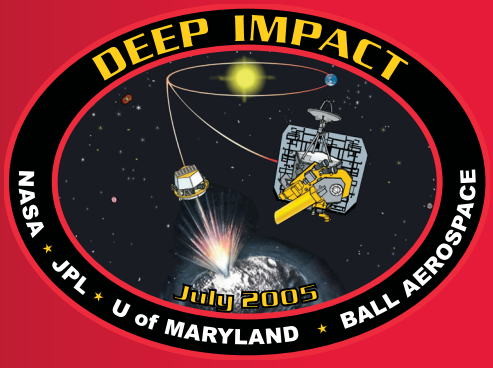


Your First Look Inside a Comet!

In January 2005, Deep Impact began its six-month journey to comet Tempel 1. Zooming along at 23,000 miles per hour, the spacecraft met the comet about 82 million miles from Earth.

The flyby spacecraft then released the impactor. For the next 24 hours, the impactor guided itself into the comet's path—until the two collided. The impact created a crater about 492 feet wide.

By peering into the crater, the flyby's telescopes and spectrometer viewed what no one has ever seen: the inside of a comet nucleus. For 15 minutes the flyby rapidly captured images and data and transmitted them back to Earth.

Meanwhile, people on Earth viewed the spectacular impact and the flying debris. The Hubble Space Telescope and other instruments in space also observed this "fireworks show," which occurred on July 4, 2005.

Comets formed 4.5 billion years ago when the solar system was forming and have changed little since then. Thus this incredible NASA mission has provided clues about our solar system's origins.

To read more about Deep Impact's science and technology, and the people who made it happen, go to

https://solarsystem.nasa.gov/deepimpact/index.cfm
www.ballaerospace.com

Or search for key words: Deep Impact home page

Model inspired by Bill Blume, Deep Impact's mission design lead

Ball Aerospace
& Technologies Corp.

Deep Impact

1/22 Scale Detailed Model

Have fun building your own Deep Impact, which is really two spacecraft in one—
a flyby craft and an impactor.

This realistic model includes three-dimensional telescopes and a removable impactor.
We recommend this model for builders 15 years old and above.

General Instructions

If you work slowly and carefully, you can build an excellent Deep Impact model. Practice the techniques described below if this is your first experience with paper modeling.

Tools You'll Need

- Small scissors with 1–2 in. blade or a mat knife with a new blade
- A scriber (available at hobby stores) or large sewing needle (or you can use the back of the mat knife)
- Pencil or dowel
- Metal ruler
- White glue
- Glue stick
- Wax paper
- Heavy book
- Cutting board or cardboard

The Parts

The model has five major parts. Each part has an instruction page. Build the parts in the order they are lettered (A–E).

Building Techniques

1. Scoring

BEFORE cutting out the parts, you must score them. Scoring slightly weakens the paper, making it easier to fold. To score:

a. Lay the part page on a cutting board or cardboard to protect your furniture.
b. Find where a fold is marked on the part with a dashed line (---).
c. Carefully line up the ruler with the dashed line.
d. Use a scriber, sewing needle, or the back of the mat knife to gently draw along the ruler.

2. Cutting

Carefully cut out the parts with scissors or with a mat knife and ruler.

