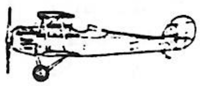
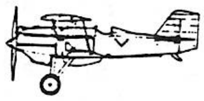
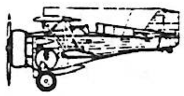
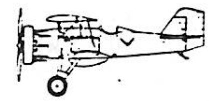

Vought VE-7SF

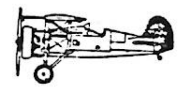

Curtiss F6C-3

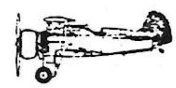

Boeing F4B-4


Curtiss BF2C-1


Curtiss TS-1 (FC-1)


Curtiss F6C-4


Boeing XF5B-1


Boeing XF6B-1

D.C. MAXECUTERS

MAX - FAX

THE NEWSLETTER OF THE D.C. MAXECUTERS

JULY AUGUST 1985

MEMBERSHIP

Dues for membershp in the D.C. Maxecuters is $10.00 per year for residents of the U.S.A., Canada, and Mexico, and $11.00 for all other countries. Your mailing label indicates the year and month of the last issue of MAX—FAX for your current membership. A red mark in the box below is a reminder that your current membership is nearing its end. Send a check, payable to D.C. Maxecuters, to the Treasurer.

DUES REMINDER ☐

MEETINGS

The D.C. Maxecuters hold meetings on the first Wednesday of every month at the College Park Airport, the oldest continuously operating airport in the world.

PRESIDENT

TOM SCHMITT
11014 Marcliff Road
Rockville, MD 20852

SECRETARY

BILL POOLE
9301 Lynmont Dr.
Adelphia MD. 20783

TREASURER AND
NEWSLETTER EDITOR

ALLAN SCHANZLE
20008 Spur Hill Dr.
Gaithersburg, MD 20879

UPCOMING EVENTS

NOTE: Our normal Friday evening flying sessions have been changed to Sunday evening. See note in Club News section.

July 14: H.L. Glider and P-30 Mini Contest at COMSAT

Aug 11: CO_2 Scale Mini Contest at COMSAT

Sept 7: Summer Fun Fly at COMSAT

CLUB NEWS

Allan Schanzle

SEVERAL ITEMS should be brought to your attention. The first is that due to construction on I-270, which is the road practically all of us use to get to COMSAT, we've changed our Friday night flying sessions to Sunday evening. I-270 is a parking lot every evening during the work week, and it's almost impossible to get to the field before 7:30 P.M., unless you arrive at 3:00 P.M. So check the upcoming events calendar. The mini-contests have also been rescheduled for the Sunday after the original Friday date.

In the last issue of MAX-FAX, I asked for your comments about a potential problem with the mass launch events, namely, everyone wants to enter them all, and on a hot, sultry summer day, that can pose a real health problem to some of the older contestants who may just overdo it. One of our Michigan members, Jack Moses, wrote to support a minimum of 3 or 4 rounds, which helps to keep strategy a part of the event. But Jack also hit on a point that I personally feel is priority number 1, and that is that any contest should be FUN, and he suggests that FAC might just stand for "FUN AND COMRADERY." A gold star to you Jack.

This issue features another interesting IAR (Industria Aeronautica Romana) aircraft by Hoby Clay. This one is the IAR-14 Pursuit, which was redesigned from an old (March 1936) plan in FLYING ACES. If you don't like rubber scale, try this one for CO_2, it looks perfect for the Brown Peanut engine. Hoby is certainly an active builder, as testified to by the following, which was included in Hoby's letter.

"I'm in the process of making a version of Pat Daily's Ansaldo SVA-5 for rubber power. This winter I did a PT-19 for Brown CO_2 and a Wiley Post Model A for my Telco Turbo 3000.

"Other than that I've redrawn a few of Jack Fike's (Scale Flight Model Co.) old 1930's dime kit plans. Corben Super Ace, Fokker D-7 and D-8 are built to date. Also have recently done peanuts of Ben Howard's Mr. Mulligan and a version of a clipped-wing Monocoupe 110. Good looking models but not terribly unusual."

In addition to this feature plan, we have a proposal by Rich Hensel for a winter "Contest for Crates," and a plan by John Walker for Joe Ott's old "Sky Flyer." Our aviation history lesson for this issue is taken from AIR TRAilS, Nov. 1950. It discusses the design of the Japanese Zero by, who else, the designer himself, Jiro Horikoshi. The aerodynamics lecture is Part 4 of the series on "Is a Horizontal Tail Necessary," which appeared in SPORT AVIATION. So take notes carefully, we'll have a quiz next issue. Finally, we have two more pages of first class photos by Tom Schmitt. And who, pray tell, is "MAX" that continues to offer cover drawings every month? We thank you, one and all.

PHOTO PAGES
Tom Schmitt

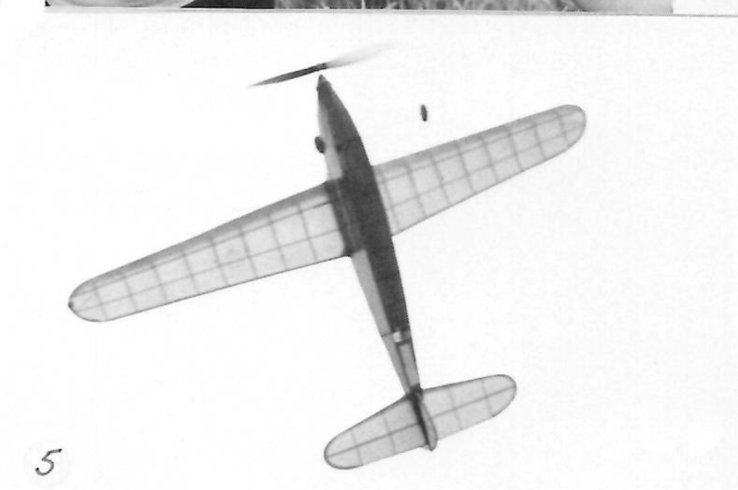
1. Our full size plan this issue, a peanut of the I.A.R.-14 by Hoby Clay. Model and photo by Hoby.
2. Pat Daily's CO2 Ansaldo is a great flyer. See Mar/Apr '85 Max-FAX for his full size plans.
3. Bert and Evelyn Phillips prepare for the June 16 Old-Timer Contest with a bright yellow 20 inch Pacific Ace.
4. Dan Driscoll has resurrected his Sparky for the Old-Timer bash.
5. Bud Carson's old timer is a Comet Phantom Fury.
6. Leave it to Frank Renaut for something different - a four bladed Palownia prop on a 'posy' decorated 30 inch Pacific Ace (wrapping paper with ping pong ball dope).
7. One of our newer and very helpful members, Bill Ceresa with a Guillow's Typhoon.
8. Rich Hensel and Jimmy Doolittle both tried and Jimmy succeeded. Don't give up Rich, so long as the CO2 holds out.
9. Don Srull's latest beauty and promising to be a good flyer also - an OC-2 enlarged from Pres Bruning's peanut plans for both rubber and electric (VL).
10. Doug Buchanan shows great form launching his Porter.
11. Allan Schanzle's Hellcat has proven to be a good flyer outdoors. See article in Mar/Apr '84 MAX-FAX.
12. The photo editor's CO2 version of Hurst Bower's RWD-10 from the May/Jun '82 MAX-FAX.
13. Another look at another MAX-FAX model - Paul Gaertner's Gugnunc in the Nov/Dec '82 MAX-FAX.
14. Another new Maxecuter, Francis Person, with his Pietenpol.
15. A little whimsy by Allan - indoor hand launch glider flying using the paper 'Jack Armstrong' zero kit - not a bad flyer.
16. Bert with his tried and true SNC - an old plan and model but still a good flyer.

