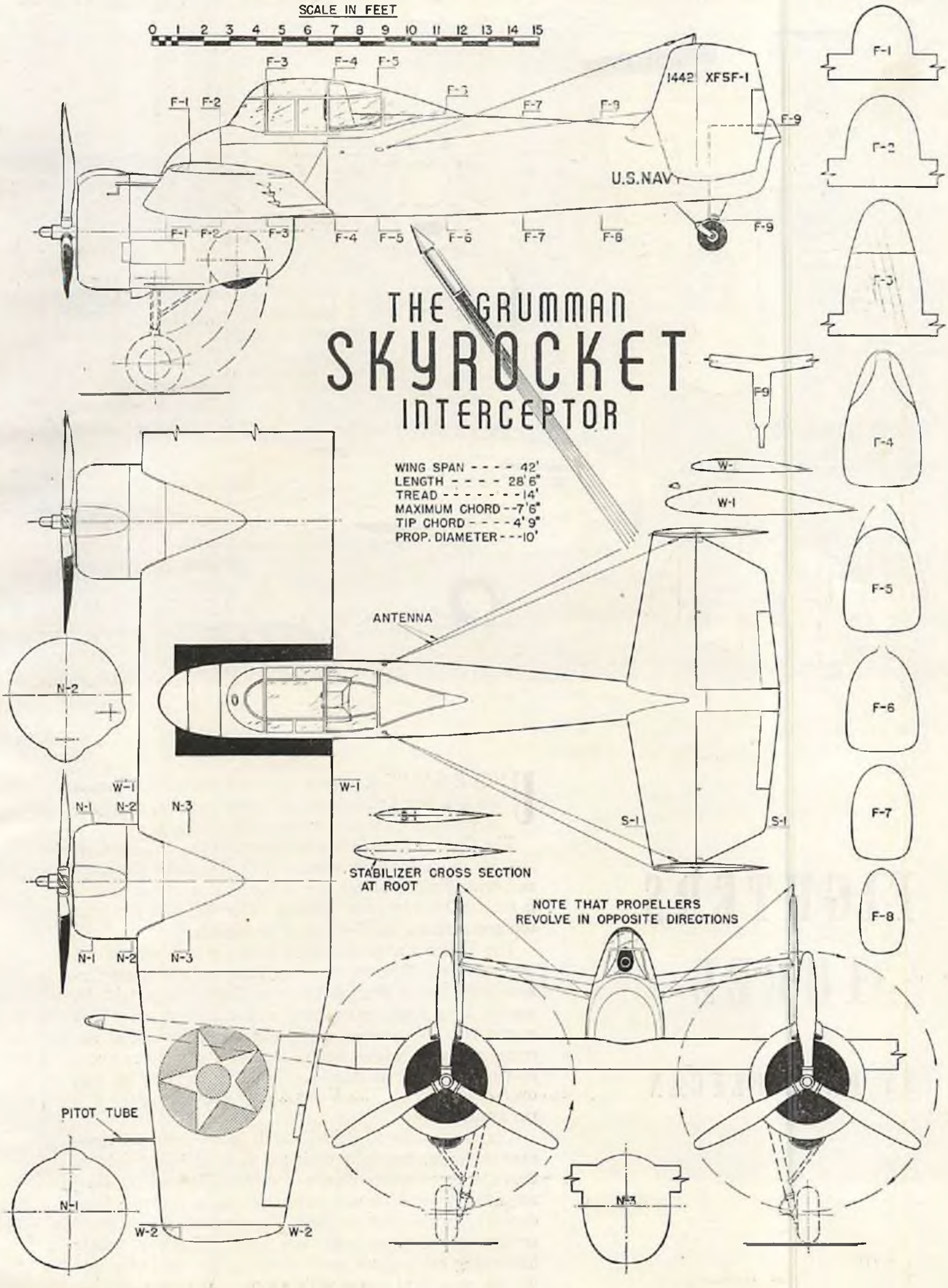
CURTISS SBC-4 DIVE BOMBER

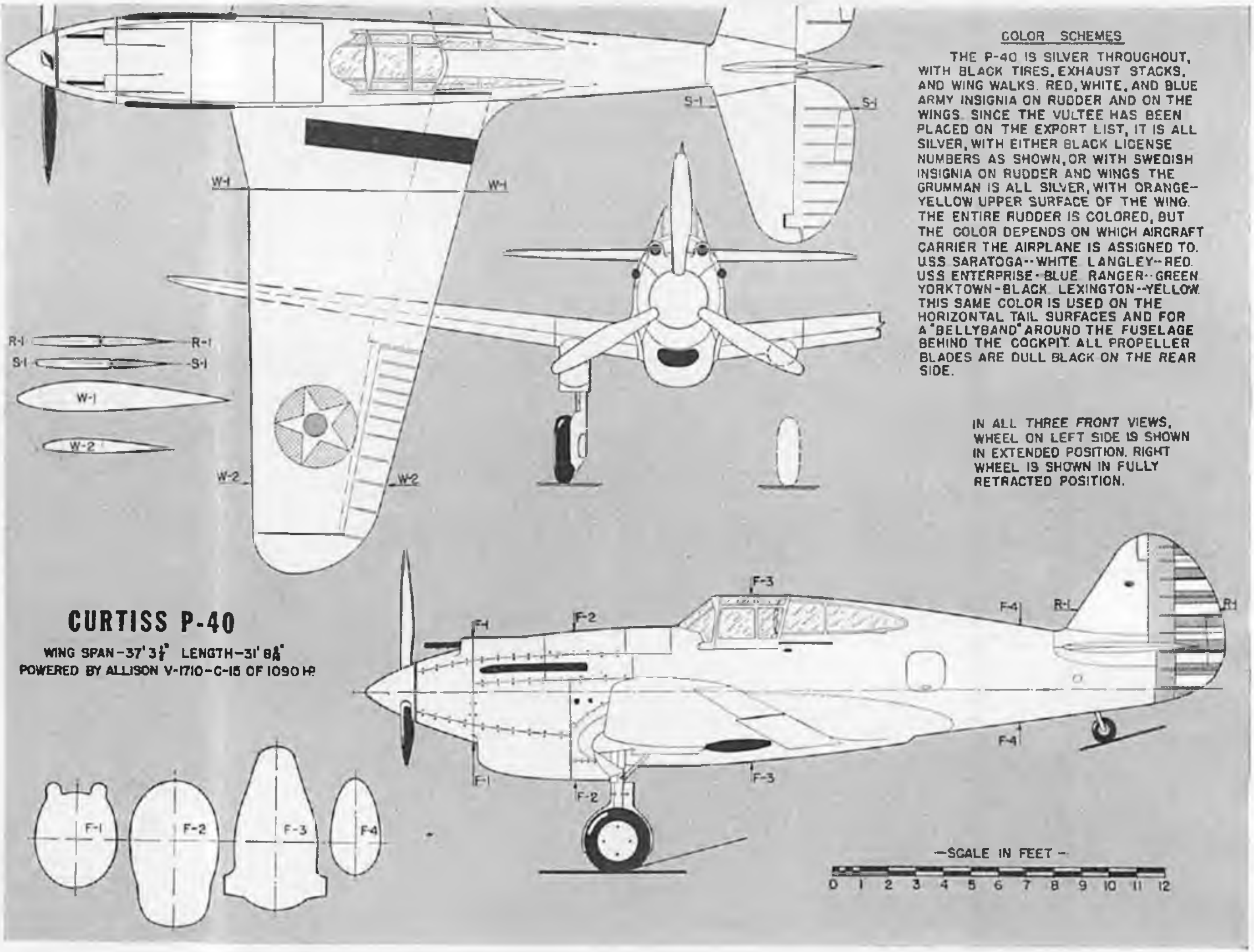
French Bomber—the DOUGLAS DB-7



GERMAN DIVE-BOMBER JUNKERS JU-87B




THE GRUMMAN
SKYROCKET
INTERCEPTOR
SCALE IN FEET
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1442 XF5F-1
U.S.NAVY
F-1 F-2 F-3 F-4 F-5 F-6 F-7 F-8 F-9
WING SPAN - - - - 42'
LENGTH - - - - 28' 6"
TREAD - - - - - - - - 14'
MAXIMUM CHORD - - 7' 6"
TIP CHORD - - - - 4' 9"
PROP. DIAMETER - - - 10'
ANTENNA
N-1 N-2 N-3
W-1 W-2
S-1
STABILIZER CROSS SECTION AT ROOT
NOTE THAT PROPELLERS REVOLVE IN OPPOSITE DIRECTIONS
PITOT TUBE



FIGHTERS THREE

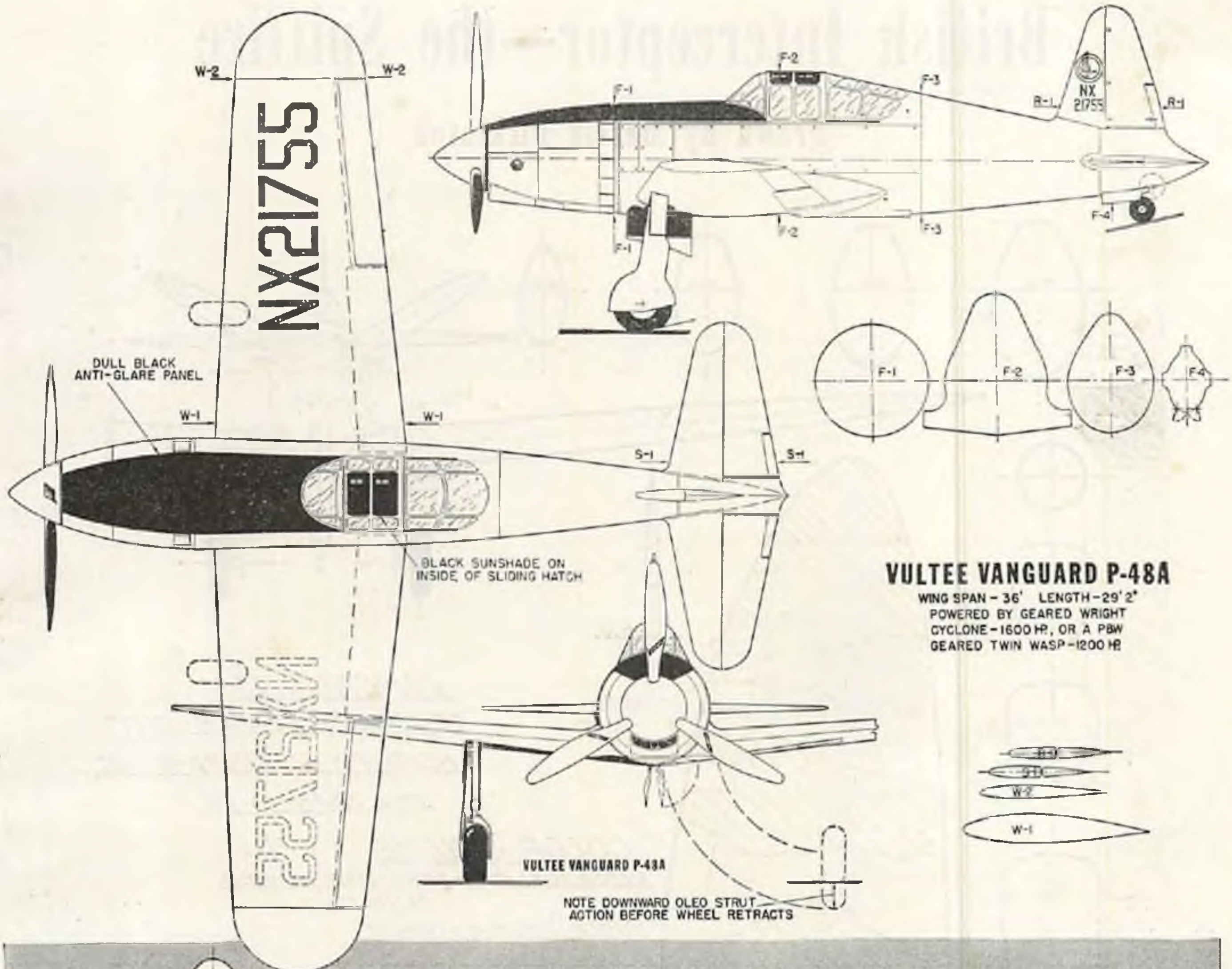
BY PAUL PLECAN

UNCLE SAM'S insurance against invading bombers is his first-line fighting planes, three foremost examples of which are shown on these two pages.

The Curtiss P-40 is the successor to the famous Curtiss Hawk, already in service with the army air corps and with France before her defeat. The P-40's engine is the 1090 horsepower Allison. Her 400-mile-per-hour top speed ranks the P-40 as a formidable fighter.

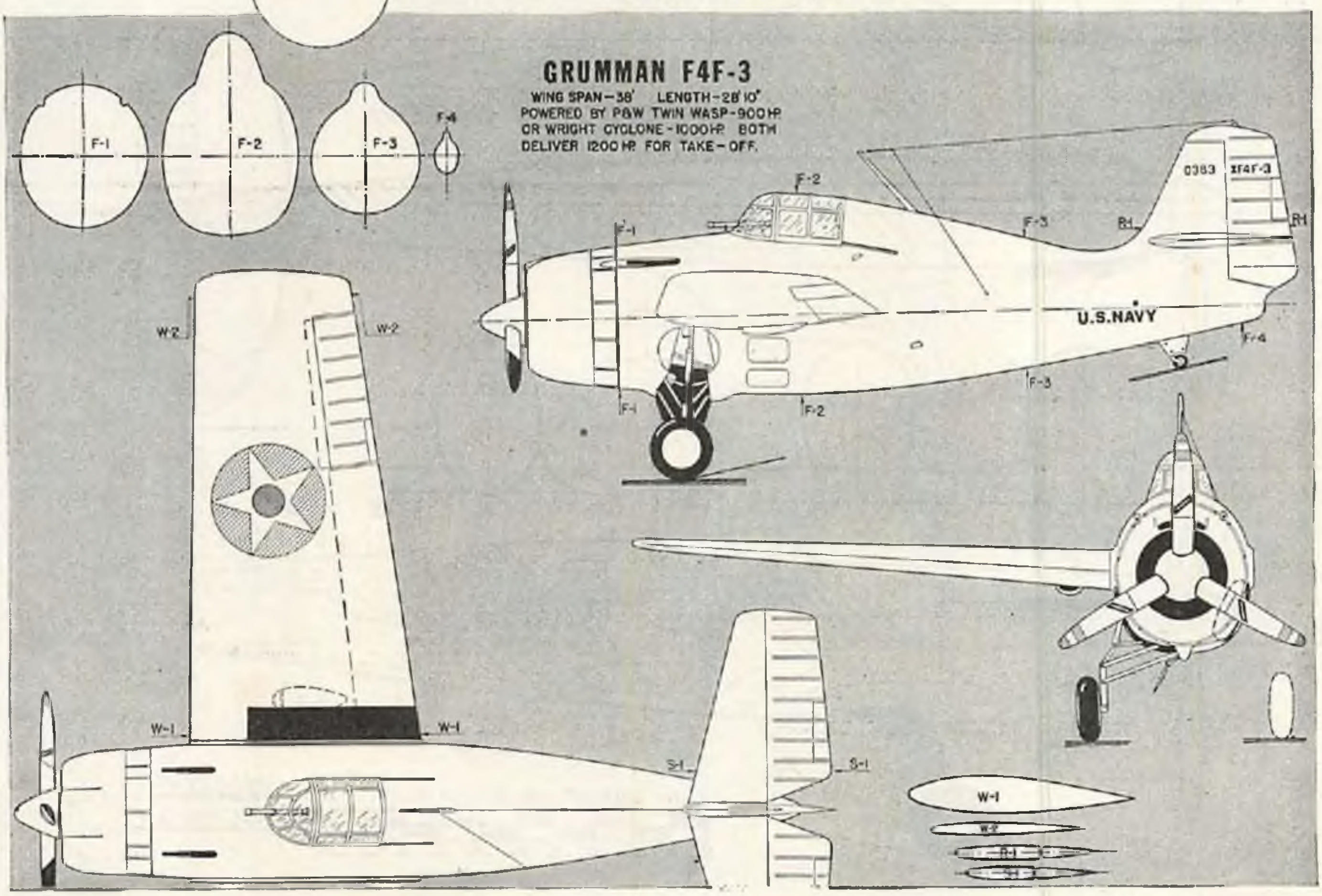
The Vultee Vanguard also is built for both export and army service. The outstanding feature of the army version is the secret Pratt & Whitney Twin Wasp, with its special long shaft, permitting a sharklike nose. This engine is highly supercharged and performs well at extreme altitudes, where raiding bombers will fly to avoid antiaircraft fire. It develops 1,000 horsepower at well over 20,000 feet. The Vanguard is good for 400 miles per hour.