Caution: ***Mat knives are extremely sharp!***

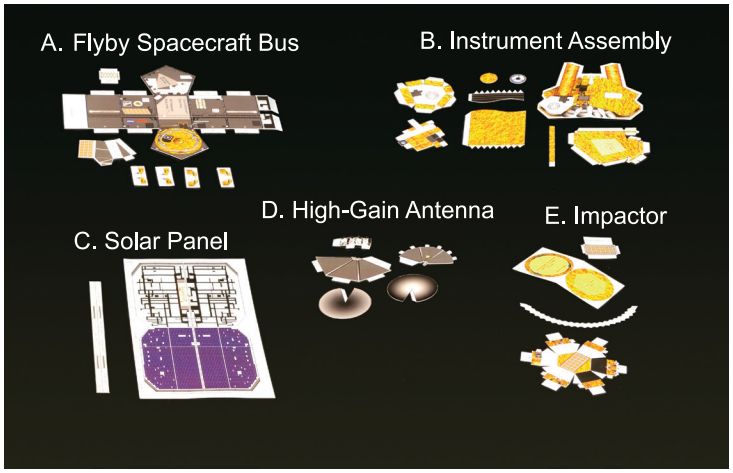
3. Folding and Rolling

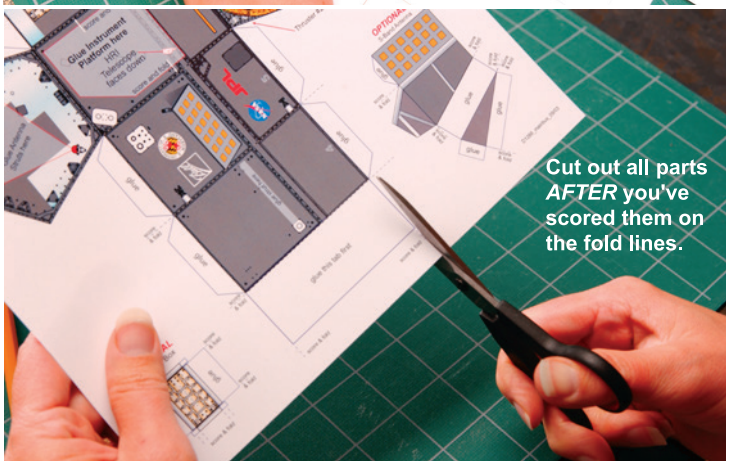
BEFORE gluing any parts, fold or roll them and check their fit. Rolling makes it easier to assemble cylindrical parts such as the telescopes. To roll, cut the part out and then roll it around a pencil.

4. Gluing

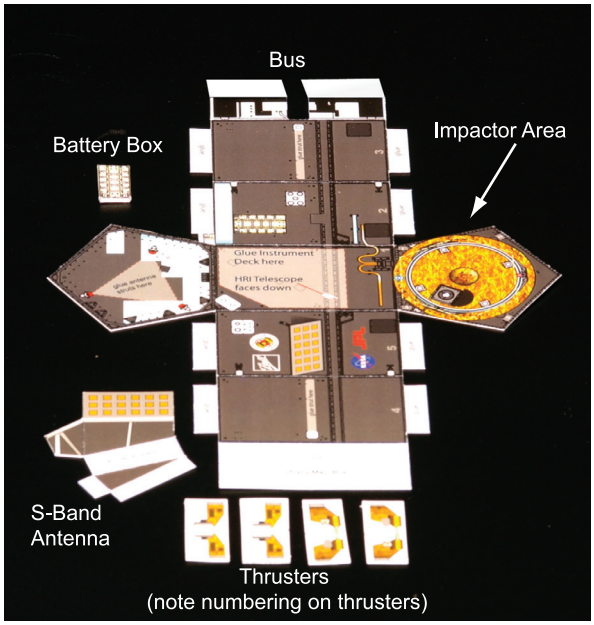
Apply glue sparingly; too much glue will warp the parts. You may want to apply glue to very small pieces with toothpicks.

Note: Use white glue for the best results. Only the solar panel requires the use of a glue stick.

