MITSUBISHI A6M5c ZERO

A true scale model that is easy to build and a joy to fly.

By Dave Platt

MITSUBISHI A6M5c "ZERO"
Designed By:
Dave Platt
TYPE AIRCRAFT
1/5 Scale
WINGSPAN
78¾ Inches
WING CHORD
14½" (Avg.)
TOTAL WING AREA
1100 Sq. In.
WING LOCATION
Low Wing
AIRFOIL
Semi-Symmetrical
WING PLANFORM
Double Taper
DIHEDRAL EACH TIP
4⅝" at W11
O.A. FUSELAGE LENGTH
65" (inc. spinner)
RADIO COMPARTMENT SIZE
Ample
STABILIZER SPAN
33 Inches
STABILIZER CHORD (incl. elev.)
8¼" (Avg.)
STABILIZER AREA
255 Sq. In.
STAB. AIRFOIL SECTION
Symmetrical
STABILIZER LOCATION
Mid-Fuselage
VERTICAL FIN HEIGHT
10 Inches
VERTICAL FIN WIDTH (incl. rud.)
9" (Avg.)
REC. ENGINE SIZE
.90-1.5 Glo (2 or 4 cycle)
1.8 cu. in. Gas
FUEL TANK SIZE
SS-16
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
8
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail.
Mix. Control, Flaps, Ret., Tank Drop
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ..... Balsa & Ply
Wing ..... Balsa & Ply
Empennage ..... Balsa
Wt. Ready To Fly ..... 232-320 Oz.
Wing Loading ..... 30.3-41.8 Oz./Sq. Ft.

A good friend of mine, who had just witnessed the maiden flight of this model, made a simple but profound summary: "The Zero," he said, "is the most **honest** scale model of all."

While I doubt that I could have caught so much truth in so few words, it was not a surprise to me that the flight had gone so well; indeed, had I felt less than totally certain of the model I wouldn't have been christening it right in front of everybody at the 1/8 Air Force's annual spring Fly-In. Zeros instill confidence. In any size and seemingly at any weight, they fly beautifully. One fellow here in South Florida, who somehow contrived to build a Top Flite (60" span) Zero to the staggering weight of 12½ lbs., reported that its handling, nevertheless, was excellent. It is easy to imagine that given a more typical wing loading, a Zero becomes a true champion of docile virtue.

Why? What magical formula sets apart this airplane from others? At first glance it appears to have no more than the typical run-of-the-mill layout of its contemporary WW II fighters. But evidently this is a design that bears closer scrutiny, because if we can analyze what makes it tick, it may guide us toward finding others of like friendliness.

As we shall see, it turns out that just about all of the assets that the Zero possesses to make it a fine R/C model are the same inherent requirements that were demanded by the specification laid before the designers of the full sized ship. Before all else, it had to be light. This was to make sure it would be totally maneuverable and aerobatic; primary requisites for a dogfighter.

These needs dictated a **simple** structure (and thus a straightforward outline), a large wing area coupled with a thick airfoil, and large control surfaces. In this last respect, the Zero's ailerons are perfect for a model: narrow chord (avoiding tip-stalls from high deflection angles at the tip) but long in span, giving them a lot of area. The ideal layout for power with gentleness.

As modelers we are lucky in that the two serious deficiencies of the Zero resulting from this emphasis on light weight hurt us not at all. Its pilot protection was poor (we lose very few pilots) and its fuel tanks, being non-self-sealing, were vulnerable. We don't get too many peppered Sullivan 16 ouncers, either.