The navy packs a wicked punch in its stumpy Grumman midwing, especially designed as a shipboard fighter. Don't let those square corners fool you. Experts say they are actually better, in the proper places, of course. Incidentally, square corners are a characteristic of the Messerschmitts, Stukas, and late-model Heinkels. One interesting thing about navy planes is the need of painting all structural parts with special corrosion-resisting paint because of the salt water. The Grumman has a 1,200-horsepower Pratt & Whitney to yank it upstairs.



VULTEE VANGUARD P-48A

WING SPAN - 36' LENGTH - 29' 2"
POWERED BY GEARED WRIGHT CYCLONE - 1600 HP, OR A P&W GEARED TWIN WASP - 1200 HP

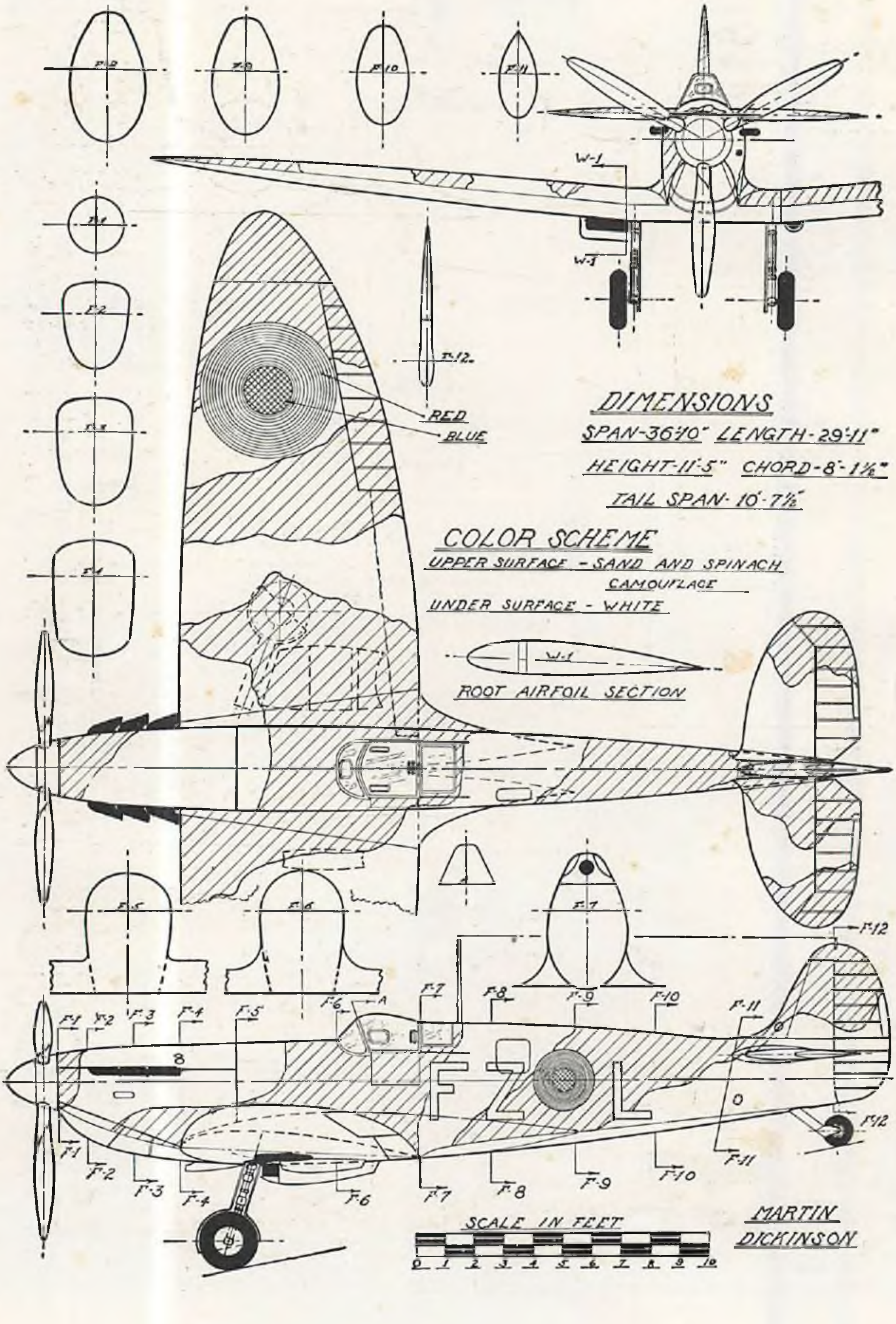


GRUMMAN F4F-3

WING SPAN - 38' LENGTH - 28' 10"
POWERED BY P&W TWIN WASP - 900 HP OR WRIGHT CYCLONE - 1000 HP. BOTH DELIVER 1200 HP FOR TAKE-OFF.

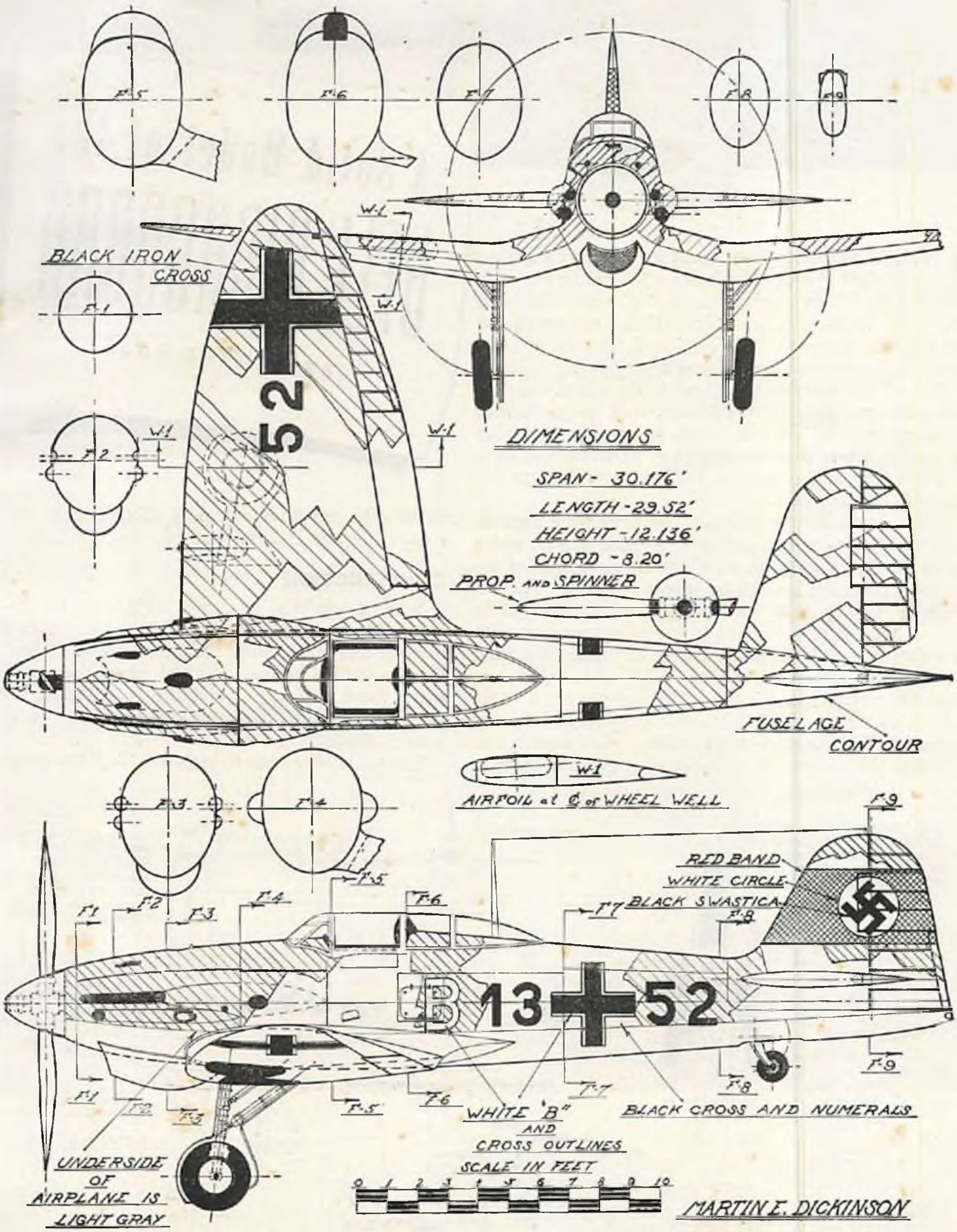
British Interceptor—the Spitfire

Drawn By Martin Dickinson



THE HEINKEL FIGHTER

BY MARTIN E. DICKINSON



A Solid Model of the BELL AIRACOBRA

BY GEORGE ROSS

LATEST pursuit to be accepted by the army air corps is the Bell P-39, or Airacobra. Official figures state that the P-39's maximum speed is "around 400 miles per hour" in straight, level flight; that it can operate at an altitude "above 36,000 feet," and that the cruising speed is "approximately 325 miles per hour."

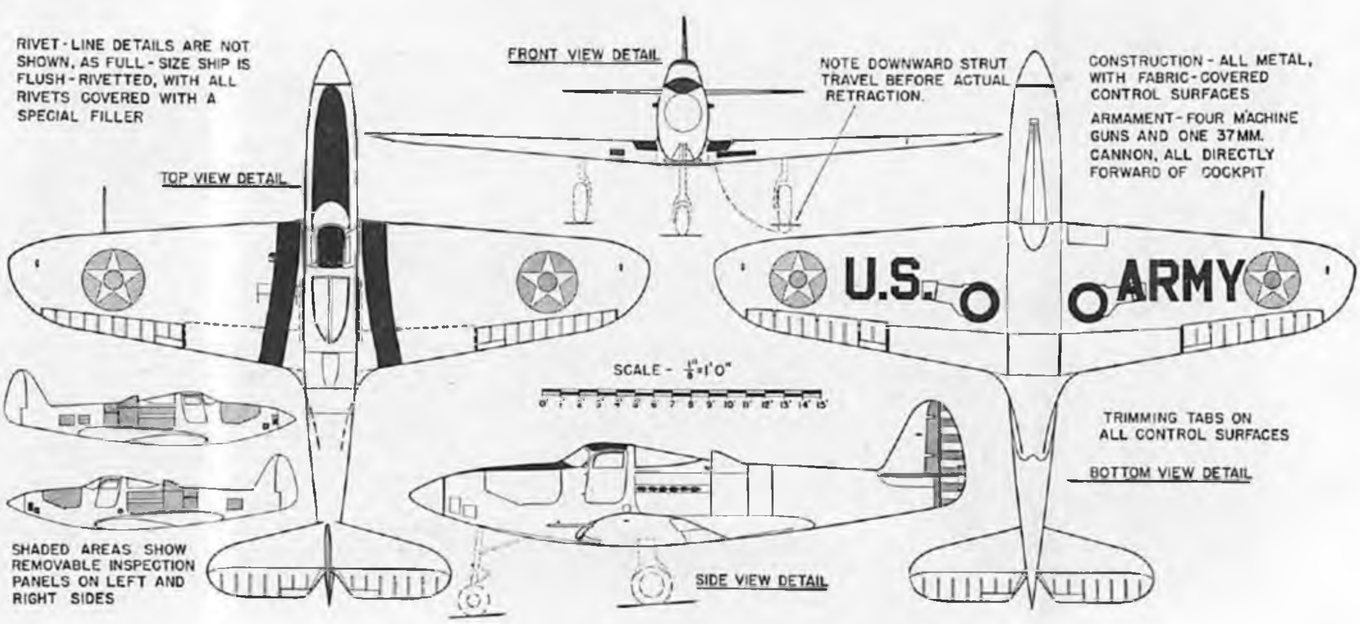
One of the many new features is the use of a quick-firing 37-mm. cannon. (A 37-mm. shell has a diameter of nearly one and one half inches, and is over six inches long, and weighs over one pound.) Four machine guns are mounted in the nose of P-39, synchronized to fire through the prop disk.

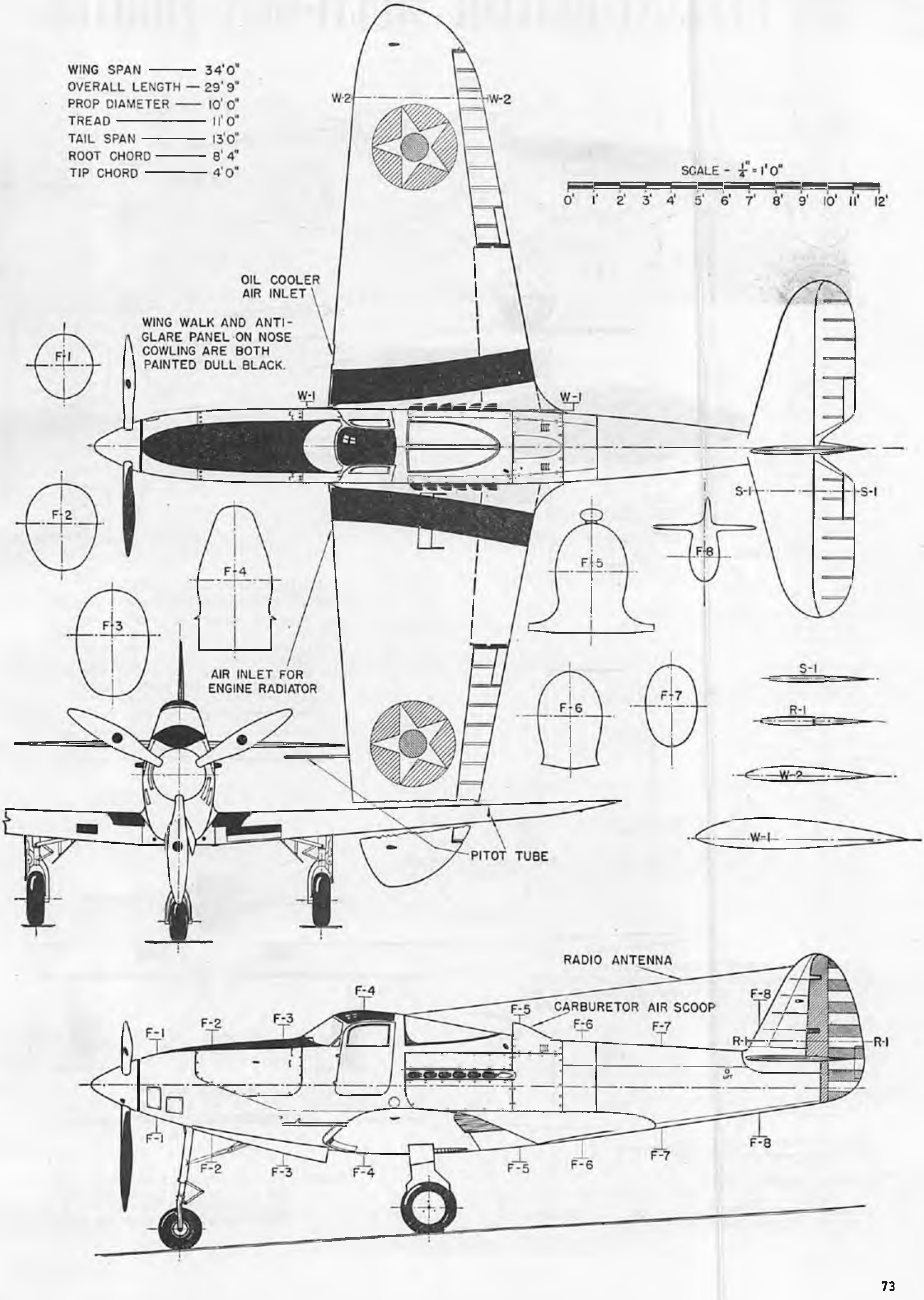
The tricycle landing gear and the large wing flaps allow the P-39 to be operated from a small airport, which is an important factor in time of war, since most of the large airports are bombed by enemy bombers. The tricycle landing gear allows landings and take-offs to be made with less consideration to wind direction than with the standard two-wheel landing gear. Since the wing loading has been kept down to 28.3 pounds per square foot, the stalling speed is below 70 miles per hour. This results in a ratio of 6:1 between top speed and landing speed, the highest ratio of any military plane now in use. Most of the present 350-mile-per-hour pursuits come in at 70 miles per hour and need about double the space required by the P-39 for landing.

