Rocket Trails

by Harry (Old Rocketeer) Stine

B/G's CHALLENGE MODELERS; "BASEMENT BOMBER" SCARE

The entire field of boost-gliders (B/G) is rapidly growing into a distant and separate part of model rocketry. More and more modelers are devoting all their time to these little winged beastsies. I talk a good deal about B/G in these columns for several reasons: (1) B/G is a wide-open subject that interests both model aviators and model rocketeers; (2) it is an area in which a great deal of aeromodeling research remains to be done; and (3) it involves more than just up-and-down. It is also a form of model rocketry in which both the advanced expert and the raw beginner can and have made contributions. The number of different B/G designs currently flying are marvelously varied, and the state of the art is progressing at a high rate.

National NAR record for B/G Duration is 2 minutes 28 seconds—held by Mrs. Gleda M. Estes, a housewife with 3 children. Just the other day, I witnessed an unofficial flight where the clock was stopped at 1 minute 45 seconds because the B/G glided out of sight . . . and it had been powered with a Type B-8-4. One of my most successful B/G designs, although far from being a record-breaker, is the Eaglerock, a reliable first airborne in 1961 and one whose design has been refined from countless flights. Don't give me any exhaust gas about it looking like an eagle and flying like a rock, because that phrase is reverently reserved for the old Alexander Eaglerock bi-planes that were made in the 1930's in Colorado Springs.

My objective with the Eaglerock B/G was to design a rocket-powered high-performance flying-wing glider with every good aerodynamic characteristic that could be stuffed into it. In its present form, it is probably the cleanest B/G flying. It has a minimum number of external parts to keep parasite drag down, it utilizes generous fillets to reduce interference drag, it has a wing with high and effective aspect ratio. Constant-percentage elevons are used.

By way of quick explanation, constant-percentage control surfaces have a chord that is a constant percentage of the wing chord. If the wing tapers, so do constant-percentage control surfaces. On the other hand, constant-chord control surfaces have the same front-to-back dimension throughout their span, regardless of wing chord. There is some advantage to constant-chord elevons on a swept-tapered wing, because they make the wing tips fly at a negative apparent angle of attack, thereby discouraging the tip-stall that is a characteristic of swept wings. On the other hand, constant-percentage elevons produce less rolling moment and lower induced drag.

Since the stall characteristics of a flying wing such as a B/G are pretty miserable (the only way you can eliminate it is to use a canard configuration), I chose the constant-percentage elevons because I wanted lower drag, a cleaner glide with a low sink rate, and proper trim without worrying about stall anyway.

Body of Eaglerock is Centuri TS-718 paper tube, i.d. 0.710 inches, length 8 inches. Nose cone is Estes ENC-30C slightly trimmed to fit the smaller tube. Model is rigged to use the "casing-jerk" system. For flight, empty engine casing with old nozzle busted out is taped to front of new flight engine, thereby putting more weight up forward during boost. On ejection, both engine casings are expelled from the model. To use casing-jerk system in Eaglerock, glue engine bulkhead into tube 5.5 inches forward of rear end.

Eleven settings are determined by the amount of clearance cut away from rear end of body tube at its lower point. To start with, cut only a small clearance for elevons, if you require more up-elevon later, you can take off more tube. Elevons are stopped by tube cutaway. Wings are 3/32" medium-hard sheet balsa cut with grain parallel to leading edge. Round leading edges with sandpaper; butt-glue wings together at root with 7° dihedral in each wing. Cut elevons from 3/32" sheet with grain running spanwise. Round leading edges of elevons and taper trailing edges. Attach elevons to wings with tissue or Silkspan hinges as is done for U-control elevators. Attach wings and elevons to body tube with double-glued joints. When dry, add wing root fillets. I find that good fillet material is AMT Body Putty.

Meanwhile in the USSR model rocketry gains recognition as is evidenced by these pages from a Russian publication. Red birds look much like our own: non-metal; standard fuel.

(Continued on page 72)
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Rocket Trails

(Continued from page 6)

for plastic cars; it's easy to apply and sands to a smooth finish. Wing root fillets reduce wing-body interference drag by at least 50%.

Cut tip rudders from 116" sheet with grain running parallel to leading edge. Sand to symmetrical airfoil. Glue to wing tips as shown—to be sure that elevons move freely. Tip rudders greatly increase the reduced drag caused by vortices generated at wing tips and serve to increase the apparent aspect ratio of wing.

Glue scrap balaa eleven depressors to elevons roots so that an installed engine casing holds the elevons at zero (and I do mean zero) incidence. If elevons are not at zero incidence, model will loop under power after leaving launch rod.

To provide up-eleven action, most B/G designs use an elastic cord under tension. This creates drag because of circular cross-section of plastic. Eaglesock uses gen-u-wine Old Rocketeer Low Drag Elevon Springs made from music wire and glued under root of each elevon as shown.

