

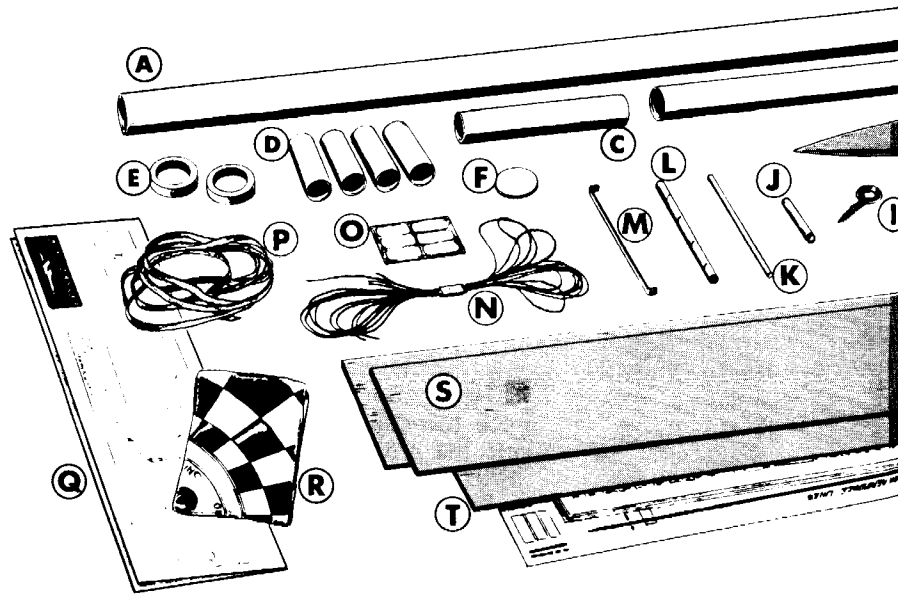


Orbital Transport

ASSEMBLY INSTRUCTIONS

Your Astron Orbital Transport model rocket kit consists of the following parts as illustrated in the drawing at right:

- | | |
|---------------------------------|---------------|
| A) 1 Booster Body Tube | Part #BT-50 |
| B) 1 Spacecraft Body Tube | Part #BT-20D |
| C) 1 Engine Mount Tube | Part #BT-20J |
| D) 4 Body Tubes | Part #BT-5T |
| E) 2 Centering Rings | Part #AR-2050 |
| F) 1 Paper Nose Block | Part #NB-20P |
| G) 1 Nose Cone | Part #BNC-50Y |
| H) 1 Nose Cone | Part #BNC-20B |
| I) 1 Screw Eye | Part #SE-2 |
| J) 1 Wood Dowel | Part #WD-1A |
| K) 1 Launch Lug Stand-Off | Part #WD-2B |
| L) 1 Launch Lug | Part #LL-2B |
| M) 1 Engine Holder | Part #EH-2 |
| N) 108" Shroud Line Cord | Part #SLT-18 |
| O) 6 Tape Strips | Part #TD-2F |
| P) 1 Shock Cord | Part #SC-3 |
| Q) 1 Pattern Sheet | Part #SP-42 |
| R) 1 Parachute | Part #PK-18A |
| S) 2 Sheets Fin Stock | Part #BFS-30L |
| T) 1 Sheet Fin Stock | Part #BFS-20L |
| U) 1 Decal sheet | Part #KD-42 |
| V) 1 Instruction set (3 sheets) | |

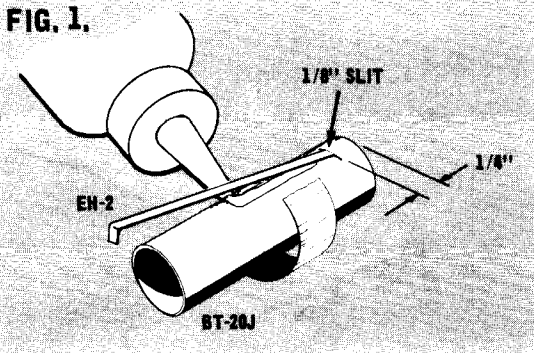


Read the entire assembly instructions carefully before beginning work on your rocket. Then start construction, following each step in order, checking off each step as it is completed.

In addition to the materials included in your kit, you will also need the following tools and materials:

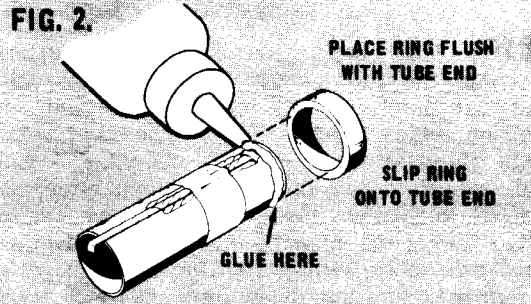
- | | |
|--|----------------------------------|
| 1) Modeling knife or single edge razor blade | 5) Several straight pins |
| 2) Scissors | 6) Wax paper or Saran wrap |
| 3) Extra-strong white glue | 7) Fine and extra-fine sandpaper |
| 4) Ball point pen or pencil | 8) Sanding sealer |
| | 9) White and black paint |

ENGINE MOUNT ASSEMBLY

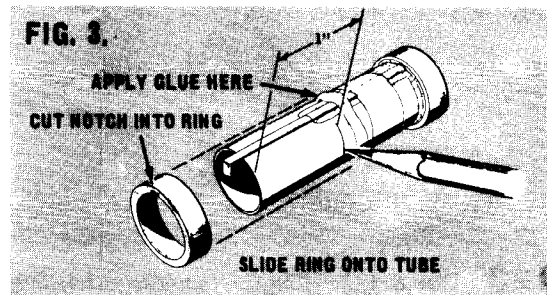


1 Mark the BT-20J engine mount tube 1/4" from one end. Cut a 1/8" slit into the engine mount tube as shown in Fig. 1. Slip one end of the EH-2 engine holder into the slit. Hold the hook temporarily in place with a small strip of masking tape.

2 Apply a line of glue around the end of the engine mount tube which you have slit. Slip one of the AR-2050 centering rings onto



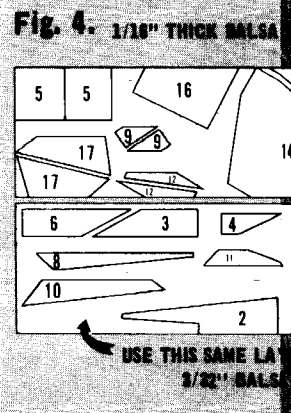
this end of the tube so that it is flush with the tube end as shown.

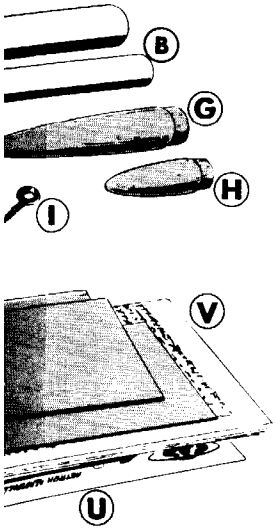


3 Cut a notch 1/32" deep and 3/32" wide

on the inside of the other end of the tube as shown in Fig. 3. Mark the notch 1" from the other end and cut around the tube just above the second centering ring. The notch is centered over the lower end of the ring as shown.

WING CONSTRUCTION





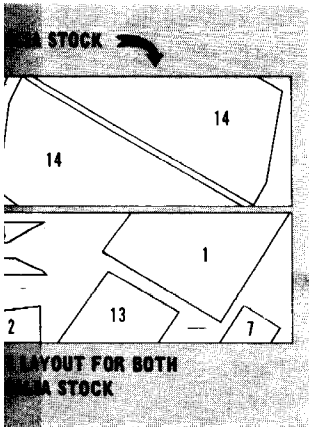
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...d in your kit
...d materials:

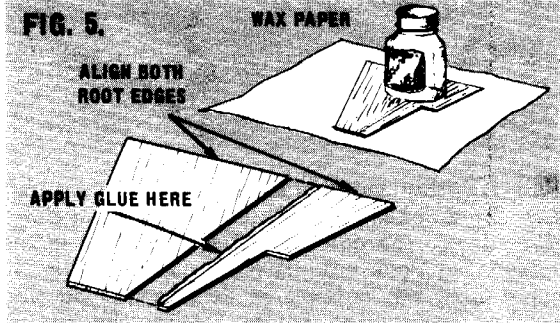
...straight pins
...or Saran wrap
...extra fine grit sandpaper
...saler
...black paint or dope

...e other centering ring as
...ark the engine mount tube
...d and apply a line of glue
...st above this mark. Slip
...ring onto the tube so that
...d over the engine hook and
...e ring is on the mark as

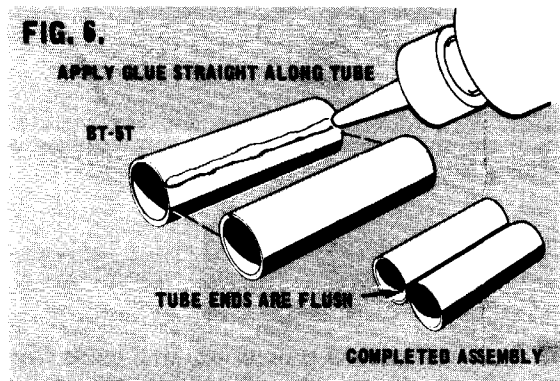
INSTRUCTION



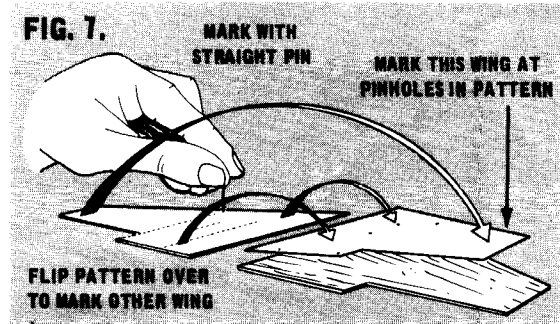
4 Cut out the booster's forward wing section pattern #1. Trace two copies, one from each piece of the 3/32" thick balsa stock, being sure to position the pattern exactly as shown in Fig. 4. Cut out the wings carefully. Cut out the booster's aft wing section pattern #2. Trace two copies, one from each piece of the 3/32" thick balsa stock as shown and cut out carefully.



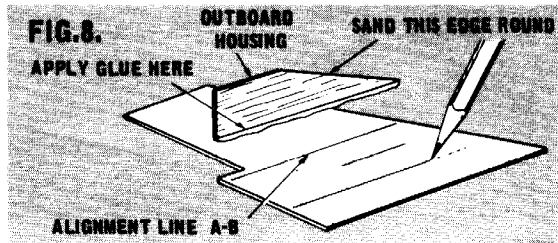
5 Run a line of glue along the rear edge of one aft wing section as shown in Fig. 5. Attach the aft wing section, being careful to align both root edges. Lay wax paper or Saran wrap onto a flat surface and place the assembled wing sections onto this as shown. Carefully wipe away any excess glue from the wing joint. Place a second piece of wax paper over the wing and set a small weight on the wing until the glue joint is completely dry. Following the same procedure, assemble the other forward and aft wing sections.