CONSTRUCTION

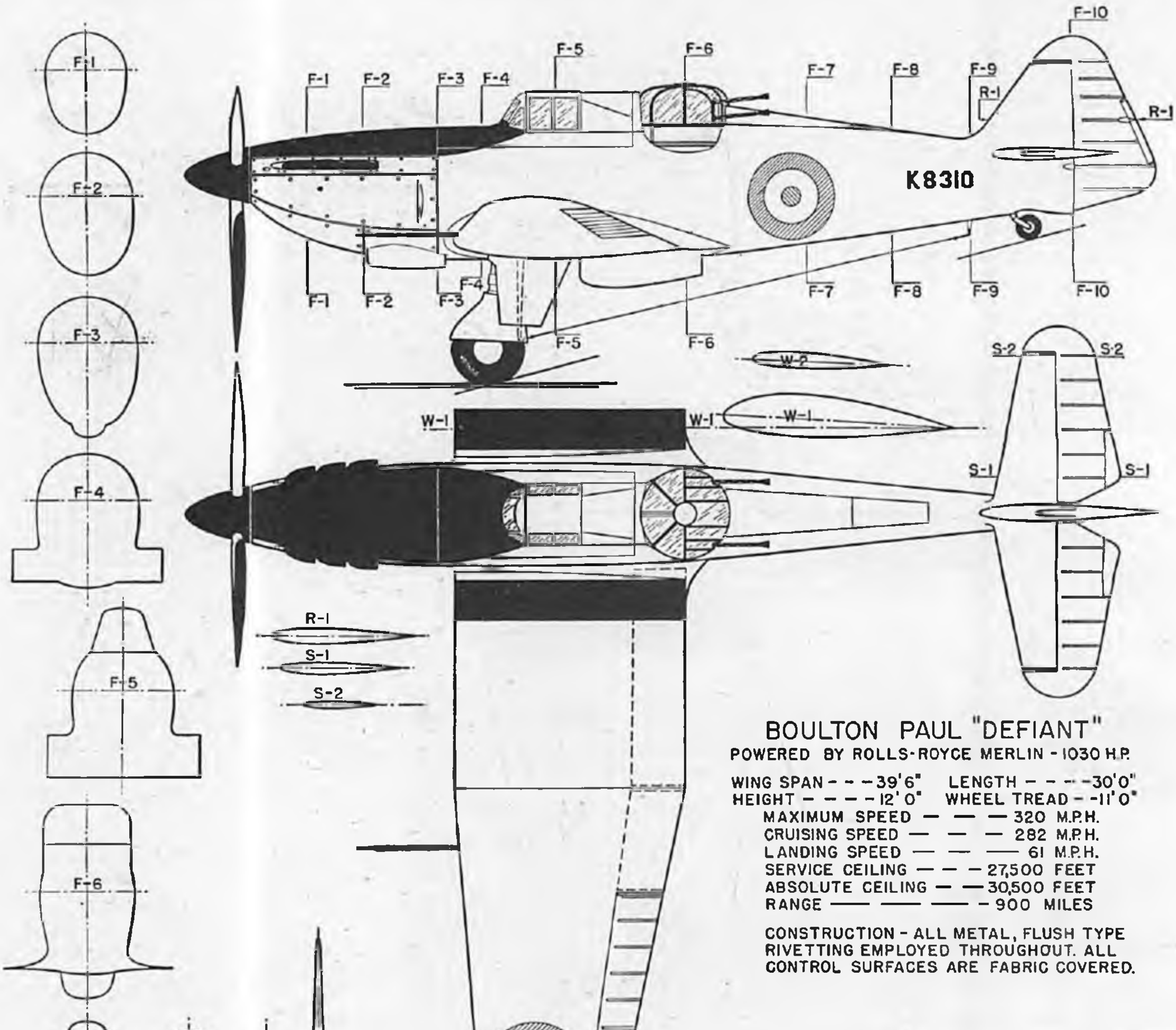
Select a soft balsa block 6½ x 1½ x ¾" for the fuselage. On the side of the block draw the outline of the fuselage and shave away the excess wood. Then draw the top outline of the body and again shave away the extra wood. Finally round the half-finished body to the cross sections shown on the plans and sand to a smooth finish.

The tail surfaces can be cut from 1/16" *(Turn to page 96)*




WING SPAN — 34'0"
OVERALL LENGTH — 29'9"
PROP DIAMETER — 10'0"
TREAD — 11'0"
TAIL SPAN — 13'0"
ROOT CHORD — 8'4"
TIP CHORD — 4'0"
SCALE - 1/4" = 1'0"
0' 1' 2' 3' 4' 5' 6' 7' 8' 9' 10' 11' 12'
W-2
W-1
OIL COOLER AIR INLET
WING WALK AND ANTI-GLARE PANEL ON NOSE COWLING ARE BOTH PAINTED DULL BLACK.
F-1
F-2
F-3
F-4
F-5
F-6
F-7
F-8
S-1
R-1
AIR INLET FOR ENGINE RADIATOR
PITOT TUBE
RADIO ANTENNA
CARBURETOR AIR SCOOP

THE DEFIANT-BRITISH MULTI-GUN FIGHTER

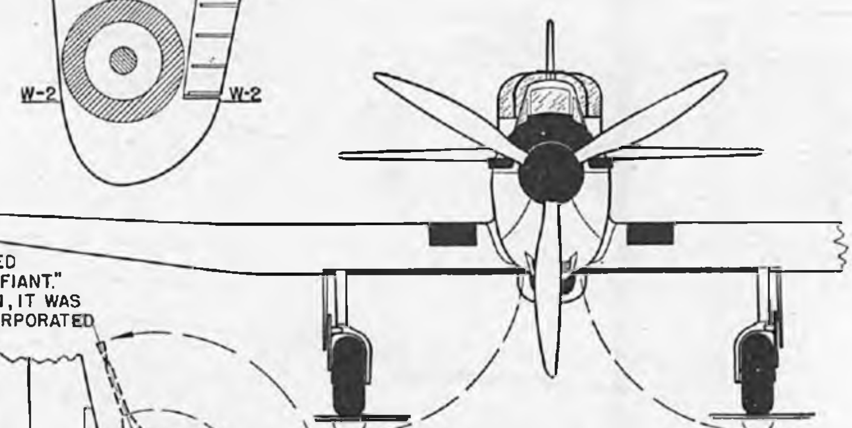


BOULTON PAUL "DEFIANT"

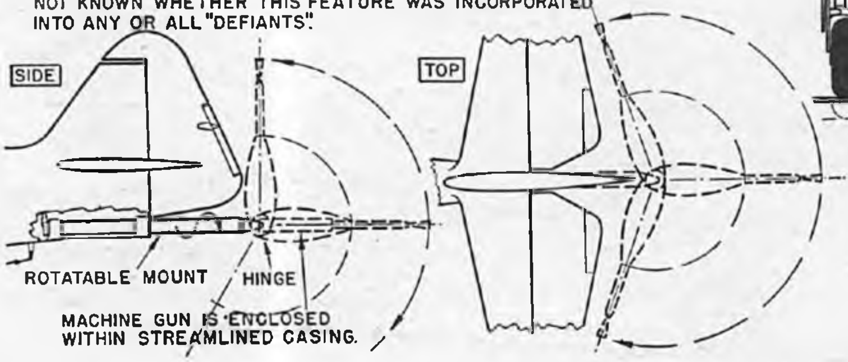
POWERED BY ROLLS-ROYCE MERLIN - 1030 H.P.

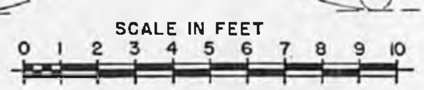
WING SPAN - - - 39'6" LENGTH - - - - 30'0"
HEIGHT - - - - 12'0" WHEEL TREAD - - 11'0"
MAXIMUM SPEED — — — 320 M.P.H.
CRUISING SPEED — — — 282 M.P.H.
LANDING SPEED — — — 61 M.P.H.
SERVICE CEILING — — — 27,500 FEET
ABSOLUTE CEILING — — 30,500 FEET
RANGE — — — — 900 MILES

CONSTRUCTION - ALL METAL, FLUSH TYPE RIVETTING EMPLOYED THROUGHOUT. ALL CONTROL SURFACES ARE FABRIC COVERED.



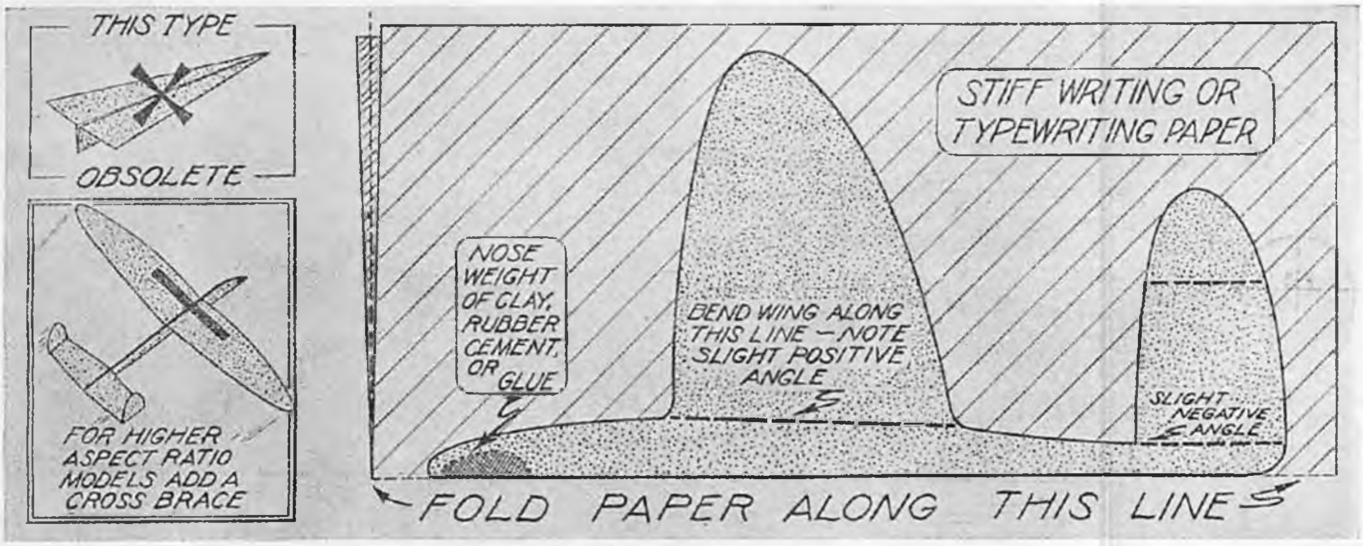
DETAILS SHOWN BELOW OF REMOTE-CONTROLLED MACHINE GUN MOUNTED UNDER RUDDER OF "DEFIANT." AT THE TIME THAT THESE PLANS WERE DRAWN, IT WAS NOT KNOWN WHETHER THIS FEATURE WAS INCORPORATED INTO ANY OR ALL "DEFIANTS".





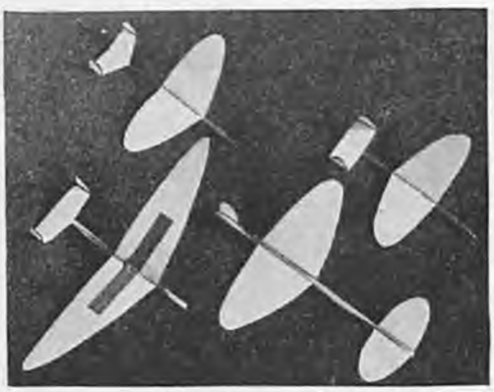
NOTE:- TAIL GUN AT LEFT SWIVELS ON ONLY ONE AXIS, BUT DUE TO THE FACT THAT THE MOUNT CAN BE ROTATED FIELD OF FIRE IS UNRESTRICTED TO THE REAR.

WHAT! PAPER GLIDERS?



DID you say paper gliders? Yes, sir, we said paper gliders! But not the type encountered in a third-grade music class. These are honest-to-goodness scientific soarers. If you don't believe it, try one yourself.

Fold a sheet of stiff paper, about the size of regular typewriting paper, and with a pair of scissors hew out a contraption similar to the one shown above in the full-size plan. Bend wings down along the dotted line at slight positive incidence. Fold down the stabilizer as shown at a slight negative angle—then bend up tips to form double rudders.



A fleet of paper gliders gives opportunity for many original experiments as to size and detail.

BY AL LEWIS

Balance the craft with glue, rubber cement, paper clip—anything that's handy. Check the alignment of the supporting surfaces, make a few test hops, then try an out-of-the-window flight. With a favorable updraft your little ship will soar away above the housetops.

Unofficial record for this type of relaxation is attributed to Hewitt Phillips of Belmont, Massachusetts—who was, incidentally, 1938 indoor Stout Trophy winner—with a flight of more than five minutes made from the top of the Hotel Fort Shelby in Detroit last July.

When Phillips' record glider—which is said to have been carved from a discarded dance program—was lost to sight it was headed toward Canada far above the Detroit River. Disgruntled paper-glider opponents of Phillips claim his flight illegal since field glasses were used by the observers. But, seriously, though, the fundamentals of correct adjustment are easily and quickly taught by these streamlined "build-'em-in-a-second" gliders.

In fact, after their introduction to novice model builders in Boston, it was pointed out that Younger and Ward in their book "Airplane Construction and Repair" devote a section to building and flying model planes with the object of studying "the principal features of flight and stability by use of flying models." What type of models do they ask the student to build? Right—paper gliders!

After the initial attempt, experiment with your own designs. High aspect ratio wings will require a cross brace like the one shown. Braces from the fuselage to the underside of each wing will do, too. Heavier paper can be used for larger gliders.

