

ROCKET-GLIDER KIT

KGB-21

INTRODUCTION

Space travel, once considered only for science fiction, has become a near reality. Man's long dream for travel through outer space and to the planets beyond has resulted in the development of many space vehicles which are half rocket and half airplane. The primary idea behind the rocket-airplane concept is to obtain high enough velocities for escape from the earth's atmosphere while providing aerodynamic lift surfaces for safely returning both the astronaut and the expensive vehicle.

While the X-21 will never reach outer space or travel faster than sound, it serves to demonstrate how space travel might be accomplished. The X-21 is designed to fly equally well as both rocket and plane. Upon ignition of the rocket engine, it climbs hundreds of feet into the sky, noses over into a short dive, and then pulls out into a smooth glide; finally returning safely for a soft, skid landing. With the insertion of a fresh engine, the X-21 is ready for another thrilling flight. The X-21's see-thru payload compartment allows you to launch live biological specimens for experimental purposes.

ASSEMBLY INSTRUCTIONS

Before starting to build the X-21, check the parts list on the reverse side to familiarize yourself with the part names. In addition to the parts contained in the kit, the following materials will be needed:

Modeling knife with sharp blade
White glue, such as Wilhold or Elmers

Scissors
Sandpaper

CUTTING OUT THE Balsa PARTS

Using a sharp modeling knife, and a metal straight-edge as a guide, carefully cut out all of the parts marked on the balsa sheets. For accuracy in assembling, cut along the center of the printed line. Cut only on solid lines.

ASSEMBLE WING SECTIONS

Lay the "Main Wing Section", the "Wing Inset", and the "Trailing Edge Strip" for each wing on a flat surface and fit into place, as shown in the assembly drawing. Match up marks on the "Insets" to marks on "Main Wing Sections". Apply a thin layer of white glue along all edges and again fit the wing parts into place. Wipe off any excess glue and allow to dry flat.

SECURE BULKHEAD IN FUSELAGE TUBE

While the wing sections are drying, insert the balsa bulkhead into aft end of the fuselage tube. With the brown spacing tube, push the bulkhead forward until the end of the spacing tube is just even with the aft end of the fuselage tube. Now, set the fuselage tube on its aft end and drip several drops of white glue into the tube around the tube/bulkhead joint. Leave the tube on end and set aside to dry.

APPLY ELEVON HINGES

On a flat surface, position elevons along the trailing edge of each wing assembly. Cut out the elevon hinges, remove the brown paper backing, and carefully apply the sticky side to the top side (unprinted side) of each elevon/wing assembly, as indicated in the assembly drawing detail. With the backing paper, press and rub hinges to form a good contact with the balsa.

ASSEMBLE MOUNTING JIG

A wing mounting jig has been included with this kit, which you will find extremely useful for accurately glueing the wing assemblies to the fuselage tube. Cut out the parts from the balsa sheet marked "Wing Mounting Jig". Assemble by glueing parts together as indicated in the Jig Assembly drawing.

GLUE WINGS TO FUSELAGE TUBE

Lay the fuselage tube in the "V" grooves on the mounting jig. Apply white glue to the root chord of each wing assembly and attach to the fuselage tube, as indicated in the assembly drawing. The jig is designed for use with the under side (printed side) of the plane showing. When the wings are lying flat on the jig, the alignment should then be perfect. After the initial glueing has thoroughly dried, run a fillet of glue along each wing/fuselage joint (both sides). To strengthen the wing assemblies, glue an "Under Wing Runner" to the under side of each wing, in the position indicated. The trailing end of each runner will extend clear past the elevon. Caution: Do not glue the runner to the elevon.

ATTACH ROOT STRESS SUPPORTS

Due to the tremendous acceleration which the vehicle must undergo during takeoff, it is necessary to strengthen the root chord with a stress support to keep the wings from shearing from the fuselage tube. Taper sand the supports as indicated on the balsa itself. Apply white glue to the unprinted side and inboard edge of each support and press into place on the wings next to the fuselage tube.

GLUE STABILIZERS TO WING TIPS

Apply a narrow strip of glue along the top and bottom sides of both wing tips. Position stabilizers on wing tips with the aid of the "Stabilizer Angle Template". To make this template, simply cut out the marked parts and glue together at right angles to each other. To use the template, hold the "base" of the template flat on the wing with the stabilizer resting on the "upright" as shown in Detail A. Rather than hold the base on the wing until the glue dries, fasten the base to the wing with a couple of straight pins. Position each of the four stabilizers in the same manner.

