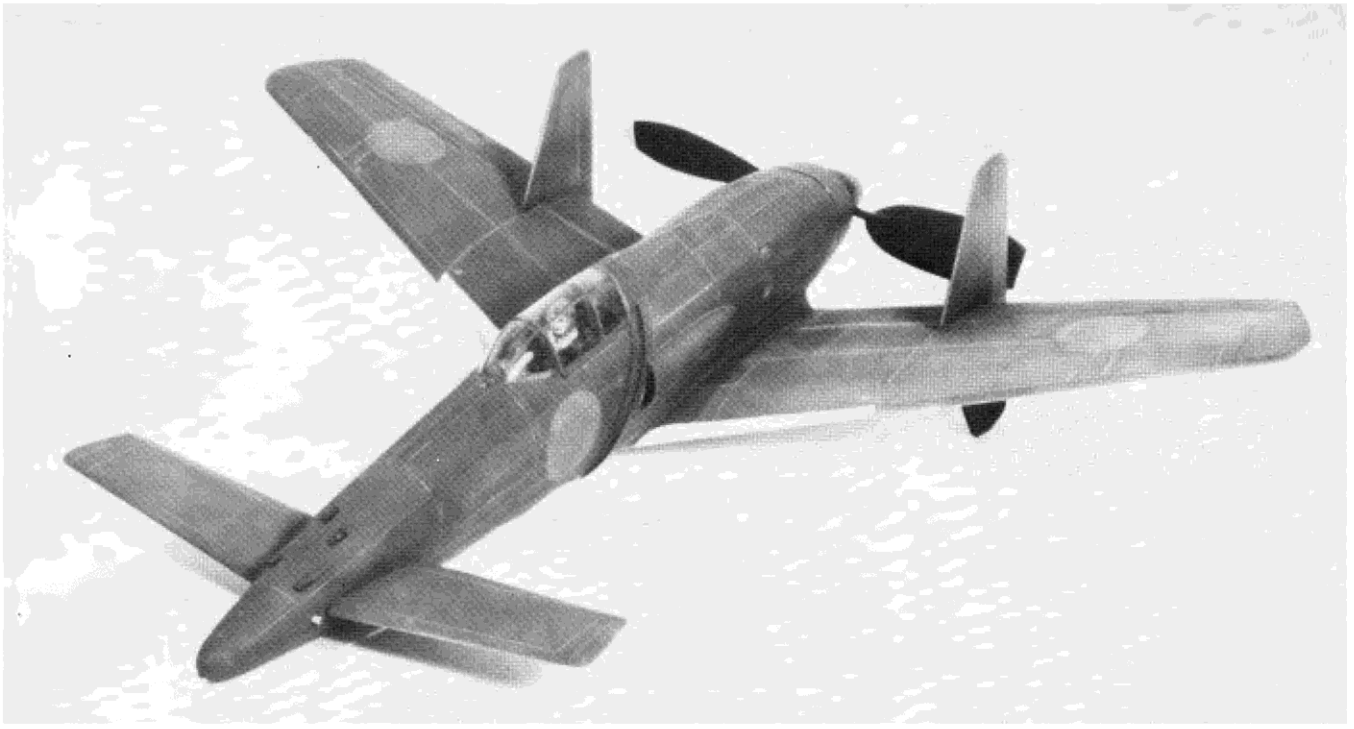


Don Srull's Free Flight Rubber Scale version of the Kyushu Shinden is a Flying Aces Nats winner. A most unusual subject. Fine workmanship.

Shinden

By Don Srull

A rubber powered version of the powerful Japanese canard/pusher fighter of WW II.

In early August, 1945, the most unusual Japanese fighter of World War II began flying from Kyushu Airfield in Japan. Only three short test flights would be completed before the war brought an end to the development of this innovative warplane. The Japanese had high hopes for the Shinden, or Magnificent Lightning, as a short range, high speed, interceptor to help defend against the impending B-29 blitz.