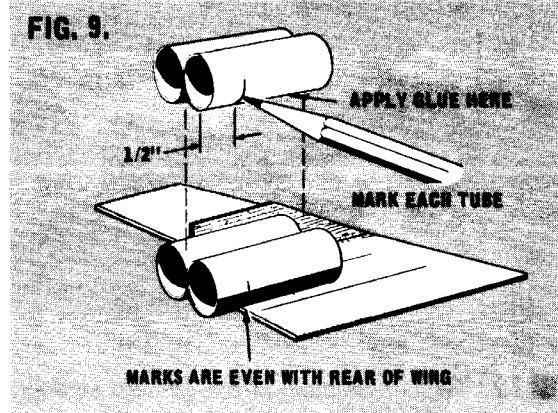
6 Apply a thin line of glue straight along one of the 1-1/2" long BT-5T scamjet tubes. Glue this to a second scamjet tube as shown in Fig. 6. Be sure that both tube ends are even and place on a flat surface to dry. Following the same procedure, assemble the two remaining scamjet tubes.



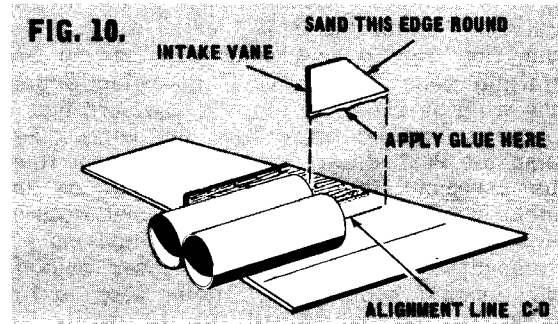
7 Place both wings on a flat surface and position them exactly as shown in Fig. 7. Cut out the wing marking guide and place it (printed side up) on one of the wings as shown. Using a straight pin, mark the wing at each of the points indicated on the pattern. Poke the pin through the pattern and into the balsa, but do not go through the balsa. Now FLIP the pattern OVER and mark the other wing by poking the pin through each of the pinholes in the pattern.



8 Carefully draw lines on the wings connecting the pinholes as indicated by the dotted lines on the wing marking guide. Trace one copy of the outboard scamjet housing pattern #3 onto the 3/32" thick balsa stock. Cut out the housing and sand the forward edge round. Apply a line of glue to the longest edge and center the housing on the outboard alignment line (A-B) drawn on the wing. Align the housing so that it is perpendicular to the wing. See also the Rear View on the General Assembly instruction sheet.

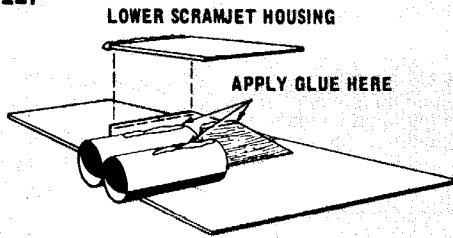


9 Mark one pair of scamjet tubes 1/2" from one end as shown in Fig. 9. Run a line of glue on each tube forward from the mark. Glue the scamjet tubes onto the wing and against the housing. Be sure that the marks on the tubes are even with the rear of the wing as shown.



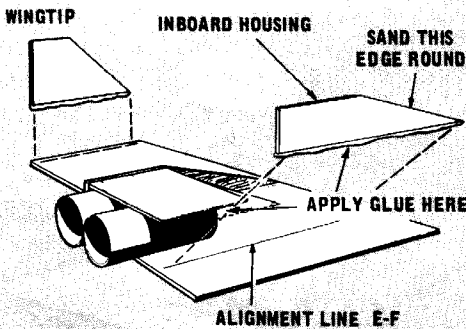
■ **10** Trace one copy of the intake vane pattern #4 onto the 3/32" thick balsa stock. Cut out the intake vane and sand the forward edge round. Apply glue to the longest edge and position the vane upon the alignment line (C-D) and against the scramjet tubes as shown in Fig. 10.

FIG. 11.



■ **11** Trace one copy of the lower scramjet housing pattern #5 onto the thin BFS-20L balsa sheet as shown in Fig. 4. Cut out the housing carefully. Test fit to be sure that it rests squarely against the outboard housing and upon the scramjet tubes and intake vane. Run a thin line of glue along each of the scramjet tubes and the intake vane as shown in Fig. 11. Apply glue to a long edge of the lower housing and glue into place.

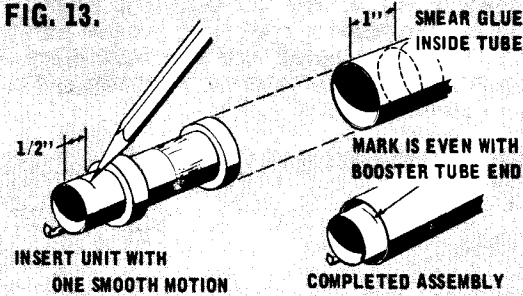
FIG. 12.



■ **12** Trace one copy of the inboard scramjet housing pattern #6 onto the 3/32" thick balsa stock. Cut out the inboard housing and sand the forward edge round as shown. Test fit the housing to be sure that it rests squarely upon the wing, also against the scramjet tube and lower housing #5. Apply a line of glue to the lower edge #5 and along the longest edge of the inboard housing. Position the housing upon the alignment line (E-F) and glue into place. Trace one copy of the wingtip pattern #7 onto the 3/32" balsa stock. Cut out the wingtip and sand the leading and trailing edge round. Glue the wingtip onto the wing as shown in Fig. 12. Be sure that it projects straight away from the wing. See also the Rear View. Use the alignment lines to assemble the scramjet housing on the other wing. Construct the scramjet housing in the following order: outboard housing #3; scramjet tubes; intake vane #4; lower housing #5; inboard housing #6. Refer also to fig. 8-12.

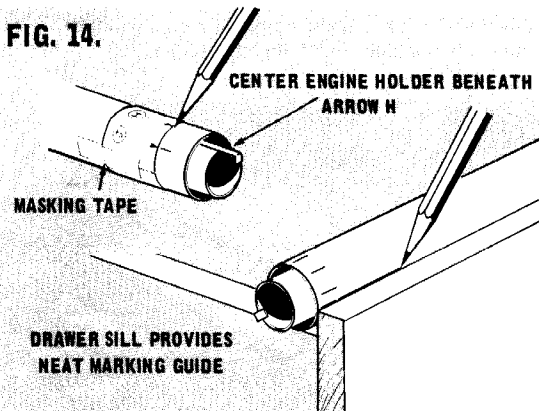
● **MAIN ASSEMBLY**

FIG. 13.



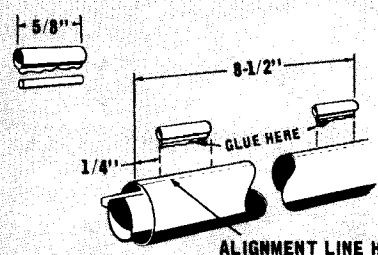
■ **13** After the glue on the engine mount unit has dried, check its fit in the BT-50 booster body tube. The unit should slide easily in the tube. If it does not, carefully peel a layer of paper from the outside of each centering ring until it does slide easily. Mark the engine mount tube 1/2" from the lower end as shown in fig. 13. Smear glue around the inside of the booster body tube to cover an area 3/4" long starting 1" inward from one end. Slide the engine mount unit into this end of the body tube so that the mark is even with the booster tube end. DO NOT PAUSE or the glue may "grab" with the mount in the wrong position.

FIG. 14.



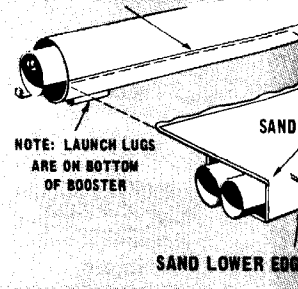
■ **14** Cut out the booster marking guide from the pattern sheet. Wrap the guide around the rear end of the body tube and center the engine holder beneath arrow H as shown. Hold the marking guide temporarily in place with a small strip of masking tape and mark the tube at each of the arrow points. Arrows J, K and L require a straight line 9" long drawn from the rear of the body tube. Arrows G and H require a line drawn straight along the entire body tube.

FIG. 15.



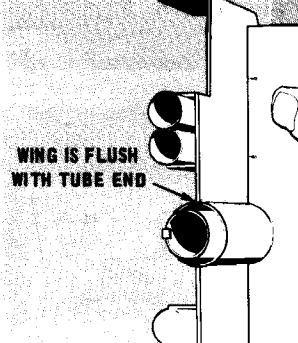
■ **15** Cut two 5/8" long WD-2B dowel. Next, cut from the LL-2B launch lug glue to one side of the dowel into place on the glue to ensure that the two pieces are assembled in the same manner. After the glue dries, apply glue to the booster body tube on the center exactly on the lug 1/4" from the front end of the lug. Attach the other lug to the booster on the rear, as shown. The project struts are now attached to the booster body tube.

FIG. 16. GLUE WING NEXT TO ALIGNMENT LINE G



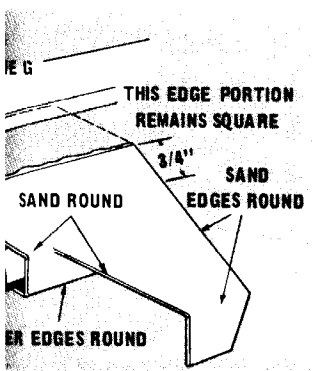
■ **16** After the glue on both wing assemblies has dried, sand the wing leading edge the first 3/4" from the rear. The wings should remain square for attachment. Check the fit of the wing that it fits evenly against the booster tube. Apply a line of glue to the wing as shown. Attach the wing to the booster tube along alignment line G. The wing should project straight away from the booster tube end. Align the wing carefully. Support the body tube while the glue dries.

FIG. 17. USE TAPE TO HOLD WING FLUSH WITH TUBE END

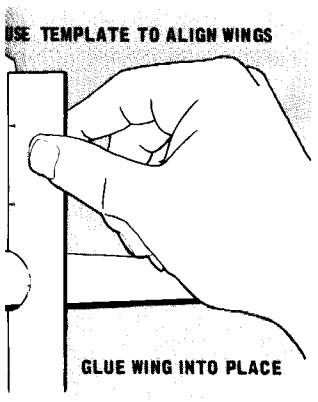


■ **17** Cut the booster wing plate from the pattern sheet. Cut carefully around the piece of cardboard. Apply glue to the other side of the wing plate. Attach the wing plate to the booster body tube.