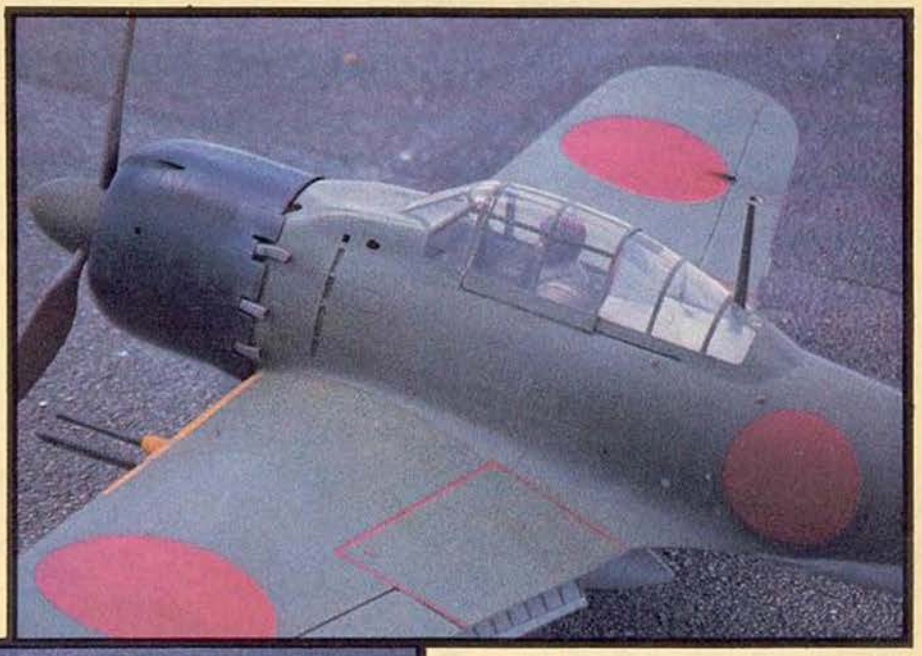
Next, the ship had to have excellent ground handling, or should we say deck handling. Carrier operations quickly punish poor gear design; no Me-109-type landing gear for Mr. Horikoshi! Instead, with a complete disdain for complicated geometry, he opted for a straight sideways inward folding landing gear with simple doors. As modelers, we can approach

