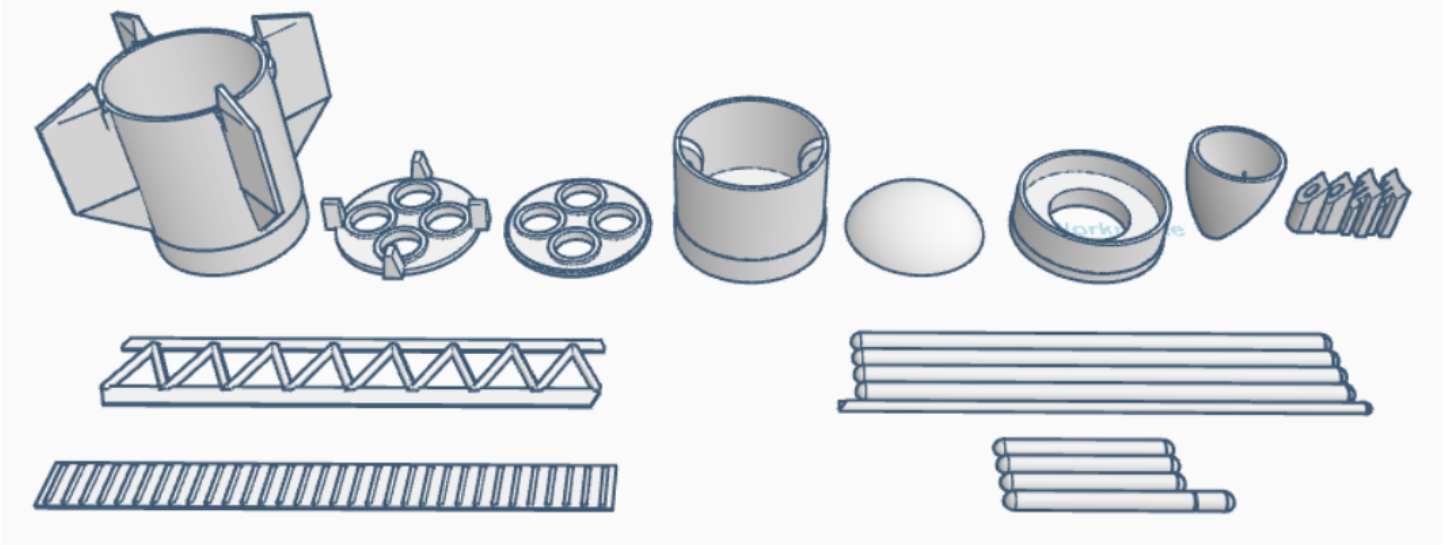
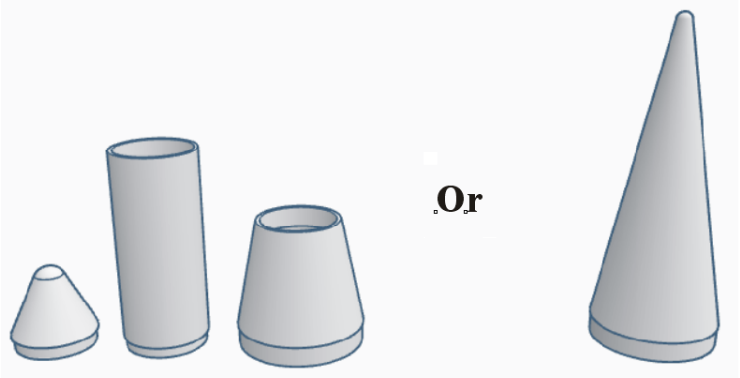
DF-4 ICBM/CZ-1 SLV

Builder's Kit Parts List

Quantity	Part
2	Centering Rings
2	Launch Lugs
2	Launch Rails
1	Main Fin Can
1	Nose Cone (DF-4)
1	Nose Kit (CZ-1; kit consists of frustum, cylindrical section, and cone section)
4	Large Conduits (Booster)
1	Narrow Conduit (Booster)
3	Short Conduits (Upper Stage)
1	Conduit with bend (Upper Stage)
1	3D Printed Ribbing Section
1	Truss Interstage Kit (Kit consists of lower ring, upper ring, truss, booster dome, and upper stage nozzle)
4	18mm Motor Blocks



PLUS



CZ-1 Nose Cone DF-4 Nose Cone

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Parts Needed to Complete

~1.6 ounces	Nose Weight
1	Body Tube, BT-80, 16.175” long (410.8 mm)
1	Body Tube, BT-80, 6.125” long (155.6 mm)
4	18mm Motor Tube, 4.0” long (101.6 mm)
1	Shock Cord, ~24” long (~610 mm) Kevlar
1	Shock Cord, ~36” long (~915mm) elastic
1	Shock Cord, ~12” long (~305mm) elastic
2	18” Parachutes (457mm)