Add small fillet of glue at wing-rudder joints to reduce interference drag there. Glue launching lug to top of tube. I tried to cut down drag by eliminating lug, but could not figure how. Location of lug reduces slip-flow around rear of body, probably adds to glide characteristics. (Wind tunnel checks may confirm this wild hypothesis.)

Model should balance 2.25 inches forward of rear end of body tube without engine installed (in glide condition, in other words). Don't worry if it is farther forward—you will just require a little more up elevon in this event. But if it is farther aft than this, you may be in trouble during powered flight, so add a little weight to the nose.

Completed model weighs 1.2 ounces, has 42 square inches of wing area. This is better wing loading than any present B/G kit model, but is not as good as some of original design high-soaring contest-winning B/G's. Further refinements may cut gliding weight, but 1/16" sheet balsa wings have not been successful to date. Thin wings of this span have a tendency to leave the party during powered flight.

Eaglerock is designed to fly from a 36" rod launcher. Ascent is clean and straight. Glide is fast but flat when properly trimmed. Some trim flights using half-A size engines will be necessary.

Great controversy, still unresolved, rages over type of finish that is best for B/G. I maintain that smooth, slick finish is better because it foretells boundary layer turbulence and consequent increase in friction drag. Devotees of rough, unpainted balsa B/G's claim paint's extra weight is N.G.

Wayne Warren of Pontiac, Mich. sent in a crazy modification of the Estes Space Plane shown. Body tube is cut to 3" length. Nose cone is hollowed out and glued to body tube. Elevons are glued flat to wings, and wings are cut away aft as shown to clear jet of engine. Space Plane spin tabs on rudders are not used. Wings are glued to body tube in mid-wing configuration like Aero-Bat. My feeling is that this short wing joint may have to be strengthened with Sikaflex or such to keep wings on the bird during powered flight. Short launch lug is glued to side of body. Engine ejection simply pulls weight off of nose. Bird can be trimmed from upper left: "Eaglerock" B/G fuselage tube cut at bottom rear acts as upward step for elevons. Ring-tailed "Essobee-Hi" by GHS. Revel plastic V-2 modified for flight won trophy shown for Oie Rockefeller. Collection of B/G's shows variety of designs, kits available.

American Modeler - July/August 1963
from our school were injured with home-made rockets. A best friend of my
classmate blew the top of three fingers off while stuffing matchheads into a
CO2 cartridge. Then the classmate flooded with a homemade propellant in a metal
tube and gets enough shrapnel in his leg to build a bridge.

"So everyone is in an upheaval over rocketry. Still, our club is trying hard
to ward off attacks on model rocketry by giving demonstrations. Last year our
small group flew over 200 rockets in less than 30 flight days. We've talked
before scout troops, science classes, and clubs and groups of every sort. We
have also entered several science fairs and exhibits. I don't think that much
more can be done."
The "model rocket" incident to which
for numerous shrapnel wounds in his
legs and arms. Their father, Frank W.
Barton, was painting a door 40 feet
away when the explosion blew him off
a ladder and peppered his left shoulder
and right knee with shrapnel. The
Phoenix papers called it a "model
rocket." It was not. This was called to
the attention of one editor during a per-
sonal visit by spokesmen from the NAR's
Valley of the Sun Section in Phoenix
but to no avail. The story went out on
the nationwide wire services as a "model
rocket accident." You model rocketeers
are engaged in a safe hobby which has
produced over 1,500,000 flights without
any accidents.

Unfortunately any accident where
someone gets hurt with a basement
bomb also damages our hobby in a way

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**THIS GIANT WON'T FIT ON ONE PAGE!**

**MOTORIZED AUTHENTIC SCALE PLASTIC CONSTRUCTION KIT**

Fred refers is example of what *model rocketry* isn't. On February 20, 1963,
Billy Wayne Barton (22) and Phillip Barton (14) of Phoenix, Arizona took
a piece of 1" steel pipe, put some sheet metal fins on it, and threaded a steel
nose cone to the front. Into the tube they poured over a pound of black
powder that their father had for loading shotgun shells. They stood the
"bomb" on its fins on a piece of sheet metal in their backyard and tried to
light it with a match. When it wouldn't
light, they poured a can of lighter fluid
into the powder. Their second try at
lighting it with a match sure succeeded
—unfortunately. The explosion rocked
the neighborhood. Billy Wayne was
dead on arrival at Memorial Hospital
in Phoenix. Phillip underwent surgery
entirely undeserved. Model rocketry has
protected the lives and limbs of thou-
sands of people (mostly youngsters) who
would otherwise have tried to make
their own rocket engines. If people
wonder why I am so vehement about
Basement Bombers, the Phoenix inci-
dent is an example.

This brings up a query I received
from a Potomac, Maryland, follower
of this column who apparently doesn't
believe what he reads. His comments:

"I and another boy are building a
rocket, and need some information. You
stated that a rocket amateur could pur-
chase most anything he needed. Also,
you stated that most amateurs did not
have the know how to make many parts
of a rocket. Both of us being Seniors
in High School, I feel we have a good

---

*American Modeler — July/August 1963*
you load your own, the smoke in the basement may be Y-O-U!