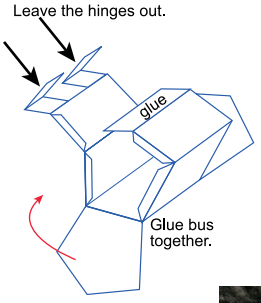




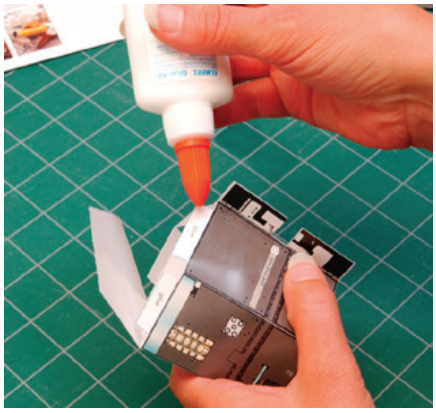
A. Flyby Spacecraft Bus



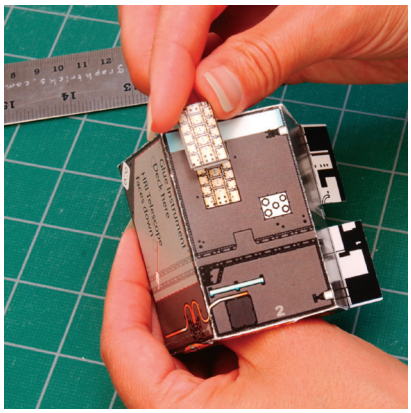
1. Score the folds. Reinforce the back of the impactor area with tape. Then cut out the bus.



2. Fold the parts to see how they go together. BEFORE trimming the thrusters, fold each one in half and glue the sides together, leaving the tabs free of glue so you can fold them out after trimming (see inset photo).

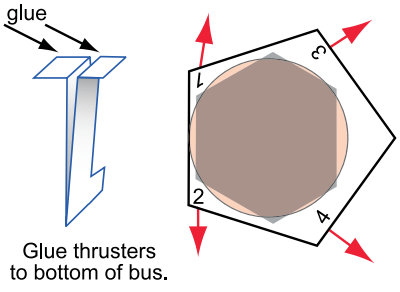


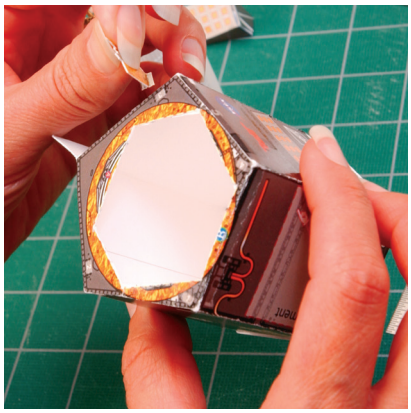
3. Glue the **bus** together, carefully lining up the sides. AFTER the glue dries, cut the impactor hole marked with a green dotted line. Start by poking a hole in the center with a sharp pencil, then use your scissors to cut out the opening.



4. Glue the **battery box** on.

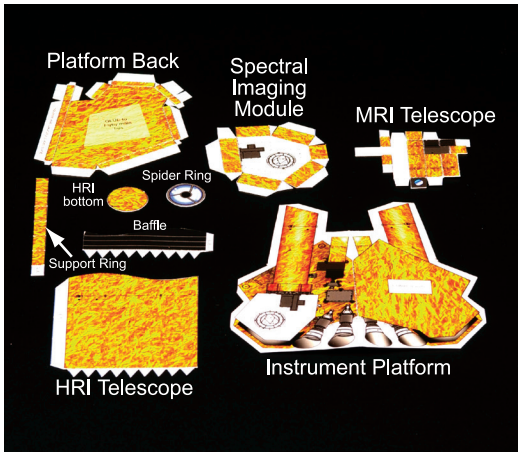
5. Glue the **S-band antenna** on.



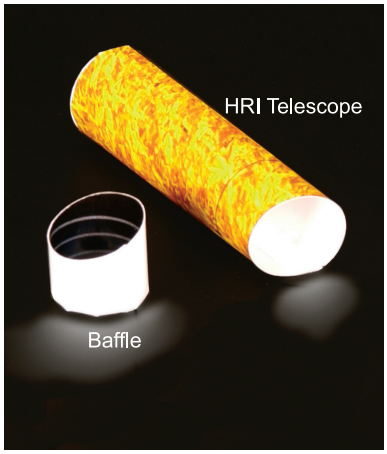


6. Glue the **thrusters** to the bus, matching the numbers on the thrusters and bus. Note the arrows on the thrusters' tabs—they should point the direction shown here.