3" lengths from the thin it, cut two 5/8" lengths of lug. Apply a line of glue to the lug and press the glue as shown. Make the pieces are perfectly parallel. The dowel and lug in the same glue has set several to the other side of the on alignment line H. the line, with the rear of m the booster tube end, lug and stand-off assembly alignment line H so that the lug is 8-1/2" from the as shown. Align both ct straight away from the

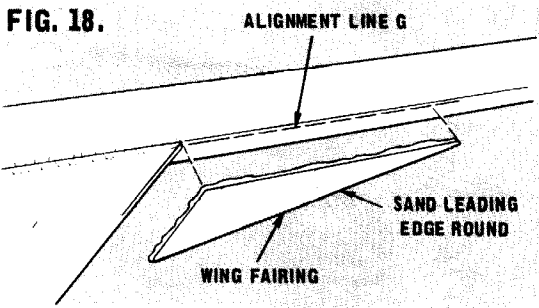


ue on them has dried, sand es as shown in fig. 16. ng edges round except for the root edge; this should attaching the wing fairing. wing root edge to be sure against the body tube. e to the root edge of one tach the wing to the body it line G. Be sure that e wing is even with the Align the wing so that it way from the body tube, away any excess glue. tube vertically while the

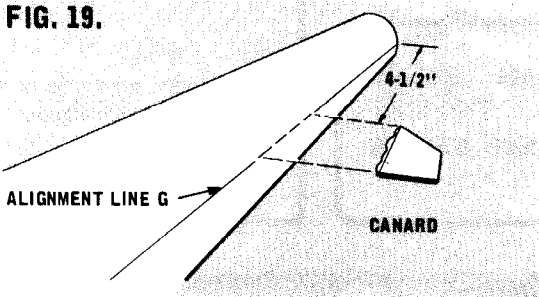


iter wing alignment tem- m sheet and glue it to a After the glue has dried, the template edge lines. ther wing's root edge and tube along the opposite

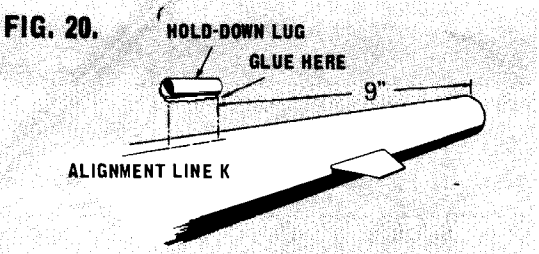
wing alignment line G. Be sure that the rear edge of the wing is even with the booster tube end and that the wing projects straight away from the body tube. Use the template to align the wings as shown. Carefully wipe away any excess glue and set aside to dry. Support the body tube vertically while the glue dries.



■ 18 After both wing glue joints are dry, trace two copies of the wing fairing pattern #8 onto the 3/32" balsa stock. Cut out the wing fairings and sand the leading round as shown in fig. 18. Test fit each fairing until it fits flush against the wing and body tube. Apply a line of glue to one wing fairing as shown and glue into place. Attach the opposite wing fairing in the same manner.

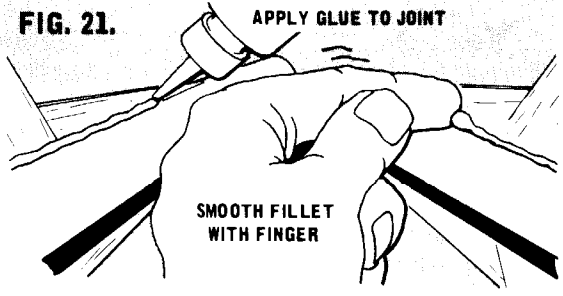


■ 19 Trace two copies of the canard pattern #9 onto the thin (1/16" thick) balsa stock. Cut out carefully and sand the leading and trailing edges round. Apply glue to the root edge (longest edge) of one canard. Attach the canard to the body tube along alignment line G with the forward end of the canard 4-1/2" from the forward end of the body tube as shown in fig. 19. Align the canard so that it projects straight away from the body tube. Following the same procedure, glue the other canard to the opposite alignment line G.

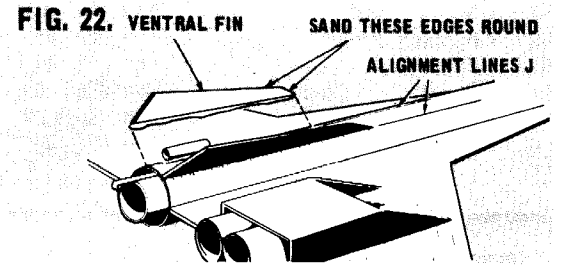


■ 20 Cut a 1/2" length from the remaining piece of LL-2B launch lug. Apply a line of glue to one side of the 1/2" lug and attach

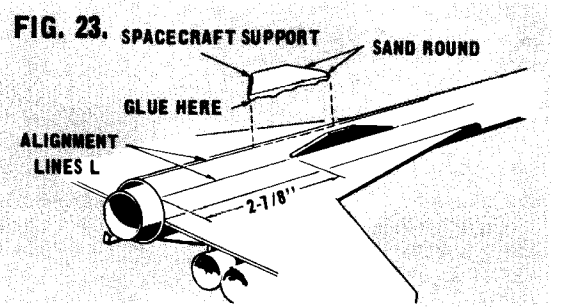
to the body tube on alignment line K. Center the lug exactly on the line with the forward end of the lug 9" from the forward end of the body tube as shown.



■ 21 Apply a glue fillet to both sides of the wing-body joint. First, apply a line of glue along the joint as shown. Then run your finger carefully along the joint to smooth the glue fillet and remove any excess glue. Support the rocket horizontally while the glue dries. Apply a glue fillet to the other wing-body tube joint in the same manner.

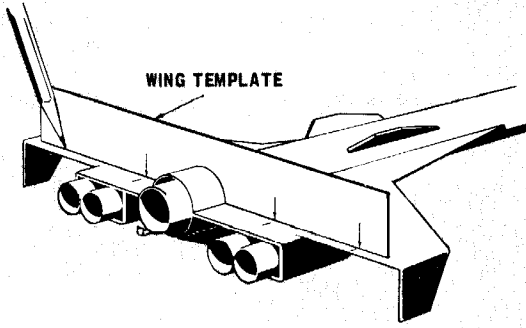


■ 22 Trace two copies of the ventral fin pattern #10 onto the 3/32" thick balsa. Cut out the fins and sand the leading edges round as shown in fig. 22. Apply a line of glue to the root edge of one fin and attach to the body tube on alignment line J. Position the rear of the fin even with the booster tube end and align so that it projects straight away from the body tube. See also the Rear View. Glue the other ventral fin to the body tube in the same manner.



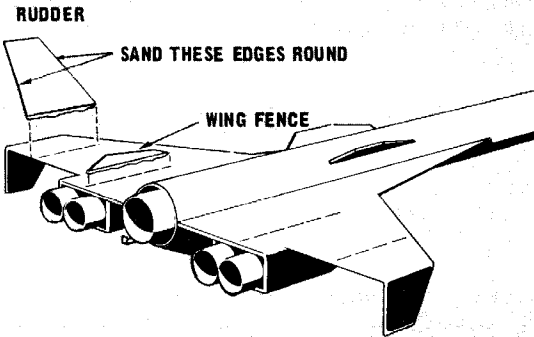
■ 23 Trace two copies of the spacecraft support pattern #11 onto the 3/32" thick balsa. Cut out the supports and sand the leading edges round. Apply a line of glue to the root edge of one support and attach to the body tube on alignment line L. Position the rear of the support 2-7/8" from the booster tube end as shown in fig. 23, and align the support so that it projects straight away from the body tube. Following the same procedure, glue the other spacecraft support into place.

FIG. 24.



24 Place the booster wing template across the top of the wing and almost even with, but still parallel to the wing rear. Mark the wing at the two arrow points labeled "wing fence." Keeping the template still parallel to the rear of the wing, move the template forward 3/8" and mark the wing at the two arrow points labeled "Rudder." Move the template forward once more until it is 2-1/2" from the booster tube end. Mark the wing again, this time at each arrow point. Using a ruler, carefully draw a line parallel to the body tube connecting the marks on the wing.

FIG. 25.

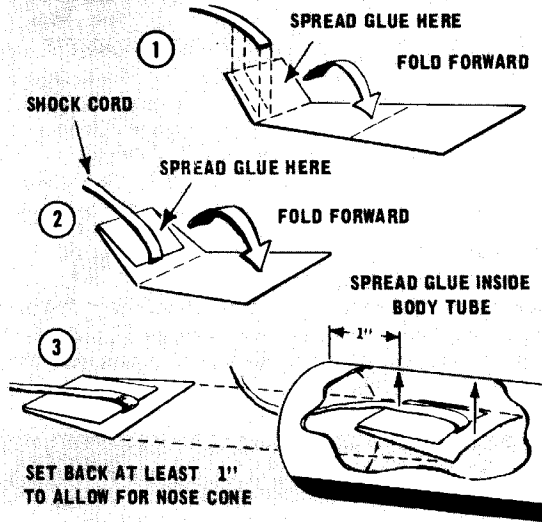


25 Trace two copies of the wing fence pattern #12 onto the thin balsa stock. Cut out carefully and sand all edges square. Apply a line of glue to the root edge of one wing fence and attach to the wing on the line closest to the body tube as shown in fig. 25. Be sure that the rear of the wing fence is even with the rear of the wing and align to project straight away from the wing. Following the same procedure, glue the other wing fence to the opposite wing.

26 Trace two copies of the rudder pattern #13 onto the 3/32" balsa stock. Cut out the rudders and sand the leading and trailing edges round as shown in fig. 25. Apply glue to the root edge of one rudder and attach to the wing on the alignment line farthest from the body tube. Position the rear of the rudder even with the wing's outboard trailing edge and align to project straight away from the wing. Following the same procedure, attach the other rudder to the opposite wing.

RECOVERY SYSTEM

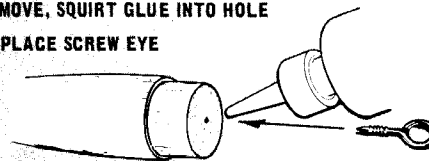
FIG. 26.



27 Cut out the shock cord mount from the pattern sheet and prefold it on the dotted lines. Lay the mount out flat, apply glue to section 1 and lay the shock cord into the glue. Fold this section over. Spread glue over the back of the first section and the exposed part of the second section. Lay the shock cord as shown and fold over again. Clamp the unit together with your fingers while the glue sets. Apply glue to the inside of the body tube over an area approximately 1" to 1-1/2" from the front end. The glue should cover a shape approximately the same as the shock cord mount. Press the mount onto the glue and hold it until the glue sets.

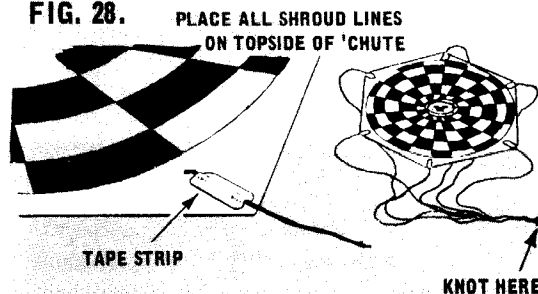
FIG. 27.