ATTACH LAUNCHING LUG

Glue the launching lug to the top side of the fuselage tube as shown in the assembly drawing.

RIG ELEVON TENSION CORD

With a sharp pencil point or piece of stiff wire, punch two holes thru each elevon, in the position indicated on the hinge material. Thread one end of the black elastic cord thru both holes in one elevon and tie securely. Repeat for the other elevon, leaving about 4½" to 5" of slack cord between the two tie points. To keep the tie points from unraveling and coming loose, place a drop of glue on each knot. Grasp the slack cord in the middle and stretch forward over the front of the launching lug. The tension should be strong enough to pull the elevons up. Creasing the hinge line with a fingernail helps to free the hinge's stiffness. Release the tension in the cord by removing it from the launch lug until ready for flight.

RIG NEUTRAL ELEVON RELEASE

Punch two holes thru each elevon in the position indicated for "release line". Now, working with the under side of the plane up, thread one end of the release line through the two holes and tie securely. Thread the other end thru the other two holes and tie loosely. Grasp the slack line midway between the two tie points, and with the line crossing over the "Under Wing Runner", pull the elevons back to neutral position. The apex or "V" point should just touch the aft end of the fuselage tube when the line length is correctly adjusted. Tie the loose end securely and place a drop of glue on each knot. Slip the line spex into the hook of the release clip and crimp the hook tightly onto the line, as shown in the assembly drawings (Bottom View).

Now, cut the "V Slot Guide" from the special adhesive paper, tear off brown backing paper, and apply over aft end of fuselage tube on plane's under side, as shown in the bottom view assembly drawing. With a sharp modeling knife, cut out "V" slot as indicated.

RELEASE SYSTEM CHECKOUT

Insert brown spacing tube or rocket engine into fuselage tube. Now slide the release clip into the "V" slot between the fuselage tube and the engine tube. Push the release clip forward until the release line becomes taut and elevons are just pressed back against the "Under Wing Runner". Excess tension will cause the wings to distort. Hook the tension cord over the launching lug and system is now ready to go.

Occasionally, you will run into a tight fitting engine which makes it difficult to push the release clip between the engine and fuselage tube. If this should happen, simply take a modeling knife and cut through the fuselage tube along the three lines indicated on the "V" Slot Guide. This will allow the clip to be pushed into place. If, after making these cuts, the clip slips out of place due to a loose fit, simply form a small kink in the clip.

In normal operation, at peak altitude, the ejection charge built into the engine causes the engine to jettison rearward, thereby allowing the release clip to fall free and elevons to flip up. Such action can be simulated by pulling the engine out yourself during checkout.

PREPARE PAYLOAD COMPARTMENT

A short payload compartment is included with the X-21 to carry live biological specimens, such as ants and other insects. Two forward wings must be attached to the plastic tube section, however it is practically impossible to glue the balsa wings directly to the plastic. Therefore, it is necessary to first apply two narrow strips of pressure sensitive paper to the plastic tube section.

Cut out the "Bonding Strips", remove the brown paper backing paper and apply the strips to the plastic tube directly opposite each other. Now with the aid of the "Wing Mounting Jig", glue the "Forward Wings" to the paper strips. When the assembled payload compartment is mounted on the plane, the two sets of wings should line up with each other.

A minimum payload weight is required to maintain stability. This minimum weight is represented by the screw-eye and the washer-like weight, included with the kit, and which weigh about 1/10 of an ounce.

When no additional payload is to be launched, the screw-eye and one weight must be attached to the nose cone base. Place the weight over the eye and thread it into the cone base.

When, however, you wish to send up a beetle, small grasshopper, or other small insect; remove the weight and possibly the screw eye also. The idea is to keep the total payload weight around 1/10 to 2/10 of an ounce. For example, a single ant weighs practically nothing, so therefore leave the weight in place. If however, you are sending up a beetle or grasshopper, it is usually necessary to remove both the weight and screw-eye. When in doubt, stay on the heavy side. Too much weight will cause the vehicle to dive steeply during its decent, whereas too little weight will cause unstable or erratic flight during takeoff.