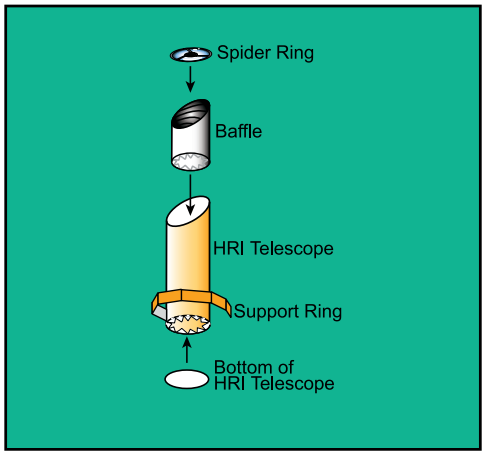
B. Instrument Assembly



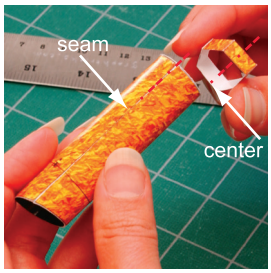
1. Score the folds, then cut out all the parts EXCEPT the MRI telescope—follow the detailed instructions for it below. **Important:** Leave some white space around the **instrument platform** as you cut it out. Fold it, then glue the two halves together. Wrap it in wax paper, and press it in a heavy book overnight. Then trim it.



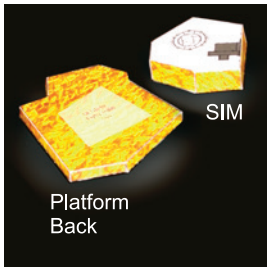
2a. Roll the **HRI telescope** around a pencil. Glue the straight tab, then fold pointed tabs in. Do the same thing with the **baffle**, except roll the color to the inside.



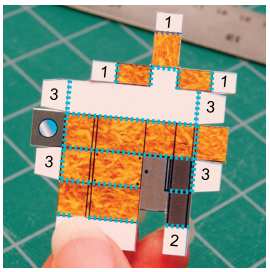
2b. Glue the **spider ring** inside the baffle, so it attaches to the pointed tabs. Then glue the baffle inside the HRI telescope, aligning the angle of the open ends. Glue the bottom onto the telescope.



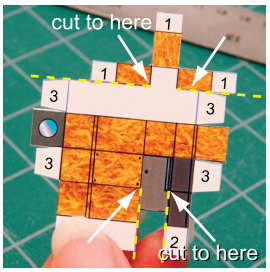
2c. Glue the **support ring** around the telescope, centering one of the ring's sides over the telescope's seam. Let dry.



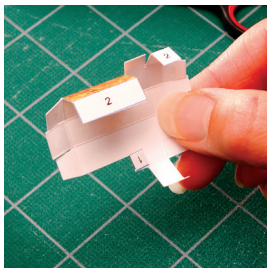
3. On the **platform back**, glue the smallest tabs to form its sides. Let dry. On the **spectral imaging module (SIM)**, glue the pointed tabs first to form the box. Then glue the straight tabs. Let dry.



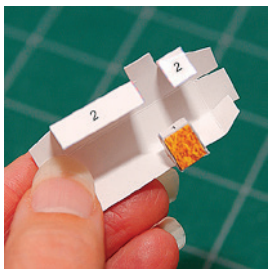
4a. We've saved the trickiest part for last—the **MRI telescope.** Start by scoring on the blue dashed lines shown here.



4b. Cut out the part. Make sure you cut into the part on the yellow lines.

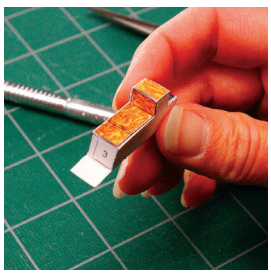


4c. Fold along the scored lines, and visualize the box you're making.

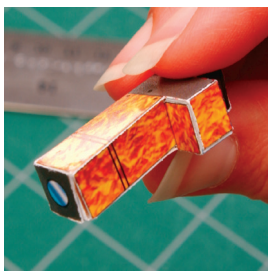


4d. Glue the "1" tabs together to form a box.