BACKGROUND

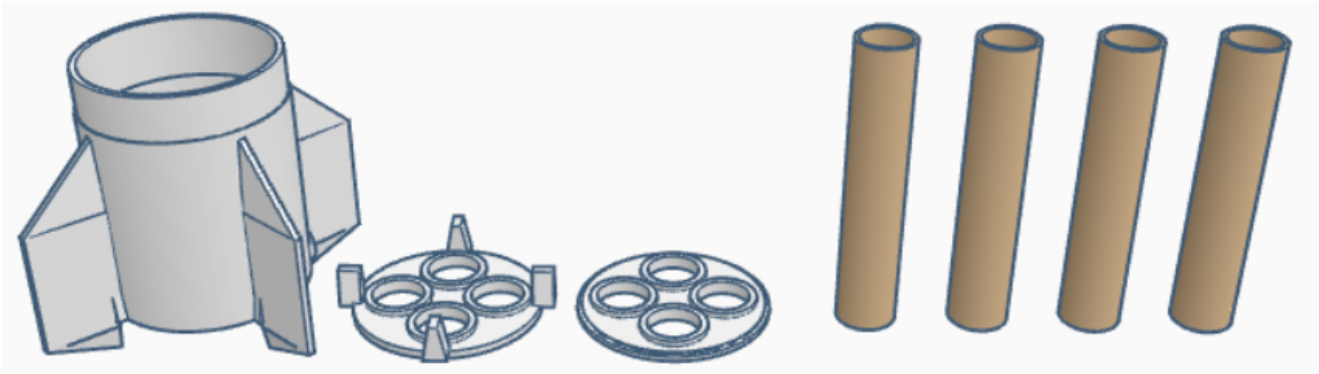
In the 1960s, The People’s Republic of China worked feverishly to develop nuclear weapons and the means by which to deliver them. China saw nuclear weapons as a means of guaranteeing their security against the United States, which opposed the formation of the Communist state, and the Soviet Union, with whom China had experienced an ideological split in 1961. China’s first operational two-stage missile was called the Dong Feng-4 (DF-4). “Dong Feng” is Mandarin Chinese for “East Wind” – a reference to a famous speech by Mao Zedong, where he predicted “the east wind shall overcome the west wind.” The DF-4, which is known to western intelligence services as the CSS-3, meets the western definition of an Intercontinental Ballistic Missile (ICBM) – but just barely. The west defines an ICBM as a land-based ballistic missile with a range of at least 5,500 km. The DF-4/CSS-3 range is estimated to be just over 6,000 km. This meant the missile was suitable for hitting targets across the Soviet Union, but a larger missile would be needed to strike the continental US. (That larger missile would be the DF-5/CSS-4). The DF-4/CSS-3 was operated from fixed sites, and is likely being phased out of service in favor of the new, mobile, solid-propellant DF-31 ICBM.

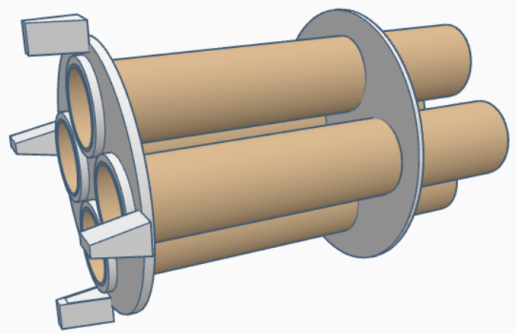
China also had ambitions to become a spacefaring nation, and the DF-4 would play an integral role. To be capable of placing a satellite in orbit, a solid-propellant third stage was added to the DF-4 to make the Chang Zheng-1 (CZ-1) space launch vehicle. “Chang Zheng” is Mandarin Chinese for “Long March,” a reference to the famous 9,000 km, 370-day Communist army retreat in the 1930s which prevented their defeat by the Nationalists. On 24 April 1970, China became the fifth nation to launch their own satellite (following the Soviet Union, US, France, and Japan), when the CZ-1 carried the Dong Fang Hong (“East is Red”) satellite into orbit.

This model was created using photos, drawings, and other widely-available information on the DF-4 and CZ-1. Based on reported dimensions, this model is approximately 1:34 scale.

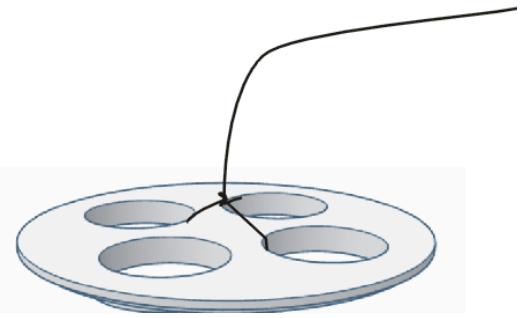
KIT ASSEMBLY

1. Build the fin can. You'll need four (4) 18mm (BT-20) motor tubes, each 4.0" (101.6 mm) long. Make sure the motor tubes fit into the holes in the centering rings. The aft ring of the fin can has four triangular blocks which align with the fins, as well as four molded-in rings which are part of the model's detailing. Insert the four tubes into this ring, stopping when the aft end of the tube is even with the aft ends of the detail rings. Do not let the tubes extend beyond the bottom of the ring. Place the forward ring on to the tubes to ensure proper alignment (tubes should be perpendicular to the rings), then apply cyanoacrylate (CA) glue, or "super glue," to the joint between the aft ring and the tubes ONLY. DO NOT GLUE THE FORWARD RING YET. Allow the glue to dry.