GLUE CONTROL STOPS IN PLACE

The control stops consist of angled steel wires which pivot in aluminum tubes. Release the tension cord from the launching lug and glue the control stops in place, as shown in the assembly drawing.

FINISHING THE "X-21"

The surface finish of high speed aircraft must be very smooth to reduce drag. Lightly sand all balsa surfaces. Round all leading edges and taper all trailing edges for best flight results. You may wish to apply a light coat of paint to your model, however, do not use heavy enamels as they will weight the plane down. For best results, spray lightly with a spray laquer or laquerized enamel. Be careful not to get paint in the elevon hinge joints.

PRELIMINARY GLIDE CHECK-TRIM & BALANCE

Because of slight variations in balsa weight, technique of glueing and painting, and elevation of flight location (relative to sea level), it is always necessary to check elevon lift and lateral balance with simple hand launchings. Swing the control stop wires to identical positions, release the elevons, and toss the plane, less engine, straight out in front of you, observing glide. Checking first for lateral balance, notice whether plane turns left or right. To counteract a left turn, tape a small weight such as a paper clip to the right wing tip. For right turn correction, attach a small weight to the left wing tip.

Now, checking for elevon lift, toss the plane again and observe angle of decent, or fall angle. More or less lift can be obtained by swinging the control stop wires. A flat glide will carry the plane the furthest distance and increase glide duration. For left or right turns in flight, try varying the swing position of each control stop.

LAUNCHING THE "X-21"

The following Centuri rocket engines are recommended for use with the X-21.

½ A. 8-2 A. 8-3 B. 8-4

Insert the rocket engine, install the igniter, hook up tension cord, connect release clip. Just prior to each launching, check to make sure that the elevons are in a perfectly neutral position and that the "Forward Wings" are in line with the "Main Wings". Launch the X-21 from a large open field measuring at least 300 feet on a side, away from houses and trees, using a rod launcher such as Centuri's LIA-50 or LIA-77. Do not attempt to launch in windy weather, as the X-21 will weathercock and lose stability under such conditions. Observe the first flight carefully, as you may wish to re-trim and balance the glider for a smoother glide. Complete igniter preparation and launching instructions are included with all Centuri engines.

For further information regarding model rocket engines, kits, launchers, ignition devices, and custom parts, write to:

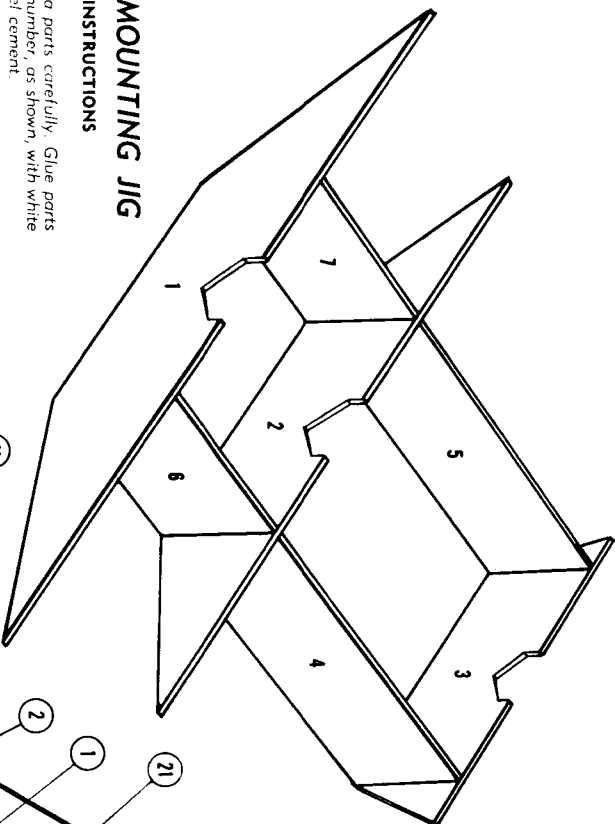
CENTURI ENGINEERING COMPANY
P. O. Box 1988
Phoenix, Arizona 85001