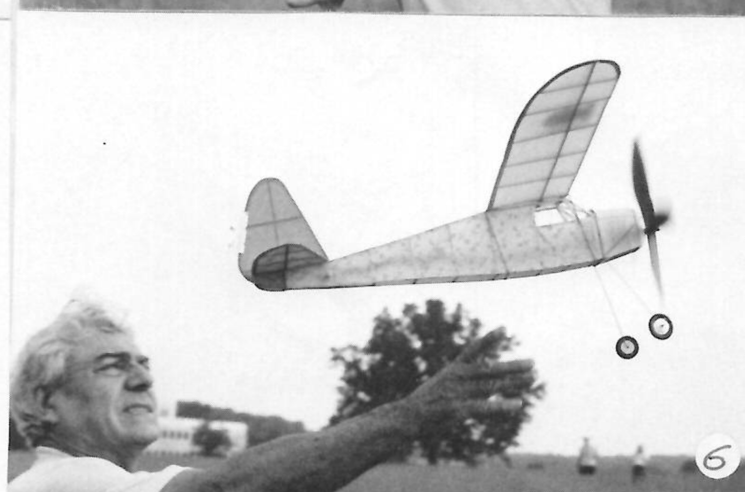

1


2


3


4

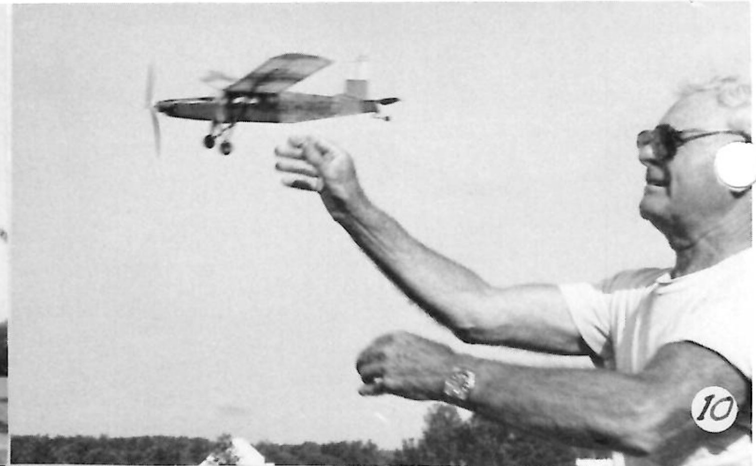

5

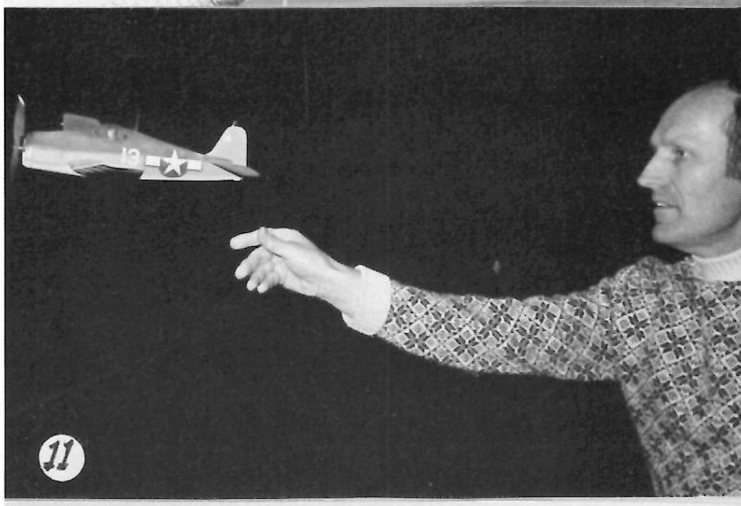

6


7


8

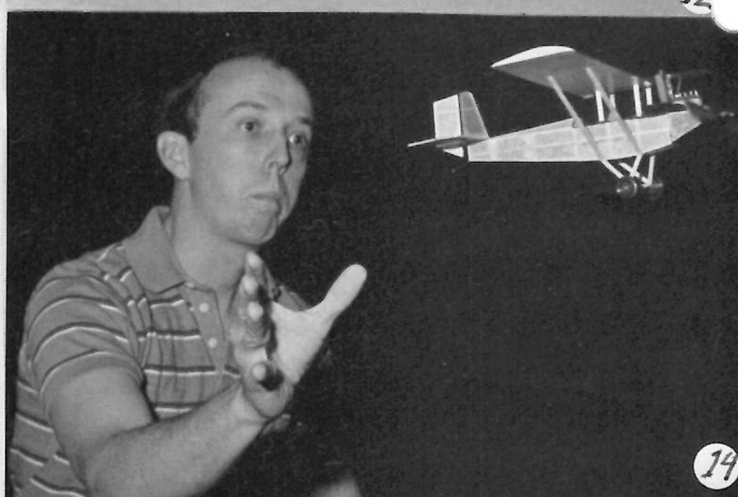

807
9


10


11


12


13


14


15


16

A CONTEST FOR CRATES

Rich Hensel

I like cute crates: scale-like, all balsa crates. They're quick and easy, and you don't have to cover them. That's why I built the peanut Ford Flivver from Walt Mooney plans in the February '72 issue of MODEL BUILDER. Walt claims that the flag flying high above the cockpit makes up in stability for zero wing dihedral. I don't know. I must have done something wrong because my little Ford had all the stability of an F-4 Phantom with its left wing shot off. So I hauled down the flag, cracked in some dihedral, and voila! It flew. Bert Phillips has some neat crates that truck around equally well, and at our last few indoor sessions I've seen some other sheet balsa ships cruising around.

So we talked and decided to have a contest. It's going to be a real laid-back kind of deal: Any airplane, any size, rubber powered. All balsa and/or foam construction. Yes, the MRC, etc. foam kits qualify. No profiles. Item must be recognizable as a full scale aircraft. Allan Schanzle has consented to be the judge of this ('bout time he does something for the club). Wheels not necessary, but ten sec. bonus for ROG, also ten sec. bonus for biplanes. Enter as many planes as you wish. Best single flight time wins. Record your flight times with me. The winner will get six issues of MAX-FAX. In other words, his dues will be paid-up the next time he sees that red X on his newsletter. The ten beans to cover this comes from selling refreshments at our last gig down at Pax River. This contest will run for the entire fall-winter, '85-86 indoor season. Oh, what about paint and markings? Let your conscience be your guide. C'mon now, take some pride in your work. The thing is, if you show up with a few slabs of balsa and claim that it's a stagger-wing Beech, by God, it had better look a little bit like one. "Else the boys on the committee might come around and stomp on all your airplanes. They might do other things, too. Nasty things. Don't ask. Lots o' luck, pal. Better to not show up at all.

Seriously though, your ship should look like whatever it's supposed to look like. And remember, it will have to pass muster by Allan. Now I'm not saying he's a tough judge. But, well, if the Moment of Truth were at hand, and I had to face either Schanzle or Saint Peter, I believe I'd take my chances with the Big Fisherman, the one who, some say, was crucified upside-down. And as far as I know, Allan isn't quite that big; he doesn't fish, and he hasn't been crucified----at least not yet.

So build a crate and come on out and have a ball. Make it a bipe and get it to go off the deck and hell's afire, man, you'll have twenty seconds nailed down as soon as it's in the air. Come on out and have some fun.

COMSAT MINI-CONTEST

MAY 10, 1985

CONTEST RESULTS FOR WW-II

NAME	AIRCRAFT	PLACE
DAN DRISCOLL	HELLCAT	
KEVIN SHARBONDA	CORSAIR	
ROLFE GREGORY	P-51	2
ALLAN SCHANZLE	P-39	1
CLAUDE POWELL	MIG-3	
DON SRULL	CAUDRON	

CONTEST RESULTS FOR WW-I

NAME	AIRCRAFT	PLACE
KEVIN SHARBONDA	LOENING KITTEN *	2
BERT PHILLIPS	VELEZ	
CLAUDE POWELL	SESA	1
ROLFE GREGORY	SES	
ALLAN SCHANZLE	JUNKERS DI *	
DAN DRISCOLL	SESA	

* MONOPLANES - 5 SEC HANDICAP WW-I

AIR TRAILS
NOV., 1950

Here is the full, true account presented for the first time on the origin and development of World War II's most controversial aircraft. Designer Horikoshi who masterminded the Mitsubishi 00 lifts the veil on the Great Zeke Mystery

I Designed the Zeke

By JIRO HORIKOSHI

■ It might seem better if the man who designed the best-known fighter plane of the losing side kept his peace. However, by the mysterious channels through which back copies of publications travel, the April 1949 issue of Air Trails came into my possession. The American friend who gave it to me pointed out David A. Anderton's article, "The Great 'Zeke' Mystery," which indicated that the "Zero" fighter was progressively "borrowed" from a number of other contemporary aircraft.

As the designer of the Zero, I would like to be permitted, for the benefit of history, to set the record straight. The Zero fighter, as the world got to know it, was no more copy than any other fighter used in the world today. All single-engined all-metal low-wing monoplanes are to some extent progressive "copies" of the original Junkers "Bleichsesel," the father of all these machines. There is a certain pool of common information from which all engineers draw. There is a certain reciprocal borrowing of detail ideas without permission during wartime, and by cross-licensing in times of peace.

There have been few scientific studies of the Zero as an airplane published anywhere. In Japan, it was naturally praised; overseas, it was frequently subjected to certain ridicule, to dogma and to prejudice. I am grateful to Mr. Anderton for his prompt discounting of many of these false rumors and half-true reports. However, I can best prove the originality of the design of the Zero by relating its history and its background. Like people, airplanes have ancestors. They get to look as they do partly by heredity and partly because of the functions which they have to perform. This is, in essence, the story of Zeke, as seen through the informed albeit maybe slightly prejudiced eyes of its designer.

Mr. Anderton, in his article, intimates that the world first saw Zeke on that day all Japanese would like the world to forget, Pearl Harbor Day. Had Mr. Anderton been given access to proper military information which I am sure must have been at the disposal of leading American military and naval intelligence personnel, he would have known that the Zero had been in action on the mainland of China for about a year and a half before the Pearl Harbor strike. In July of 1940, it began to replace the leading Army type, the Type 96-4 carrier fighter which had been a standard machine since 1936. Since the air phase of the operation in China was chiefly a Navy show, the Mitsubishi 96-4 (A5M4) had, up to then, been the leading single-place job.

Here let me explain, again for the record, how the Japanese numbering system of identification worked. The 96 denotes the year that the plane was put into regular service, the 2596th year of the old Japanese era, 1936 AD. The figure 4 indicates the fourth modification or revision. The symbol A5 indicates that it is the fifth fighter prototype built by Mitsubishi, or M. This system was adopted by the Japanese in 1936, but was applied to planes built before that period also in reference files. The Army and Navy, which seldom got together on anything important, used somewhat different designations for everything but the year of service.

As the war in China moved further inland, the Navy felt that they needed a fighter with a much longer range, in order to escort the bombers to and from the targets. It was this need for combination of speed, range and maneuverability that begat the Zeke.