Development work in Japan on the pusher canard configuration began in 1943 with glider and low powered test vehicles. Success with the MXY-6, an all-wood 32 hp aircraft, lead to the decision to design and build the J7W1 prototype interceptor. The J7WI was an all-metal, low wing canard, powered with a rear mounted 18 cylinder radial Mitsubishi engine of 2030 hp. A 6 bladed propeller of minimum diameter was used to keep the landing gear as short and light as possible. The gear had to be long enough to allow for proper clearance when the aircraft rotated at take-off and landing. Even with careful planning, the first flight test attempt was aborted when the pilot over-rotated during the take-off run and the six bladed prop dug into the runway. As a temporary fix, small wheels were added to the bottom of the fins, which protected the fins and prevented the aircraft from rotating too much at take-off.

Subsequent tests proved successful, and the Shinden was ordered into production. Several minor modifications were planned to be made as a result of the test flights. The engine cowlings were re-shaped to improve cooling and to eliminate prop flutter. In addition, automatic aileron trim tabs were added to help compensate for a strong starboard torque pull at high power. (More about this idea later.)

The Shinden was to carry four 30 mm cannons in its nose, and was estimated to have a stop speed of 468 mph at 28,560 feet altitude, with a celing of 39,000 feet. It had a span of 11 meters or about 36 feet, and an empty weight of 7,600 pounds. Only two prototypes were built and when the war ended the single remaining vehicle was sent to the Willow Grove Naval Air Station for study. It eventually wound up in the Paul Garber restoration facility of the National Aerospace Museum in Silver Hill, Maryland. The Magnificent Lightning hopefully will be restored some day, so all aviation buffs can have a closer look at one of the most unusual and interesting aircraft of World War II.

The Model

The Shinden makes an off-beat and interesting subject for rubber power free flight scale. It is an outstanding flying model, and, because of its unusual configuration, is particularly suitable for the popular Flying Aces Club scale events. These scale events reward unusual configurations, such as canards and pushers, with bonus points to make them more competitive with conventional, easier to fly configurations. The model has done well in these competitions, winning the 1980 FAC Nats and several other FAC scale contests in 1980.

During all phases of building the model, keep in mind the importance of holding the model's weight down to a minimum. This is especially important for pusher canard configurations such as the Shinden. One peculiarity of any pusher-type model is that there is no high speed prop-wash being blown over the model's surfaces, since the prop is in the back. This means at take-off (or hand launch) there will be much less help from control surface trim sittings, compared to tractors (models with the prop on the front). This is less of a problem if the model is kept very light so that a fairly small, low torque motor can be used. If the model weight is too high, a stronger rubber motor is necessary and controlling the initial torque becomes more difficult. So remember to be a little more careful to keep weight down on rubber-powered pushers.

It would be possible to borrow the full-scale Shinden idea of an automatic aileron tab to handle the excess torque problem, especially if the model is overweight. But it's best to avoid this complexity and get better performance by simply using lightweight materials.

Construction

Construction follows conventional rubber scale practices throughout. The fuselage is built by the "half-shell" method directly over the plans. The top and bottom keel pieces are laminated from two strips of 1/16 square balsa, using white glue, and pinned onto the plans. Formers and stringers are added next. The only unusual area is the large side air

scoops. Build the nose section first, back to former F-10, including stringers. Fit and glue on the diagonal scoop former F-9A and then F-11 through F-14. The rear stringers can then be added from F-9A rearward.

The wing should be built next and fitted to the fuselage carefully. Wing fillets are not added until covering and assembly are complete. Build the canard surfaces from firm balsa and add the 1/16 piano wire pins. Aluminum tubing retaining sockets are then fit to the fuselage, and after aligning the wing and canard surfaces, reinforce and epoxy the sockets in place. The canards are held in place for flying by small dabs of model cement, such as Ambroid. They should be snug, but should knock off easily if they strike anything during landing.