INSERT SCREW EYE INTO NOSE CONE
REMOVE, SQUIRT GLUE INTO HOLE
REPLACE SCREW EYE



28 Insert the screw eye into the base of the BNC-50Y nose cone. Remove the screw eye, press the nozzle of the glue bottle to the hole and squirt glue into the hole. Replace the screw eye and wipe away any excess glue.

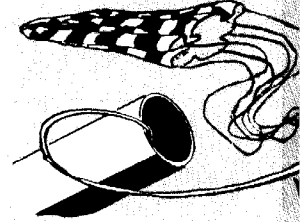
FIG. 28.



29 Cut out the par lines as indicated on the 18" lengths of shroud line one shroud line to each p with a tape strip as show free ends of the lines to

FIG. 29.

TIE SHROUD LINES AND SH

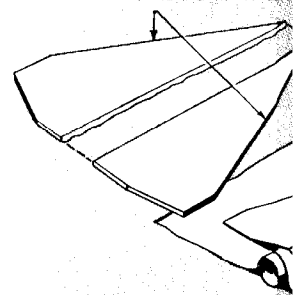


30 Connect the shock screw eye as shown in parachute into the body shroud lines and shock the base of the nose c end of the body tube.

31 Apply a glue fil joints. Apply a glue fil each launch lug stand-off the rocket horizontally v Apply a glue fillet to rudder-wing joint. Allow dry completely.

SPACECRAFT CO

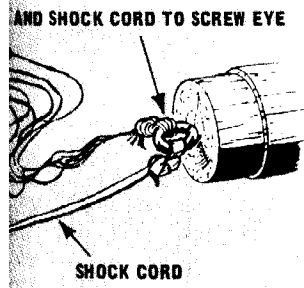
FIG. 30. SAND LEADING ED



WINGTIPS MUST REST ON FLAT SURFACE

32 Trace two copies wing pattern #14 onto the stock exactly as shown carefully and sand the le wing round. All other remain square. Place tube (part BT-20D) on cover it with a piece of wrap. Apply a line of g of one wing and allow th 20-30 seconds. Attach align the root edges c wing assembly on the b the wing joint runs stra the body tube. Allow against the flat surface.

e parachute on its edge on the plastic. Cut six and line cord and attach each point of the parachute shown in fig. 28. Tie the s together.

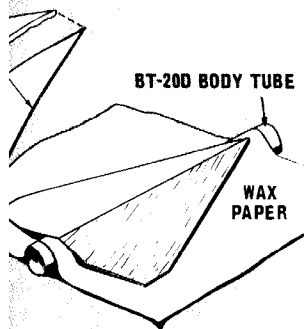


Shock cord, parachute and shown in fig. 29. Push the body tube, packing the shock cord over it. Push the cone into the forward

fillet to both wingtip and fillet to both sides of end-off assembly. Support while the glue dries. t to both sides of each. Allow the glue fillets to

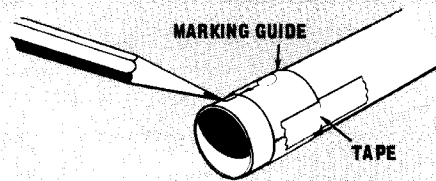
CONSTRUCTION

NG EDGE ROUND



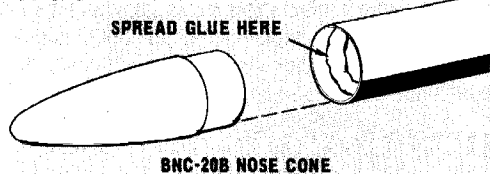
copies of the spacecraft to the 1/16" thick balsa shown in fig. 4. Cut out the leading edge of each other wing edges should trace the spacecraft body on a flat surface and use of wax paper or Saran of glue to the root edge how the glue to "set" for attach the two wings and as carefully. Place the the body tube as shown so s straight along the top of low the wingtips to rest ace.

FIG. 31.



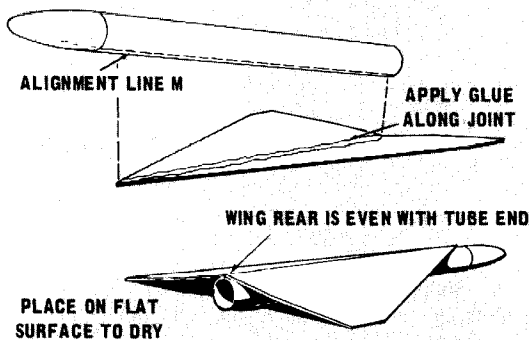
■ **33** After the wing glue joint has dried, remove the body tube. Cut out the spacecraft marking guide, wrap it around the body tube and hold it temporarily in place with masking tape. Mark the body tube at each arrow point. Remove the marking guide and draw a line through each mark straight along the entire body tube. Use a drawer sill or similar guide to mark the tube as you did in step 14.

FIG. 32.



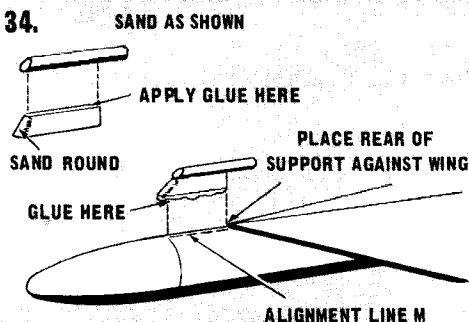
■ **34** Smear glue around the inside of the body tube for a distance of 1/4" from one tube end. Insert the nose cone (part BNC-20B) into this end as shown.

FIG. 33.



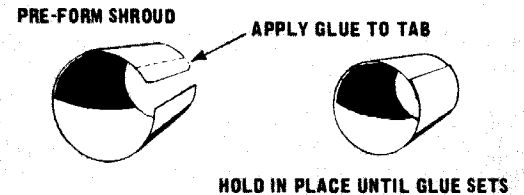
■ **35** Apply a line of glue to the top of the wing joint. Press the body tube into the glue along the wing alignment line M. Center the alignment line exactly along the wing joint and position the rear of the body tube even with the wing rear. Place the body-wing assembly upside down on a flat surface as shown in fig. 33 while the glue joint dries.

FIG. 34.



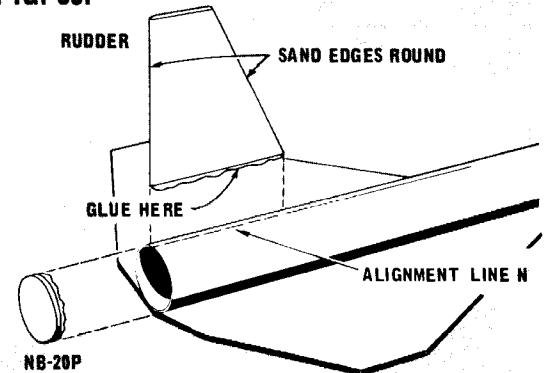
■ **36** Trace one copy of the spacecraft hold-down support pattern #15 onto the 3/32" thick balsa. Cut out the support carefully and sand the tapered end round. Sand one end of the 1/8" x 1" dowel (part WD-1A) as shown. Apply a line of glue to the short edge of the support and attach the dowel. Be sure that both pieces are perfectly parallel. After the glue has set several minutes, apply glue to the other edge of the support and attach to the body tube along the wing alignment line. Place the rear of the support against the wing and align to project straight away from the body tube.

FIG. 35.



■ **37** Cut out the nozzle shroud carefully along its edge lines and form the shroud into a cone. Apply glue to the tab and press it into position. Hold it in place until the glue sets, then set it aside to dry.

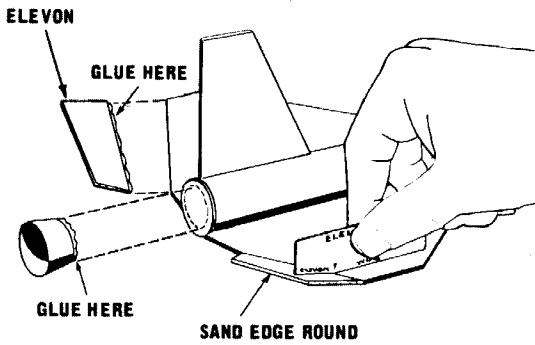
FIG. 36.



■ **38** After the body-wing glue joint has dried, run a line of glue around the NB-20P disc as shown in fig. 36. Attach the disc to the rear of the body tube. Carefully wipe away any excess glue. Trace one copy of the spacecraft rudder pattern #16 onto the 1/16" thick balsa stock. Cut out the rudder and sand the leading and trailing edges round. Apply a line of glue to the root edge of the rudder and attach it to the body tube on alignment line N as shown. Position the rear of the rudder even with the rear of the body tube and align to project straight away from the body tube.

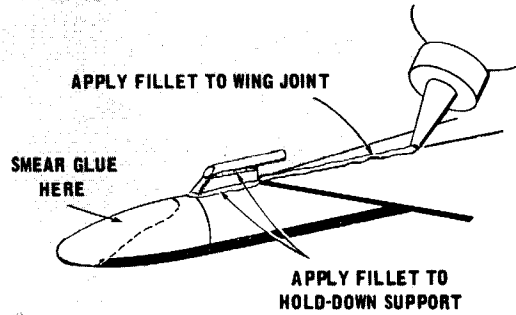
■ **39** Apply a line of glue around the small end of the nozzle shroud. Attach it to the rear of the spacecraft and center it exactly on the paper disc. Trace two copies of the elevon pattern #17 onto the 1/16" balsa stock. Cut out the elevons and sand the trailing edges round as shown in fig. 37. Cut out the elevon

FIG. 37.



guide pattern carefully along its edge lines. Apply a line of glue to the "hinge edge" of one elevon and allow the glue to "set" for 20-30 seconds. Attach the elevon to the trailing edge of one wing. Place the Elevon Guide edge marked "wing" on the spacecraft wing and center the arrow point over the hinge joint. Hold the elevon guide parallel to the wingtip edge and move the elevon upward until it rests evenly against the guide edge marked "elevon." Hold the elevon in position until the glue sets, then allow the hinge joint to dry completely. Following the same procedure, attach the other elevon to the opposite wing and align it using the elevon guide.

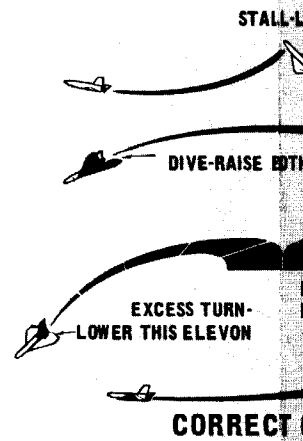
FIG. 38.



40 Apply a glue fillet to the bottom of the wing joint as shown in fig. 38. Wipe away any excess glue. Apply a glue fillet to both sides of the hold-down support. Smear a coat of glue over the lower portion of the nose cone as shown by the dotted lines. The glue coat will protect the nose cone against landing damage. Apply a glue fillet to both sides of the rudder-body tube joint and allow to dry completely.