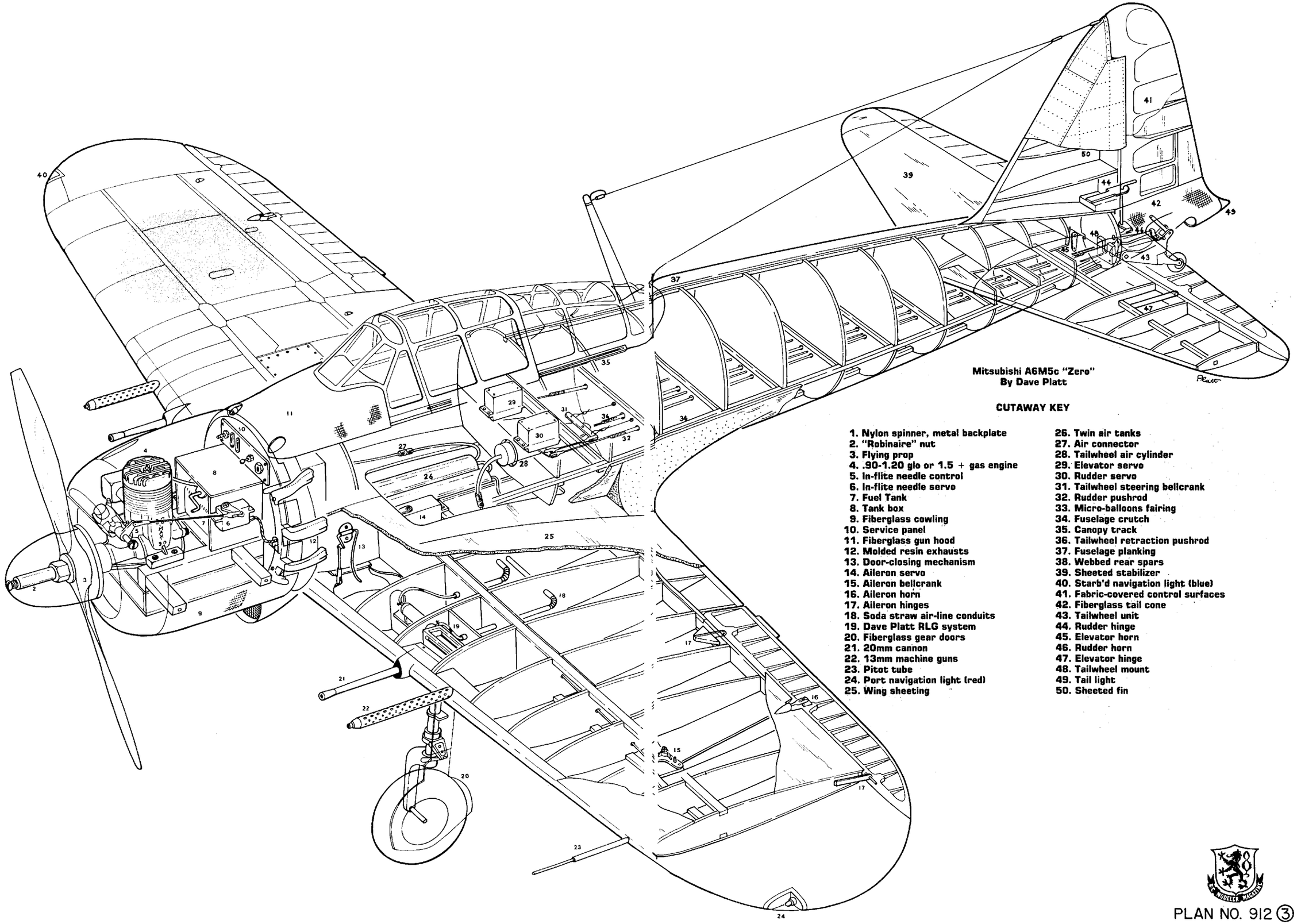
this wide tracked easily duplicated gear with a good deal more cheer than those of, say, the Wildcat, Vindicator or Firefly, all Zero contemporaries. While on the subject of landing gears, it can be observed that this fortunate lack of sophistication was a standard Japanese feature. Just about any WW II Japanese subject will give the model designer an easy time in this area.

A high degree of inherent stability at low speeds is another vital element in carrier aircraft design that might not preoccupy the manufacturer of a land based fighter to a similar degree. Contributing to this in the Zero we notice first the unusually large stabilizer (larger, in fact, than most R/C pattern designs, on a "percentage of wing" basis). Moreover, this wonderful stab has a long moment arm and lies high enough to be well clear of the wing wake at even relatively high angles of attack. In combination, these factors produce two effects that are blessings to the scale modeler: solid stability in the pitch axis (perhaps the single most necessary attribute in a scale R/C model), and reasonable tolerance to various C.G. positions. In the Zero we find an acceptable C.G. range from 28% to 35% or so, an unusually wide band. Other factors affecting stability --- aspect ratio, airfoil section, vertical area displacement, dihedral --- all find the Zero well-endowed.

In just one respect the Zero comes up short; literally short. The nose moment is not as long as we would choose. The danger here is coming up with a rather tail heavy airplane needing much nose weight to correct. And, by extension, an overall heavy model. While laying out my own Zero, I decided to design all structure aft of the wing spar as lightly as possible; not merely the tail end. Conversely, the nose end was designed like a tank. It worked. The original prototype, with O.S. Max .90, weighed 14½ lbs. and balanced right without nose weight. Builders will need to keep weight in mind; not **how much** there is, but **where** it is.

A second prototype, having more detail needed for the Scale Masters final and thus a heavier tail end, was handily compensated by installing one of the new Super Tigre 2000 engines for an all-up weight, again without nose weight, of 18 lbs. So long as an acceptable C.G. position is maintained and adequate power is available, I believe the model would still fly well as high as 22-23 lbs., an unlikely eventuality.