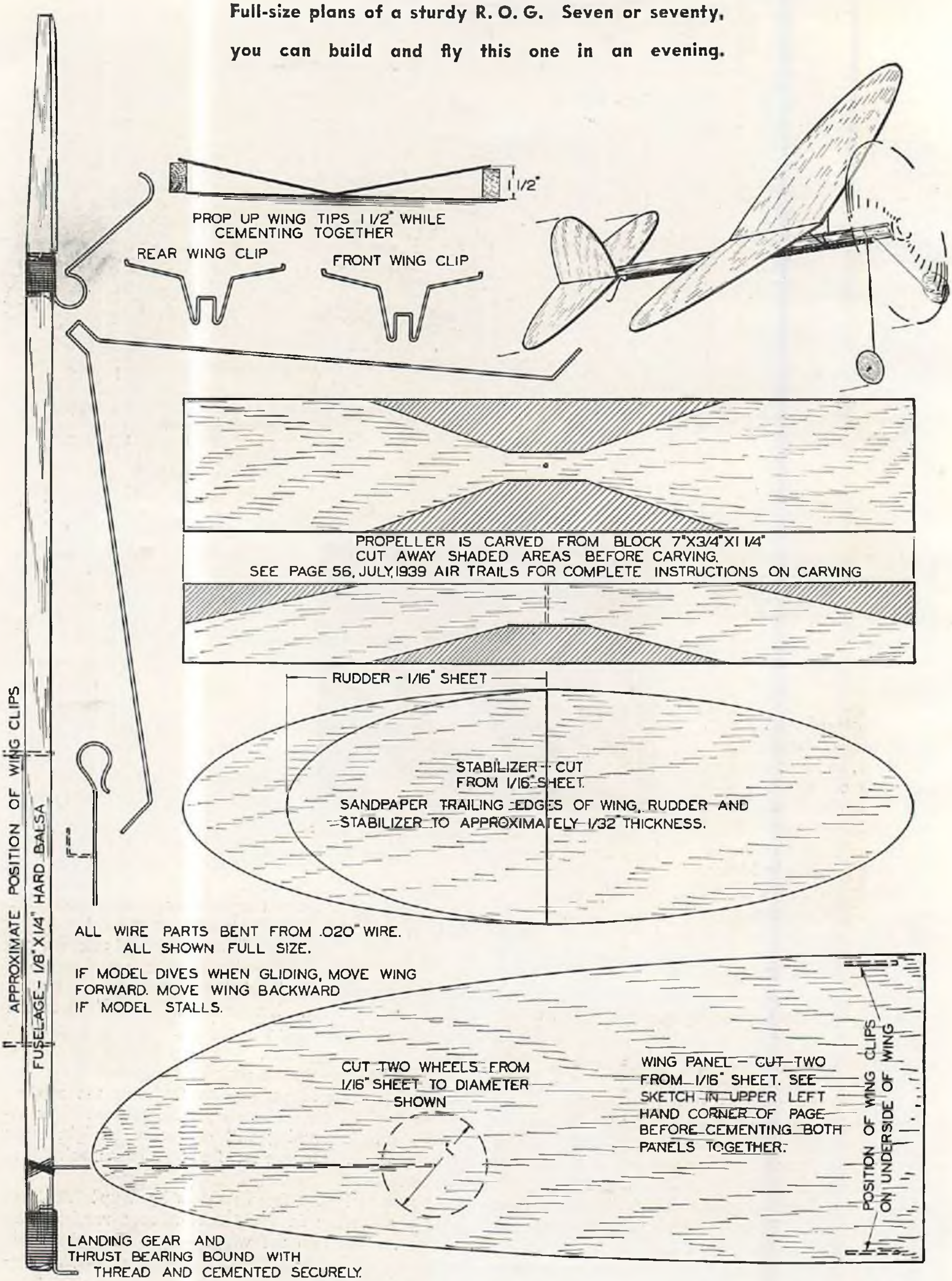
Paper gliders serve a practical purpose. In a few minutes' time it is possible to find out the relative efficiency of all sorts of aerodynamic set-ups. For instance, a little pruning will convert a straight taper into an ellipse. Or you can find just how much tail is really needed.

Be sure and keep those rudders lined up! And see what a difference in flight performance results when camber is bent into the wings—or when a change is made in the wing setting—or the stabilizer angle—or—

Some fun, hey?

BABY BUZZARD

Full-size plans of a sturdy R. O. G. Seven or seventy, you can build and fly this one in an evening.



HIGH ROAD WEATHER

No guesswork for our skyway pilots. They know the weather before they fly to meet it.

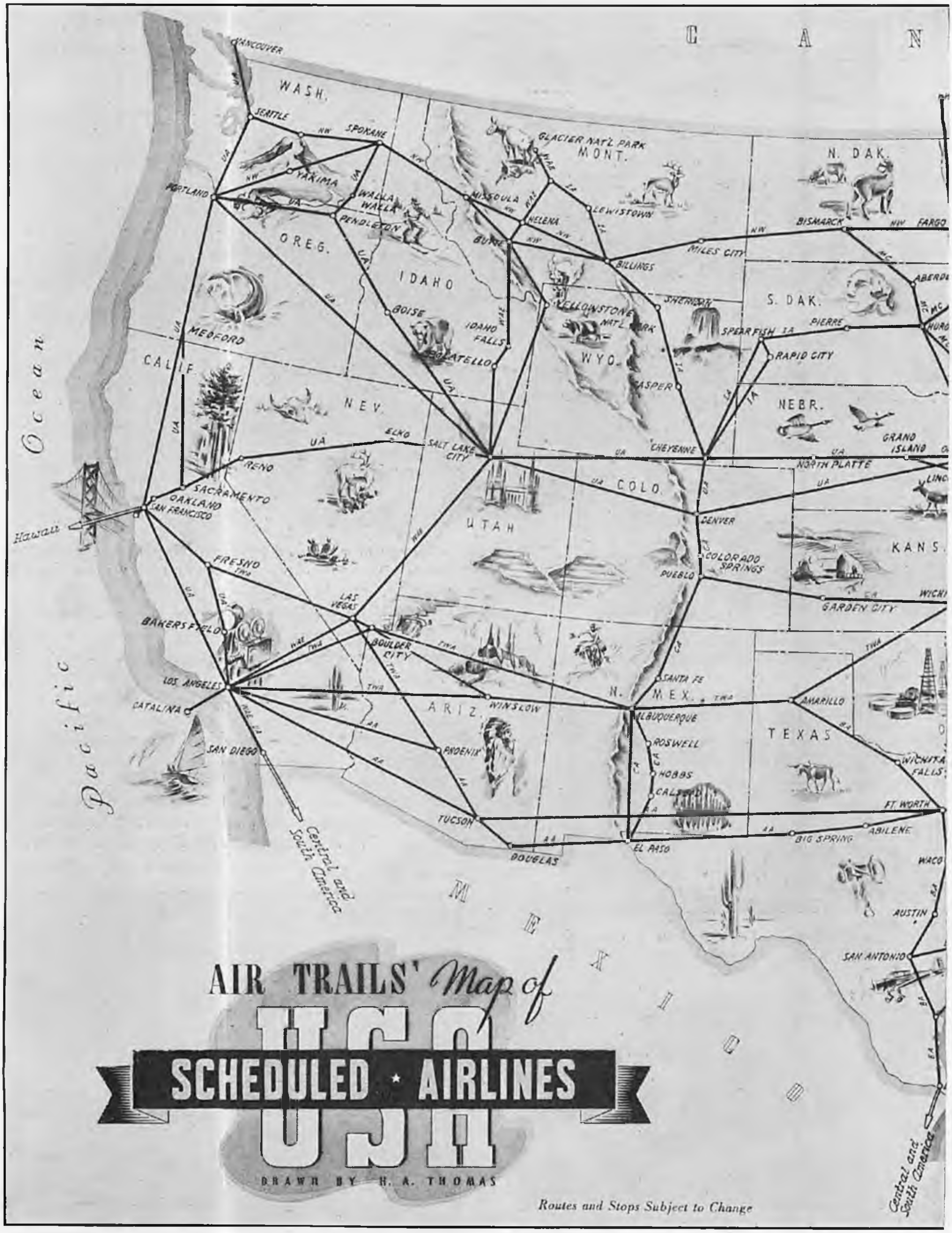
Hundreds of balloons are released; from them wind, ceiling, and visibility data are obtained.

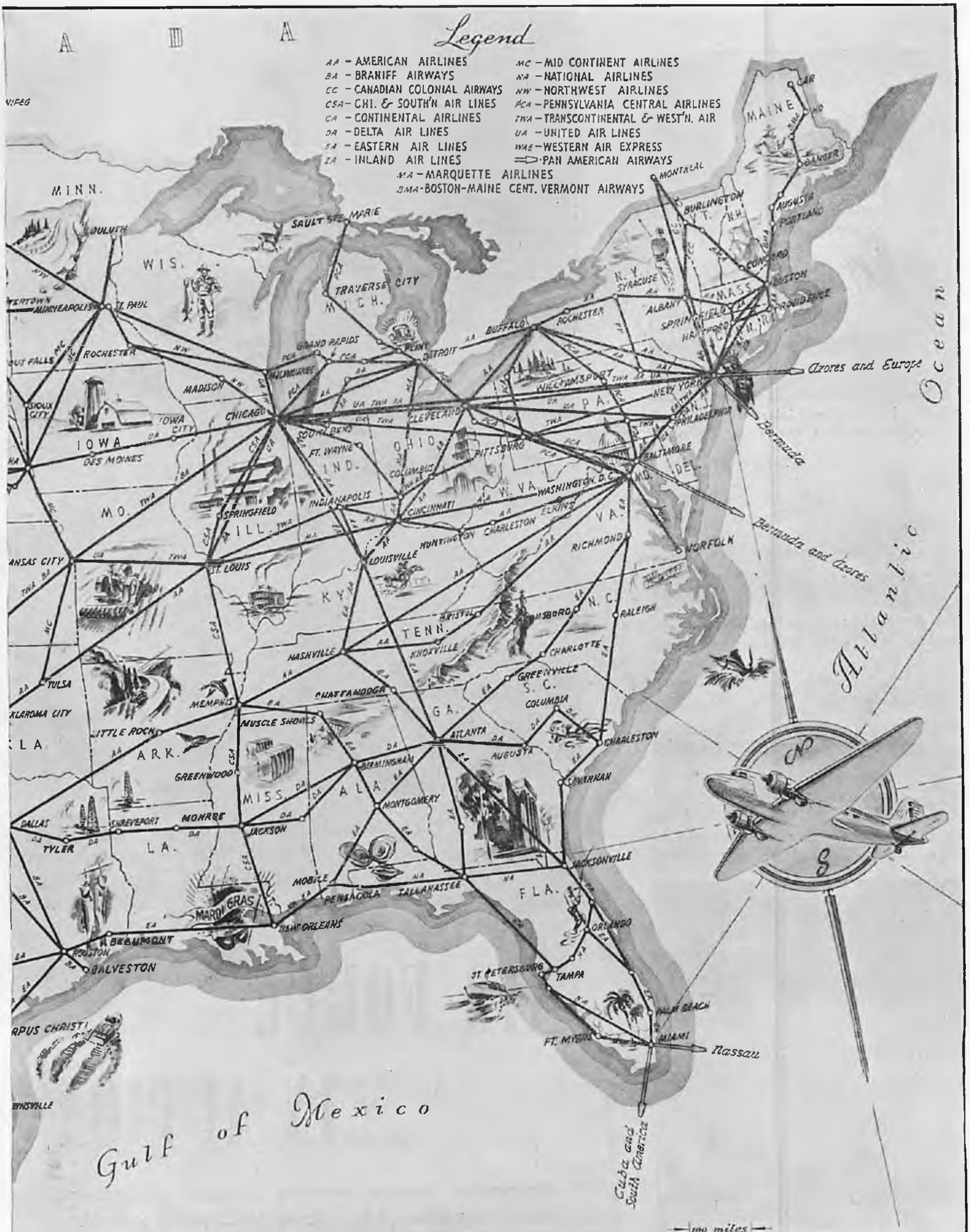
Emblematic of modern air travel, this Flagship drones over New York safe in the knowledge of accurate route weather forecast.

"FAIR and warmer" may be enough of a weather report for vacation-bound families, but it hardly does for a captain of a Flagship. He must know exactly what to expect for every mile of his trip. In order to know this, complex meteorological charts are kept constantly, in order that air-mass movement and change may be watched. From these charts the meteorologist and captain plan each flight to take advantage of helpful tail winds and smooth air, and avoid storm areas. Final approval of the flight plan before take-off is up to the captain. Once aloft he must stick to it unless permission is granted by radio for a change. This is so exact location of plane will be known.

The flight path of the balloon is observed through a theodolite and variances tabulated.

Before take-off, captain and meteorologist go over data and decide flight path. Right, three types of clouds: cirro-stratus (top), alto-stratus, middle and cumulus below, in one shot.


AIR TRAILS' Map of
USA
SCHEDULED ★ AIRLINES
DRAWN BY H. A. THOMAS
Routes and Stops Subject to Change
Pacific Ocean
Hawaii
C A N
WASH.
OREG.
CALIF.
IDAHO
NEV.
MONT.
WYO.
UTAH
COLO.
ARIZ.
N. MEX.
TEXAS
N. DAK.
S. DAK.
NEBR.
KANS.
M E X I C O
VANCOUVER
SEATTLE
SPOKANE
YAKIMA
PORTLAND
WALLA WALLA
PENDLETON
BOISE
MEDFORD
RENO
ELKO
SALT LAKE CITY
SACRAMENTO
OAKLAND
SAN FRANCISCO
FRESNO
BAKERSFIELD
LAS VEGAS
BOULDER CITY
LOS ANGELES
CATALINA
SAN DIEGO
WINSLOW
PHOENIX
TUCSON
DOUGLAS
GLACIER NAT'L PARK
MISSOULA
HELENA
BUTTE
LEWISTOWN
BILLINGS
MILES CITY
IDAHO FALLS
POCATELLO
YELLOWSTONE NAT'L PARK
SHERIDAN
CASPER
CHEYENNE
DENVER
COLORADO SPRINGS
PUEBLO
SANTA FE
ALBUQUERQUE
ROSWELL
HOBBS
EL PASO
BISMARCK
FARGO
ABERDEEN
PIERRE
SPEARFISH
RAPID CITY
NORTH PLATTE
GRAND ISLAND
GARDEN CITY
AMARILLO
WICHITA FALLS
FT. WORTH
BIG SPRING
ABILENE
WACO
AUSTIN
SAN ANTONIO
Central and South America
Central and South America


Legend
AA – AMERICAN AIRLINES
BA – BRANIFF AIRWAYS
CC – CANADIAN COLONIAL AIRWAYS
CSA – CHI. & SOUTH'N AIR LINES
CA – CONTINENTAL AIRLINES
DA – DELTA AIR LINES
EA – EASTERN AIR LINES
IA – INLAND AIR LINES
MC – MID CONTINENT AIRLINES
NA – NATIONAL AIRLINES
NW – NORTHWEST AIRLINES
PCA – PENNSYLVANIA CENTRAL AIRLINES
TWA – TRANSCONTINENTAL & WEST'N. AIR
UA – UNITED AIR LINES
WAE – WESTERN AIR EXPRESS
PAN AMERICAN AIRWAYS
MA – MARQUETTE AIRLINES
BMA – BOSTON-MAINE CENT. VERMONT AIRWAYS
Azores and Europe
Bermuda
Bermuda and Azores
Atlantic Ocean
Nassau
Cuba and South America
Gulf of Mexico
100 miles

North American O-47A is used for observation, photography, reconnaissance.

Lockheed P-38, pursuit-interceptor powered with Allison engines, has retractable gear.

The Bell P-39 Airacobra, pursuit-interceptor, has fire power and maneuverability.