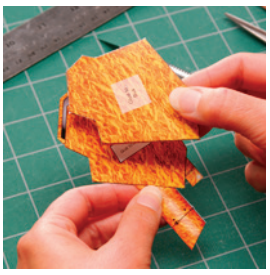
4e. Glue the "2" tabs to the inside of the telescope, forming another box as shown.



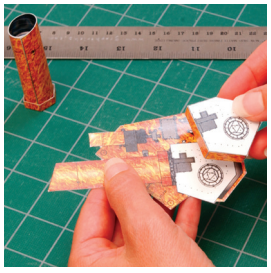
4f. Glue the "3" tabs together to close the ends of the telescope.



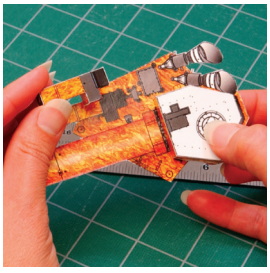
4g. Glue the unnumbered tabs down, and you have the finished MRI telescope. Let dry.



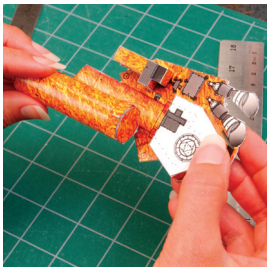
5. Glue the platform back to the instrument platform.



6. Glue the SIM to the instrument platform.



7. Glue the MRI telescope to the instrument platform.

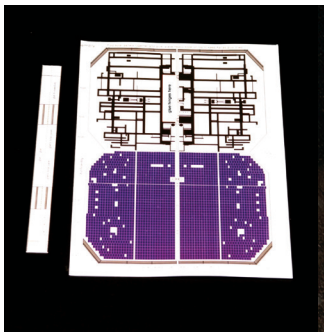


8. Glue the HRI telescope to the instrument platform.

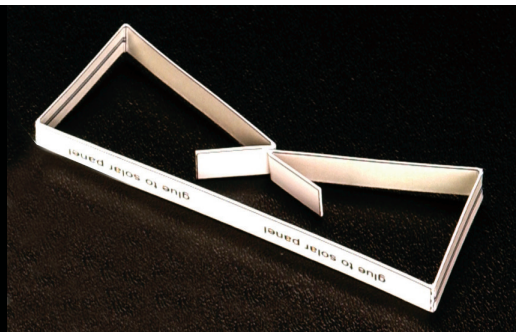
9. Here's the finished instrument assembly.

10. Glue the entire assembly to the bus, keeping the bottom edges parallel.

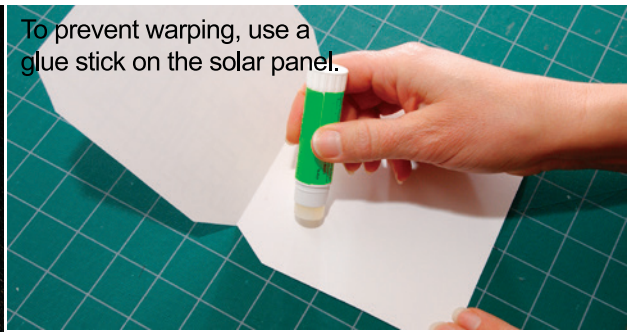
C. Solar Panel and Strut



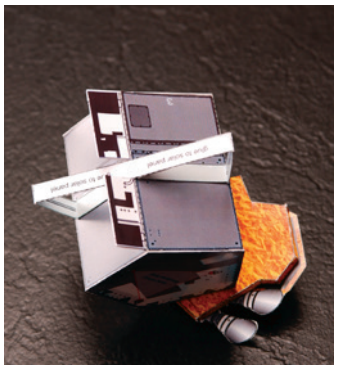
1. Score the strut and solar panel. **Important**: Cut out only the strut. Do not cut out the solar panel yet.