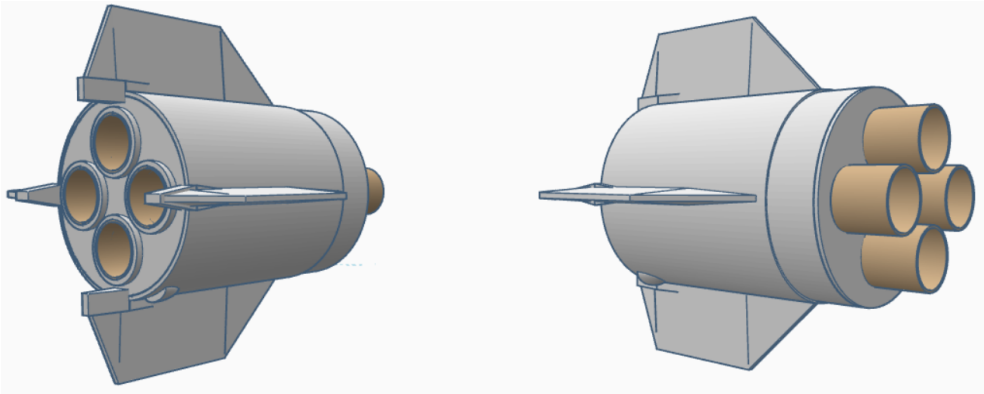




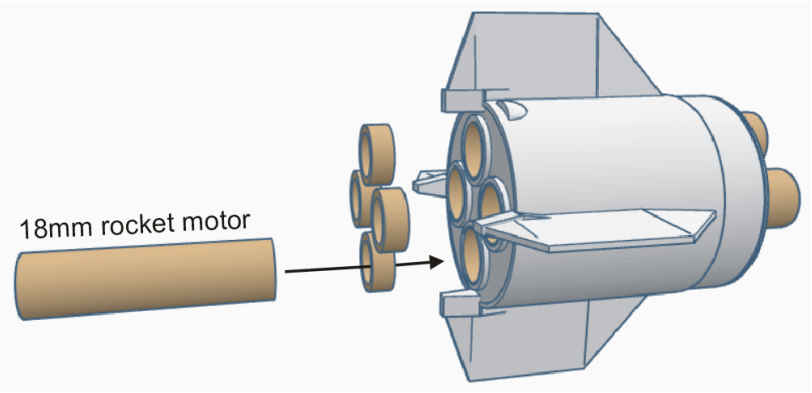
Once the glue is dry, remove the forward ring. Tie the Kevlar shock cord to the forward ring by looping it through two of the tube openings. The loop should go across the middle, not between adjacent openings on one side.



Glue the aft centering ring into the fin can. The “triangles” are jet vane housings, and should align with the notches on the fin. Be sure the ring is fully seated into the can to ensure the ring is perpendicular to the can. Next, slide the forward ring over the tubes and glue it into the can. The motor tubes will extend beyond the forward face of the forward ring. Allow the glue to dry.

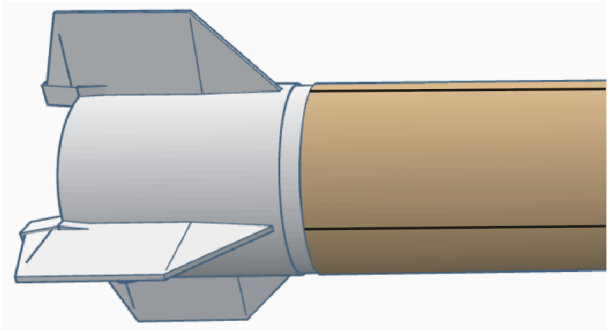


Before starting this final step, make sure the motor blocks fit into the motor tubes. Sand to fit as necessary. Mark four 18mm motors 5/8” (15.9mm) from one end. Place a bead of glue into the aft end of each motor tube, then insert one motor block into each tube. Use the motors to push the rings into the tubes, stopping at the 5/8” mark. Remove the motors so they do not become stuck in the glue! This model is designed to use “friction fit” for the motors, so no motor clips are provided. It is important the motors protrude 5/8” from the aft end of the motor tubes to minimize scorching on your model!

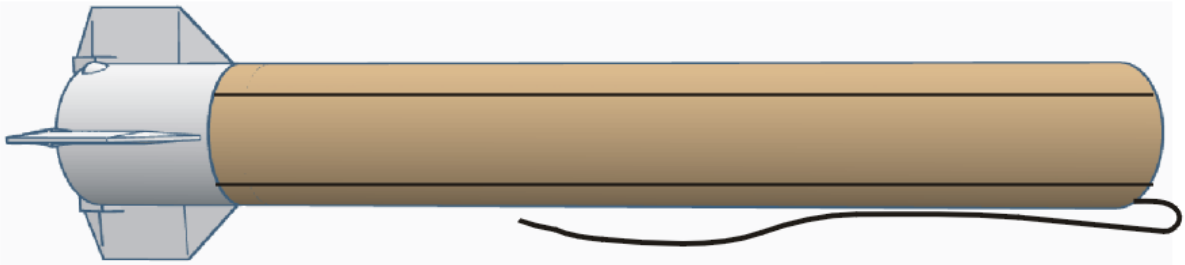


Tie the 36” length of shock cord to the 24” length of Kevlar to complete the booster’s shock cord.