Build up the prop nose block (tail bock?) from very soft and light sheet balsa. Remember that everything behind the wing leading edge should be kept light as possible to avoid having to add nose balast later. The prop and prop block, unlike tractor rubber models, must be kept very light. This means we cannot use one of the commercial plastic props, which otherwise are ideal for rubber scale models. Laminate the prop blades from two layers of 1/32 sheet balsa and form on a coffee can, or on a carved wooden form. The prop I used was left-hand (opposite normal props), with 10 inch diameter and 12 inch pitch. The hub is a piece of 3/16 dowel, drilled at the center for the 1/16 music wire shaft. The blades are carefully notched for the hub, and glued to the hub so that they have 45° pitch 2 inches from the prop centerline. Sand and carefully balance the prop before finishing the prop and block with several coats of sanding sealer. Use an "S" hook to keep the rubber motor from crawling off-center as it unwinds. In this case, the hook should look like an "S" when viewed from the front of the fuselage toward the rear. You might be wondering why a left-hand pitch prop was chosen. You can, of course, use either, but with the left hand pitch you will wind the rubber motor the same direction as a conventional model. That way, you don't have to remember to wind backwards and you will be less likely to be embarrassed by launching a model with the motor wound the wrong way!

Add the 1/32 wire landing gear now, if you choose to use a gear. It will protect the model if you fly from hard surfaces, but it will add a little extra weight.

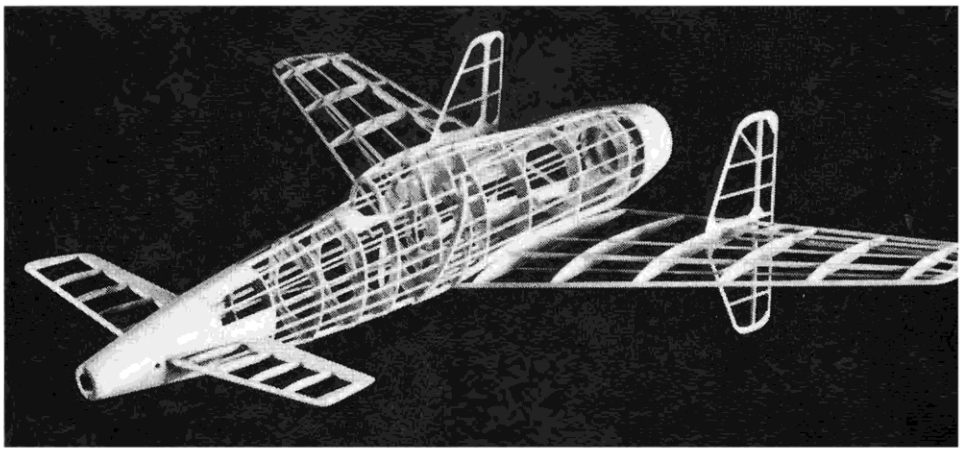
Covering and Finishing

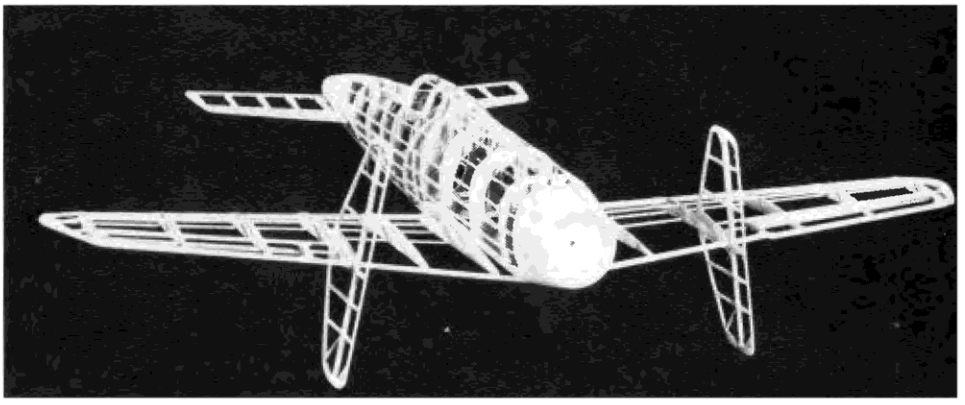
Finalsand the airframe until smooth and free of irregularities. Add the nose machine guns before covering the fuselage. They are made of aluminum tubing. First "drill" 4 holes in the nose by hand with a piece of sharpened 1/8 O.D. brass tubing. Glue small pieces of 1/8 O.D. aluminum tubing sockets into these holes, and fair the tubing into the nose sheeting with dabs of epoxy. When dry, add machine guns made of lengths of 3/32 and 1/16 aluminum tubing.