Mr. Anderton's knowledge of the early history of Japanese aviation is remarkably sound. As he stated, Japanese Naval aviation is chiefly British in its ancestry, while the Army aviation drew heavily from French and German sources. These were the easy old days, after I received my degree in aeronautics from the Imperial University in Tokyo and entered the Nagoya Aircraft Works of Mitsubishi Heavy Industries, Ltd., as a design calculator—or subordinate structures engineer, as one would be called in the United States. This was the period during which Japanese industry was trying to catch up with the more advanced technical status of certain Western powers by hiring experts and buying ideas and experience.

By the time I entered Mitsubishi, at the age of 23, the noted American designer, Mr. Smith, and his party were no longer with the company. There were no Americans with the firm at the time. Prof. Baumann, the noted German designer, and Mr. Schade and Mr. Keil, both from Junkers, were with the company. The noted French designer, M. Vernisse, was employed in the outfit, as was Mr. Petty from Blackburn Aircraft Co. in England, and his assistants, Mr. Bolton and Mr. Wilkinson. These men stayed for contracts ranging from one to three years during the formative period between 1926 and 1931. They designed aircraft, taught other engineers the techniques of design. Unfortunately, I was in the lower echelon, my task was supervising stress calculations, and I had no opportunity to contact these foreign experts directly.

This importation of foreign experts was universally practiced during this period when Japan's infant aviation industry was gathering momentum. Nakajima, Kawasaki, Aichi, Tachikawa—all of these had experts from abroad on their payrolls. Their influence during this period can be seen directly in the airplanes that were acquired by the Army and Navy. During this period, the Japanese companies went heavily into the purchase of patent licenses of all kinds. For example, the Handley-Page-Lachman leading edge wing slot was acquired jointly by Mitsubishi and Tachikawa for a hundred thousand pounds. Licenses for accessories, engines, instruments and the like were purchased wholesale, to permit the infant industry to get into a competitive position.

I was sent abroad to study during this period, and from June to December, 1929, I traveled in Europe. England, France, Germany and the Netherlands, visiting airplane factories. I stayed with the Junkers company for three months, studying their procedure in design. In December 1929 I embarked for the United States where I visited many plants. I stayed several months at the Curtiss Company's plant in Buffalo, where I acted as inspector for the P-6 pursuits that had been purchased by Mitsubishi.

When I got home in the early fall of 1930, there was a new movement in the air. The Japanese designers had a feeling that they wanted to try their own ideas in designing. By 1932, the Japanese government was about ready to listen. The Japanese Navy was particularly anxious to start a new line of aircraft, built entirely by Japanese. They ordered three important types under this program, a carrier-fighter, a carrier torpedo-bomber and a reconnaissance seaplane. These were designated as the 7-Shi class since they were ordered during the seventh year of the Showa reign or era, 1932. Nakajima and Mitsubishi got orders for the carrier jobs, and I was appointed chief designer of the carrier fighter, chiefly on the basis of my experience and knowledge of fighters gained by contact with the P-6.

By this time, the trend was definitely to monoplanes in fighters. By modern standards, the 7-Shi fighter was a clumsy, angular monoplane, but it was in the contemporary line of design. The wings were thick, full-cantilever structure, fabric covered, using the popular elliptical planform that was the current leader. The fuselage was dural semi-monocoque structure. The prototype had a three-strut landing gear. The second machine had a full-trousered leg. The tail was dural structure, fabric covered.

The machine was conventional for its time, many of its characteristics having been dictated by the rigid demands for visibility and performance laid down by the Navy.

None of the machines presented for the 7-Shi competition met the Navy's requirements. Nakajima had presented a carrier version of the old Army 91-type fighter, evolved by the French designer Marie. I don't know what happened to the other machines in the 7-Shi competition. Ours didn't fare too well. The original machine shed a stabilizer during a power dive test. Luckily, the pilot bailed out without any trouble. The second airplane went into a flat spin during an aerobatic test, the ship went in from a double roll. The pilot, Lt. Okamura, got out all right. Despite his bad experience with my first original design, Lt. Okamura stood by me, giving me ideas and encouragement for my further work.

By 1934, the Navy eased up on size and range demands for their carrier fighters and dive bombers. By this time, I had a lot more experience and a few more original ideas. When the call came for the 9-Shi fighter, I conceived long, slim lines for the new ship instead of the thick, stubby ones.

Most of the leading Navy pilots had most of their experience on the old biplane fighters. They conceded the need for speed and climb, but their tactical concept ideas still called for turning combat, the old dogfighting idea. To get the combination of speed and maneuverability into the airplane I desired, the answer was a light airplane.

We retained the fixed landing gear in this design, since the gear constituted only 10 percent of the overall drag. A retractable gear would have raised the top speed from 400 to 410-15 km per hour. We did not figure that the increased weight and mechanical complexity of the retraction mechanism was worth the investment.

The 9-Shi incorporated the use of tension-field spar webs, an idea that was brought to Japan from Rohrbach in Germany by Capt. Wada who later became Vice Admiral and Chief of the Navy's Air Headquarters. This system permitted great lightening of the wing structure, without sacrifice in strength.

The 8-Shi was the first plane in Japan to use flush riveting and was probably the second design in the world to do so. The first, I believe, was Heinkel He-70.

The first 9-Shi was test-flown at Kagamigahara Field in February 1935. It had a top speed of 280 mph, 63 kmph faster than the old 7-Shi and the Type 95 carrier fighter it was built to replace. The fabric-covered Nakajima machines, built for the competition, were sold to the local newspaper, "Asahi," to be used as liaison planes.

The first 9-Shi was an inverted gull-wing job, built without flaps. The ship developed a pitching motion at high angles of attack, due to the turbulent flow at the V-shaped concave part on the upper surface of the wing. Thus, despite the better visibility and the weight saving afforded by this configuration, the second 9-Shi had a straight center section.

The 9-Shi was undoubtedly, as the Americans call it, a "hot ship." A shallow approach was required, and the ship had a decided ballooning tendency on touchdown. It was thoroughly tested under the supervision of Lt. Comm. Yoshito Kobayashi, chief pilot of the flight test section. Its virtues were noted, particularly its speed. Its faults were analyzed, and corrective measures taken. Then the ship was used for static testing.

The second 9-Shi was fitted with a split flap and a larger engine, a direct-drive type, since the first machine had developed some trouble with the reduction gear system. This machine suited the rigid requirements of the Navy. On the basis of its performance, the Navy tried to cancel an order for French Dewoitine D-510's. They finally had to take two, which were kept, chiefly for the study of the motor cannon. The noted pilot Marcel Doret flew the planes on demonstration for us. We flew comparative tests against the 9-Shi at Kasumigaura Navy Field, and the Mitsubishi machine proved superior on almost every point of performance.

It is interesting to note that as early as 1927, Mr. Noda, then chief of the wind tunnel section and later assistant manager of Mitsubishi's Nagoya Works, filed patents on a simple split flap. Because the prophet is often without honor in his own country, Mr. Noda's flap was buried under the avalanche of foreign patents that were being purchased. It was several years before the idea was picked up and put to actual use.

The gap between the final approval of the 9-Shi airframe and its final adoption as a military machine stemmed from our inability to produce a suitable powerplant. A number of radial engines, varying from 600 to 800 hp were considered by the Navy. Finally, the smallest unit, the Nakajima Kotobuki 2-1 was adopted because it was the most reliable unit in production. The 9-Shi machine went into service as the Type 96-1 Carrier Fighter (A5M1).

For the time being, the production machine's performance was lower than the prototype's, but it was put into production for use in the Sino-Japanese conflict which began in July of 1937. There were over a thousand of these fighters built; 800 by Mitsubishi and two hundred odd by the Sasebo Naval Arsenal and the Kyushu Airplane Company. Its power was progressively stepped up as better engines became available. What went into actual mass production was a Type 96-4, powered with a 700 hp Kotobuki 41 engine.

During the time when the 96 was the leading Japanese fighter, we had the opportunity of running comparative tests against the Seversky P-35. We purchased ten of these for purposes of test and study, and found that the machines were heavy, unmaneuverable and did not compare with the performance of the Type 96 in virtually all major points. Actual combat against the Gloster Gladiator, the Curtiss Model P-75 and the Russian I-15 and I-16 indicated that for most purposes, we had the superior machine. However, the Navy was not deluded into believing that these tests made us the tops in fighter design; it stood to reason that no country was going to export its best aircraft. For that reason, we were encouraged to improve our design and keep step with the world.

The Navy determined that the next machine, which was to be faster and have reasonably proportionate performance, must retain greater maneuverability than opposing aircraft. In brief, the Navy air strategists wanted speed and climb, but they still demanded a tight turning circle.

These were exacting demands; the sole solution appeared to be in building the lightest possible airframe and keeping the wing-loading as low as possible. We were forced, therefore, to eliminate consideration of such things as fire protection, self-sealing tanks, armor plate and anything else that was weight consuming. The design specifications laid down by Naval Air Command appeared impossible.

We knew that Japan was a nation of limited resources. Therefore, it was important that we build what airplanes we did produce as superior machines. I had laid down three criteria for the design of a fighter; performance, producibility and ease of service. For a small country, performance was the major object—even at the cost of the other two or if need be, the safety of the crews.

It was against this background of virtually impossible demands that we began work on the 12-Shi prototype in 1937. We estimated that it would take three years to produce the plane that Supreme Command wanted. Yet as the war retreated further inland in China, the range of the old 96 was proving inadequate. Even with drop tanks, it was getting more difficult as the Chinese moved the scene of battle further from the coast.