Mitsubishi A6M5c "Zero"
By Dave Platt

CUTAWAY KEY

1. Nylon spinner, metal backplate
2. "Robinaire" nut
3. Flying prop
4. .90-1.20 glo or 1.5 + gas engine
5. In-flite needle control
6. In-flite needle servo
7. Fuel Tank
8. Tank box
9. Fiberglass cowling
10. Service panel
11. Fiberglass gun hood
12. Molded resin exhausts
13. Door-closing mechanism
14. Aileron servo
15. Aileron bellcrank
16. Aileron horn
17. Aileron hinges
18. Soda straw air-line conduits
19. Dave Platt RLG system
20. Fiberglass gear doors
21. 20mm cannon
22. 13mm machine guns
23. Pitot tube
24. Port navigation light (red)
25. Wing sheeting
26. Twin air tanks
27. Air connector
28. Tailwheel air cylinder
29. Elevator servo
30. Rudder servo
31. Tailwheel steering bellcrank
32. Rudder pushrod
33. Micro-balloons fairing
34. Fuselage crutch
35. Canopy track
36. Tailwheel retraction pushrod
37. Fuselage planking
38. Webbed rear spars
39. Sheeted stabilizer
40. Starb'd navigation light (blue)
41. Fabric-covered control surfaces
42. Fiberglass tail cone
43. Tailwheel unit
44. Rudder hinge
45. Elevator horn
46. Rudder horn
47. Elevator hinge
48. Tailwheel mount
49. Tail light
50. Sheeted fin

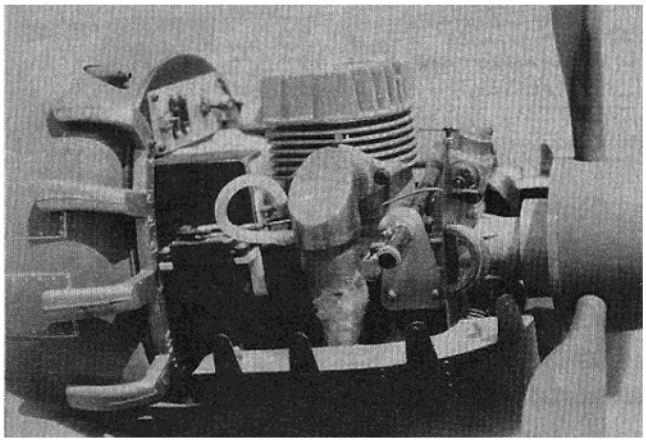
PLAN NO. 912 ③

Another perfectly viable alternative for keeping the nose heavy would be to install a gas engine. Further, most of these would fit well in the cowling. If using a gas engine, remember that when revs are relatively low and required airspeed is medium to high, pitch is far more important than diameter. Do **not** use less than 10" pitch when rpm will be 8,000 to 8,500. Cut down the diameter until an rpm in this range can be achieved; final diameter can be as low as 14" without harmful effect. More likely, the prop will end up at 16/10 and revs about 8,200. With weight at under 20 lbs., performance will be exhilarating.

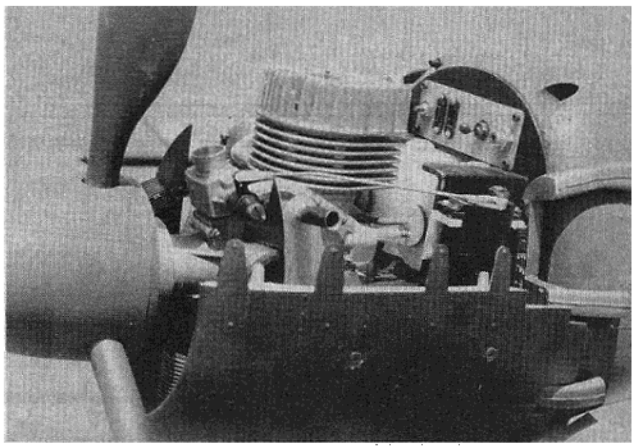
None of the foregoing is to imply that a gas engine is to be preferred --- to the contrary. Personally, I'd rather stay with the glow engine for its less vibration, lighter weight, better power, easier starting, more compact size and freedom from excessively fussy procedures. But, if you are one of those modelers to whom cheaper fuel is more important than the above, by all means, use a gas engine in the Zero. Provided that sufficient power can be assured, a four-cycle engine can be used too. I saw a figure of 10,000 rpm on a 15/8 quoted for the O.S. 1.20 FS and, if this is so, it's ample power for the ship.