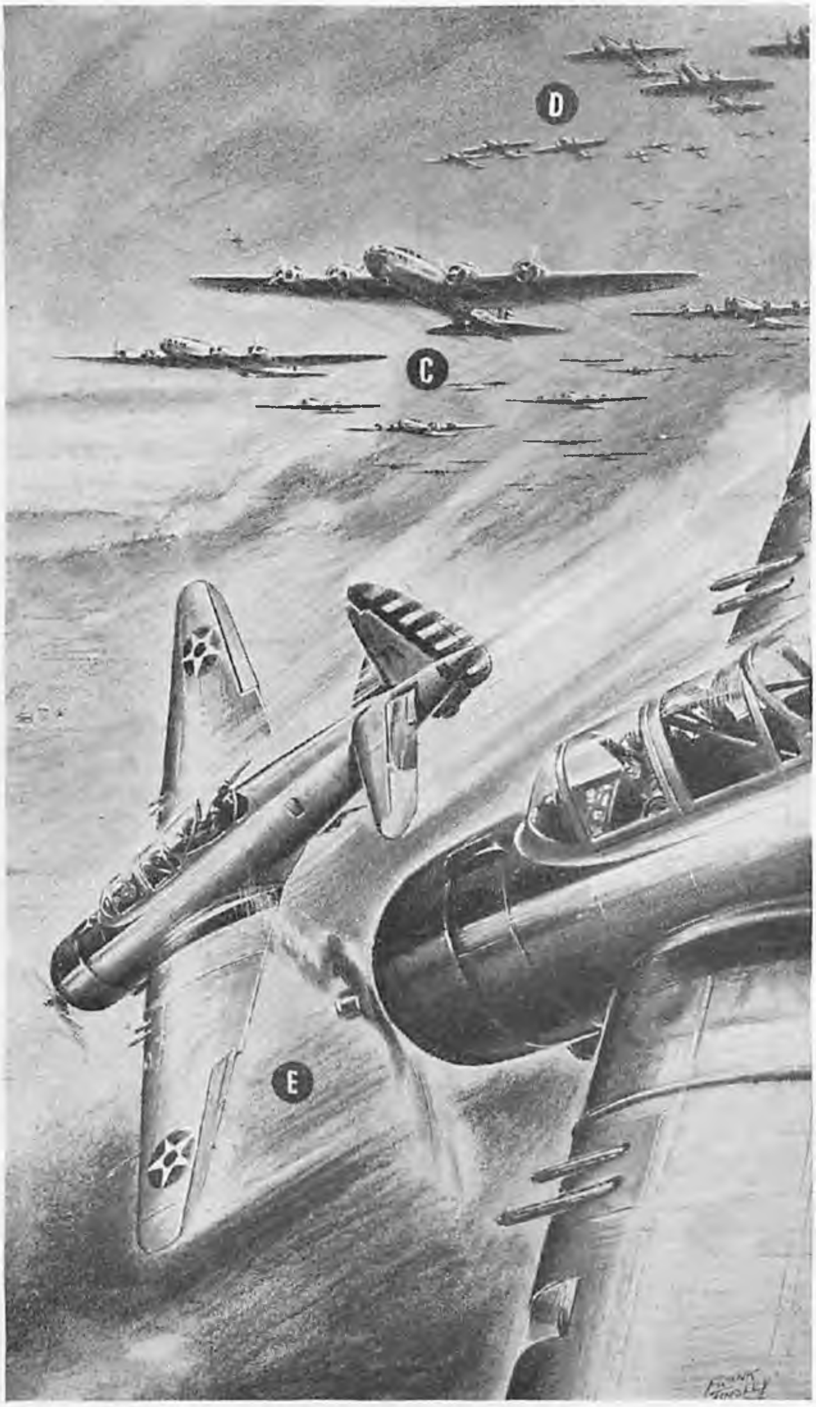
Douglas B-18A medium bomber has retractable landing gear, three gun turrets.

Curtiss P-36 standard pursuit ship has inclosed cabin and retractable landing gear.

Curtiss P-40. This is basically the P-36 with liquid-cooled Allison engine installed.

AIR FORCE IN ACTION

Composite drawing showing tactical missions of various branches of U. S. Army Air Corps in operation.



An air force consists of many types of aircraft, each designed for specific purposes. These various arms of the army's winged service co-operate with each other as well as with ground forces for general effectiveness. As indicated by letters, we see five missions being handled by planes designed for work of each. At "A" we see North American O-47A's carrying out observation and reconnaissance work. At "B" are Bell Airacobras climbing to intercept Boeing B-17B four-engined bombing planes at "C." Above them at "D" their convoy of twin-engined Bell Airacudas prepares to dive to the defense. In the foreground "E" we see Vultee attack planes peeling off for dive-bombing of tank column and antiaircraft guns.

Bell YSM-1 Airacuda, Multi-engined fighter for light bombing and convoy work.

Boeing B-17 "flying fortress" has crew of six to nine, five machine guns, four engines.

Douglas B-23. This new medium bomber is one of our first to feature a tail turret.

Vultee attack ships are designed for strafing troops, and light bombing missions.

Northrop A-17A attack ships, released in numbers to England, for light bombing.

Curtiss A-18 twin-engined attack plane is made for low altitude attack work.

Grumman Skyrocket, two 1,200 h.p. Wright Cyclones, can serve as interceptor or convoy.

Grumman shipboard fighter. Export model, Cyclone engines, 1,200-mile range, 350 m.p.h.

Consolidated PBY patrol bombers have 4,000-mile range. Either P. & W. Wasps or Cyclones.

Brewster's shipboard, 950 h.p. Cyclone. Four machine guns or two with two cannon.

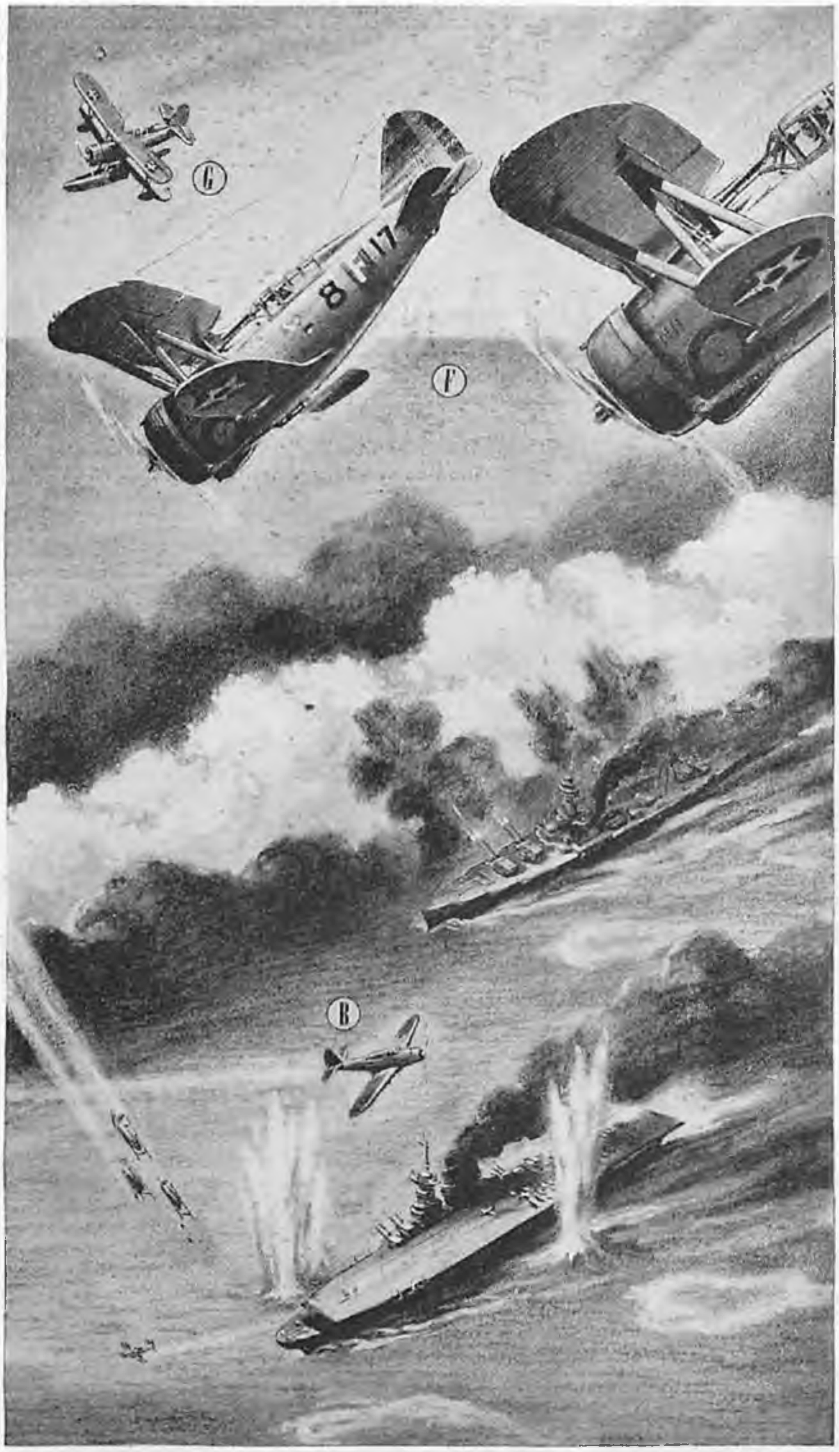
Consolidated PB2Y 1,200 h.p. P. & W. Twin Wasps. Range 5,200 miles at 210 m.p.h.

Douglas (Northrop) BT-2 shipboard dive bomber. Twin Wasp, Jr. Perforated flaps.

Curtiss Seagull, 450 h.p. Wasp, is used as catapult plane for cruisers and battleships.

NAVY WINGS STRIKE

A naval air force in action, illustrating the tactical employment of its various parts against a surface fleet.



Douglas TBD-1 torpedo bomber, for carriers, has a 1,200 h.p. Twin Wasp and 3-man crew.

Curtiss XSOC-3 has interchangeable land-plane gear, 450 h.p., twelve-cylinder Ranger.

Bell's Airabonita, seagoing version of Aira-cobra, has two-wheeled gear for carriers.

Vought SB2U-1 scout bomber, powered by Twin Wasp, Jr. Bomb carried beneath body.

Grumman's F3F-2 biplane steps 275 m.p.h. with its 1,000 h.p. Wright Cyclone engine.

Curtiss SBC-4 scout bomber is also used for dive bombing. Test model withstood 13½ Gs.

Martin's huge gull-winged patrol bomber has 118-ft. wing and weighs 39,000 pounds.

THE action opens with a simultaneous torpedo and dive-bombing attack. In the lower left can be seen a pair of "smokers" (A), laying a low curtain intended to screen the approach of the torpedo carriers from the gunners of a heavy cruiser. As one of the "tin fish" scores a bull's-eye, the torpedo plane (B) zooms upward to safety. Meanwhile, flights of dive bombers (C) hurtle downward toward the broad deck of an aircraft carrier, from which defending fighters (D) are taking off to intercept the squadrons of heavy patrol bombers (E) which will deliver the main blow at the surface fleet. Attacking fighters (F), which have been lurking high above the clouds, plummet seaward to pounce upon the fast-climbing interceptors. One of the latter has gained sufficient altitude to be greeted by a burst of shellfire from the nose turret of the leading flying boat. In the upper right is an observation seaplane (G), watching fight after reporting enemy fleet via radio to defending forces.

CANADA'S WAR PLANES

The British-built Avro "Anson," is being used as specialized trainer by R. C. A. F.

This Fairey Battle two-seater bomber is used for advance training and defense.

This Fairchild 51, equipped with skis, is still in service in Ottawa where it is used for R. C. A. F. flights.

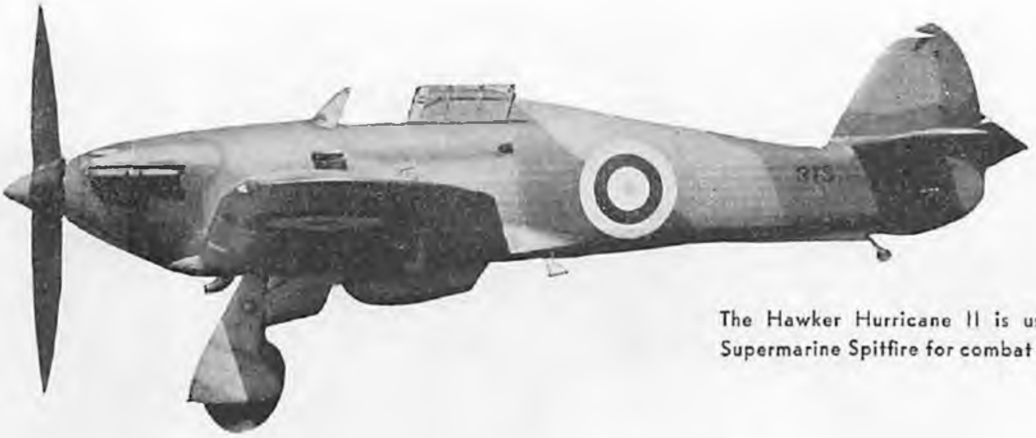
Avro Tutor 621s are used in great numbers for R. C. A. F. student training. They are rugged and easy to fly.

Designed for long-range bombing, the Supermarine Stranrear is used for coast patrol and for training.

The Westland Lysander II being manufactured in Canada is used for training. These have guns in "pants."

This American amphibian Grumman G-21-A is used for personnel transportation and for interfield flights.

Another American plane used in training R. C. A. F. pilots is this Fleet 7 trainer with a 100 h.p. Kinner K-5.



The Hawker Hurricane II is used with Supermarine Spitfire for combat training.

Beechcraft Model 18-D donated to the R. C. A. F. by John Eaton of Toronto.

Fairchild Super 71-P powered with a 750 h.p. Wasp. This ship is used for transport and similar service.

Another version of the Fairchild does yeoman service. This 71-B bears former markings for Civil Service.

The Vickers Vancouver II is principally used on coastal and fishery patrol. Number means military service.

The Hawker Tomtit has proven to be an excellent trainer for instruction in blind flying and instrument landing.

This Canadian version of the Fleet 7-C is powered with a British 150 h.p. Armstrong-Siddeley Civit engine.

Blackburn Shark, designed as a torpedo-spotter-reconnaissance plane used as a trainer for these air duties.

CANADA'S WAR PLANES

Detoured to Canada to be used in coastal convoy work, these Lockheed Hudson B-14Ls were originally ordered by England.

The Electra 10-A has become popular with the R. C. A. F. for training and personnel transportation service.

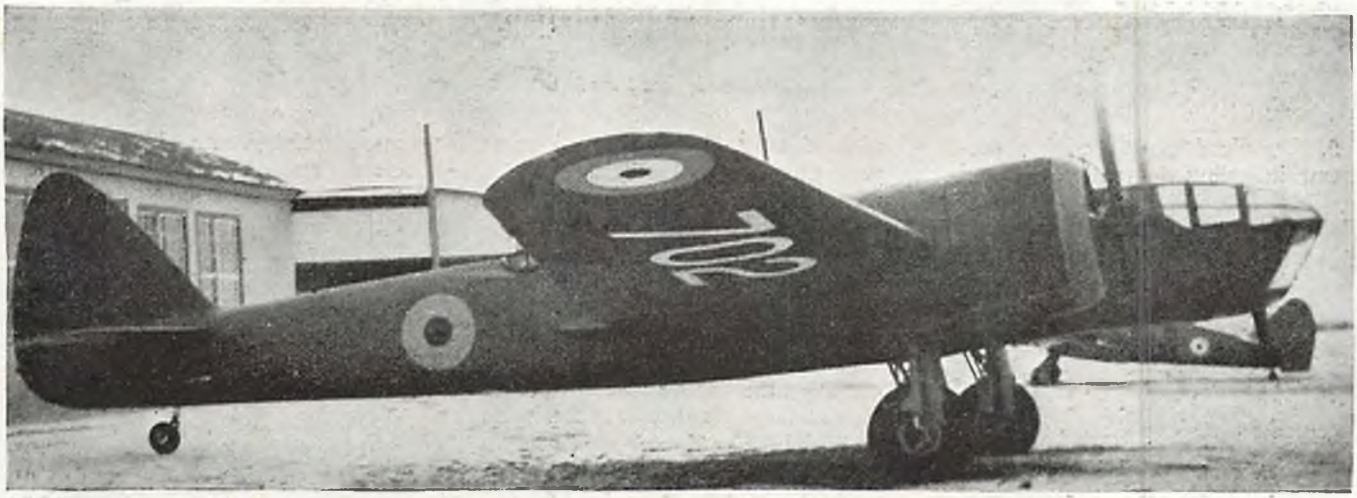
Similar in appearance to the Lockheeds, the Barkley-Grow T8P-1 transport is used by the Canadian air arm.