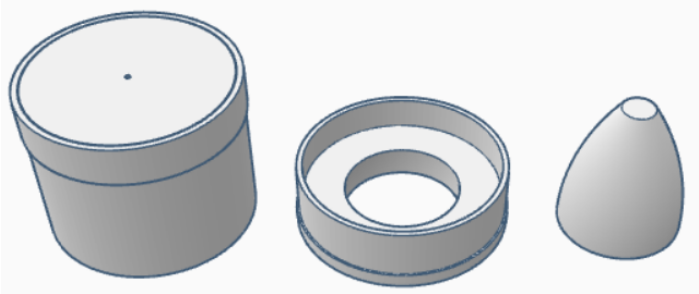
2. Mark the tubes. The fin can will be used as a fin marking guide.First, place the fin can into the upper stage body tube (6.125” long, or 155.6 mm). Mark the four fin locations, then remove the fin can. Extend the four markings the length of the upper stage tube. Now place the fin can into the main body tube (16.175” long, or 410.8 mm). Mark each of the fin locations, then remove the tube. Extend the marks the length of the main tube.

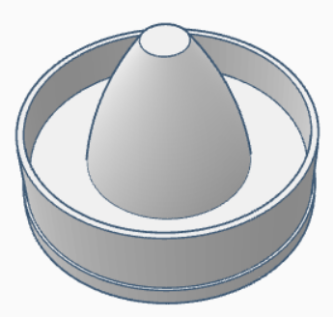


Drop the shock cord through the main body tube. Using epoxy or CA glue, glue the fin can into the main body tube. The four markings should be offset 45° from the fins. We recommend adding putty to the fin can/body tube joint to hide the seam.

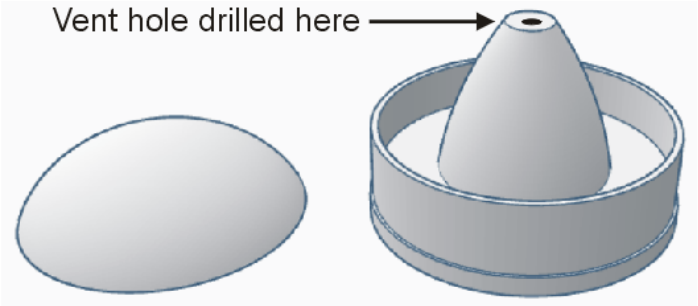


3. Build the interstage truss. The aft ring of the truss is essentially solid; the forward ring has a large opening for the upper stage nozzle. Glue the upper stage nozzle into the forward ring using CA glue. The ring can only be inserted from the aft end.

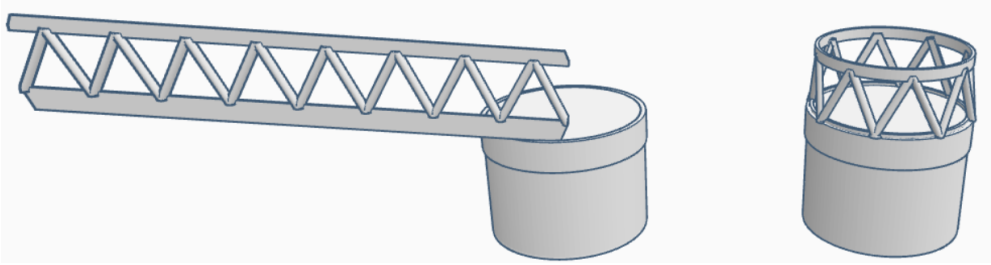




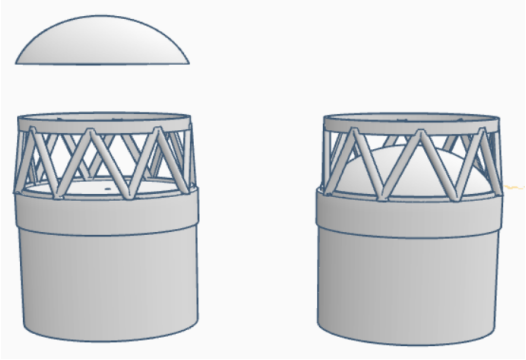
Before proceeding, the rounded piece which replicates the booster's forward propellant tank dome, and the aft ring with nozzle, should be prepared for finishing. These parts are impossible to sand once the truss is built! Do not do any finishing on the aft ring at this time. Spray the exposed portions of these parts with filling primer and sand. Repeat the process to get a smooth finish. Then continue construction.