Specifications:

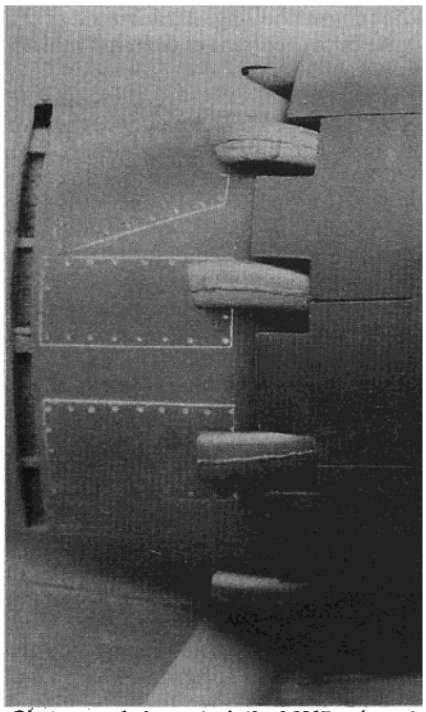
This model falls into the "1/5 scale" category. Actual scale is 1:5.5 or 2.18" to the foot. Wingspan is 78¾", area



Right side of engine compartment — it looks crowded. Service panel is visible on firewall. Tube behind card is for skewer that holds upper cowl.



Left side of engine compartment showing Super Tigre 2000. Engine is just right for this model.



Close-up of characteristic A6M5 exhaust. Also note the closeness of the wing fit.

Good pilot figure breathes life into model.

Another perfectly viable alternative for keeping the nose heavy would be to install a gas engine. Further, most of these would fit well in the cowling. If using a gas engine, remember that when revs are relatively low and required airspeed is medium to high, pitch is far more important than diameter. Do **not** use less than 10" pitch when rpm will be 8,000 to 8,500. Cut down the diameter until an rpm in this range can be achieved; final diameter can be as low as 14" without harmful effect. More likely, the prop will end up at 16/10 and revs about 8,200. With weight at under 20 lbs., performance will be exhilarating.

None of the foregoing is to imply that a gas engine is to be preferred — to the contrary. Personally, I'd rather stay with the glow engine for its less vibration, lighter weight, better power, easier starting, more compact size and freedom from excessively fussy procedures. But, if you are one of those modelers to whom cheaper fuel is more important than the above, by all means, use a gas engine in the Zero. Provided that sufficient power can be assured, a four-cycle engine can be used too. I saw a figure of 10,000 rpm on a 15/8 quoted for the O.S. 1.20 FS and, if this is so, it's ample power for the ship.

Specifications:

This model falls into the "1/5 scale" category. Actual scale is 1:5.5 or 2.18" to the foot. Wingspan is 78¾", area 1100 sq. in. Required power is from .90 to 1.5 glo (2 or 4 cycle) or 1.8 cu. in. up (gasoline). Weight between 14½ and 20 lbs.

Building:

This section is not intended to be a step by step procedure for building but, rather, a brush across some of the highlights of the structural design. Certain parts were deemed necessary to make in fiberglass: the cowling, obviously; the gun hood because of its complex and subtle shaping; and the tail cone which again is a complicated shape and also needs to be hollow. With these three difficult areas disarmed, the rest of the model is of conventional wood design. The fuselage can be skinned with large panels, or can be strip-planked. The latter method, though taking longer, produces a better, stronger result. In fact, with the CA glues we now use, the time taken to plank a body properly is little more than skinning, and only a fraction of what it used to be "pre-Zap."