This Vickers-Northrop Delta MK-11A was tested with this gun turret which was found impractical and removed.

This Canadian-designed Noorduyn Norseman MK-IV is particularly efficient as a ski-equipped transport.

North American Harvard I's have been delivered to R. C. A. F. These trainers are used at Camp Borden.

Canadian Airspeed Oxford A.S.10, used for training in navigation, photography, bombing, and gunnery.



Canada's counterpart of the Bristol Blenheim, the Bristol Bolingbroke, is powered by two Bristol Mercury engines of 840 h.p.

An advance trainer, the Avro 626. These, through three cockpits, may be used for all types of mission training.

Armstrong-Whitworth Siskan III fighter, with 400 h.p. A. S. Jaguar engines. Some built for dual instruction.

Used extensively for patrolling, these Vickers Vedette flying boats are powered with engines of 220 h.p.

The Bellanca Pacemaker powered with Whirlwind J-6 engine, has seen considerable service across the border.

The familiar Douglas B-18A appears as Douglas Digby, in Canada, where it serves for student bombing training.

The De Havilland 82-A, 130 h.p. Gypsy-powered trainer. Note cockpits that may be inclosed and eyebrow slots.

Education And Aviation

(Continued from page 31)

2. Organized plant training programs including apprenticeship, and vestibule schools, carried on by employers in co-operation with labor.

3. Extension training in schools for employed workers to fit them to take jobs requiring new skills.

4. Refresher courses and intensive short-unit preparatory training courses for unemployed youth and adults to fit them for positions in industry requiring rather narrowly specialized skills.

5. Longer, full-time trade-preparatory courses in vocational schools to prepare youth as skilled mechanics, pattern makers, electricians, welders, and the like.

6. Technical and engineering courses to turn out the engineers, draftsmen, and technicians needed for positions of leadership and research in the industry.

The Congress has already recognized the strategic position of the vocational and engineering schools of the nation in contributing to a rapid increase in several of these types of training by appropriating $15,000,000 to assist in training workers for national defense industries, using the facilities and staffs of vocational schools in the various States. This program has already got under way in a number of the States. During this summer it will provide intensive ten-week training courses for thousands of workers drawn for the most part from the ranks of the unemployed. The widespread plant and equipment of 1,200 vocational and technical schools and colleges throughout the country involving an investment of over a billion and a quarter dollars, and regularly employing a trained teaching staff of more than 35,000 persons will be utilized, and extra shifts of students and teachers put on during the summer and fall. Several thousand additional public secondary schools with good shops are also available. New teachers, men drawn from industry and trained to teach, will be secured if needed. These schools can turn out more than a million trained workers to man our defense industries within the next nine to twelve months. In addition to the regular enrollment this vast organization for training, if operated to capacity, can accommodate and train more than two and a half million persons per year.

In a situation where time is of the essence, the use of existing plant and equipment enables us to put the new training program into rapid operation without delay. The appropriation was passed by Congress on June 23rd. A number of schools began operations a week later. Since then we have received daily announcement of the establishment of emergency training programs for the defense industries in the vocational schools of many States. As an example of how this program is operating throughout the nation let us look at the work already in full swing in Wichita, Kansas.

In Wichita, 279 students are already busy eight hours a day, five days a week, in shops and related subjects in such courses as aircraft metal work, aircraft wood work, aircraft drawing, and aircraft shop practice. Enrollees range in age from eighteen to twenty-six with a few persons over twenty-six. Approximately half of those now in training have been out of employment for the past three to six months or more. Their previous general education ranges from ninth grade to graduation from a four-year college. The intensive summer training courses in Wichita will, in general, run from six weeks to three months. However, since students make progress at their own rate of learning, at any time they have mastered the essential skills and knowledges they are set to work at production in the plants of the community. Applicants for enrollment were required to meet the standards set up by local industries for entrance into these courses. These standards were determined by advisory committees upon which were represented labor and management. Besides the preparatory courses just mentioned, many employees of the plants in Wichita are coming back to the schools for extension training to improve their skills in preparation for more responsible positions. In this city these extension classes are held for eight hours on Saturdays. In other cities these extension courses are scheduled for late-afternoon or early-evening hours.

It should perhaps be emphasized that positions are waiting for all of the enrollees now in training in Wichita. Recently the industry in that community announced the need for 500 additional men within the next three months. It is to meet these emergency demands that the training program in Wichita carried on by the vocational schools of that city has been stepped up. The men employed as instructors by the school authorities have all had practical experience in industry and keep in constant touch with current developments in aircraft manufacturing. As additional teachers are needed, men are drawn from the industry itself and are trained as instructors through the teacher-training activities of the Wichita Department of Vocational Education.

Reports from other cities and States indicate that what is happening in Wichita is typical of many other communities. Thus, Indianapolis recently reported: "Nearly 300 men were enrolled yesterday for the industrial training course which opened in Arsenal Technical High School, the purpose of which is to train men for jobs in factories as a result of the national defense program." Connecticut reports "a plan to speed industrial training designed to add several thousands of workers annually to push the national preparedness program in the State. In this program eleven State trade schools will operate in two additional shifts, from 5 p. m. to 12 p. m. and from midnight to 7 a. m. Facilities of the trade schools will be used extensively throughout the summer, including Saturdays." Many other such examples could be cited if time permitted.

I have been speaking up to this point of the part which the vocational schools of the country can play and are playing in the rapid expansion of training programs to provide skilled workmen to man the industries producing aircraft and other instruments of war. After military aircraft are built, they must, of course, be flown and serviced. Here again the emergency requirements of rapid expansion can be met to a considerable extent through the use of existing facilities and staffs of our schools and colleges.

In addition to the contribution which the *vocational* schools can make to the training of mechanics and specialized maintenance men to service our aircraft, mention should be made of the contribution of the schools and colleges to pilot training. During the past year, under the stimulus and direction of the Civil Aëronautics Authority, some 11,000 youth in 435 universities and colleges have been given pilot-training courses. Two aspects of this civilian pilot training program deserve special emphasis. In the first place, since it is a *civilian* pilot-training program, participation both of the schools and of the students has been entirely voluntary. Incidentally, this program has distinct military value in that it has served to provide a reservoir of youth with elementary skills as pilots from which young men can be drawn, if necessary, for more intensive military-pilot training courses later. Second, this program has been carried out without interrupting the normal relations between colleges and their students. College authorities have had entire freedom in selecting the trainees and have had control of the training activities of the students except when students were in the air. Here we have another example of Federal stimulation and financial aid to an educational program carried on in co-operation with public and private educational institutions, using existing facilities and to a considerable extent existing educational staffs as well. This is an example of what can be done by way of Federal stimulation in providing many other types of training for young people to meet national needs both in peacetime and in time of national emergency.

Let us turn now to the second major question raised earlier, namely, what are the long-time contributions which education can make to the development of aviation in the United States? For purposes of this discussion, we may distinguish two broad educational areas, namely, the area of vocational education which has for its controlling purpose the development of those special knowledges and skills which make for vocational competency in particular occupations and, second, the area of general education in which the controlling purpose is the development of those common attitudes, knowledges, and skills which make for civic, economic, and personal efficiency without regard to the particular occupations by which men and women make their livelihoods. I have already indicated the character of the contributions which vocational schools and classes can make and are making to the development of aviation and other defense industries in this emergency. About 7,000 students were enrolled in aviation mechanics and other closely related fields for the year ended June 30, 1939. It is estimated that for the year ended June 30, 1940, about 25,000 enrollments will be reported. Most of this increase resulted from the expansion of the industry during the past year.

In peacetime, vocational and technical training in aviation has largely been limited to secondary and junior college levels, at which such courses as the following have been offered:

Aircraft blueprint reading, aircraft drafting, aircraft sketching and designing, aircraft sheet-metal work, aircraft servicing and maintenance, aircraft welding, aircraft engines, aircraft lofting, sheet-metal layout and template making, aëro engineering layout, trade mathematics, aircraft stress analysis, aircraft inspection, aircraft machine-shop work, aircraft engine accessories, top overhauling.

At the college level, a study made in 1938 indicated that sixty-five universities and colleges were offering courses in aëronautics. A current study would undoubtedly reveal an increase in the number of institutions offering such courses. However, systematic organization of courses into approved curricula in aëronautical engineering is to be found in only twelve institutions, according to a recent report of the Engineers' Council for Professional Development, namely:

University of Albama, California Institute of Technology, Catholic University of America, Georgia School of Technology, Massachusetts Institute of Technology, University of Detroit, University of Michigan, University of Minnesota, New York University, Rensselaer Polytechnic Institute, University of Cincinnati, University of Washington.

Among the courses usually so organized in aëronautical engineering curricula are the following:

Aëro dynamics of airplane design, airplane design practice, aircraft structures, aëronautical laboratory work, details of construction of aircraft, aircraft production methods, aircraft shop work, airship theory, aircraft instruments, instrumentation laboratory, advanced airplane engine design, aëronautical problems, aircraft propeller design, vibration measurements.

It should be remarked in passing that there appears to be a trend toward expanding the range of course offerings which relate more or less directly to aviation in many colleges and universities to meet the needs of the industry for men trained in the fundamentals of financing and other business administration phases of the air transportation industry, as well as in the technical phases of airline operation, manufacturing methods, and industrial organization.

So much for the peacetime contributions of vocational and technical schools and colleges to aviation. Turning now to the area of general education, what contributions are the schools making, and what further contribution can they make? That the schools of the nation are in a position to promote air-mindedness no one can doubt. About one fourth of the people in this country attend schools and colleges regularly and are under the immediate direction of paid teachers. If we limit our consideration to youth in secondary schools and colleges, we find that there are about eight and one half millions of these youth taught by more than 400,000 teachers in some 30,000 schools dotting the length and breadth of the land. It is a commonplace observation that youth are more air-minded than adults. The amazing development of aviation in this country during the last twenty years has captured the interest of youth, and on this account aviation has to some extent found its way into the curriculum of the public schools. Nevertheless education has not heretofore kept pace with the rapid progress in this field. Despite a keen interest among many high-school pupils and college students, only 130 high schools and 109 colleges and universities were reported as offering aviation courses in 1938. The total enrollments in that year in aviation *courses* in all secondary schools when added to enrollments in aviation *clubs* totaled 34,000 students, less than 0.5 of one percent of the total enrollment in these schools. Compare this seeming indifference of our schools with what has been happening in certain of the dictator nations. The governments of Germany, Russia, and Italy early initiated programs in the schools designed not only to make youth air-minded but also generally to develop the elementary knowledges and skills which would provide a reservoir upon which to draw for the training of pilots and aircraft mechanics for military purposes. In Germany every school, starting with the primary schools, was required to have at least one teacher qualified in aviation. The government published for these teachers a weekly bulletin which contained the latest information on aviation advances in order that the schools might keep Germany's youth informed on current developments. Between the ages of ten and sixteen most German boys were engaged in building models and flying them. From this, older youth moved on to the building and operation of gliders, and thence to actual flight training. In numbers, if not in thoroughness, the Russian effort exceeded that of the Germans. Italy also developed a thoroughgoing program in the public schools similar to that of Germany which resulted in the training of thousands of selected youth in various phases of aëronautics. Although we may not care to imitate the dictator nations by peacetime training of our youth for military aviation, yet if we are to develop the air-mindedness in our population which is desirable by reason of the increasing importance of aviation in our national life, it seems to me that we must in definite ways stimulate our schools, especially our high schools and colleges, to make aviation a more important part of the curriculum.

At present, in the later elementary and junior high school grades, aviation finds its way into the curriculum in two ways:

1. Through incidental reading and discussion of topics relating to air transportation in social studies courses, to principles of flight in general science courses, and to occupational opportunities in aviation in vocational civics courses. Girls make studies of air hostess work while boys inquire as to the necessary units in high school required for entrance into engineering institutions or the possibility of securing training for some practical phase of aircraft manufacturing or airline servicing and repairing. Air-minded teachers and pupils in addition sometimes carry on discussions of current aviation topics, and to a limited extent of elementary technical aspects of flying.

2. In aviation clubs, most popular and extensive of the activities of elementary and junior high schools having to do with aviation, students engage in the building and flying of model aircraft and discuss such topics as types of modern airplanes and engines, air transportation routes, and the history and progress of aviation.

There has been little uniformity or organization of the aviation activities of elementary and junior high schools. Each instructor in charge uses his own initiative in developing his own units of instruction and his program of club activities.

Teachers in the senior high schools sometimes seek to motivate work in science and mathematics by drawing illustrations or problems from the field of aviation. For example, a teacher may point out the practical use of triangulation by the suspension of a small airplane on a pipe at one end of the classroom and have students calculate the height of the airplane from the floor by measuring its horizontal distance from one end of the classroom and finding one acute angle of a right triangle. Similarly, teachers in secondary schools sometimes use aviation as a means of interesting pupils in astronomy, history, geography, physics, mechanics, or electricity. In many high school courses aviation has been developed as an organized unit or phase of one or another of these subjects. Industrial arts courses frequently encourage some study of aviation in connection with the construction of model aircraft in school shops. But as previously mentioned, only 130 high schools in 1938 offered one or more organized courses in aviation.

Reference has been made to Germany's insistence upon having at least one teacher competent in aviation in each school. So far as I am presently informed, only two institutions in this country are now offering special training courses to fit teachers for giving training and instruction in aviation in our secondary schools. One of these institutions has been giving for a number of years courses to prepare teachers for aviation class and club work in junior and senior high schools. The construction of the airplane, principles and operation of aircraft engines, radio as applied to aviation, airline operating, aircraft manufacturing, distribution of airlines, and other general matters pertaining to various phases of aviation are covered in the teacher-training courses of this institution.

This brief review of what is now being done by elementary and secondary schools and colleges in the area of general education as related to aviation makes it painfully evident that schools generally have been slow to capitalize upon the interest of youth in this new mode of transportation. Much stimulation is necessary if the schools are to be brought to take advantage of the full possibilities of the study of aviation in the general education of youth for life in the modern world. The United States Office of Education recognizes its obligation to provide all possible educational leadership in this fruitful field.

Let me, then, in closing, briefly indicate a number of ways in which the United States Office of Education should, in my judgment, attack the problem of stimulating aviation education. In this connection it is hoped that there may soon be set up in the Office a Division of Aviation Education. Such a division, requiring only a small but competent staff and costing not to exceed $150,000 a year, might through study, experimentation, dissemination of information and professional counsel do much to stimulate and help the schools to develop more effective programs of instruction in this important field. Specifically, such a division might be expected to accomplish the following:

1. Establish co-operation between governmental and other technicians in the field of aviation and experienced educators with a view to preparing usable teaching materials for use at the various levels of school systems and in connection with the different subjects.

2. Stimulate co-operation between school administrators, teachers, and the industry in a study of how aviation education may be given more adequate attention in the schools. The United States Office of Education has for many years enjoyed the confidence of State, county, and local school officers. Many problems of a type similar to those involved in aviation education have been attacked and solved co-operatively by the educational profession. The United States Office of Education not only can stimulate studies of the curriculum and teaching problems in this field, but it can disseminate the findings of such studies through public report, through counseling with school authorities, and by other means. Through the schools the Office can help to create a widespread interest in the general problems of aviation.

3. Study what the outstanding and more progressive schools and colleges are already doing in the field of aviation education, prepare descriptive accounts thereof, and disseminate these reports for the guidance of educators generally.

4. Study practices of teacher training in the field of aviation education; counsel with and stimulate teacher-training institutions to make prospective teachers conscious of the possibilities of aviation education and skillful in giving instruction in this field.

5. Study and report how the extracurricular and other activities now playing such a large role in educational programs can contribute to the various aspects of a more adequate program of aviation education, compile and distribute materials which will be helpful in conducting aviation club activities.