Ring Tails? From Barry Orton, Bayonne, N.J., the following:

"Please tell me more about ring-tails. Your article in the November 1958 issue of AM did not give me enough info."

A ring-tailed model has a single cylindrical fin around the tail section instead of ordinary flat fins. It is often held in position by small ballast struts, or even by stub fins. The equivalent flat-plate fin area of a ring-tail is: 1.4 times the area of a side-view projection of the ring. Ring tails have no stability in roll. For optimum performance, the ring chord should be about 1.5 calibers (rocket diameters). The greater others fly. They are interesting, but flat fins seem to do the job just as well and are easier to build.

Federal Control. On March 14, 1963, the FAA put into effect Part 48 of the Civil Air Regulations, "Operation of Unmanned Rockets." The new regulation closely controls the flight of amateur rockets. Clearances must be requested well in advance for amateur rockets. However, Paragraph 48.21 of this new regulation specifically exempts model rockets from FAA control provided they weigh less than 16 ounces, have less than 4 ounces of propellant in them at takeoff, are made of non-metallic parts, and are operated so that they do not create a hazard to aircraft. It took Bob Hurley of the FAA nearly

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on our hands. I ask you, how much "know how" can they have about rockets?

Contrast their letter with this one from James R. Newton of Osseo, Minn.:

"I have been a fan of yours long before I joined the NAR. The first time I heard of the NAR was in an article you wrote in 1961 for American Modeler magazine on new concepts of model rocket design. More AM articles drove me farther away from amateur rocketry and closer to model rocketry. In fact, my first kit was the Astron Mark, one of your own designs. NAR-approved model rocket engines have superior performance. Your articles in AM are very informative. Keep up the good work."

I give the matchstick/gunpower crowd this thought for the month: If the diameter of the ring, the greater the stability but the less the thrust augmentation effect. Ring tails are very stable models, but are slow because of the drag of the ring supporting struts. They do not fly very well in a wind, as the ring tail tends to stall out completely because the air flow through the ring gets choked off.

I once thought that this flow-choking stall of a ring-tail was a unique discovery of model rocketry. But Adm. Levering Smith, formerly of the Polaris program, pointed out to me that the Navy had run into the same problem many years ago with ring-tail "hedgehog" rockets for anti-sub work. Ring-tails are interesting, but they don't like high winds. I have built and flown some ring-tails, and have watched many

4 years to get this regulation into effect. I understand that the amateur rocketeers gave him a good deal of trouble on it. On the other hand, the NAR and model rocketeers can be honestly credited with the help of the FAA in many ways to establish a reasonable, workable regulation.

Gentlemen, the new FAA reg doesn't mean that you can set up a launcher on the end of runway 27 without permission. But it does mean that you can fly the kind of model rockets we talk about without checking FAA.

HQ Change. The National Association of Rocketry has a new address: National Association of Rocketry, Stamford Museum & Nature Center, Stamford, Conn.
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Amish Modeler — July/August 1963

1957, 1958, and 1959, rockets and guided missiles were very IN with plastic manufacturers. You could find 'em by the hundreds. I have built every plastic rocket and missile ever produced, and we used to be able to get some dandies. Today, they are as scarce as homens for kittens. Hawk's Jupiter-C is no longer available, but would make a beautiful flying job. Same holds true for the big Ray-Sun plastic missiles that were too big at the time for the power of any of our engines but which would be just right today for flight mod.

Revell is the only one today that makes anything capable of flight mod. Their Corporal, German V-2, Lockheed X-17, and North American X-15 are all capable of flight mod, and I have seen these little plastic birds turn in very nice flights. The Revell Terrier and Nike-Hercules kits don't modify because of size or stability problem. And these kits are often very hard to obtain. Every time I find one hidden on the shelf of a hobby story, I buy it and cache it away for future use.

According to a good flight mod often means that you have to throw out over 50% of the parts in the kit. It requires a good deal of head scratching to figure where to mount engines, get the recovery system in, and achieve the proper balance for stability in flight.

You must do a darned good job putting the model together because it isn't going to merely sit on a desk—it's going to fly at speeds of 150-mph or more. Problems arise involving the compatibility of glue since many internal parts of a flying plastic job are made from balsa. Finishing the model is often a challenge due to the different types of enamels involved. The end result is more than worth it, because you can sit it on the mantle with all of the non-flying plastic erectors that go with it and proudly announce to people that it is a little bit different from all the other plastic models around. It flies, too.

One of these days, Utopia will arrive. A plastic manufacturer will come up with such Space Age plastic models as Ranger, Mercury, Gemini, Apollo, Saturn C-5, X-20 Dyna-Soar, and others of this ilk. You will be able to buy the kit in two forms: non-flying and flying. They will be designed in such a way that they are large enough to be powered by existing model rocket engines.

In the meantime, hobby stores with their racks of plastic models give you the impression that we are still in the age of Barney Oldfield and Eddie Rickenbacker. Doesn't the hobby business believe that we are in the Space Age?
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