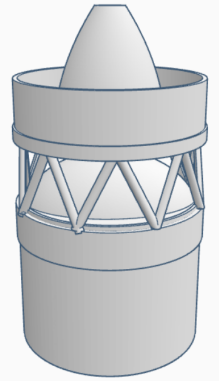
Remove the interstage truss from the 3D-printed “raft” by gently bending the raft to pop the part free. The truss has a wide attach flange at the bottom and a narrower attach flange at the top. Construction begins with the bottom (aft) end. Note the channel on the aft ring – it is not quite a complete circle. The closed notch in the channel will align with the open end of the truss. Gently insert one end of the wide flange a short distance into the channel. (Note, the truss is rounded on one side and flat on the other; make sure the rounded side is facing OUT). DO NOT USE ANY GLUE YET!! Moving around the ring, work the entire flange into the channel. It may be necessary to cut away a small portion of the flange where the ends meet the closed notch – but be careful not to remove too much material! Once you are satisfied that the alignment of the truss with the channel is correct, slowly work the flange deeper into the channel until the “V” strut bottoms are in contact with the flat surface of the aft ring. Next, repeat this process with the forward ring, BUT ONLY INSERT THE TOP FLANGE A SHORT DISTANCE INTO THE FORWARD RING CHANNEL AT THIS TIME. For now, the forward ring is in place only to ensure the truss is circular. Once you are satisfied with the shape of the truss, apply a ring of CA glue between the bottom flange and aft ring (Note: when fully seated, the flange still protrudes slightly – roughly 1/16” or 1.5 mm – and this flange is glued to the aft ring). Allow this glue to dry fully, then remove the forward ring.



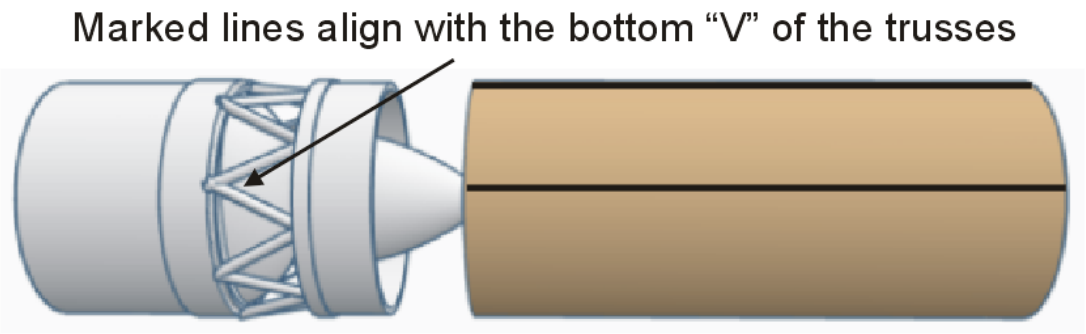
Glue the forward dome on to the forward face of the aft ring.



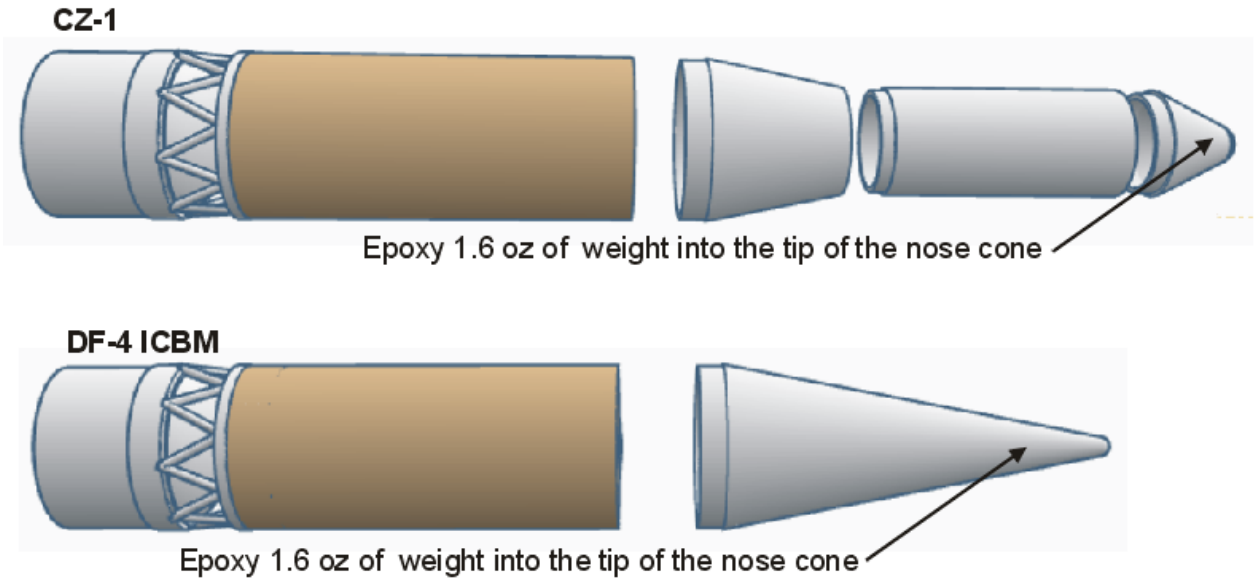
Using the same process as you followed for the aft ring, work the forward flange into the channel on the forward ring. This time, the flange should be fully seated. Once fully seated, apply a ring of glue to the flange/forward ring joint.



Glue the forward ring into the upper body tube using CA or epoxy. The four markings on the tube should point into the bottom of four "V" notches. This alignment process helps to align the upper and lower portions of the rocket later on. We recommend adding putty to the forward ring/upper body tube joint to hide the seam.