6. Render further assistance to vocational and technical schools and colleges in organizing and carrying on courses designed to meet the specific occupational needs of those preparing to enter or desirous of making progress in the aviation industry.

7. Gather and disseminate reliable information concerning occupational opportunities and requirements for employment in the field of aviation to be used in school guidance organizations.

The undertaking of the responsibilities which I have enumerated, the focusing of educational research, and the stimulation of educational effort in this far-flung field of aviation, an effort embracing all educational levels in the school system, is of increasingly vital national concern. In the challenge of the present emergency, as well as over a longer peacetime period of time, the schools of the nation are in a position to make a substantial contribution to the continued development of aviation in our nation. Given leadership and financial support, they will not fail in meeting their responsibilities and in measuring up to their opportunity for service.

Identification Of Army Aircraft

(Continued from page 5)

Command airplanes of the GHQ air force are identified as follows:

(1) Squadron command airplanes—two five-inch stripes five inches apart encircling the fuselage at right angles to the axis of the airplane immediately back of the rear cockpit.

(2) Flight command airplanes:

"A" Flight—one five-inch stripe encircling the fuselage at right angles to the axis of the airplane.

"B" Flight—one five-inch stripe encircling the fuselage at a forty-five-degree angle from the horizontal, with the top part of the stripe inclined toward the front of the plane.

"C" Flight—one five-inch stripe encircling the fuselage at a forty-five degree angle from the horizontal, with the top part of the stripe inclined toward the rear of the plane.

In a group of three or four squadrons, squadron recognition colors are painted upon the engine cowlings to a suitable depth. In attack, pursuit, and bombardment squadrons, the cowlings are painted one solid color, white, yellow, or red. In a four-squadron group, blue is used to designate the fourth squadron.

On group headquarters and headquarters' squadron airplanes, the cowlings are divided into three or four equal segments by longitudinal lines. In three-squadron groups, these segments are painted yellow, white, and red respectively. In four-squadron groups, the fourth segment is painted blue.

In reconnaissance squadrons, the colors or color combinations for cowlings are as specified by the wing commander. No recognition colors are employed on planes of wing headquarters squadrons, air base squadrons, or GHQ air force headquarters squadrons.

Organization insignia is placed on fuselages as individual organizations see fit. This insignia is often a coat-of-arms or other distinctive emblem basing its design upon the history, tradition, and purpose of the organization.

In addition to unit-identifying insignia, all aircraft of the United States army air corps bear the insignia of the army air corps. This insignia consists of one vertical blue stripe and thirteen horizontal alternating red and white stripes on the rudder, and one red, white and blue star in a circle insignia on the top and bottom of each wing tip. On the rudder, the white stripe is wider than the red. The words, U. S. ARMY, in black block letters, are placed across the bottom of the lower wing panel so as to be visible from the ground; U. S. on the left panel, ARMY on the right panel.

Tactical squadrons not a part of the GHQ air force—for instance, those in foreign service—bear their own peculiar squadron markings. Some of these markings and designs are very gaudy and elaborate. Also, many tactical squadrons at home have peculiar markings distinctive of the organization. The yellow-black checkerboard design on the cowlings and wheels of the third staff squadron at Sherman Field, Fort Leavenworth, Kansas, represents a typical example of individual squadron coloring.

Power Plane Pilots Should Soar

(Continued from page 7)

soaring flight at Ellenville, N. Y., I was approached by a barnstorming pilot with 3,500 hours. He heard I was to take off from Mount Mongola and warned me to stay away from a certain part of the north side of the mountain. I asked him why. "Because I once dropped 1,500 feet there and nearly crashed." He actually believed this condition to exist all the time and was totally unaware that he had blundered into a particularly violent downdraft on the lee side of the mountain on a day of strong south wind!

Why did one of our airliners crash some years ago when the pilot attempted to climb blind out of a valley up which he had been proceeding on contact until the ceiling closed down on him? I believe that a careful sifting of the facts indicates that he did not allow for a downwash while climbing over the ridge into the wind.

Why did the tail come off a new airliner in the Northwest? True, the empennages of this type were consequently strengthened against flutter, but would this first instance have occurred had the pilot not flown low through a pass noted for the violence of its downdrafts in certain weather conditions?

To get away from the source of danger found in air currents around mountains, let us take a few cases involving the far greater potential dangers of powerful thermal upcurrents and consequent thunderstorms. Why did a large, twin-engined bomber disintegrate in midair last year over a Midwestern State, losing the entire crew? Pieces of wings and fuselage were found a mile or more apart, with no traces of fire or explosion. The last radio report said the air had become so rough that it was no longer possible to control the ship. Chances are that it was hurled on its back by one of the terrific vertical gusts found in such a storm and the inverted loads, combined with further violent up-and-down currents, caused a structural failure.

There are many other cases on record where sound, carefully inspected and licensed airplanes lost wings in flying through such conditions. The majority of these accidents would never have occurred had the pilots had soaring experience in, and consequent respect for large cumulus clouds. When pilots of the motorless fraternity have actually had their ships lifted from the ground to 20,000 feet in five minutes—*forty-five miles per hour straight up*—and experienced terrific turbulence with vertical currents of over one hundred miles per hour, is it not logical to make a rule *never* to fly an airplane through any thunderstorm? Yet, I have talked to air-line as well as other commercial pilots who said that I was crazy and that their modern ships could stand any storm. I say to them that none of us alive today will live to see a successful airplane built strong enough to fly with safety through a big thunderstorm or line storm. Nor is there any need to build such superstrong aircraft when it is so easy to stay out of such dangerous conditions once they are recognized.

Here are a few more incidents that ended all right, but only luckily so. Less than two years ago a DC-2 was flown straight into a line storm. The hostess had strapped down all the passengers, but didn't have time to tie herself down. She was thrown against the roof of the cabin and then hurled down again so hard that her leg was broken. What sort of stresses were those wings being subjected to then? I know of several cases where large airliners were lifted to tremendous heights of 18,000 to 23,000 feet out of control. It is probably safe to say that those pilots won't ever get into such predicaments again, but how about the thousands who have never flown near, under, or through a big cumulus? Being sucked up into one when you are flying a good sailplane with a parachute, full complement of blind-flight instruments, the ability to use them and the will to be there, can be wonderfully thrilling. Caught unawares in an airplane, it can be quite another story.

We have heard enough of the negative side for a while—how about the positive side, accidents avoided and advantages gained through soaring knowledge? Here it is necessary to draw on personal experience. Although it would be possible to go on at length, I will mention only a few when I was pilot for the Joint Iranian Expeditions in 1935-36. Conditions in Iran were tougher than any I have had to tackle in the United States. The terrain averages over 5,000 feet above sea level with great mountain ranges we had to cross rising as high as 16,000 feet. This doesn't sound necessarily bad, but I was flying a standard Waco Cabin powered with an unsupercharged, 225 h.p. Jacobs engine with a wooden prop.

One experience I shall never forget. At the end of a side expedition into Luristan, the hitherto-little-known, mountainous province in the southwestern part of the country, we were flying from Khorrumabad to Teheran. The air was smooth and the wife of the director of the expedition, who had only a little air-work experience, was flying when we started across a mountain range. On the other side lay a dry salt lake of dazzling whiteness. It was about noon, we were flying into the wind, and here were ideal conditions for powerful "dry thermals" unmarked by cumulus clouds, so I took over the wheel. It was lucky I did, for in less than a minute the ship hit such a violent upcurrent that I had to fight for control to keep it right side up and the speed down with the rate of climb reading over 1,000 feet per minute up—and this at 12,000 feet with full load of four people, seventy-five gallons of gas, aërial cameras and baggage! As quickly we hit the downdraft on the other side and dropped sickeningly. In short order we were out of it in smooth air again, but if I had not been ready for such a condition, the ship might have been tossed on its back, dropped into an inverted spin, and with that load it might have been touch and go getting it out.

On two occasions I used upcurrents to great advantage. Taking off with our usual full load at Kermanshah at 4,500 feet altitude in thin, hot air, I had to climb over an 11,000-foot range. The rate of climb showed only 250 feet per minute as we struggled to gain height, so I steered for the famous Behistun Cliff, nearly 4,000 feet high. The wind was right against it, the slope upcurrent intensified by thermals off the desert plateau. The rate-of-climb needle rose to better than 1,500 feet per minute as we made figure eights in front of the rock face. Soon we were high enough to be on our way, at a considerable saving in time and gasoline, so precious in that country with landing fields 250 miles apart.

Another time when gas was uppermost in our minds, I had flown a member of the expedition staff from our southern base at the famous ruins of Persepolis to Isfahan, 250 miles northward. As it was getting late and the weather looked threatening, we started right back without taking on more gas. Fred Lilich, our mechanic, was my only passenger and he shared with me an unforgettable experience. Halfway back we had to make a wide detour to skirt a black thunderstorm. Once past it, we encountered a stiff cross headwind. With the gas supply low and our retreat to Isfahan now cut off by storms, things didn't look so good. We were making slow headway and the gas gauges kept dropping. Faced with the possibility of a forced landing in a rocky, desert valley over 9,000 feet high, I swung to the left and dropped low over a range almost paralleling our course. The wind hit this ridge at an angle sufficient to cause an upcurrent area. Holding the nose down to stay in it, we added better than fifteen miles per hour to our normal cruising speed, as we kept this up for more than forty miles. It was very rough, but I am convinced that it saved the day, as both gauges read empty as we glided down to the Persepolis field half an hour later.

A most encouraging sign in the recognition of soaring by professional pilots was the purchase last year of a Bowlus Baby Albatross by Captain Charles of Eastern Air Lines with headquarters in Atlanta. After some practice he became very proficient with this sailplane and on one instrument flight exceeded 10,000 feet in a cumulus. Recently he bought from Chet Decker my old Minimoa high-performance sailplane stressed for cloud flying. It will be remembered that with it Chet won his "Golden C," highest soaring award, last summer, covering 233 miles and climbing 11,500 feet, so we expect to hear great things from Atlanta one of these days. Another report comes that a group of air-line pilots are interested in starting a soaring club in the Midwest. I hope to hear soon that they have knocked the spots out of my records with this type of ship.

Of course, soaring can best be done in a sailplane. If individuals or groups of pilots will buy intermediate or high-performance sailplanes selling from $750 to $1,200 and fly them according to the approved methods of the experienced soaring fraternity, they can be assured of a world of fun as well as valuable experience in the most thrilling type of flying. To those who cannot afford a sailplane, but have a light plane such as the Cub, Taylorcraft or Aeronca, I suggest that they try some soaring with these ships. Equipped with a good variometer or sensitive rate-of-climb indicator, these ships will soar under the good thermal conditions found on many days throughout the year, but especially in the warmer months. There have been many instances of prolonged flights made with light planes with engines idling.

I say to you, one and all, whether would-be pilots or old-timers hoary with experience, if you want to make yourselves thoroughly capable airmen, go out and do some soaring. And you will find that it is far more fun than airplane piloting ever was.

What Ship Is That?

(Continued from page 8)

seen from below. In this dilemma our observer must turn to his knowledge of design. The outline and proportions of the wing in relation to the size and shape of the fuselage usually identifies the ship. If still stuck, as he probably will be if the plane in question is a light sport plane, he will have to fall back on such details as the shape of the engine cowling or the design of the tail planes. These features differ slightly in the Cub, Taylorcraft, et cetera.

To warring airmen across the Atlantic, the ability to distinguish between hostile and friendly aircraft is a matter of life and death. This is especially true in the present conflict, where insignia is often obscured and practically all military planes are camouflaged. As in the last war, books of recognition silhouettes are issued to the fighting pilots of all armies. These pocket-sized encyclopedias of aircraft design are assiduously studied until the characteristics of the various models are learned by heart. In the case of friendly planes, recognition training is speeded up by the fact that flying cadets are constantly surrounded by their own service types. Captured enemy ships, flown in practice combat, help train the tyro's eye to distinguish hostile contours. Needless to say, recognition sillhouettes of newer models are promptly distributed and the fighting pilot, if he values his skin, must constantly keep up to date.

As a preliminary to the study of individual plane designs, a knowledge of the main types of aircraft is necessary. The first step in airplane identification is, of course, the general classification of the ship in question. Is it a landplane, seaplane (equipped with floats), or flying boat? Is it a monoplane or biplane? Is it of conventional design or one of the unorthodox types, such as the Hammond "pusher," the autogiro, or the Waterman tailless "Arrowbile"? This basic classification flashes through the observer's mind almost instantaneously and he can go on to a more detailed examination. If the ship is a biplane, are the wings of equal or unequal span? Are they staggered? Positively or negatively? If a monoplane, is it of low, mid, or high-wing type? Examine the power plant. Has our ship one or more motors? How are they placed? Are they round, bulbous, air-cooled radials, or slimly cowled, in-line engines? What is the ship's general layout?

Having answered these secondary questions, our observer has narrowed the field down to a handful of possible planes. He then proceeds to study the wing plan. What is its general proportions (aspect ratio)? Is it long and narrow, or short and broad? Are the edges of the wing straight or do they taper? How about the wing tips? Are they square, square with rounded corners, round, or raked? If tapered, do the edges of the wing have an approximately equal taper, or is one edge tapered and the other straight? Is the degree of taper mild or sharp? Do the wings back-taper in at the fuselage or do they bend downward to form a "gull wing"? All these points are important in identifying a plane and all should be studied carefully.

By this time our observer should have recognized the plane. If he hasn't, it is probably due to the fact that quite a few ships resemble each other very closely in plan form. Among the bimotored, low-wing transports, the Barkley-Grow T8P-1 and the Lockheed Electra, 12-A and 14 are almost indistinguishable at a distance, differing only in size. They all have slim, well-streamlined fuselages, twin, air-cooled motors, twin rudders and wings which taper sharply on both edges to a rounded tip. The only difference, difficult to detect at a distance, lies in the proportions of the tail planes and the milder taper of the Barkley-Grow's leading edge. The Beechcraft 18 is also very similar in wing shape and plan to the above ships, but may be identified by the placement of its twin rudders.

Many of the single-engined monoplanes are equally difficult to tell apart. Among the medium-sized, high-wing jobs, we find that the Fairchild 24, Howard DGA-11 and Cessna Airmaster vary only slightly in their proportions and plans. Bellanca's famous fleet, however, are easily spotted by their square wing tips, while the Stinson Reliant has an unmistakable wing form.

In the low-wing category, we tend to run into the same trouble. The silhouette of the Fairchild 45 closely resembles that of North American's military two-seaters. The sharply tapered wings of the Ryan-SC are almost duplicated in the new Phillips 1-B. The Pasped Skylark, Miller Zeta and Security S-1B could pass at a distance for Ryan's famous S-T trainer. Distinctive among the low-wings, however, are the sharply raked wing tips of the Spartan Executive and the Severskylike wing plan of the Dart sport trainer.

The new gig transports and transoceanic flying boats are comparatively easy to identify. The contours of the DC-4 are familiar to every newspaper reader in the land. Boeing's Stratoliner is easily picked out by its four motors and capacious, cigar-shaped fuselage. This latter feature is also characteristic of the new Curtiss twin-engine transport. The Boeing wing plan in conjunction with a slim, turret-studded fuselage has come to mean "Flying Fortress" in any language. Glenn Martin's celebrated Clippers are readily recognized by their sea wings and indented trailing edge, the bigger Boeing boats by their triple fins and deep hulls. Among the medium-sized flying boats we find a strong similarity between Sikorsky's amphibious S-43 and the Consolidated PBY-2. The latter, however, can be distinguished by the square wing tips formed by its retractable wing floats.

Accompanying this article is a number of three-view silhouettes of well-known American aircraft. They are intended as the basis of a recognition book, that may be augmented by photographs of known planes in various flying poses. Complement your study of these by as much field work as possible and you will be surprised to see how soon you will be able to call your shots when the old eagle eye focuses on that distant speck against the blue.

Heads up!

What Happens To Old Army Ships?