The plans show the flaps, which can be installed if desired or left off. While the cosmetic effect achieved by including them is undeniable, their functional usefulness in slowing down the ship in landing approaches becomes somewhat moot, since the unwavering stability during approach and slow landing speed could scarcely be improved.

The plans also include details of the square tipped "Hamp," or A6M3. Apart from the square tips, if you choose the -3, the cowl gills are not cut away and the multi-exhaust stubs are left off. The addition of a streamlined fairing around the drop tank attachment, and different gun arrangement complete the

conversion. There's precious little to choose between the 3 and 5; this again becomes purely a matter of individual preference.

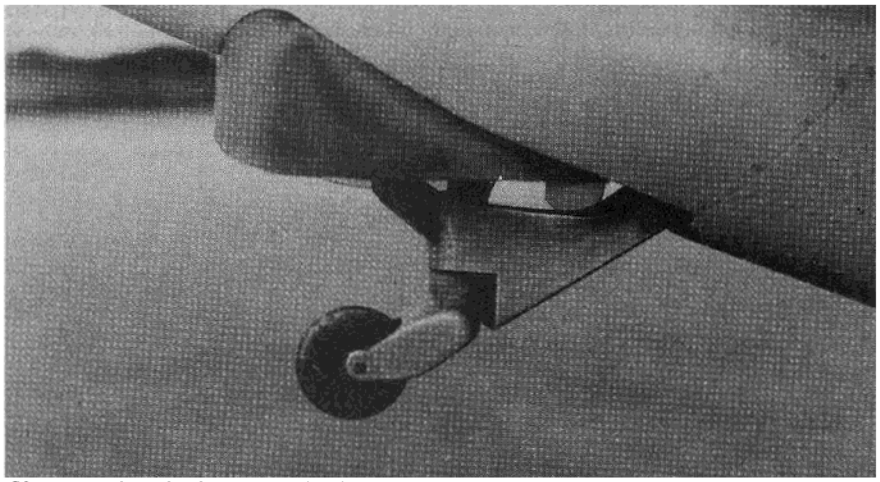
The cutaway drawing shows the basic simplicity of structure. The Zero, as we have already commented, is a simple aircraft, and there was no call for sophisticated or complex design. Note that the entire cockpit bay area is left free of unwanted structure or radio components. This enables the builder to fit the available cockpit kit in place and have it look right. Along with the available Japanese feature pilot shown in the photos, an attractive cockpit area is achieved without special skills or experience. All in all, I feel that due primarily to having a cooperative subject, this model is as easy to make as my early efforts with Top Flite, the P-51, 40 and 39.

Serviceability:

A common view of R/C scale models

From RCModeler May 1984

Main gear leg shows that "Stand-Off Scale" has come a long way.



Close-up of scale detail on tail wheel assembly.

shared by many sport fliers is that they are "fussy." Many factors contribute to this opinion, among them lack of accessibility to the engine and fuel tank; awkward placement of R/C gear, switches, clevises and the like; difficult starting due to low visibility of engine controls, glo plug, and so on.