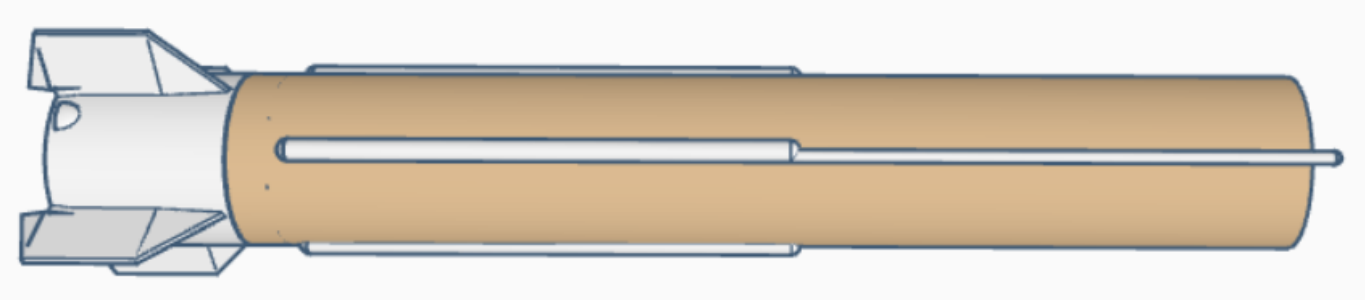


4. Assemble the nose cone. If you are building the DF-4 ICBM, epoxy at least 1.6 ounces of weight (45.4 grams) into the tip of the nose cone. Once the epoxy dries, glue the cone into the forward end of the upper body tube using epoxy or CA glue. If you are building the CZ-1, epoxy the weight into the forward nose section. Once the epoxy dries, glue the frustum (truncated cone) section to the 3D printed cylindrical section and glue the forward nose section into the cylindrical section as well. Then glue the entire assembly into the forward end of the upper body tube using epoxy or CA glue.

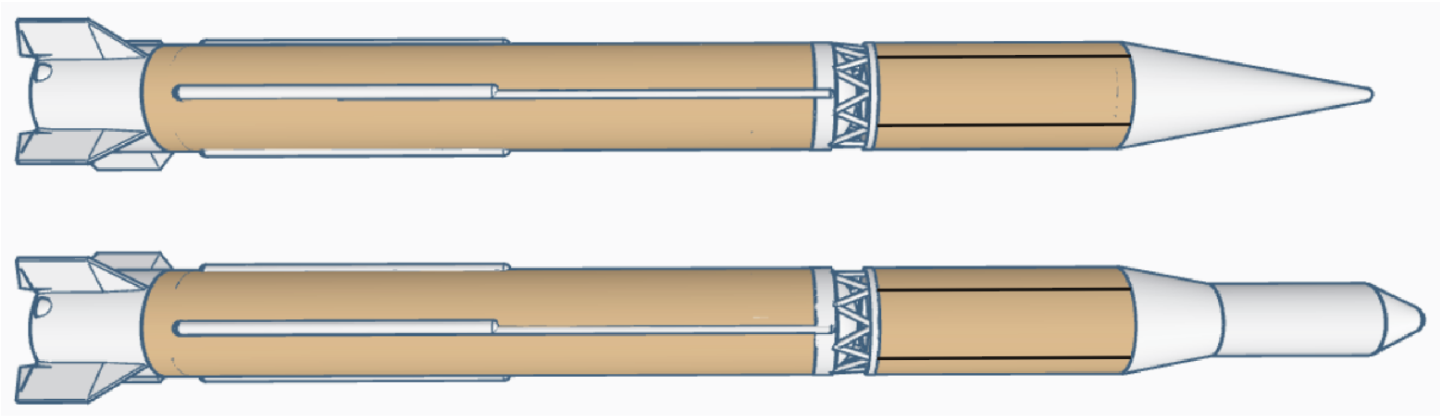


5. Main body details. Locate the large diameter "conduits" and remove them from the 3D-printed raft. These are not actually cable conduits – the propellant in the upper tank was pumped around the lower tank to the engines, and these bodies are actually covers over those propellant feedlines – hence their large size. Mark the lines drawn on the main body tube 3.45" (87.6 mm) from the aft end of the fin can (think of this point as the aft end of the main body; do NOT measure from the bottom of the fins!). Glue one feedline cover on the body tube, centered on the line on the body tube, with the aft end at the 3.45" mark. Next, locate the booster electrical conduit (this one really is a conduit). Pick one feedline cover to be the location for this conduit. This conduit sits to the right hand side of the line of the body tube, running forward. Glue this conduit in place, and understand a

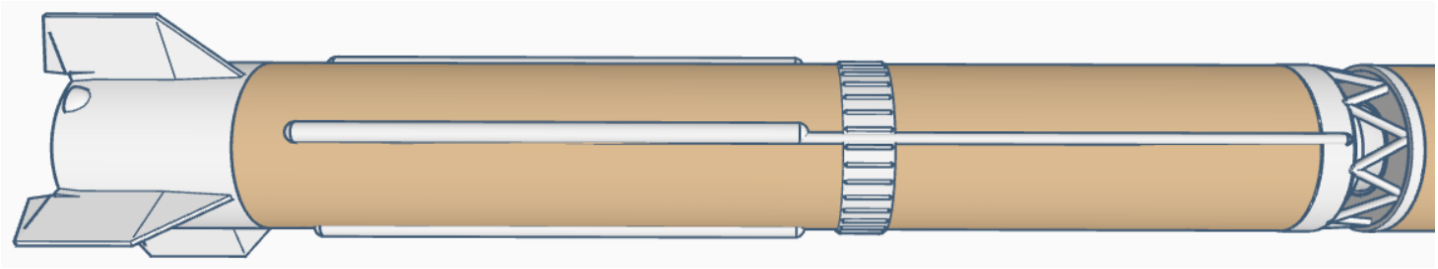
small portion will protrude off of the end of the tube. Once the glue dries, carefully remove the portion sticking off of the body tube, but DO NOT DISCARD IT.