The earliest designs in the 12-Shi project were built around the 875 hp 14-cylinder Mitsubishi Zue-sei engine, swinging a Sumitomo two-position propeller, a Hamilton-Standard design. Later, the Nakajima Sakae, a slightly larger and more powerful engine became available, and was incorporated into the third machine. The bulk of the production Zeros carried this engine. Later, when most of the Zeros were land based, the Mitsubishi Kinsei engine was used.

To achieve the performance demanded by the Navy, weight conservation was the prime order in the 12-Shi design. We built the wing in one piece, thus eliminating heavy center-section fittings. We used the smallest possible fittings to join the wing to the fuselage. The flanges of the main wing spars were made of a new type aluminum alloy called ESD. The fuselage was built in two sections for convenience in storing and for easier transport on trains. The entire structural philosophy of the 12-Shi design was aimed at lightening the structure.

The plane itself was built for minimum air resistance, good control and stability. The wing area was determined on the basis of keeping the wing loading below 21.5 lbs. per square foot, in order to satisfy the take-off, climb and turn requirements.

The 12-Shi model used a new wing curve that was specially created for it. It has the same thickness ratio as the B-9, which had the best polar curve at the time and a similar camber line as the NACA 23012 series with a maximum camber of two percent. The new airfoil was designated as the Mitsubishi 118. Its polar curve was about the same as the B-9, but it had only about half the movement of the center of pressure. This same wing curve was used in the Type 1 land-based bomber, known in the U. S. as Betty.

To prevent tip stall the wing was given a 2 degree washout angle. The tail surfaces of the Zeke were designed to give maximum longitudinal and directional stability. The original planforms were laid out to match that of the wing. This system used a removable tailcone, which, we believed, would be useful for structural maintenance. This system was used in the 7-Shi series fighters. A later experimental model used a flat-sided fuselage, fairing into the rudder. Most of the Zeke series used the tailcone configuration. The vertical stabilizer and rudder on this first configuration was set above the center line and well forward of the end of the fuselage. This plane had fine spinning characteristics. Toward the end of the Zeke run, the flat-sided fuselage was used for the sake of producibility, and was also used on the later types that I designed, the Raiden and Reppu.

The effect of our general effort toward aerodynamic refinement showed up well in our competition with other fighters which emerged later in the war. In comparative runs with the Army fighter "Hayabusa" (Oscar) and "Shoki" (Tojo), our design showed itself to be a prime design despite certain mechanical advantages enjoyed by the newer ones. For example, the Oscar, with its more powerful engine was equal in speed and climb and was a less maneuverable machine. Its gross weight and useful load was the same.

In its general structural features, the Zero and the model 96 were quite similar. Aside from the obvious use of the retractable landing gear and other improvements previously mentioned, the major change was the extensive use of the ESD high-strength aluminum alloy which was developed by the Somitomo Co. This alloy is rich in zinc and chrome, and was generally similar to other high-strength alloys. Sumitomo pioneered this field and their product had 30-40 per cent greater tensile strength and 70-80 per cent higher yield point than the alloys previously used.

This alloy, however, had definite limitations; it has a tendency to develop cracks when rolled or extruded. Heavy extrusions had to be clad heavily with pure aluminum, and proved reliable only when these were furnished by the original supplier, and were usable without bending or drawing. This limited the efficient use of the alloy to relatively small aircraft and in such applications as main spar flanges. I used the alloy only for this portion of the main beams, but they did effect a considerable weight saving.

This philosophy of lightness in structure which characterized the 12-Shi or Zero was basic in its nature; we knew that we were going to have certain problems at the outset, and we were willing to take those chances in order to achieve the result we wanted.

The first Zero was flown by Navy test pilots at Kagamigahara Field in July, 1939, and was accepted by the Navy after 119 hours had been put in on the prototype by the company's personnel and 43 by the Navy. The second machine was accepted in September 1939, and the prototype was used for static testing. There was no great pressure put on the Mitsubishi Company to produce the 12-Shi model until early in 1940, since the old 96 was held adequate for use in the Sino-Japanese operation. As a matter of fact, the first machine to be termed a Zero model was our 12-Shi land-based bomber (designated as Betty by the Americans). Performance tests were held with a number of powerplants. There was a general beefing up of the airplane, especially in the power section, and minor changes were made in the control system to augment maneuverability.

During the trial period, we lost two experimental aircraft. Out of these accidents, we learned that the ESD spars had certain structural limits, and the wing structure, particularly the spar caps, were redesigned. One of the victims was 1st Lt. Shimokawa, who was investigating flutter during a dive. Again there were structural revisions in the wing.

The Zero went into service in China, as previously stated, in mid-1940. However, there were progressive improvements in the design. Actually, no Zeros were produced after August of 1945, the end of the war, although my later designs, the Raiden and Reppu, were then being readied for production.

The Zeke, as the war went on, was altered. Armament and power were varied, armor and self-sealing tanks were added. On one modification the wings were clipped to improve the rate-of-roll, general structural concessions were made to permit better diving speeds. However, we suffered to a great degree from an ultra-conservative topside, who were slow to put into effective practice such changes.

In summing up the defense of the design originality of the Zero, I will give credit where credit is due. As I stated previously, and as virtually all competent airplane designers will hold with me, the business of creating any new airplane is a process of adapting the existing art and science to the problem at hand. For example, I will state that the undercarriage retraction design on the Zero was inspired by the Vought 143, and that the system for fastening the engine cowl and the method of mounting the engine came from other foreign planes. Any designer who fails, out of vanity, to adapt the best techniques available to him, fails at his job. All engineers are influenced by their teachers, by their experience and by the constant stream of scientific information that is placed at their disposal.

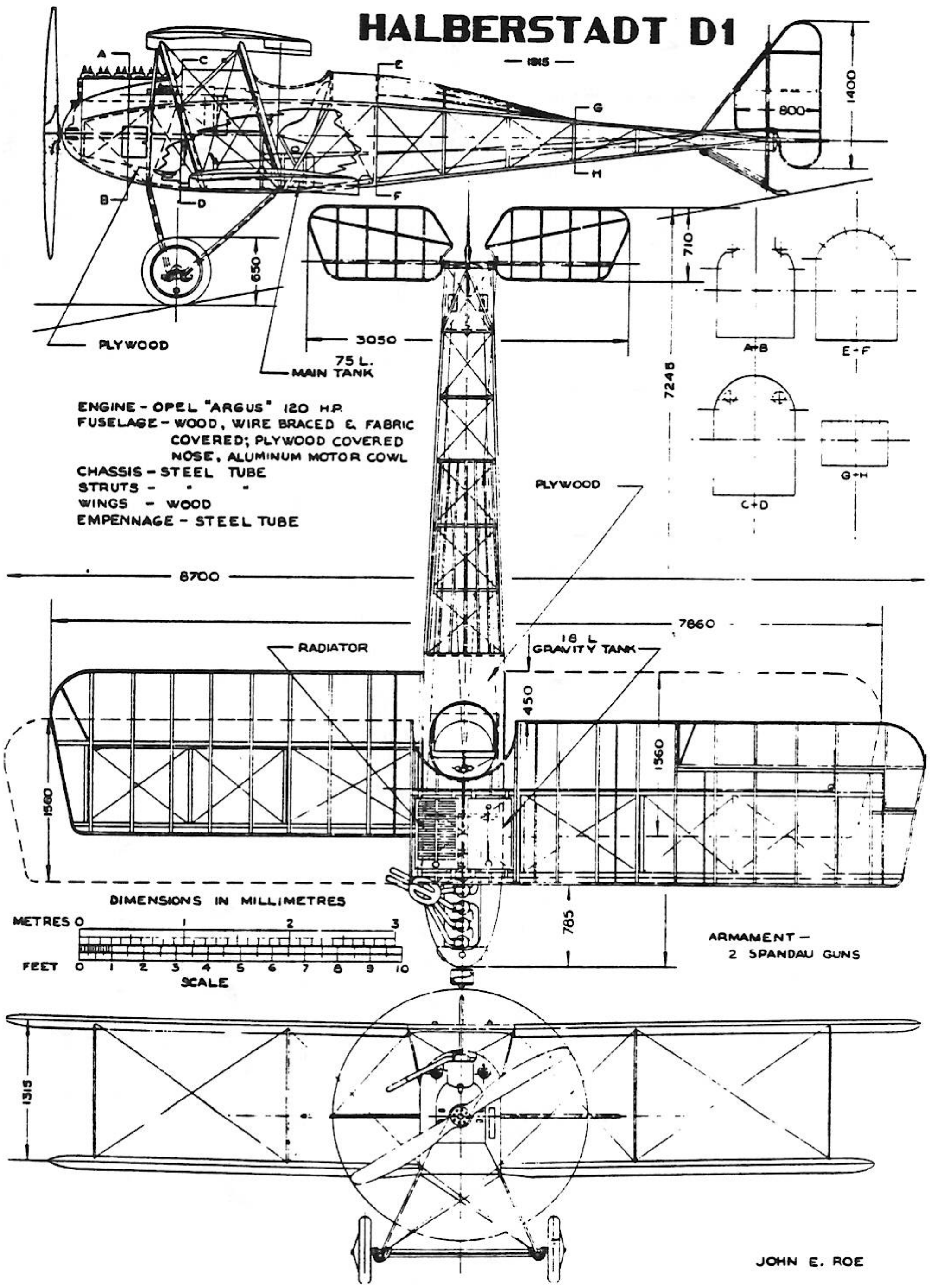
In the case of accessories, many of these were built under license from abroad; wheels were manufactured by Okomato Engineering Company under license from Bendix and Palmer, instruments were built by the Tokyo Instrument Company under license, or later in the war, by direct copy from Sperry, Pioneer and Kollsman. Sumitomo built hydromatic propellers under a license from Hamilton Standard, as well as the German VDM propeller. The Nihon Musical Instrument Co. built the Junkers and Schwarz propellers, while the Kogusi Aircraft Company built the French Ratier propeller. We built 20-mm cannon licensed by Oerlikon of Switzerland and copies of the 13-mm (.50 cal.) Browning.