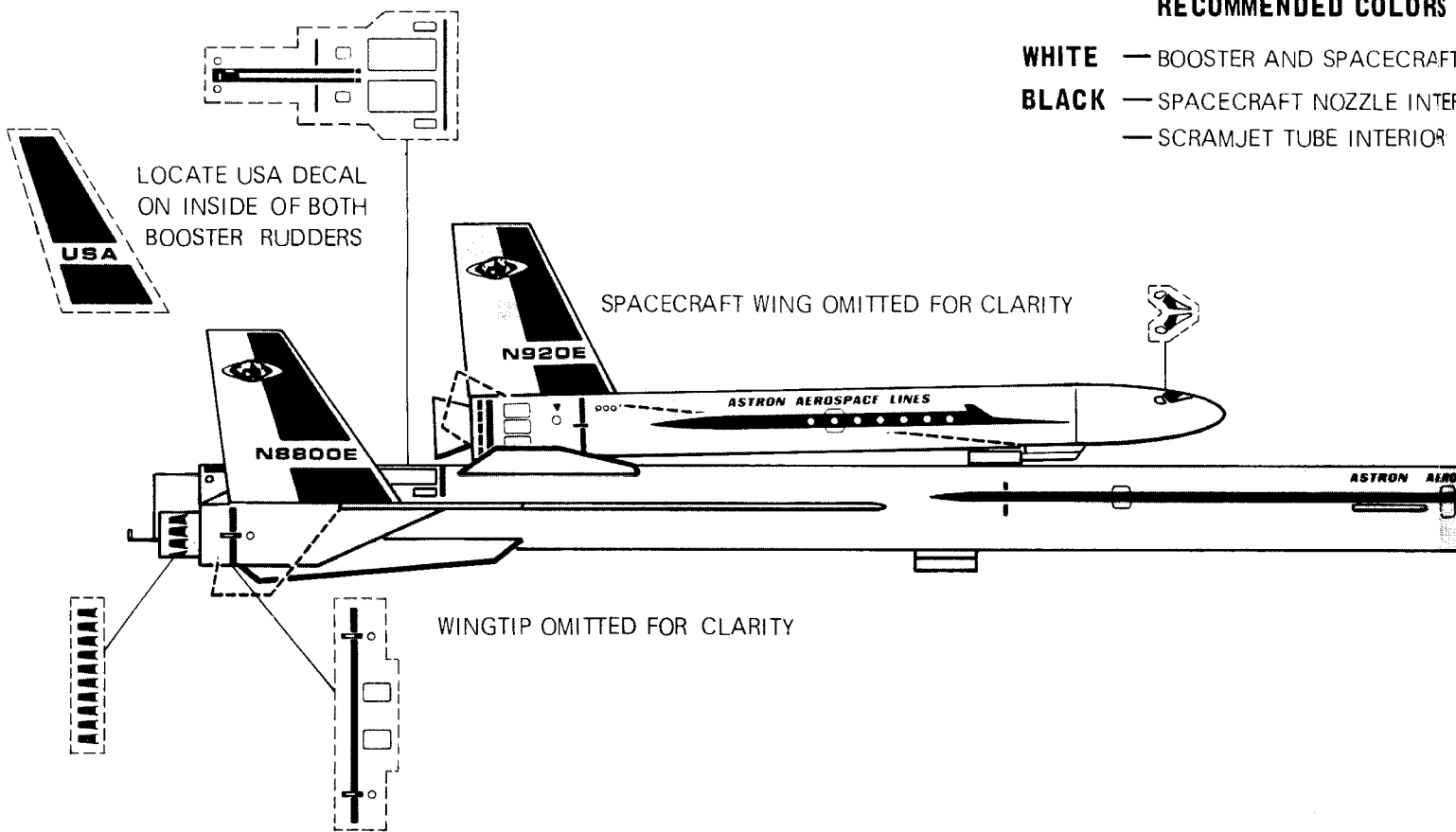
41 Test glide the spacecraft before it is painted. Gently hand launch the spacecraft from about shoulder height. A glide of 10-15 feet is normal when there is little or no wind. If, after several hand launches, the spacecraft tends to stall, dive, or turn sharply, adjust the elevons as shown in fig. 39. To change elevon

FIG. 39.



position, hold the elevon illuminated light bulb for 30 seconds will soften the glue joint. After a slight movement of the elevon is necessary for proper glide, adjust the elevon carefully to prevent the elevon in the new position until the glue sets (30 seconds). Test glide the spacecraft and re-adjust the elevons if a better glide is obtained. You may adjust the spacecraft's glide to make a right turn so that it does not stall in recovery area.

Fig. 40



RECOMMENDED COLORS

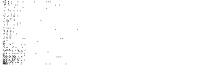
- WHITE** — BOOSTER AND SPACECRAFT
- BLACK** — SPACECRAFT NOZZLE INTERIOR
- SCRAMJET TUBE INTERIOR

● FINISHING AND PAINTING

TALL-LOWER BOTH ELEVONS



RAISE BOTH ELEVONS



EXCESS TURN-LOWER THIS ELEVON



ADJUST GLIDE

even hinge joint close to a 90 degree angle for 30 seconds. The heat of the joint enough to permit the elevon up or down as a glide turn. Move the elevon to prevent breaking it. Hold the elevon in position and blow on the glue joint to reset (about 5-10 seconds) the spacecraft again and if necessary until a good glide. You may wish to adjust the elevon to make a slight left or right turn does not glide beyond your

42 Before finishing, be sure that all the glue on the outside of the rocket is completely dry. Cover all balsa surfaces on the booster and spacecraft vehicles with a coat of sanding sealer. Let it dry completely and sand lightly with extra fine sandpaper. Apply a second coat, sand and apply still another coat until all the pores in the balsa are filled and the surfaces look and feel smooth. The recommended paint color is white for both vehicles.

Give the two vehicles a light spray coat of white paint and allow to dry. Follow with two more spray coats of white paint. Allow several hours drying time between each paint coat. For other finishing and painting tips, see your Estes catalog.

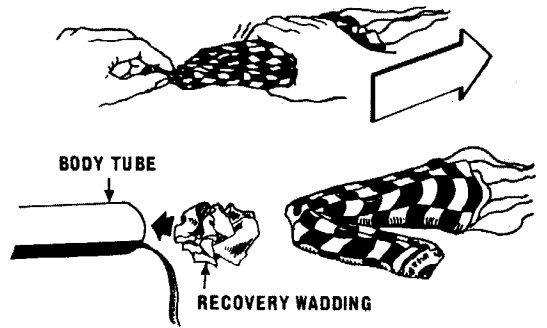
● APPLYING THE DECALS

43 Cut out each decal carefully around its edge lines. To transfer, dip the decal in water for approximately 30 seconds, or until the decal slides easily on the backing paper. Slide the decal off the paper to desired surface and blot dry. Refer to fig. 40 and the General Assembly View for decal positioning. Allow the decals to dry for about 24 hours.

● COUNTDOWN CHECKLIST

Your Astron Orbital Transport is designed to fly with B6-4 and C6-5 engines ONLY. Use B6-4 engines for the first few flights until you have adjusted the glide of the spacecraft so it remains within your recovery area.

Fig. 41 FORM THE "SPIKE" SHAPE



13 Pack flameproof recovery wadding (4 or 5 squares) into the booster vehicle body tube from the top. The wadding should fill the tube for a distance of about 1-1/2" and should fit closely along the sides of the tube. Hold the parachute between two fingers at its center and pass the other hand down it to form a "spike" shape. Fold this spike in half. Push the folded parachute down into the tube on top of the wadding. Slide the nose cone into place.

12 Select an engine. Wrap enough masking tape around the forward and rear ends of the engine to make a snug fit in the engine mount tube. This will prevent ejection gas leakage and insure positive "chute deployment."

11 Form an electrical igniter and insert it in the engine as directed in the instructions which came with the engine.

10 Place the rocket on the launcher. Make sure that the spacecraft is securely attached to the booster vehicle hold-down lug.

9 Check to be sure the launch panel is disarmed. Remove the safety interlock or key from the launch control panel. (If a simple spring switch is used, install the protector around the spring.) Carry the key or interlock on the person of the launch control officer. Clean the micro-clips and attach them to the igniter.

8 Clear the launch area. Alert the recovery crew and trackers.

7 Check for low flying aircraft and unauthorized persons in the recovery area.

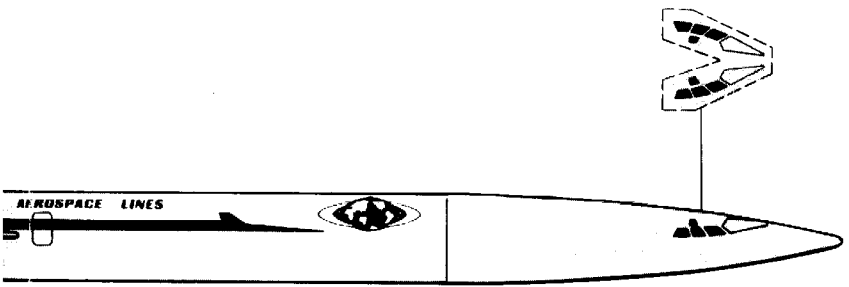
6 Arm the launch panel.

5 4 3 2 1 LAUNCH!