(Continued from page 9)

that is the fate of all army ships of today when they are considered obsolete; but that is not true. There was a time when the second-line fighting ships of the air corps were turned over to the national guard for pilots of that unit to fly. This is no longer done, for now the national guard has its own appropriation for ships and purchases them new from the factory.

Many are the times I have heard civilians make the statement that the army should sell its second-line planes to civilians and thus realize a return on the money that had been put in them? This statement always brings to mind one picture that is not very pleasant.

Let us take a ship in the army. It is used and used hard, but it is built to stand it and has the best upkeep in the world. Skilled mechanics are busy with maintenance at all times. Finally, though, after two years of service the cost of maintenance is so high that it is no longer considered worth while to keep it in the service. True, the ship will still fly, and it is perfectly all right for cross-country work and transition time. Should that ship be placed on the market and sold to a civilian pilot it would be in perfect condition for ordinary flying. But—who would buy it? Nine times out of ten it would go to some youngster who could not scrape up enough money to purchase a new ship. Just a young pilot who was burning with the zeal to fly—so he bought it. All need for repair is waived aside and no time is wasted getting the ship into the air. The pilot is in a former army pursuit plane, so what does he do? He starts in to attempt to put it through every maneuver that was ever listed in a pursuit manual. Maybe he *will* get away with it. The ship might take it for a few times. But when it fails to stand the gaff, who would get the blame—the one who flew the ship, or the one who sold the ship? Yes, exactly.

For the past several years it has been the custom of the army to send its second-line ships to the Advanced Flying School at Kelly Field, Texas. This was by no means unsafe, for there they still received the meticulous upkeep customary with the army. The sending of these ships there allowed the student to become accustomed to flying a ship which was a little more advanced, and thus when the young officer graduated he was better suited for the step into the first-line fighting craft of a tactical unit.

Students going through the school during the past several years have flown North American A-17 and Curtiss P-12 as advanced trainers. On going to a tactical unit they went immediately into the North American A-17A and the Seversky P-35 and Curtiss P-36.

But even last year this custom was done away with and the ship now used at the advanced school is the army BC-1. With the establishment of the nine civilian schools as primary training schools, Randolph Field became a basic stage and Kelly and Brooks Fields (all near San Antonio, Texas) became the advanced school, but no specialized work in any of the branches of the air corps is offered. This is received after the student reaches a tactical unit. For that reason all students now fly the same type of ship at the advanced school instead of specializing as was done in the past.

When a contract is placed by the air corps for a new type of ship, all of that order is not filled at once. Only a few ships go to some unit. They are used for a while and little unforeseen difficulties arise. There are a few points of failure, so all ships must be grounded until this is remedied. After this, another small number of ships from the original order will arrive, but they will have changes incorporated so that the original difficulty is done away with. This procedure may be repeated a number of times before all the unfavorable qualities are done away with. This is known in the air corps as ironing out the "bugs." When the final shipment of the order arrives, all unfavorable points that have arisen since the first ships were supplied have been eliminated.

The planes are probably used for a while in the continental limits of the United States and then sent to a foreign station, such as Panama, Hawaii, or the Philippine Islands. These stations outside the limits of the continent do not get the planes until after their usefulness is gone, as it might seem. They have merely been kept here until they are thoroughly proven and all corrections have been made. It will not be necessary now continually to send new parts to the foreign posts for the ships have already gone through that stage and will need nothing but ordinary routine overhaul.

By the time the army craft has remained in foreign service a few years it will be nearing the end of its usefulness as a tactical ship. One of two things may be done with it. The plane will continue in foreign service until it is ready to be done away with or will be returned to the United States. On its return to the United States it will probably be assigned to a nontactical unit where the flying will not be quite so strenuous.

It will then become a ship that is used by staff units and all members of the air corps who are employed at jobs not connected with tactical training. Such pilots will use these planes to maintain their efficiency.

At last, however, we must come to the final stage. The ship has reached the end of its usefulness. It will still fly, but the cost of maintaining it is becoming so high that it is no longer considered worth while to do so. All useful parts on the aërial fighter are removed and placed back in stock. This might consist of instruments, carburetors, magnetos and all of the thousand little things that could have been recently installed.

After this is done, little except the hull remains. The ship is then "surveyed" or marked off the records as done away with. It is turned over to the salvage officer, who signs a receipt as having received it. On reaching the salvage yard, all parts remaining are broken up so that they are no longer useful on an aircraft. Once each year, the salvage officer advertises for bids and all of the accumulated debris is sold as scrap.

Occasionally there is an exception to this and an airplane is sent to one of the training schools, where it will remain as a grounded guinea pig for students to experiment with.

Thus we find that the final resting place of an airplane belonging to Uncle Sam is the same as any other piece of machinery that has seen its usefulness. It is not burned, sold into civilian life, or given away, but is kept until its usefulness is done, then stripped and turned to scrap.

Sand And Spinach

(Continued from page 16)

and patterns, we find that the designers employed by the various powers have arrived at substantially the same answers. The planes of Germany, France and England, therefore, now resemble each other closely as far as color is concerned, and can be identified only by means of their national insignia and differences in structural design. The topsides of pursuit ships are painted with a camouflage design of olive-green and yellow-brown, nicknamed "sand and spinach" by Britain's airmen. The undersides of the little fighters are done in white or sky-blue. This same general color scheme is also used on day bombers, observation and ground-attack machines. Night bombers and fighters substitute a nonreflecting black paint for the sky-blue tints and partially obscure their insignia.

How effective is aërial camouflage? Can it really make a plane invisible? The answer is no. We can no more make a plane invisible with paint than we can make a man invisible with a trick coat. However, if a man blackens his face and hands and wears black clothes, he becomes practically invisible in a dark room, even in the beam of a flashlight. Ski troops dressed in white coveralls are almost invisible against a background of Alpine snow fields. Both of these are examples of good camouflage.

The same principle applies to aircraft. Against a light sky, the opaque shadow of the underside of a plane is at least partially neutralized by painting it white. Viewed from above, the recognizable outlines of the ship are broken up by good camouflaging, which tends to melt it into the varicolored landscape below.

There are two distinct types of camouflage, each with an entirely different function. So far, we have confined ourselves to the protective-coloration type, which tends to make an airplane difficult to see. It is employed to disguise long-range craft operating over enemy territory. The second type is called "dazzle camouflage." This type breaks up the outlines of a plane and reduces it to a bewildering maze of weirdly colored angles, something like cubist art. The idea is that when a dazzle-painted ship flashes across an opponent's sights, it is almost literally impossible for him to make head or tail of it.

Dazzle camouflage is intended primarily for short-range, local-defense fighters. These ships, assigned to the protection of strategic and industrial centers, have no need of disguise or fear of enemy ground batteries. Their camouflage aims at increasing their combat efficiency in dogfighting and in readily distinguishing them from the hostile raiders.

Flying Cadet's Day

(Continued from page 56)

explain thoroughly just what we are expected to do. A typical morning schedule will run something along this order: from 7:30 until 8:30, a period of three-ship formation work, then a rest period until 9:30; from 9:30 until 10:30, a period of instrument flying; then from 11 until 12 another period of formation flying. You must understand that this schedule is not fixed, but varies from day to day as the course progresses. After our sixth week at Kelly Field we begin cross-country flights, which occur about once a week.

This is probably the most interesting phase of the instruction and the part of the work that I like best of all. Our first few cross-country flights are fairly simple, consisting of short trips to points easy to locate. As we become more experienced, the flights become longer and longer. Finally, our last three cross-country flights consist in leaving Kelly Field for some distant point during the day, and then flying back to the field that night. I think that I have learned a great deal about flying on the few cross-country flights that I have already taken. You see, we are really on our own for the first time, and it is our responsibility to get from Kelly Field to our destination and return. We prepare our own maps, compute wind corrections and ground speed, and calculate just how long it will take us to get from place to place. It sounds like a great deal of work, but I like every minute of it.

Another phase of the instruction that I think would prove of interest to you is formation flying. I don't believe that it is as difficult as it appears from the ground. We receive our first taste of formation by flying in the same plane with our instructor. After two or three hours of this dual instruction, during which time we are thoroughly indoctrinated with the technique of formation flying, we are permitted to fly alone. Our instructor, however, continues to lead all formations. After we are proficient in three-ship formation work, we progress to six-ship formation work. I thought when we first started formation work that I would never be able to do it, but my instructor tells me I'm doing all right.

Another very interesting and important phase of our instruction is instrument flying. Here we are taught how to control the airplane relying solely on the instruments in it. We fly with our instructor for the first two or three hours and learn how to maintain straight and level flight, how to make gentle turns to the right and left, and how to climb and dive the plane. After we are proficient in this phase of the work we start flying on the radio beam. First, we learn to identify the various signals of the radio beam; secondly, we learn how to orient ourselves in any one of the four zones of the beam; and finally, we learn how to fly a given leg of that beam into the "cone of silence." This may sound like a great deal for one man to learn, but we are eased into each phase of instruction so gently that we don't realize just how much we really are accomplishing.

At 12 o'clock we report back to the cadet barracks for the noonday meal. As is probably natural, we never can quite forget about flying and airplanes, and consequently, even while we eat, the principal topic of conversation is flying. I think, dad, that if you were to live with a Flying Cadet here at Kelly for twenty-four hours you would discover that his mind never wanders very far from the flying line. It gets in your blood.

At 12:45 we are ready to begin the afternoon schedule, and report to what is known as the "buzzer room" to learn how to send and receive messages using the international code. This room consists of three long rows of tables to which are connected telegraph keys and headsets. Each Flying Cadet sits down to his assigned key and headset, and takes down on paper the letters sent to him from a master key at the head of the room. You see, before each cadet is graduated from the flying school he must be able to send and receive at least fifteen five-letter words per minute. As soon as we are proficient in this phase of the work, we are required to attend the class but once a week. However, dad, I'm still attending every day.

At 2 o'clock we report down to the Post Theater for a lecture by some member of the faculty of the flying school. The first two weeks the lectures dealt mainly with "The Squadron Duties of a Junior Officer." Then several lectures were given concerning radio and its aids to air navigation. Today, the subject of the lecture is "The Organization of the Air Corps." Future lectures will be given on the various branches of the air corps, on "The Combat Orders in the Air Corps" and on the other branches of the army. These lectures generally last about an hour or an hour and a half at the most. For my part, I continue to look forward to them.

We are generally through with our duties around 4 o'clock in the afternoon, after which time we are free to do what we like in the way of recreation. Kelly Field possesses the necessary facilities for tennis, handball, basketball, baseball and golf, so consequently we are never at a loss as to what to do. We are required, however, to get at least two hours of exercise per week, so I choose to play tennis in the afternoons with one of my classmates who has a similar taste.

At 6:30 we are ready for dinner. That is the big meal of the day, and we are really in a mood to appreciate it. As at breakfast and luncheon, we still talk flying, and most of us try to outdo each other with wild stories about our experiences during the day. It's the Tall Tale Hour. After dinner we are free to do what we like. We can go to the early movie at the Post Theater, or to the cadet recreation hall. Here we can play pool or billiards, bridge, or read the plentiful selection of magazines. If the mood strikes, one might study or just sit around and talk to the boys. However, we are not allowed to leave the confines of the post at all during the week, except on Wednesday and Friday nights, permission being granted, and over the week ends. At ten o'clock the bugler blows taps, at which time all lights are out and all cadets are in bed.

You have asked the question as to what I do on Saturdays and Sundays. On Saturdays our day runs along on schedule until after breakfast. Then we prepare for our weekly inspection, which takes place at 9 o'clock. We must have our foot lockers at the foot of our cots cleaned out and properly arranged; we must have all our shoes shined; we must have all our uniforms pressed; we must have clean sheets on our cots; in general, we must be as immaculate as possible. Promptly at 9 o'clock the commandant of Flying Cadets begins his inspection. He looks over each cadet and his equipment and reports him for anything not in its proper place. Inspection lasts about an hour and after that time we are free.

If we care to, as I am planning to do this week end, we can sign out in the departure book at noon on Saturday, not having to report back to Kelly Field until 10 o'clock Sunday night. This, however, is a privilege and can be withheld for some infraction of the rules. Most of us go to San Antonio for the week end, although we are allowed to go anywhere within a radius of fifty miles of Kelly Field. This week end happens to be a special one, because Saturday night is the date of the big Cadet Dance at the Gunter Hotel in San Antonio. You see, dad, I was lucky enough to be elected to the Cadet Club Committee, which has charge of the arrangements for the dance. About ninety-five percent of the cadets go to the dances, and it has been my experience that they are well worth attending. We have very little trouble getting dates for our dances, because, through numerous tea dances given for us while cadets at Randolph Field, we met many of the young ladies of San Antonio. The dances generally last from nine until one o'clock.

After the dance I plan to stay in town at the hotel and report back to the field sometime Sunday afternoon. This, in my estimation, is the ideal arrangement, because then I am able to eat supper at the field, go to bed early Sunday night and be ready Monday for another full week. I think that now you have a fairly concise idea of just how I spend my time during the day. If there are any questions that I have left unanswered, dad, I certainly hope that you will remind me of them. However, it is getting very close to ten o'clock, so I'd better sign off.

Your son, BOB.

A Solid Model of the Bell Airacobra

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sheet balsa. Trace their outline on the wood and cut them out with a single-edged razor. The body is notched for the stabilizer, and the rudder is cemented atop the stabilizer using plenty of cement for strength.

The wings are cut from soft balsa sheet about $^5/_{16}''$ thick. Try to obtain a heavy cut of $\frac{1}{4}''$ sheet if the other size can't be obtained. The wings are cut out in the same manner as the tail. However, the wing blank—all one piece—must be shaved down to the proper wing section. Then the tips are tapered off before sanding. To mount the wing, cut a notch to fit in the bottom of the fuselage and cement the wing in place. A wood filler can be used to fill in the crevices and to build up a fillet after the joint has dried.

Use small dowels for the landing gear. Those for the main wheels can have sheet balsa glued on the side to imitate the wheel-well cover plates.

If a fine finish is to be obtained, leave off the details until after painting. A good finish consists of a coat of some wood filler, followed by a sanding, and then at least two top coats of whatever color is being used, with a fine sanding in between. Four to five top coats would leave little to be desired. The last coat should be rubbed down and then polished. Ask your supply dealer about fillers, paints, rubbing compound, et cetera. A natural silver color is suggested. Aluminum paint or else silver bronzing powder and liquid are two possible paints. Rudder is regular red, white and blue.

Slingshot Aviators

(Continued from page 6)

be fired. The pilot opens his throttle a little more than halfway. The rough rumble of the radial motor smooths into a steady growl. The observer in the rear cockpit gets his head down between his knees, arms hooked under his thighs. The terrific acceleration could easily snap a slack-muscled neck. The pilot's eyes never leave the upraised hand of the catapult officer.

Now only four fingers are up. One of the five minutes is gone. Three fingers—two fingers—one. Then comes the crucial-moment action signal—crossed index fingers. Thirty seconds to wait. The catapult officer rotates his right arm, the signal to rev up the motor.

The pilot is suddenly very busy. He cracks the throttle to maximum manifold pressure, checks oil pressure and tachometer. The plane trembles against the safety-wired saddle, seemingly eager to be off. The pilot shoves out a clenched fist to indicate his motor is full out, then gets his arm in quickly. He tenses his head back against the crash pad and stiffens his neck muscles. His feet steady the rudder pedals; his right arm grips the stick while the left holds the throttle.

The shock of the explosion is paralyzing. Deck and men disappear in a blur. The stomach packs back against the spine, the back of the head flattens the crash pad. A terrific thump of the saddle car against the bumper and the plane is snapped into the air at sixty knots. The constant-speed propeller soon pulls the ship into safe flying speed. The body pressure lessens as the body catches up with the sudden speed of the plane, and nothing more unpleasant than a momentarily accelerated pulse is experienced.

A pilot's usual remark following his first experience at catapulting is something like: "Now I know how a bullet must feel when the gunner pulls the trigger!"

D.C