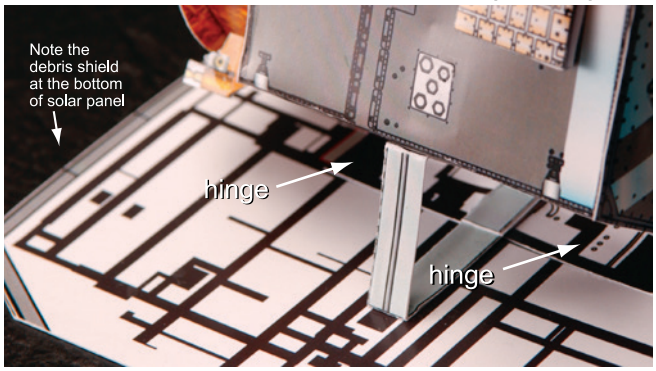
2. Fold the **strut** lengthwise and glue the halves together. Wrap it in wax paper, then press it in a heavy book until it dries. Make the remaining folds as shown.



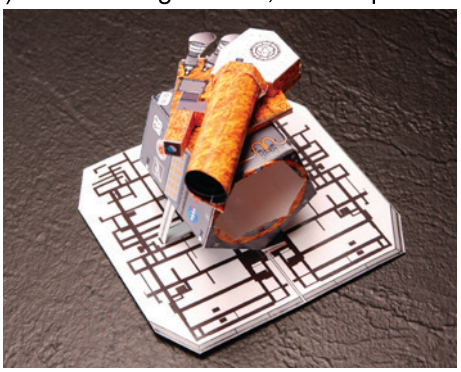
3. Fold the **solar panel**. Then use a glue stick to apply a very thin layer of glue on one inside half and glue the sides together. Wrap it in wax paper, and press it in a heavy book overnight. (For additional strength, trace one half of the panel on a blank piece of card stock. Cut it out and layer it inside the folded panel before you glue it together.) AFTER the glue dries, trim the panel.



4. Glue the strut's "1" tabs to the inside of the strut as marked. Then glue the strut to the bus.

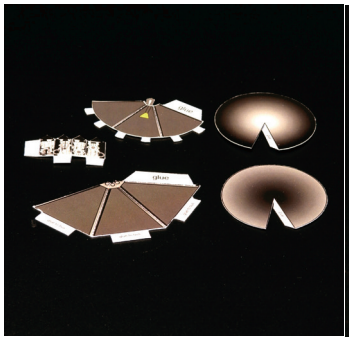


5. Apply glue to the inside of the bus's hinges and glue them closed. Then glue the solar panel to the hinges and the strut.



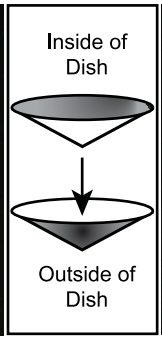
6. Here's the finished solar panel and strut attached to the bus.

D. High-Gain Antenna

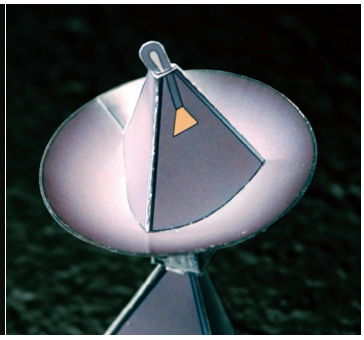


1. Score the antenna strut, feed horn strut, and gimbal. Then cut out all the antenna parts.

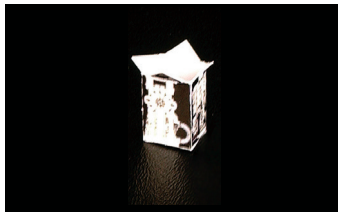
2. Fold and glue the **antenna strut** and **feed horn strut**.



3. Glue the inside of the **antenna dish** together, then glue the outside together. Next, glue the inside part to the outside part.