Cover all surfaces with light model tissue, shrink with water, and coat with 3 thin coats of Sig Litecoat dope or clear lacquer. Plain dope, nitrate or butyrate, shrinks too much and will tend to cause warps. If you do use these dopes as sealers, pin down the flying surfaces after they are doped, and leave for 2 or 3 days until most of the shrinking is done.

The wing is now assembled to the fuselage and formers and stringers below the wing added. After this area is covered and doped, a small wing fillet of paper is added. Add the small balsa side scoops, and give them several coats of sanding sealer.

Next airbrush the model with a thin coat of dark flat green paint on the upper surfaces, and light grey on the lower surfaces. I used Floquil Railroad Colors enamel, RR40 "Dark Green" and Sig "Polar Grey" dope for my model. Thin the paint well and just fog on a single coat. Use a light cardboard, hand held mask for the red disc insignias, and spray these on. The canopy is now added. The forward section should be molded on a Vacuum-Form if you have access to one, but it can be made from flat acetate sheet if necessary. Finally, add a vacuum-formed or balsa spinner and paint the prop assembly flat black. Panel lines and other details added with a drafting pen completes the model.





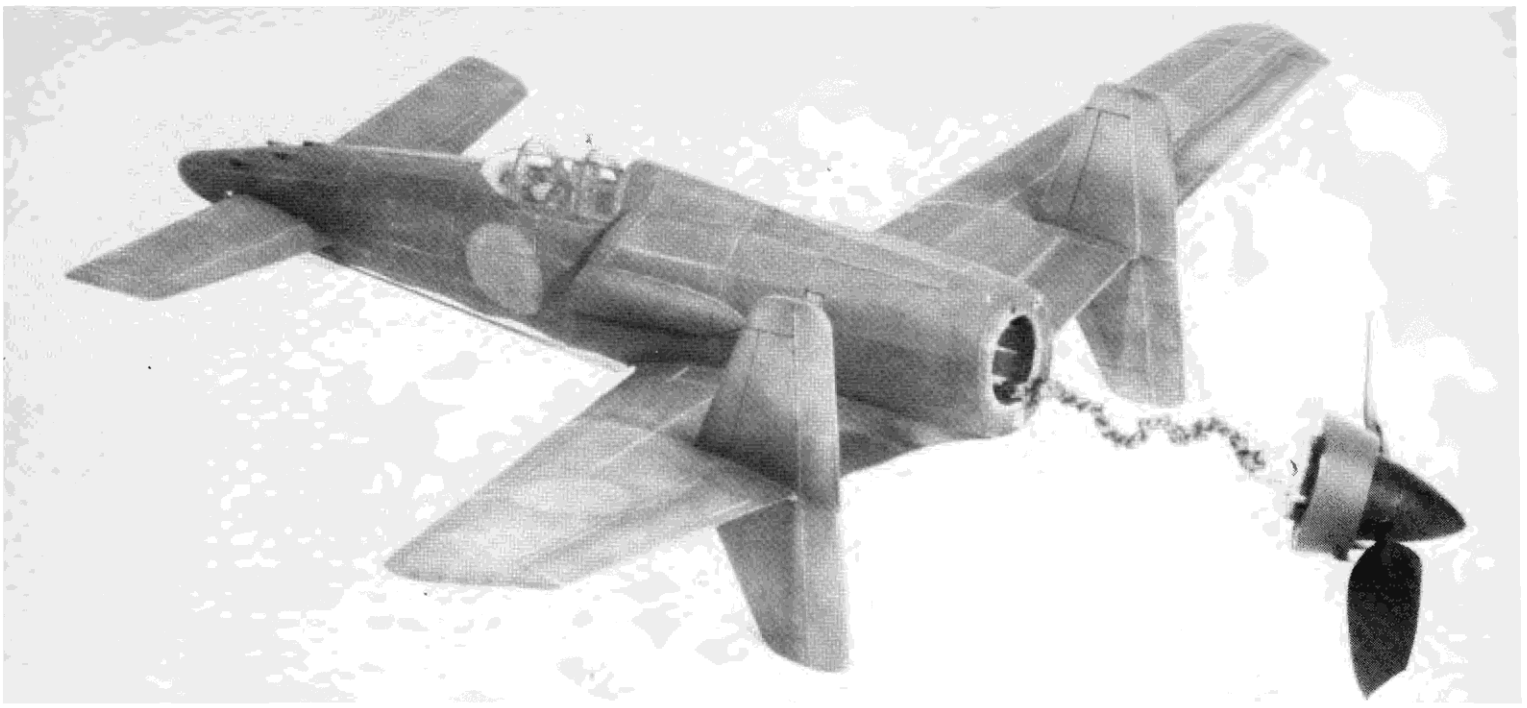




This bare bones shot (top) shows off the Shinden's former and stringer type construction. Use light balsa to keep framework light (**above**). Designer and plane after F.A.C. Nats win (**below left**). Flying Aces rules give points for unorthodox craft. Don prepares Shinden for flight (**below right**). Stooge holds plane.

Flying

Your model should weigh between 1.5 and 2.0 ounces before the motor is added. Check for warps and remove any that have developed. A little left rudder, about 1/16" to 1/8", should be built into both fins. Everything else should be straight. Thrust line should be about 3° up and 3° left. In other words, the prop shaft should point above and to the right of the nose. Make up a test motor of 4 strands of 1/8" rubber about 20" long. Balance the model as shown by adding clay to the nose or tail as required. Put in about 300 turns and, grasping the model by the prop and rear fuselage, launch straight ahead. It will take a little practice to launch the model with the wings level and at the proper flying speed.



Don't add any more winds until you have a consistent smooth, long powered glide with just a hint of left turn. At this stage, only use the ailerons and canard tabs for adjustment. Keep the C.G. within the limits shown. Only after the low power behavior is O.K. and your launch technique is consistent, start to add turns a hundred at a time. Make minor adjustments to keep a wide left pattern, with good speed and no stall. Before changing anything, try 2 or 3 