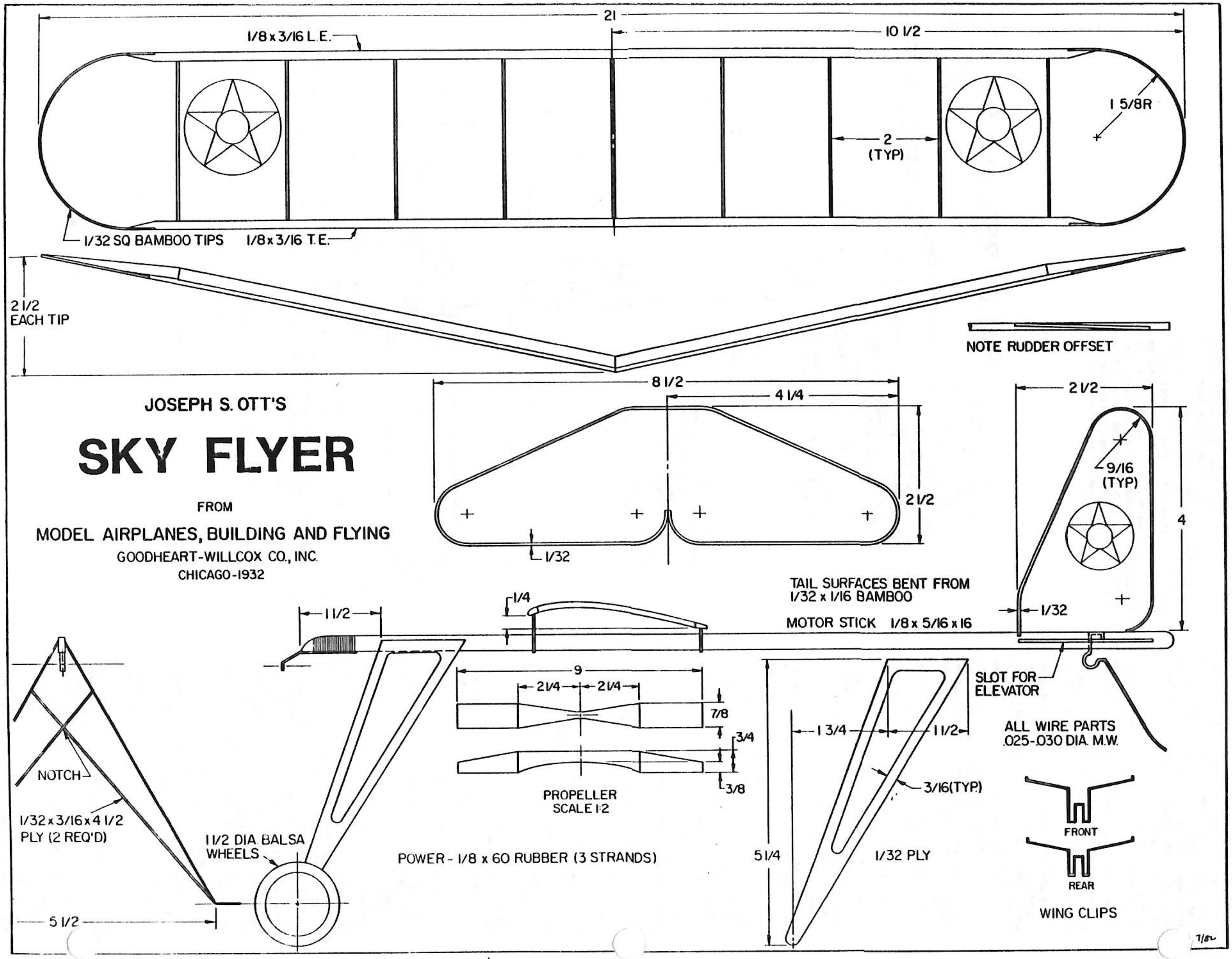
In the matter of communications radio, our material was adequate, but not in the class of the U. S. equipment. Our radar never reached full-scale use, although we had excellent research along these lines. Our powerplant development was consistently behind the U. S. and England. For example, we never developed a successful turbo-supercharger, despite the obvious need for a high-altitude powerplant.

We did do a lot of early work in water-methanol injection, but this was an attempt in the direction of improving power output with 91 octane fuel. It was no match for water with 100 octane.

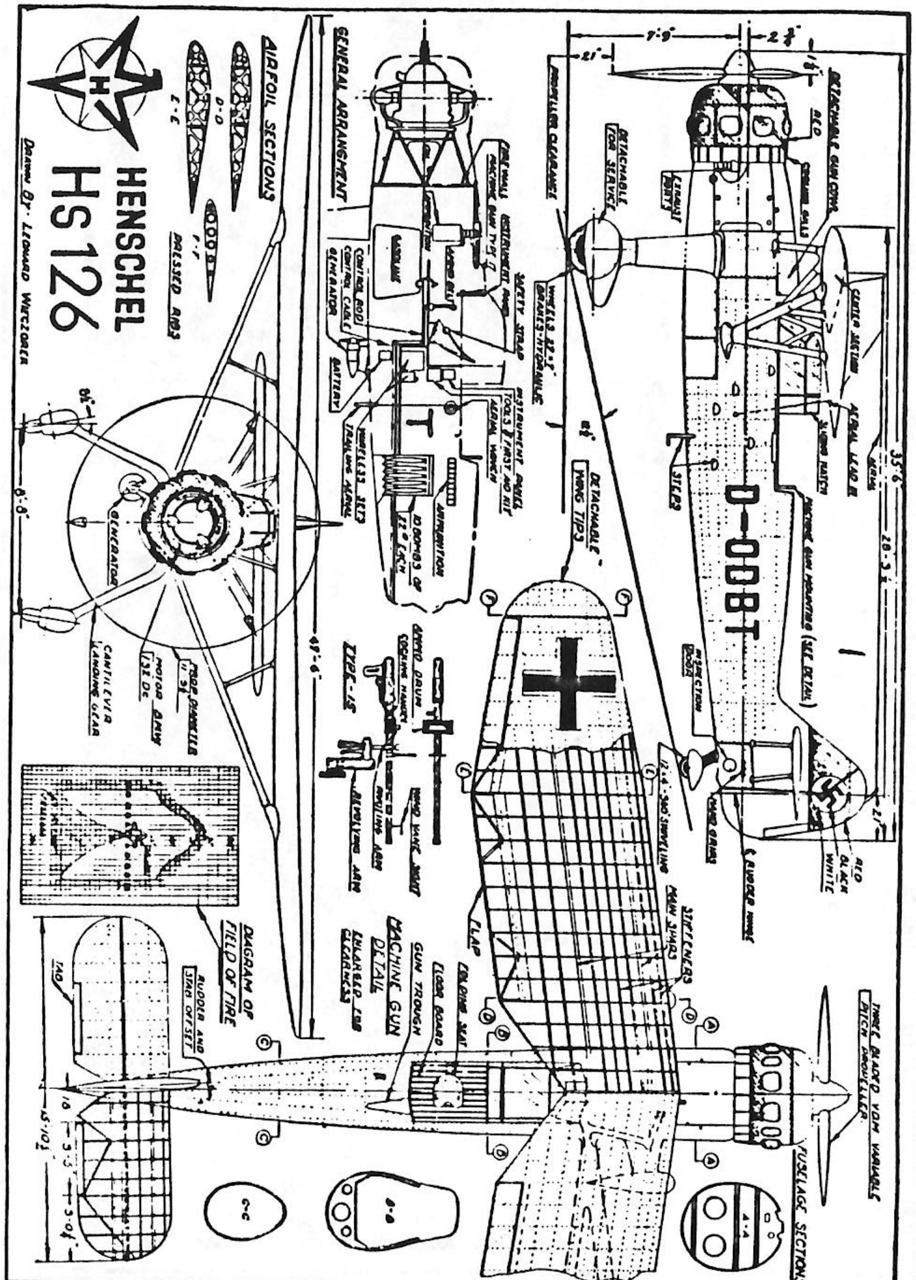
Probably the major contribution of the Japanese during the war to the field of aviation was the ESD prime material, and the production technique developed for its proper use.

I can claim, in the study of the Zero, its ancestors and descendants, that it was original to the same degree as other planes are, and that while it contains certain special features that were all its own, it serves as a prime example of a special design created to suit an unusual set of circumstances.