Place the upper stage into the booster. The lines on the booster tube are aligned with the fins, which means they are 45° off of the feedline covers. The upper stage alignment marks pointed down into the notch of one of the truss “V” members. To ensure proper booster/upper stage alignment, the line for the electrical conduit should point UP into a “V” member. Extend the line used for placing the electrical conduit on to the aft truss ring, and glue the remaining piece of the electrical conduit to the ring, again to the right-hand side of the line (just as the bulk of the electrical conduit was to the right of this line). Be careful to NOT glue the aft truss ring to the booster body tube.

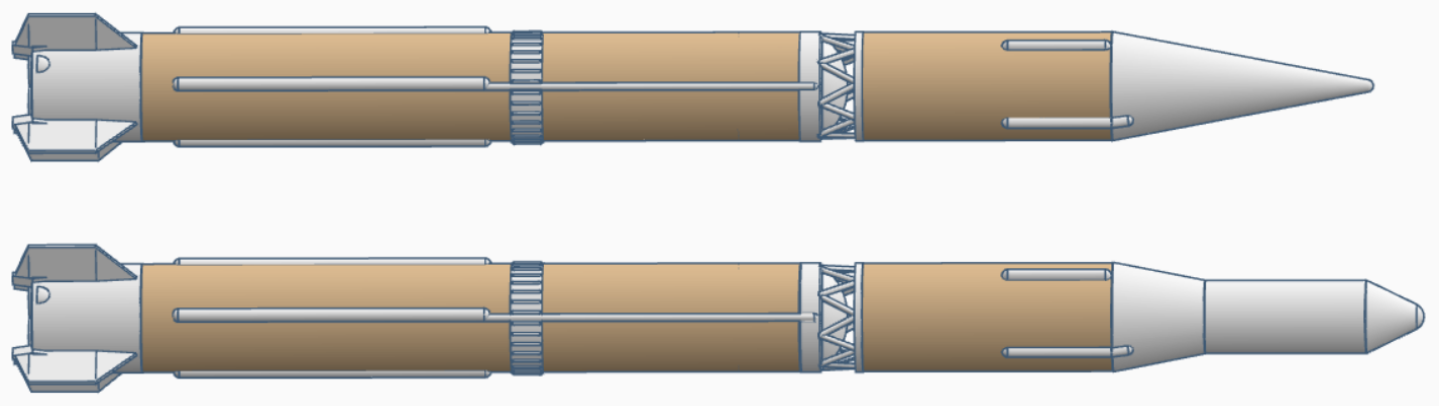


Mark the booster body tube 11.75” (298.5 mm) from the aft end of the fin can. Removed the ribbed body wrap from the 3D printed raft. Test fit the wrap at the 11.75” location. Remove small bits of the wrap until the ends stop at the electrical conduit when wrapped tightly around the body (we recommend removing small pieces at a time, taking equally from both ends, until the correct fit is achieved). Once you are satisfied with the fit, glue the wrap in place using CA glue.



6. Launch lugs/rails. Decide if you want to use the launch lugs or launch rails. On the side of the body opposite the electrical conduit, pick a location between one fin and the feedline cover to mount the lugs. Note, we also recommend picking a location between two "ribs" on the body wrap for the launch lug locations. Use a straight edge to draw a line the length of the body in this location. Mount the lower lug/rail with its AFT edge 4.4" (11.8 mm) from the aft end of the fin can. Mount the forward lug/rail with its AFT edge against the FORWARD edge of the body wrap. Note, these locations were carefully chosen for ease of paining of the CZ-1. Not following these directions can make later assembly more difficult!

7. Upper body details. Locate the three short upper stage conduits. Mark the four lines on the upper body tube 3.6" (91.4 mm) from the aft edge of the forward truss ring (think of this as the aft end of the upper stage body). Glue three of the conduits to the bod with their aft edge at the 3.6" mark. There should be a slim gap between the upper edge of the conduit and the nose/body (DF-4) or frustum/body (CZ-1) joint. The final conduit also has its aft edge at the 3.6" mark, but the forward end goes past the end of the body tube and is glued also on the nose cone (DF-4) or frustum (CZ-1).



8. Finish the 3D-printed pieces. To finish the 3D-printed pieces, sand all pieces thoroughly, then spray the entire model with a sandable, filling primer. Sand the primer, then repeat the process at least once more. After two rounds of primer and sanding, the grooves from the 3D printing should all but disappear.

For the DF-4, we placed a thin (1 mm) band of striping tape around the cone, 1.7" (43.2 mm) from the edge of the body/cone joint. This represents the point where the reentry vehicle separates from the second stage.