flights to make sure it wasn't your launch or a shift of wind that caused a problem. By the time you reach about 600 turns or more, only use thrust adjustments to achieve a smooth, slight left climb and glide. As more winds are added, begin to launch the model harder and in a climbing altitude. The perfect launch would be at the initial climb angle and climb speed. This is an important aspect of flying the Shinden, since as mentioned previously, there is no prop wash to initially provide control forces. A too slow launch at high power will usually cause torque roll problems. When the trim is okay on the test motor, you may want to pack in more rubber for longer flights. If so, try a motor of 4 strands 5/32" rubber (or 4 mm if you're using Pirelli) about 30 inches long. Braid the motor to remove some of the slack. Make sure the C.G. is in the right place with the new motor. With this motor near max winds, the Shinden should climb rapidly almost straight out, or even slightly to the right until the power burst is over. It then will cruise and glide in large left hand circles. Dead air flights of between 1 and 2 minutes should be possible. It's a lovely model to watch on those warm and calm summer evenings.

Footnote

An automatic aileron tab was built into the original model to compensate for torque. The front motor anchor tube was spring loaded and allowed to travel about ⅛" in a slot on one side. Under full winds the motor pulled the anchor tube back against the spring. The tube pushed a thin flexible cable which operated a small plywood bellcrank back in the wing center section. The bellcrank pulled a thread which was attached to a small ply horn on the bottom of the right aileron, which was spring loaded to the neutral position. The result was that under full winds the right aileron was deflected down about 1/32" to 1/16". As the winds ran down, the aileron returned to neutral. How did it work? I found that with a 4 strand 5/32" motor, the variable tab was not needed at all. At full winds (which I hardly ever use on scale models), a hard launch, banked a little to the left, worked fine. After much flying and several repairs to the model, and adding a larger prop, I went to a 4 strand 3/16" motor, since the model had grown to over 2.5 ounces minus rubber—definitely overweight! With the larger motor near full winds, the tab was needed along with a hard launch. It worked, but was tricky to tune up and had to be kept operating smoothly, with no hang-ups or catches. At full winds on that 40" long motor, the motor run is about 2 minutes and the climb is spectacular. With the tab working well the flights are impressive and tend to wander a little—starting left, then straight, next right and finally a wide left turn! Build it light and keep the gadgets off—unless you like gadgets, as I do, in which case. . . . ⊂