21
10 1/2
1/8 x 3/16 L.E.
1 5/8R
2 (TYP)
1/32 SQ BAMBOO TIPS
1/8 x 3/16 T.E.
2 1/2 EACH TIP
NOTE RUDDER OFFSET
JOSEPH S. OTT'S
SKY FLYER
FROM
MODEL AIRPLANES, BUILDING AND FLYING
GOODHEART-WILLCOX CO., INC.
CHICAGO-1932
8 1/2
4 1/4
2 1/2
1/32
2 1/2
9/16 (TYP)
4
1/32
TAIL SURFACES BENT FROM 1/32 x 1/16 BAMBOO
MOTOR STICK 1/8 x 5/16 x 16
1 1/2
1/4
SLOT FOR ELEVATOR
9
2 1/4
2 1/4
7/8
3/4
3/8
PROPELLER SCALE 1:2
1 3/4
1 1/2
3/16 (TYP.)
5 1/4
1/32 PLY
ALL WIRE PARTS .025-.030 DIA. M.W.
FRONT
REAR
WING CLIPS
NOTCH
1/32 x 3/16 x 4 1/2 PLY (2 REQ'D)
1 1/2 DIA. BALSA WHEELS
POWER - 1/8 x 60 RUBBER (3 STRANDS)
5 1/2
7/82

HERE'S HITLER'S HENSCHEL HS 126



D.C. MAXECUTER'S 85 SUMMER FUN FLY

Sept 7
9 to 6

AMA SANCTION
1143

CONTEST DIRECTOR
ALLAN SCHANZLE
20008 SPUR HILL DR.
GAITHERSBURG MD. 20879

301 840-9883

EVENTS:

FAC SCALE:
Judging starts at 11:30 AM. Qualifying flight must be made by this time.

GOLDEN AGE REPRODUCTIONS COMMEMORATIVE:
For FAC Scale planes built from a Golden Age kit. Modifications allowed for prop, nose plug, and rear motor peg location. Structure may be added, but none removed.

FAC CO_2 SCALE:
No tank restrictions. Qualifying flight by 11:30 AM.

MASS LAUNCH:

The Races	1:00 PM.	A single launch for all racers.
WW I	2:00 PM.	A 7 second bonus for multi-wings.
WW II	3:00 PM.	Combat WW II aircraft only.
Golden Age	4:00 PM.	Any aircraft built from 1920 to 1935 and any plane not designed for military use from 1935 to 1940. Planes eligible for the races excluded.

EMBRYO:
FAC rules

H.L. GLIDER:
AMA rules

CATAPULT GLIDER:
Must use MAXECUTER launching pole. AMA H.L. rules.

IS A HORIZONTAL TAIL NECESSARY?

Pitch Stability Further Examined

Part 4

By George B. Collinge (EAA 67, Lifetime)
5037 Marlin Way
Oxnard, CA 93030

Illustrations by the Author

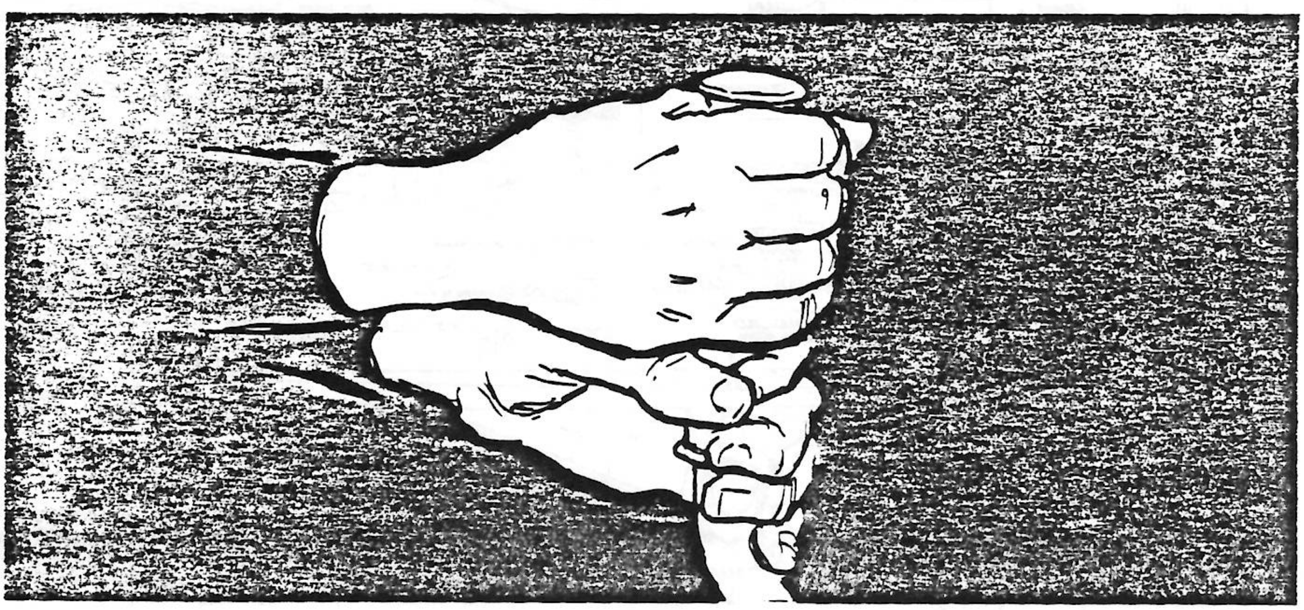
A PILOT NEEDS to feel stick forces to help judge speed and how much load to apply to the airframe. If the control forces, from a trimmed state, increase with any attitude change, then the airplane is, in all likelihood, stable. However, there is a little more to add. So far in this review, longitudinal stability has been broadly covered under a two-part classification. Terms, static and dynamic were used to sequence the reaction to an upset.

There is yet a third category. When an airplane is purposely disturbed or given a gross displacement for observational intent and allowed to fly by itself, a difference is noted if the stick is then held firmly or if it is left free.

Stick Fixed - For this mode, at a trimmed steady speed, the stick is pushed about one half of its forward travel until the nose is well down. The stick is then immediately returned to its original position and held or clamped immobile (Figure 4-1), while the aircraft's movements are watched. The test is repeated except that the stick is pulled backward, then centralized.

Usually, in each case, the nose should come back to the beginning position, go past (due to inertia) then reverse and so damp out in a few cycles. If it does not subside, the CG is too far aft and/or the stabilizer is too small or at the wrong angle. The distance between the stabilizer and the CG could be too short as well.

Fig. 4-1 Fixed.



12

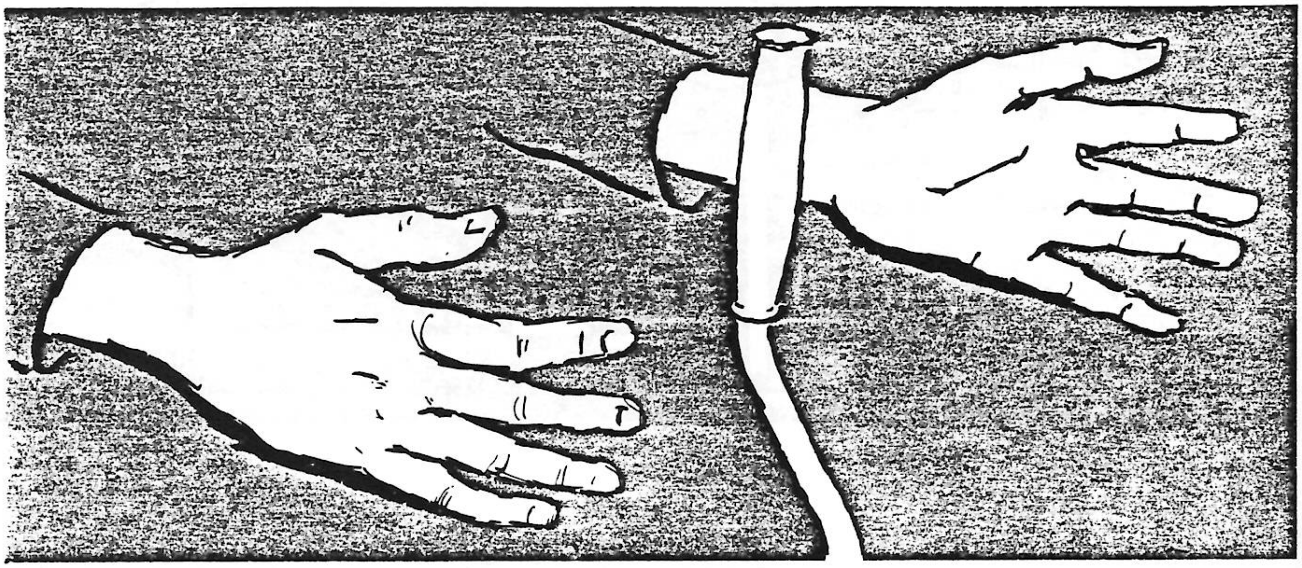


Fig. 4-2 Free.

As the CG position is moved aft due to design or loading (passengers, cargo or fuel) the degree of stick movement necessary to cause a speed change will get less and less until, just past the neutral point, the airplane will go either way, up or down, by itself (mentioned in Part 2 of this series).