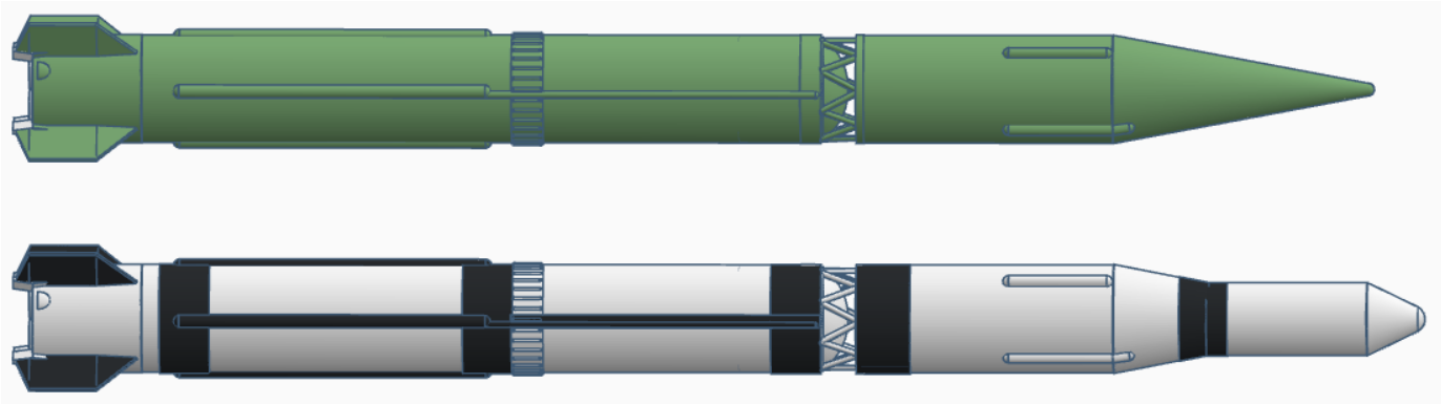
9. Final assembly. Use a 18" (457mm) parachute for the booster and a second 18" parachute for the upper stage. Do not connect these sections – allow them to come down separately. Attach one parachute to a loop in the elastic shock cord on the booster. Attach the upper stage parachute to a roughly 12" (~305mm) length of elastic shock cord which runs through the ring in the base of the aft truss ring.

10. Finishing. Give your model one last coat of primer and ensure you are satisfied with the finish before painting. The DF-4 is painted olive drab. If you search the internet, you may find test missiles which have white bands painted on the booster and upper stage, but it is believed the operational missiles are simply one color. After the paint dried, we hand painted the inside of the upper stage nozzle using silver paint. CAREFULLY use a brush, reaching through the truss to reach the nozzle.

The CZ-1 is mostly white with black bands. We found it easier to paint the model black first, then cover the black bands and paint the model white. This works ONLY if you use the kinds of paint where light colors like white can cover darker colors without any "shading" from the darker color. We use Rustoleum enamels, allowing AT LEAST 48 hours of drying time between coats of paint. Do NOT mix paint types or the results can be disastrous.

The black portions of the CZ-1 are as follows:

- The fins are black, but the jet vane actuators are white. See kit photos.
- The aft-most circumferential band begins 3.05” (77.5 mm) from the aft end of the fin can, and is 1.2” (30.5 mm) wide. This ring begins below the propellant feedline covers, and envelops the aft ends of those covers.
- The middle circumferential band ENDS at the body wrap (the bod wrap is white), and is also 1.2” wide. This band envelops the forward ends of the propellant feedline covers.
- The feedline covers are also black. The bands should be the width of the covers.
- The forward black band on the booster is also 1.2” wide, but this width includes the aft truss ring. The portion on the body tube is just over 0.7” (17.8 mm) wide. We recommend putting the parts together, then measuring 1.2” down from the forward edge of the aft truss ring. Note, the truss and components within the truss remain white!
- The electrical conduit is black. The width of this band should match the width of the band on the in-line propellant feedline cover, such that it appears to be a stripe of constant width running up the rocket.
- The black band at the aft end of the second stage is 1.3” (33.0 mm) wide (not sure why it’s wider than the others, but this is how it appears on photos. This band begins at the aft end of the forward truss ring.
- The black band on the frustum/cylinder section is 1.2” tall. 0.5” (12.7 mm) of this band is on the cylinder and the remainder is on the frustum.



What about decals? We have found blurry phots indicating the CZ-1 probably had a marking on the booster. Unfortunately, the marking is unclear. It may say “CZ-1,” but the version of the CZ-1 which launched China’s first satellite is often debated. Some say it was a CZ-1, but others think it could be a CZ-1A or CZ-1B. Since we cannot be sure what the correct marking would be, we omitted it from the model. We apologize for any historical inaccuracy!

11. Flying. The motors must be “friction-fitted” in the model. Wrap tape around each motor and insert into them into the motor tubes The motors should be snug (so they won’t be ejected) but not so tight you won’t be able to remove them later. We recommend using C5-3, C6-3, or C6-5 motors (always use four identical motors, of course!).

Aggressor Aerospace Rocketry