X-21 ASSEMBLY DRAWINGS

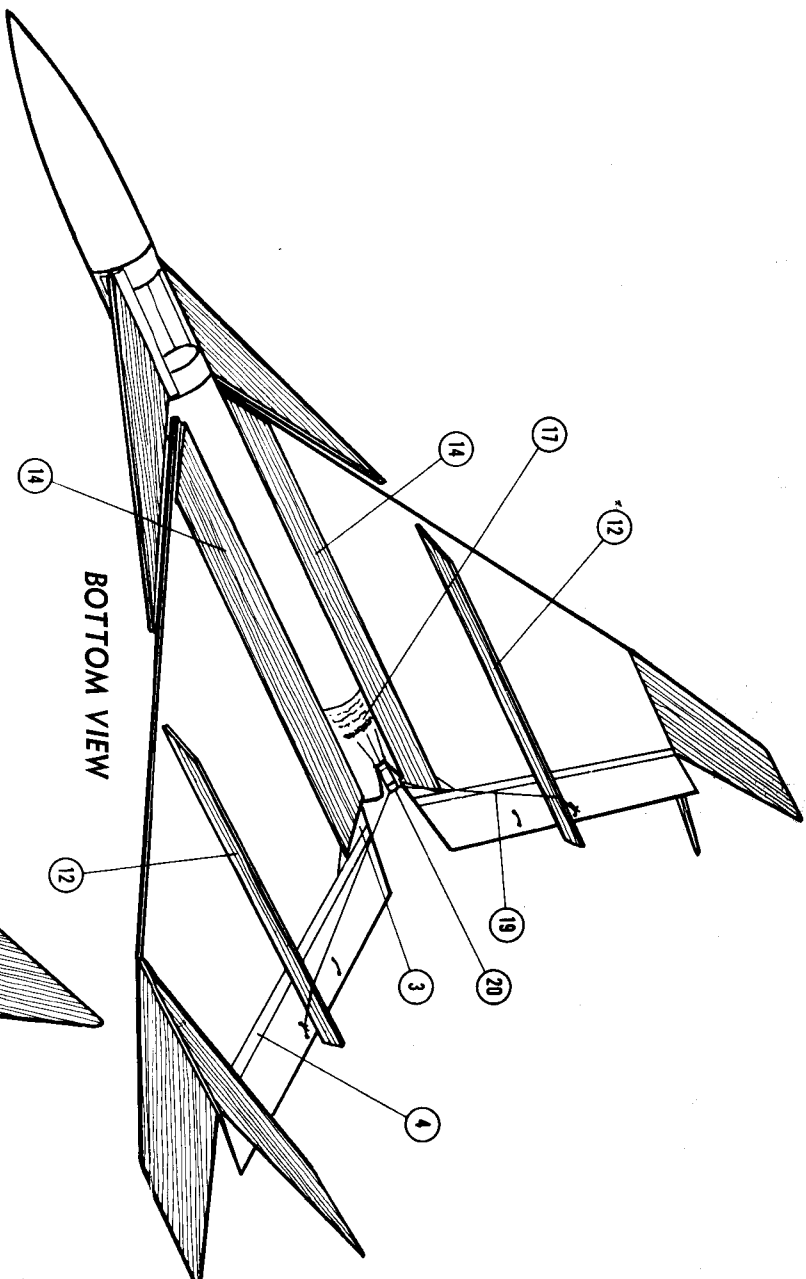
WING MOUNTING JIG

INSTRUCTIONS

Cut out balsa parts carefully. Glue parts together by number, as shown, with white glue or model cement.