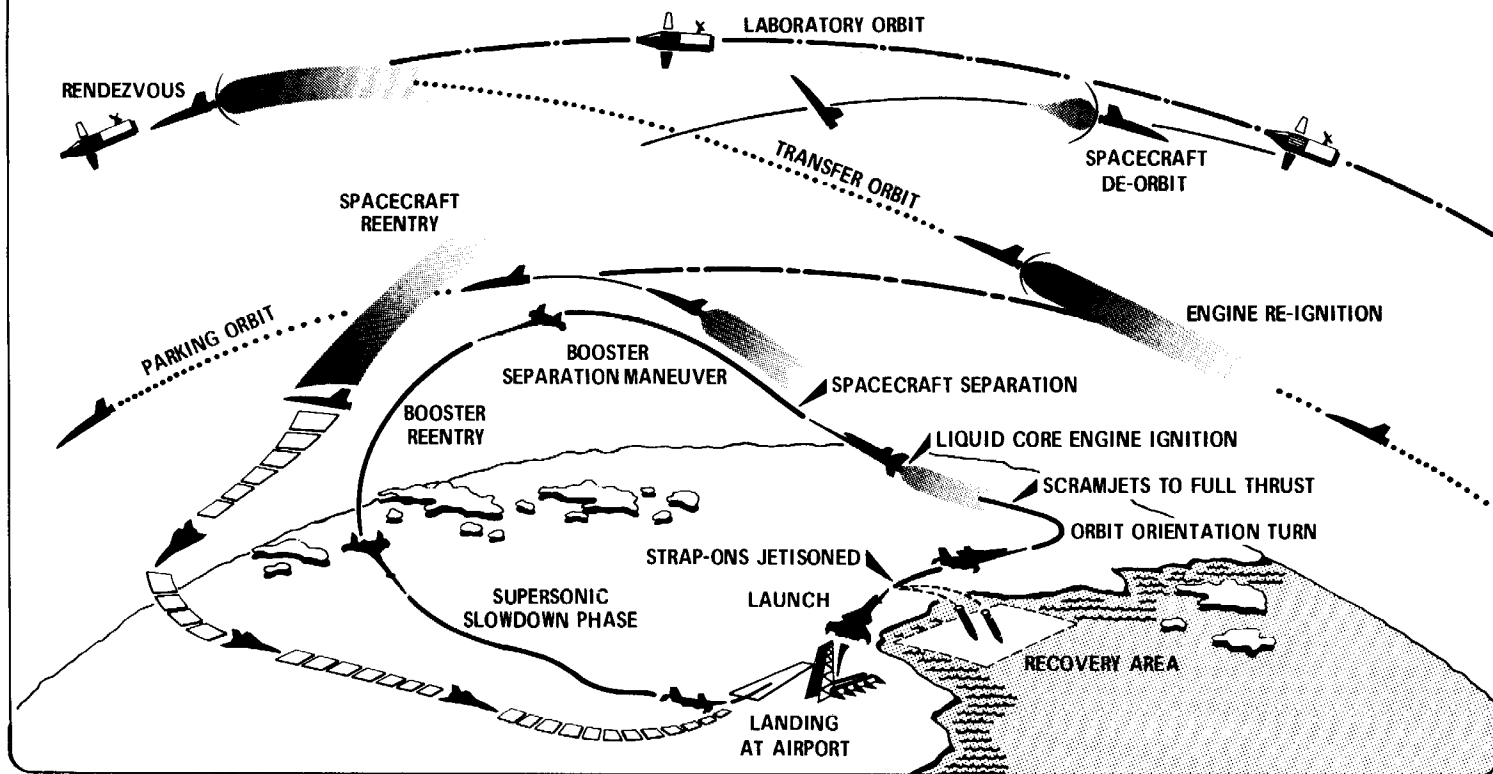
ESTES
SPACECRAFT VEHICLES
INTERIOR
DECALS



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Orbital Transport Concept



Some day soon you may ride an elevator to the passenger compartment hatch of a liquid-fueled second stage/reentry vehicle. You and 11 other passengers in pressure suits are strapped to acceleration couches while, immediately in front of you, the three man crew runs through final preflight preparations. A small television screen shows similar preparations in the 2-man cockpit of the first stage booster vehicle.

As the countdown proceeds the hatch is closed; the elevator structure rolls away, leaving the rocket supported by the launch tower. At "zero" the two solid propellant strap-on engines roar to life. In a fraction of a second thrust has reached lift-off level and the transport begins to rise from the tower. It begins its pitch-over maneuver almost immediately.

By the time an altitude of 3000 feet is reached you are traveling almost horizontally. In less time than it takes a subsonic jet airliner to become airborne you have broken the sound barrier. The dual mode subsonic/supersonic combustion ramjets begin to produce significant thrust and the solid propellant strap-ons are jetisoned. Your flight

enters its cruise phase, heading east to get in position for the orbital run.

Two hundred miles from the launch site your booster pilot begins a wide turn to the south; as he levels off you are in line with the orbit of the Weather Bureau's new observation laboratory. You cruise along this path for almost a minute. Then you're hit in the back as the engines are brought to full thrust and the nose is pulled up into a gradually increasing climb angle.

It only takes a minute to reach Mach 5.5. You can feel the shock as the ramjets change from subsonic to supersonic combustion. Acceleration jumps to 2.5 g's, then begins to decrease gradually as you pass 100,000 feet altitude. When the liquid-fuel core engine comes to life at 120,000 feet, acceleration again increases reaching a peak of 3 g's before you reach 140,000 feet.

Near 160,000 feet the scramjets are shut down; the transport continues to accelerate under rocket power to its staging velocity of 10,000 miles per hour. The engine cuts off; you feel a jolt as booster and second stage separate. As you coast on up the booster maneuvers down and to the side.

Twenty seconds after separation the second stage engine ignites and you continue on to orbit. Meanwhile the booster is continuing up in a ballistic trajectory. It will coast over the top and plunge back into the atmosphere, its leading edges glowing cherry red as it slows in a wide turn and heads back to the launch site.

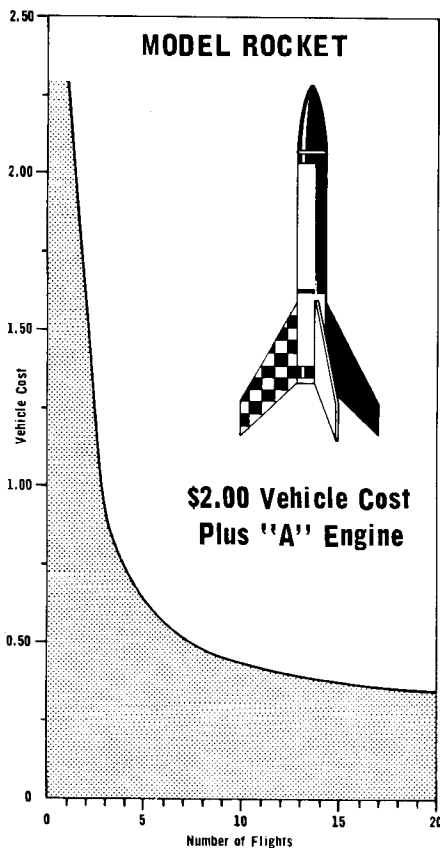
The second stage engine thrusts for a total of about three minutes, boosting you into a parking orbit. After one revolution the engine fires again briefly and you enter a transfer orbit, rising to the altitude of the laboratory. Several short correction bursts from the engine are felt, then several more from the attitude thrusters, before you actually dock at the lab.

While arriving passengers are moved into the laboratory and departing passengers take their places, the cargo container is removed from its compartment and secured to the side of the laboratory. Within fifteen minutes of docking the spacecraft casts loose and begins to maneuver for reentry. It will return to the same base from which it was launched. After servicing it will be joined to a booster vehicle for another flight.

Man's efforts in space today are much like a bather dipping his toe into the water to check the temperature; he must decide whether he is going to stay out or plunge in. If the decision to plunge in is made, the first requirement will be a low cost method of placing large payloads in orbit.

Although the cost of putting a pound of payload in orbit has dropped from around \$1,000,000 in 1958 to near \$1,000 in 1969, another reduction of similar proportion is necessary before space travel can become a common activity. The Orbital Transport represents one approach to this cost reduction goal.

Two concepts appear to be the keys to low-cost orbital flight--the reusable vehicle and air breathing (jet) propulsion. By recovering, refurbishing and re-flying a vehicle basic manufacturing costs can be spread over many flights. The use of oxygen from the air offers a considerable reduction in propellant costs when compared with liquid oxygen or some exotic oxidizer.



Model rocketry offers a good example of the cost reduction realized when vehicles are reused. The diagram shows the average

cost per flight of an Astron Alpha (including paint, glue, wadding, etc.) when A8-3 engines are used. Notice that although the average cost drops most over the first few flights, it takes many flights to reach a "rock-bottom" figure which is a little more than the cost of engines.

The "pre-flight" cost of a reusable space vehicle would undergo a similar (but not so dramatic) reduction. The costs of recovery and refurbishment are much greater in proportion. Early proposals called for reuse of more conventional vehicles by deploying parachutes on lower stages after reentry, letting the stage land in the ocean and returning it to a remanufacturing center by barge. Recovery costs in this case become quite high.

For smaller, unmanned vehicles, this method may be feasible. However, it would be preferable to have the booster return directly to the point at which it will be serviced and relaunched. The obvious way of doing this is to fit the booster with wings and let it fly back.

Once the decision to use wings has been reached, the addition of airbreathing (jet) propulsion becomes a logical next step. Vehicle costs are roughly proportional to take off weights. Jet engine booster systems offer reductions ranging from one tenth to one half the weight of rocket systems of comparable payload capacity.

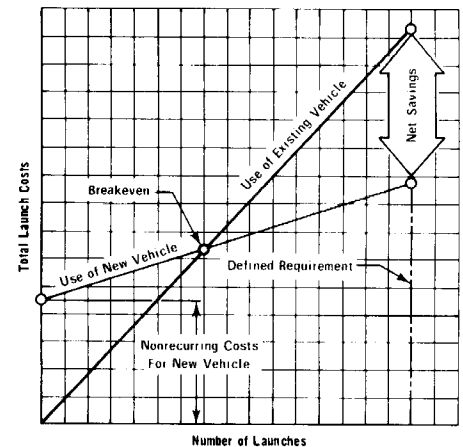
Lower initial weight means that less propellant is needed, cutting the cost of each launch. At Mach 12 (roughly half of orbital velocity) the supersonic combustion ramjet can provide 4 times as much thrust per pound of propellant used, compared to the best rocket engine. This increase in efficiency results in a further reduction in propellant costs.

Finally, once a rocket is launched, it must continue on up to orbit or abort. An airbreathing vehicle can go into a holding pattern after takeoff, allowing great flexibility in scheduling and orbital altitudes and angles. Rendezvous missions can be accomplished much more easily since the vehicle can cruise to the ideal location before beginning the actual orbital run.

The big problem facing air-breathers is that no one type of jet engine will operate efficiently over the velocity range of a booster stage. Turbojets cannot be used at velocities much over Mach 4.

Conventional ramjets must be accelerated to several hundred miles per hour before they begin to produce thrust; they in turn cannot be used at velocities much over Mach 6. The supersonic combustion ramjet (scramjet) won't function below Mach 3; it will, in theory anyway, work at velocities in excess of Mach 25 (orbital velocity). As a result an airbreathing vehicle requires a combination of propulsion systems to allow it to function efficiently.

ECONOMIC JUSTIFICATION

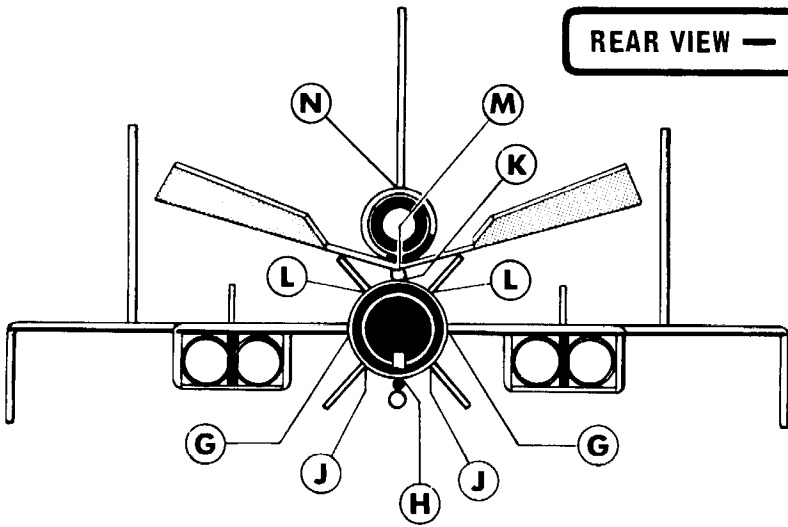


Technology, time and money available will govern the choice of systems for a practical orbital transport. Some groups favor horizontal takeoff systems, others support vertical takeoff. Scramjets are not practical today--but 5 years' research might perfect them. Structural materials for hypersonic velocities at lower altitudes are not yet available--but rocket engines for use at high altitudes are.