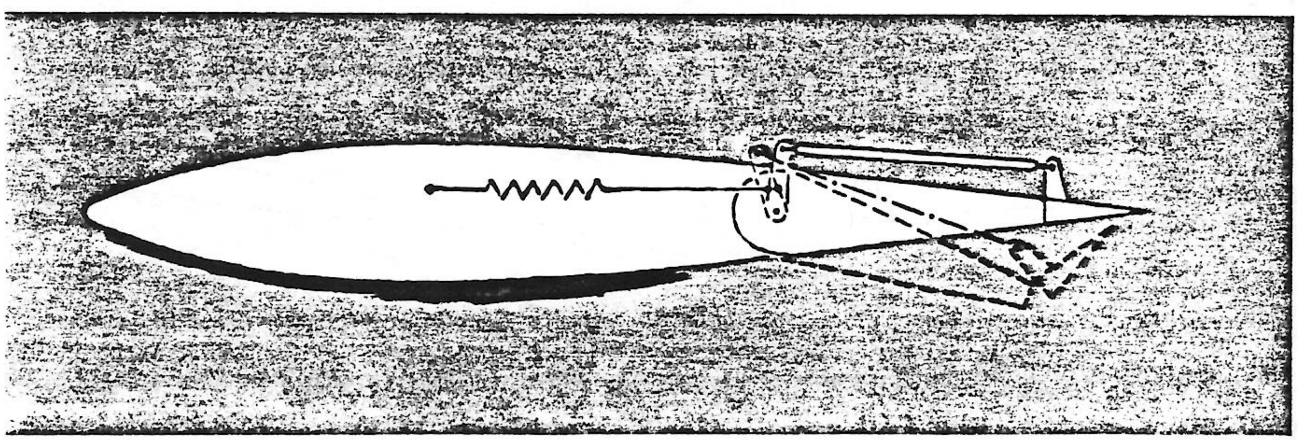
It just might be satisfactory for an airplane to have neutral stick-fixed stability provided that the controls feel normal and it still requires a push to go faster and a pull to go slower, as pressure is more important to the pilot than actual movement or travel of the stick.

Stick Free - For this test, again the same stick movements as for "fixed" only it is not brought back to the reference position but completely released (Figure 4-2). When stick free, airplanes take longer to decay after an upset, depending on how readily the elevator floats and at what angles. Only the fixed part, the stabilizer, has any real effect and it is of considerably less area than the entire tail.

An airplane will be stable in the stick-free mode as long as the correct stick movements are still necessary to change the airspeed from a trimmed condition. Whereas stick-fixed stability is governed by tail size and CG position and is generally permanent once the airplane has been built, the degree of stick-free stability can be easily enhanced, with only small modifications to the control system.

In other words, it is possible that an airplane with only neutral stick-fixed stability can be persuaded to accept a measure of stick-free stability. This is because one or more automatic contrivances actually move the elevator to cause a nosedown recovery. By so doing, the airplane can then perhaps tolerate an even more aft position of the neutral point. This increase in stick-free stability in the low-speed

Fig. 4-3 Fix.



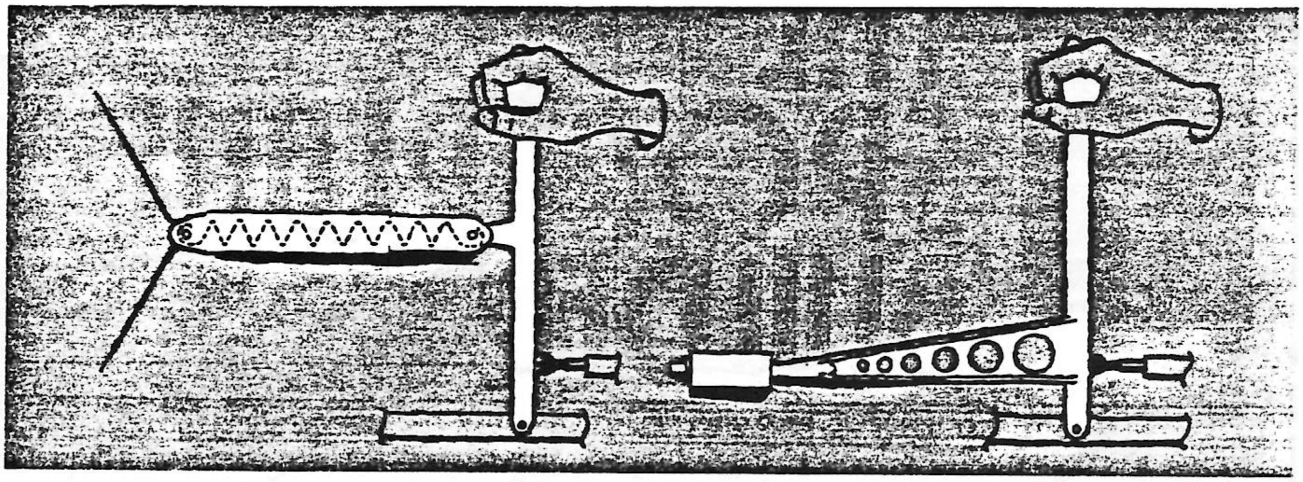


Fig. 4-4 More fixes.

mode and provision of a nose-down message through the stick to the pilot is done with a spring tab (Figure 4-3).

At low speeds, air pressure diminishes so that the spring pulls the tab up. The tab in turn moves the elevator down, making the airplane nose down to restore speed. At high speeds the tab has no effect as air pressure is too high for the spring strength to overcome.

Two other devices to give the pilot better feel and to increase stick-free stability are either a spring or weight bearing directly on the stick or somewhere in the control run (Figure 4-4).

One or all of these three fixes can improve stick-free stability better than the stick-fixed mode. Springs are not effected by acceleration (g) but weights are. Therefore, weights are superior because they give an increasing force with acceleration. From this it is obvious that a tail-trimming system based on springs can alter stability characteristics over the speed range.

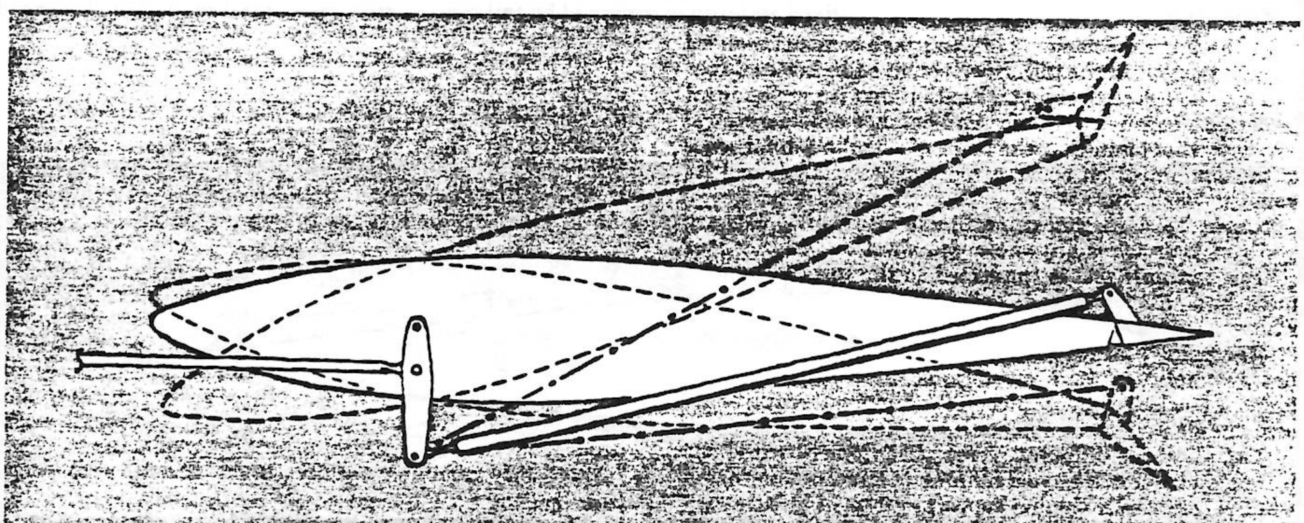
A fourth item, the geared anti-servo tab, is more effective with speed at increasing stick-free stability and has a further advantage of working both up and down (Figure 4-5). One-piece tails with anti-servos can also be reduced in area, but not too much, because then stick-fixed stability will begin to suffer.