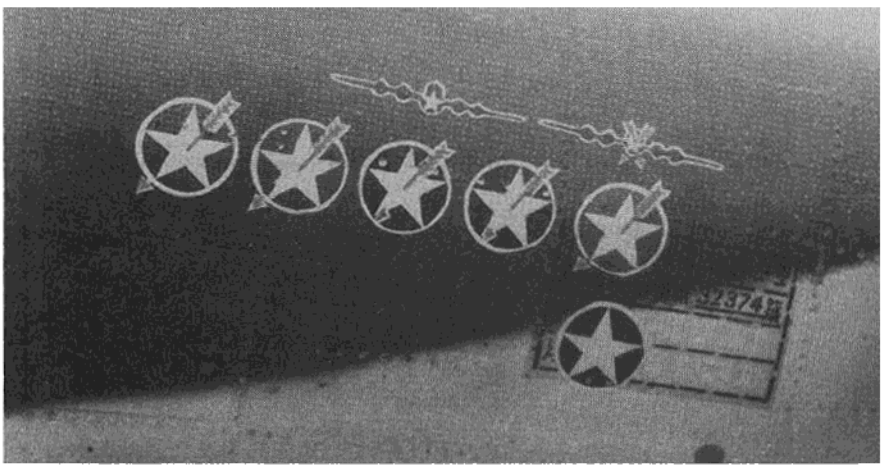
Admitting that this dismal view contains more truth than could be tolerated, I set about improving the serviceability and maintenance aspects of this airplane. Numerous times, hardware already fixed was discarded, modified, and replaced. Through it all, the aim was to produce a model that could be **flown for fun** with the same ease of assembly, fueling, starting, switching, charging, etc., that Sunday Fliers are used to. In short, the model had to combine the breeding of an accurate, Masters-level scale model with the dependability factor and low pressure operational elements of an Ugly Stik.

These requirements have now been met. Transport and assembly at the field are simple, with only a few extra connections to make while screwing the wing on in the usual two-bolt format. With the upper half of the cowl removed, the entire engine and tank area lies exposed for fueling and starting. A special "service panel" has been introduced to handle battery charging, switching, air filling and pressure monitoring. Even the "DSC" (direct servo couple) jack is included for owners of modern radios. Any component that shows up faulty can be fixed or replaced in minutes. With the engine started, adjusted and cut back to idle, the cowl upper half is replaced and this ship is ready for take-off, all with nothing visible on the outside that doesn't belong. Attachment of the cowl gave problems at first, a situation now corrected.

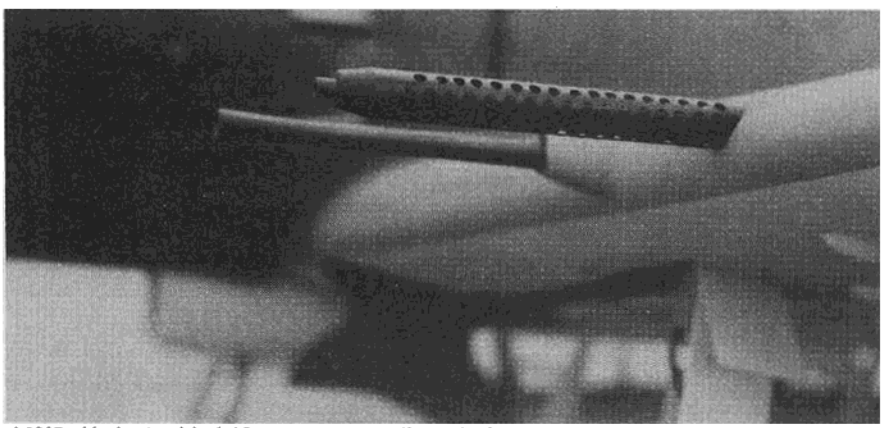
Flying:

As already mentioned, whether for serious competition or relaxed fun, this is a flying machine **par excellence.** Credit for this, as explained, lies with the Mitsubishi design team. I have put as many as six flights in one day on my Zero (for me, that's a lot) and frequently take it out to fly at our busy field on a weekend, just for fun. The only manuever it won't do well is a knife-edge. This could be due to the somewhat excessive dihedral, or it could simply be me. But all the rest, look out! Rolls --- regular, slow, four-point or vertical --- a snap. Loops, Cuban Eights, touch 'n go's. Lovely solid inverted. Stall turns. Spins, no problem, recovery in 1/4 turn. Inverted spins too. When did you see one of these from a true scale model WW II fighter? Come to that, when did a WW II fighter ever do one --- intentionally?

Now, let's see . . . what else can I make that I'll be as happy with? □



Victory markings of Takeo Tanimizu's A6M5c.



A6M5c Variant added 13 m.m. guns outboard of cannon.