Much also depends on traffic requirements. When traffic volume is low, it's better to use one launch site with specialized ground support equipment. When volume increases to the right level it is best to provide several flight origin sites located for the convenience of the passenger. When this level is reached, vehicles which can use conventional airfields with a minimum of special ground support equipment will be necessary. Often the same airfield which handles SST civilian traffic will be ideal for orbital traffic.

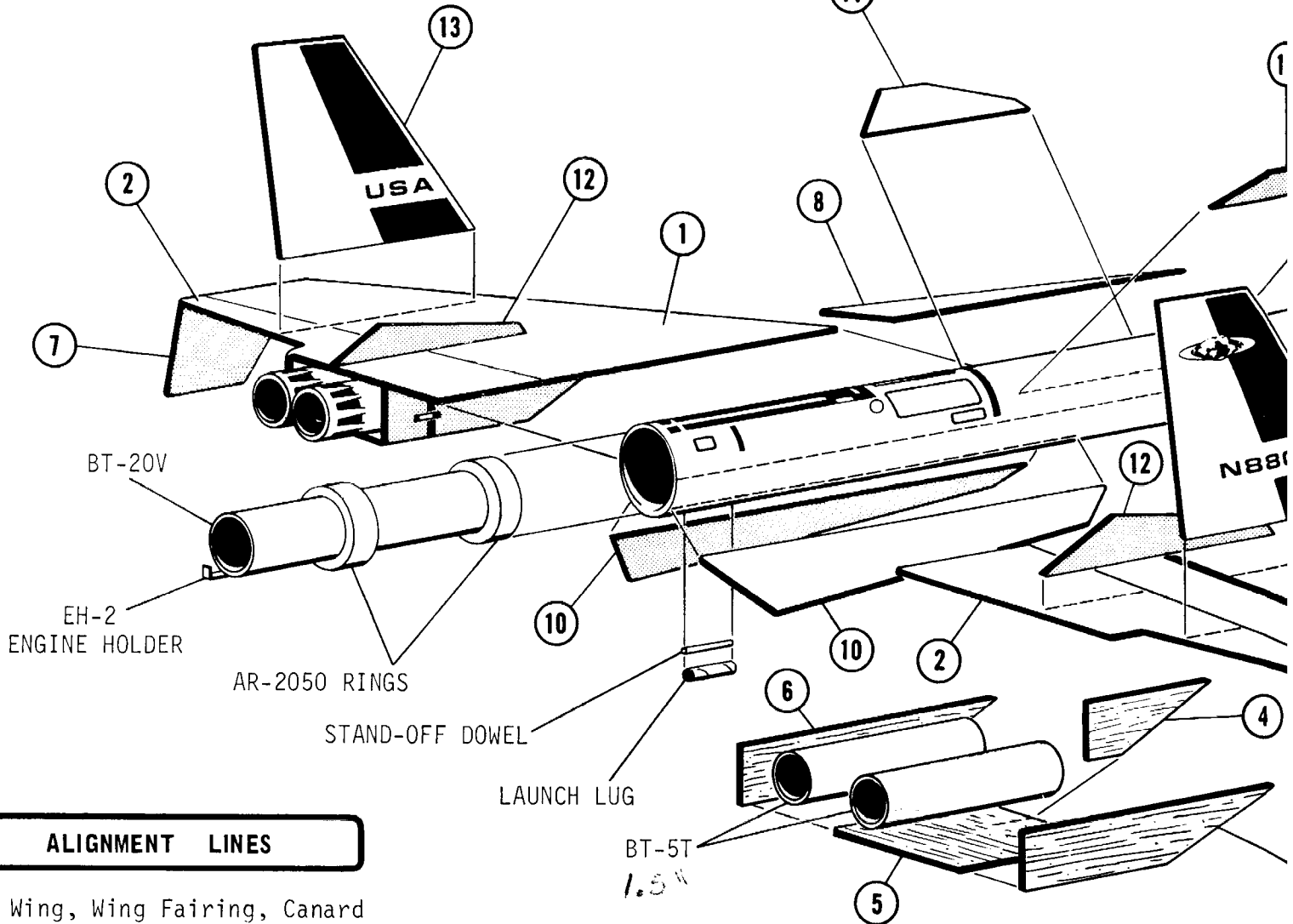
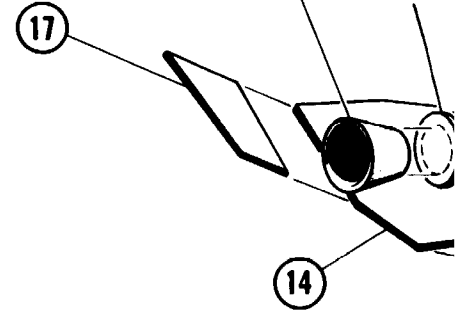
The Astron Orbital Transport looks to the nearer future when traffic still originates from one or two points in the United States. Its design is based on technology which is well within reach in the next 15 years. When vehicles like this are flying, we will truly be in the space age.

REAR VIEW — Showing Alignment Lines



NOZZLE SHROUD

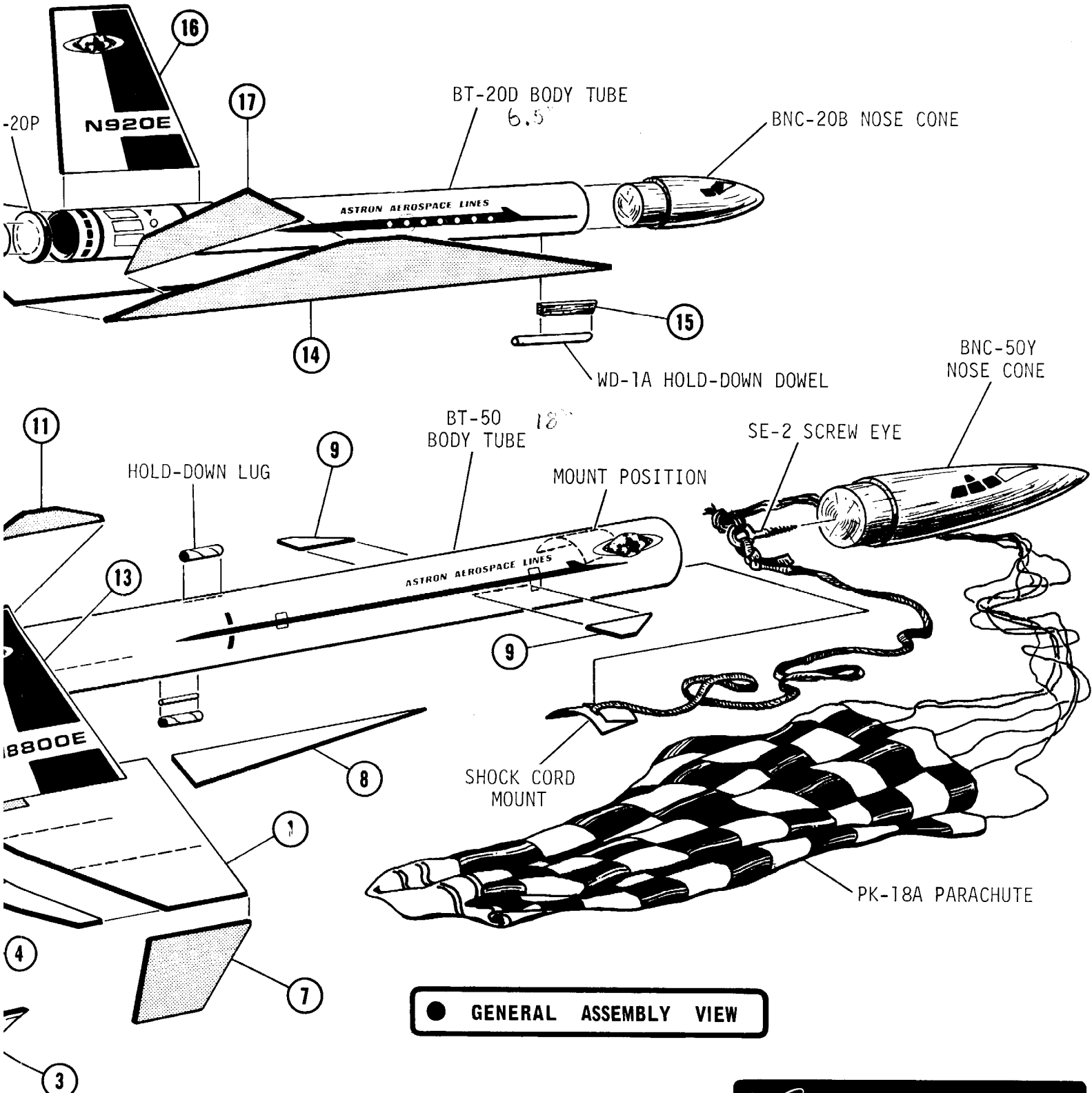
NB-20P



ALIGNMENT LINES

- G** Wing, Wing Fairing, Canard
- H** Launch Lug
- J** Ventral Fin
- K** Hold-Down Lug
- L** Spacecraft Support
- M** Spacecraft Wing
- N** Spacecraft Rudder

- 1** Forward Wing Section
- 2** Aft Wing Section
- 3** Outboard Scramjet Housing (Farthest From Fuselage)
- 4** Intake Vane
- 5** Lower Scramjet Housing
- 6** Inboard Scramjet Housing (Closest To Fuselage)
- 7** Wingtip
- 8** Wing Fairing



● GENERAL ASSEMBLY VIEW



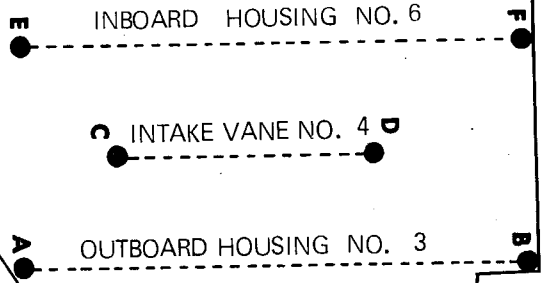
- ing
- using (stage)
- 3
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- 7
- 8
- 9 Canard
- 10 Ventral Fin
- 11 Spacecraft Support
- 12 Wing Fence
- 13 Rudder
- 14 Spacecraft Wing
- 15 Hold-Down Support
- 16 Spacecraft Rudder
- 17 Elevon