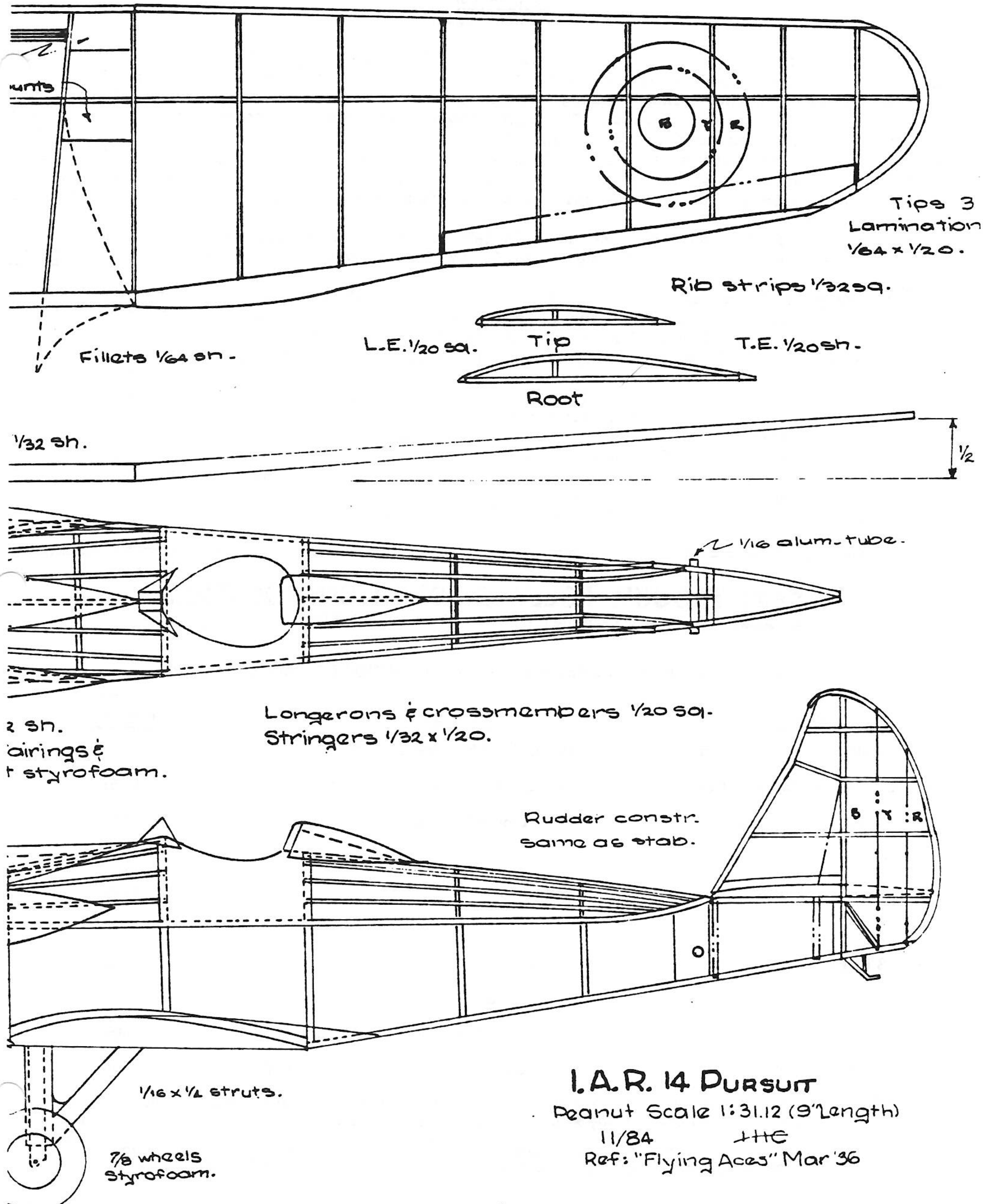
Some designers of high-performance gliders settle for reduced stability in exchange for reduced drag, by following the idea of rather small-area tailplanes. By choosing the two-piece design and intentionally omitting weighty mass-balance, some stick-free stability is retained. For example, due to inertia, an up-gust causes the elevator to lag. This down-elevator helps lower the nose to recover airspeed.

One of the trade-offs is that the elevator inertia, feeding back through the stick will tend to increase the normal pull-force that is required in a turn or a pull-out.

Next month . . . Tailless.

Fig. 4-5 Anti-servo.




unts
Tips 3
Lamination
1/64 x 1/20.
Rib strips 1/32 sq.
L.E. 1/20 sq.
Tip
T.E. 1/20 sh.
Fillets 1/64 sh.
Root
1/32 sh.
1/2
1/16 alum. tube.
Longerons & crossmembers 1/20 sq.
Stringers 1/32 x 1/20.
2 sh.
airings &
t styrofoam.
Rudder constr.
same as stab.
B
Y
R
1/16 x 1/4 struts.
7/8 wheels
styrofoam.
I.A.R. 14 Pursuit
Peanut Scale 1:31.12 (9" Length)
11/84
Ref: "Flying Aces" Mar '36

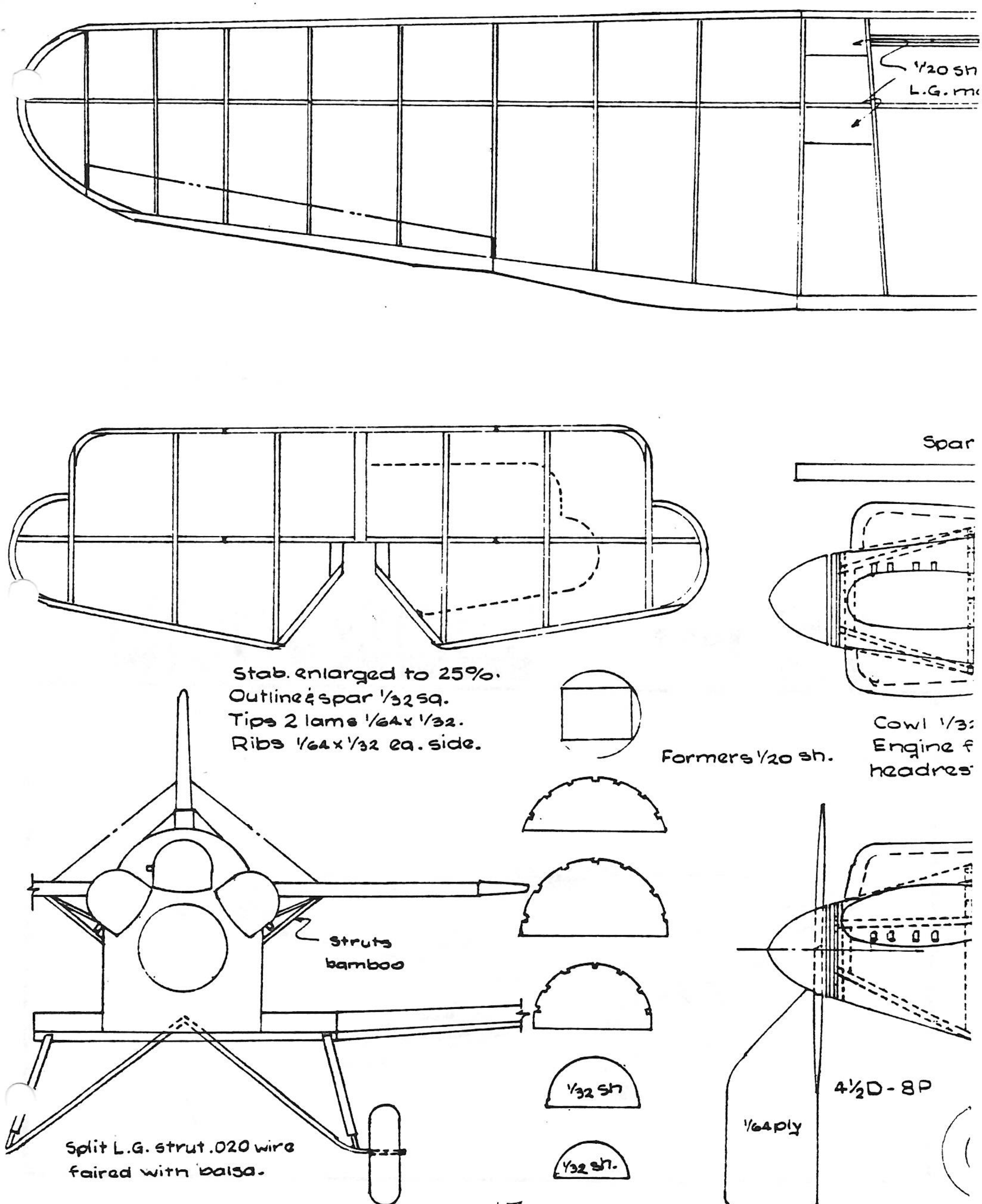
IAR 14 PURSUIT

Hoby Clay

After I did the peanut IAR 81 for Allan several months ago, he sent me a copy of the IAR 14 1/20 scale rubber model plan from the March '36 Flying Aces Magazine. So I prompt[ly] drew it up to meet the 9-inch fuselage length peanut scale rule. This gives a long narrow wingspan of nearly sixteen inches. The puny stab was enlarged for better stability. I used styrofoam for the engine fairings, headrest and wheels. If you plan to enter it under the F.A.C. rules, substitute soft balsa. Keep wood sizes down as much as possible. I couldn't find a color reference so I fogged on a little Floquil Olive-green which looks right for the between wars period. The plane's chief claim to fame has to be the twelve engine cylinders in three banks.

Note added by the editor. We have failed to unveil a 3-view of the IAR-14, but the following is taken from the original article by Elbert Weathers in the March 1936 FLYING ACES.

> "Accuracy of design and detail is guaranteed by the author as it was built from factory drawings. ..... The general color scheme is khaki (equivalent to our olive drab) and silver. Use a good grade of colored dopes. The olive drab parts are as follows: Fuselage, top of wing, top of stabilizer, spinner, radiator, stabilizer struts, and section of rudder not covered by rudder stripes. Silver parts are as follows: Bottom of wing, bottom of stabilizer, landing gear, wheel centers, windshield frame, and prop blades. Color the following details black: Front piece of headrest, tail skid, tires, section shown on side view of fuselage - each side (just under side cylinder blocks), starter crank holes in nose block, the figure "4" on sides of fuselage (see drawings), and the Venturi tube. The three colors needed for the Rumanian Insignia are blue, yellow, and red. Size and location of wing cocardes is indicated on plans."


Spar
Stab. enlarged to 25%.
Outline & spar 1/32 sq.
Tips 2 lams 1/64 x 1/32.
Ribs 1/64 x 1/32 ea. side.
Cowl
Formers 1/20 sh.
Struts bamboo
1/32 sh
1/32 sh.
1/64 ply
4½D-8P
Split L.G. strut .020 wire
faired with balsa.

FIRST CLASS

20008 Spur Hill Dr.
Gaithersburg MD 20879

JULY
AUG
1985

max-fax