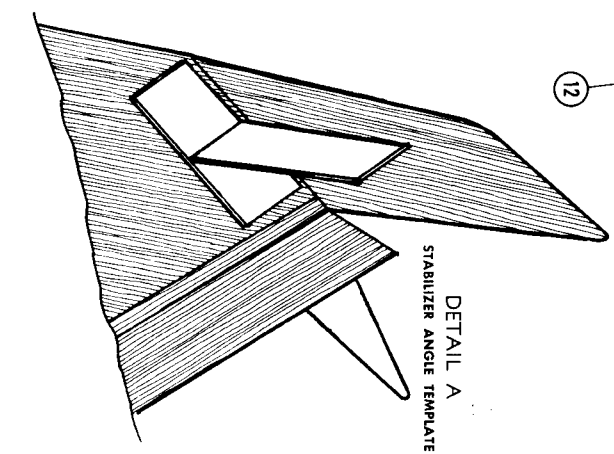
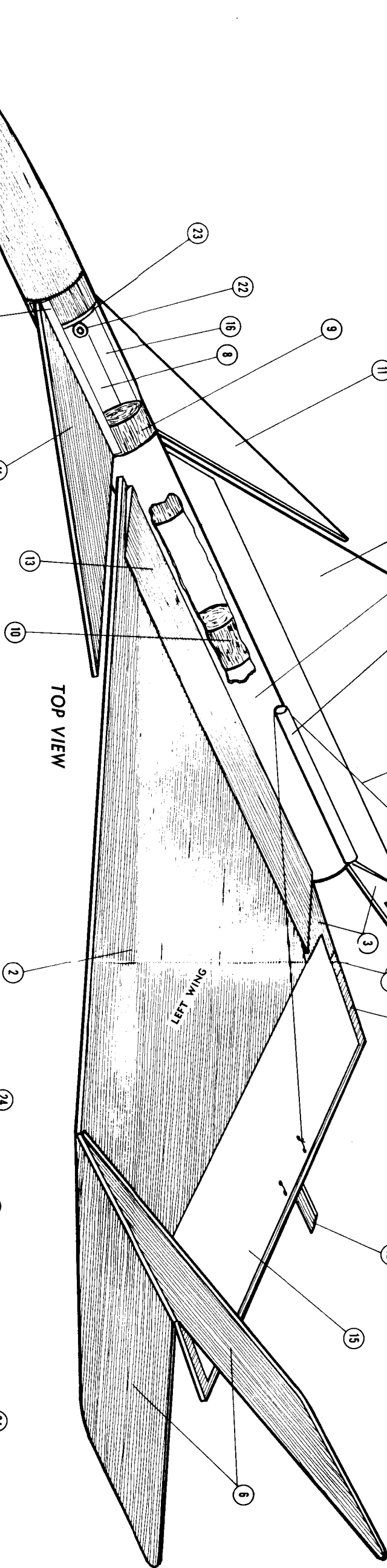


RIGHT WING

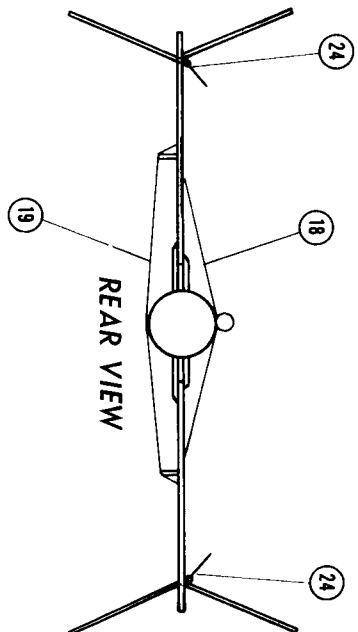


BOTTOM VIEW

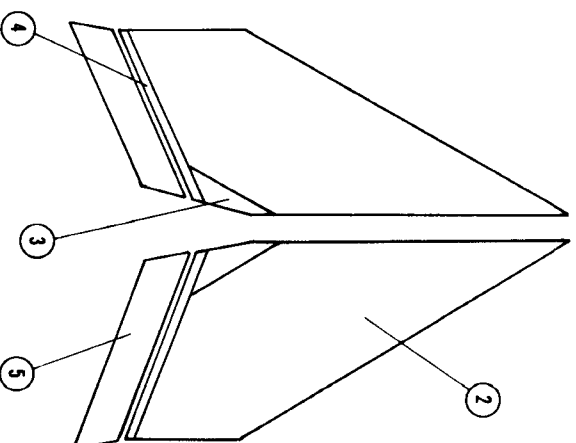
TOP VIEW



DETAIL A
STABILIZER ANGLE TEMPLATE



REAR VIEW



WING ASSEMBLY

PARTS LIST

PART NO.	PART NAME	PART NO.	PART NAME
1	Fuselage Tube	13	Top Root Stress Support
2	Main Wing Section	14	Bottom Root Stress Support
3	Wing Inset	15	Elevon Hinge
4	Trailing Edge Runner	16	Bonding Strip
5	Elevons	17	"V" Slot Guide
6	Stabilizer	18	Tension Cord
7	Nose Cone	19	Release Line
8	Payload Section	20	Release Clip
9	Balsa Connector	21	Launching Lug
10	Bulkhead	22	Screw Eye
11	Forward Wing	23	Nose Weight
12	Under Wing Runner	24	Control Stop