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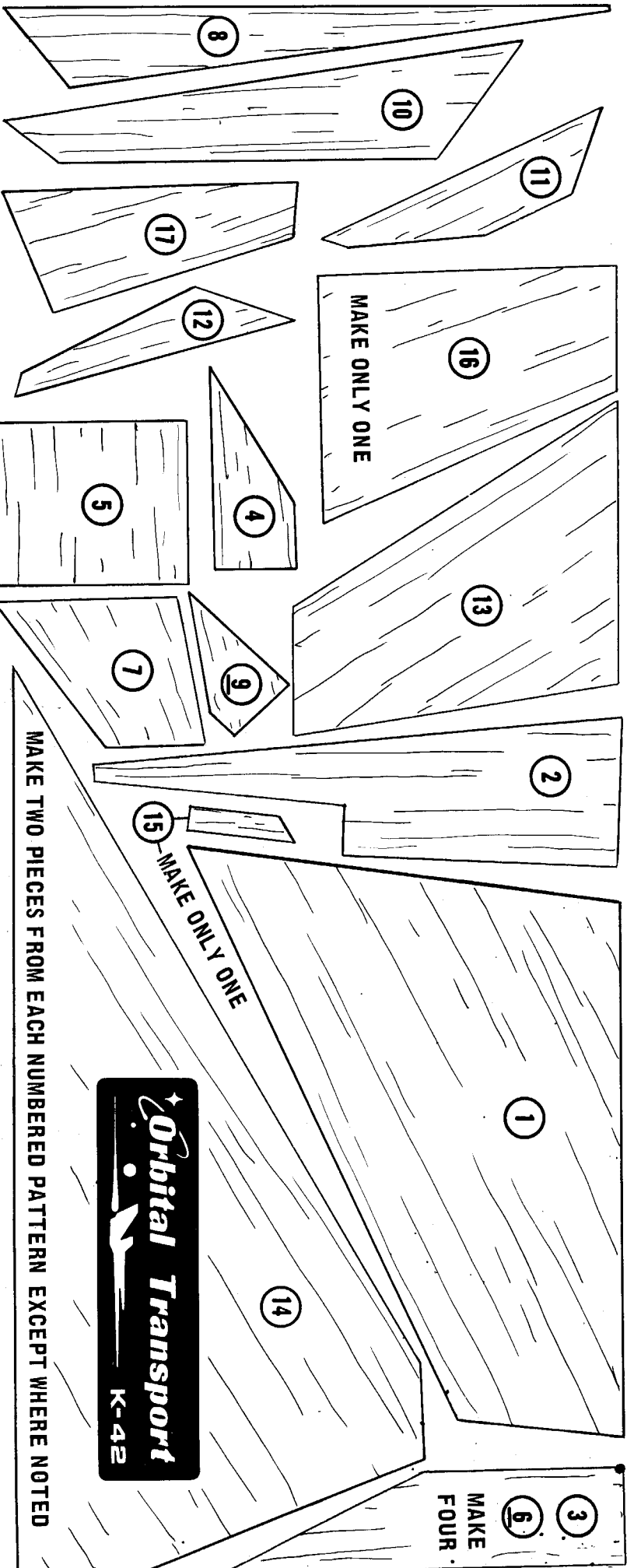
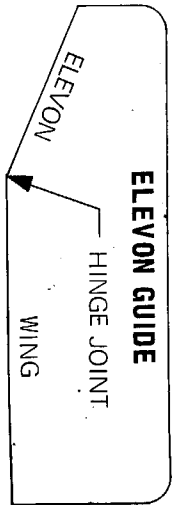
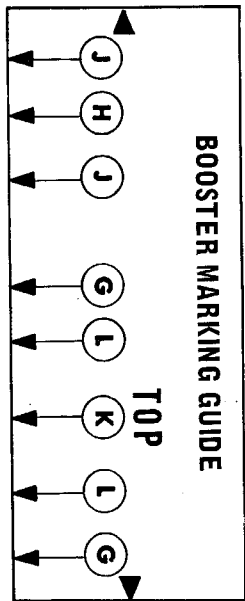
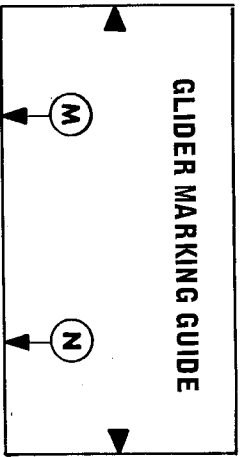
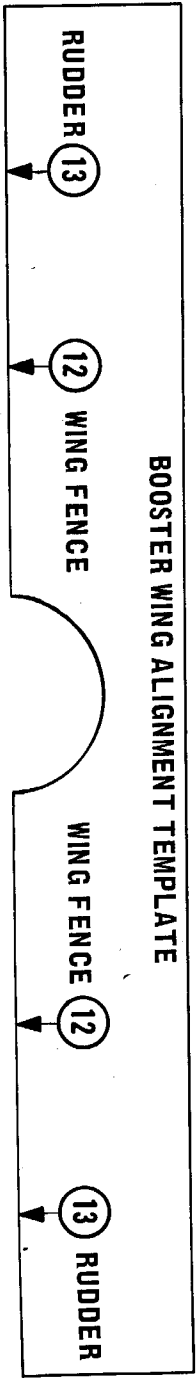
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WING MARKING GUIDE



MARK OTHER WING THROUGH PINHOLES ON REVERSE SIDE OF PATTERN

NOZZLE SHROUD



MAKE TWO PIECES FROM EACH NUMBERED PATTERN EXCEPT WHERE NOTED

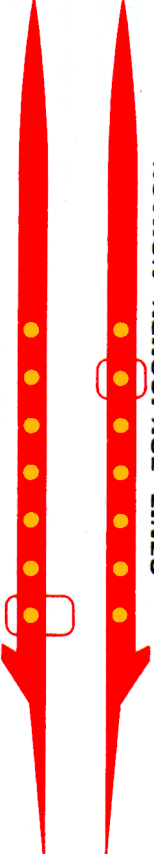
ASTRON AEROSPACE LINES



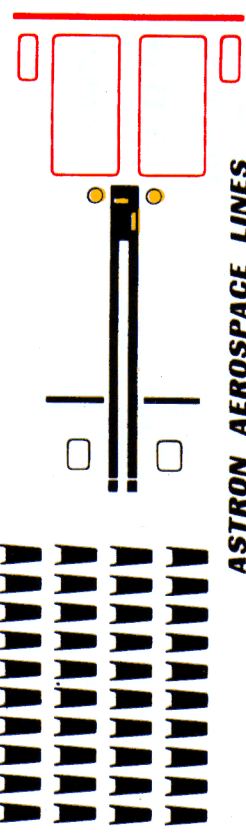
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ASTRON AEROSPACE LINES



ASTRON AEROSPACE LINES



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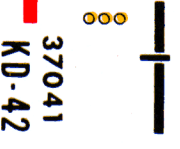
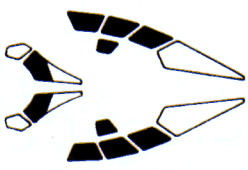
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USA

USA

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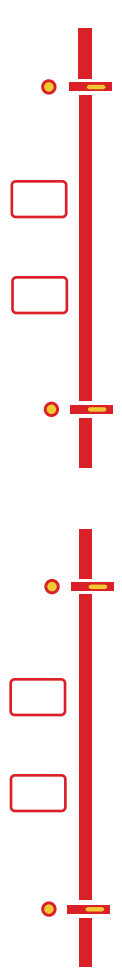


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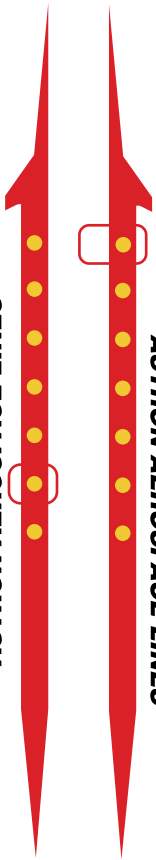
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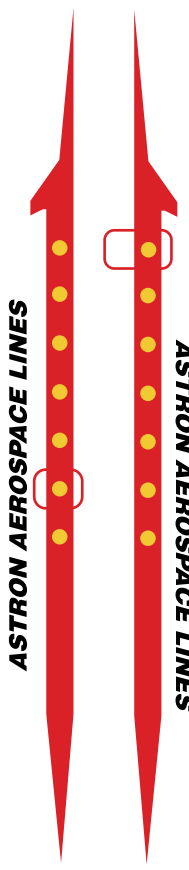
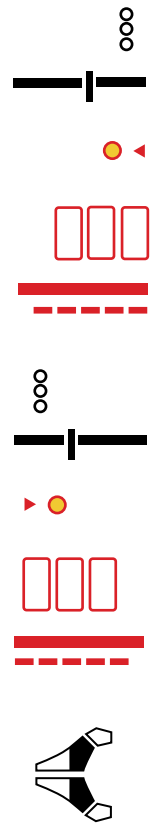
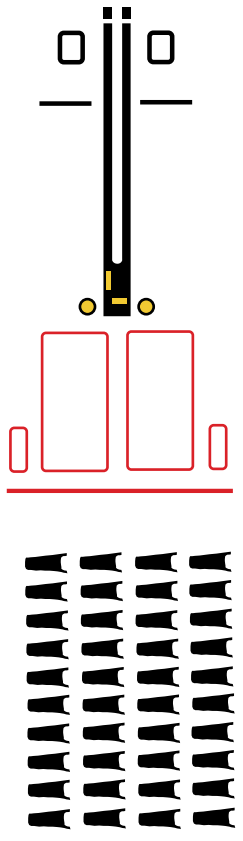
ASTRON AEROSPACE LINES



ASTRON AEROSPACE LINES

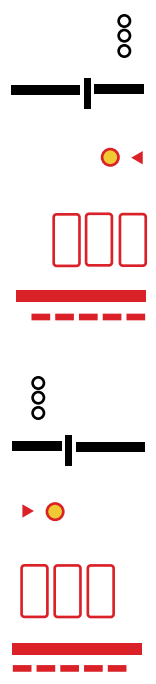


ASTRON AEROSPACE LINES



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A Division of Estes

ORBITAL TRANSPORT

- READY FOR IMMEDIATE USE
- INDEPENDENT DESIGN
- EASY TO LAUNCH AND OPERATE
- GLEESOME RECOVERY BY KITE!



\$3.25

ORBITAL TRANSPORT

KIT NO. E-42

18.75

CONSTRUCTION
 Length 14 1/2"
 Wt. (incl. fuel) 1.07
 Fuel Vol. 4.00
 Thrust 20.0

CONSTRUCTION GUIDE
 18-18 18-18
 See Website For Steps

PARACHUTE AND GLEESOME RECOVERY