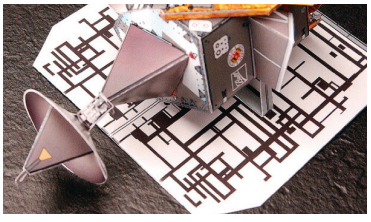


4. Glue the feed horn strut to the center of the dish.



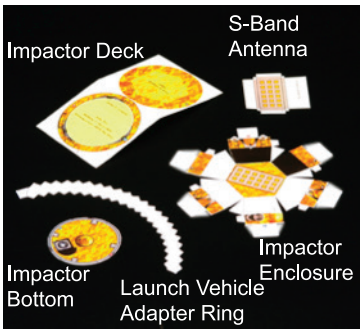
5. Fold and glue the gimbal into a box shape, leaving the end with the black tabs open. Let dry.

6. Apply glue to the closed end of the gimbal, and attach it to the antenna strut. Let dry. Then apply glue to the gimbal's black tabs and attach the antenna dish. Let dry.



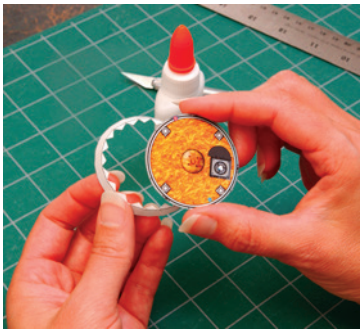
7. Glue the finished antenna to the bus where marked.

E. Impactor



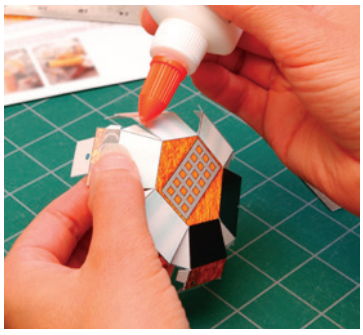
1. Score the folds, then cut out all the parts. **Important**: Leave some white space around the **impactor deck** as you cut it out. Fold it, then glue the two halves together. Wrap it in wax paper, and press it in a heavy book overnight. Then trim it to the black edge as marked.

2. Glue the ends of the **LV adapter ring** together, then fold all of the pointed tabs in.

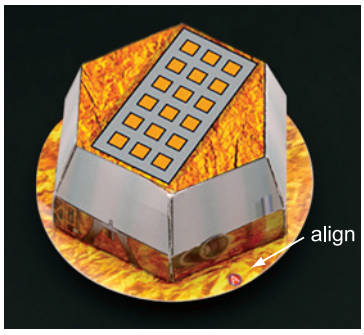


3. Glue the **impactor bottom** to the smaller diameter side of the LV adapter ring. Let dry.

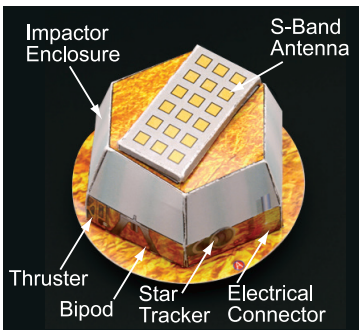
4. Glue the impactor deck to the larger diameter side of the LV adapter ring—being careful to align the A and B letters on the deck with those on the impactor bottom. Let dry.



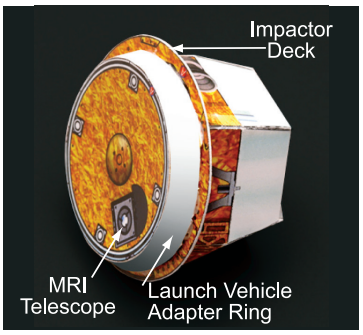
5. Apply glue to the **impactor enclosure's** tabs, then form its sides as shown. Let dry.



6. Glue the enclosure to the top of the impactor deck, aligning the A and B letters. Let dry.



7. Glue the **S-band antenna** on top of the impactor enclosure.



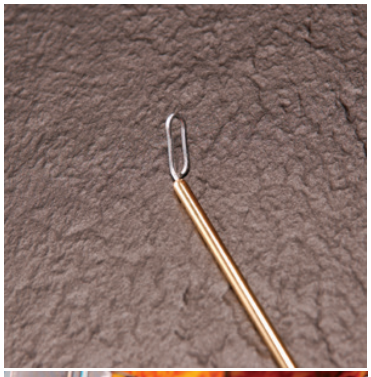
8. Here's the finished impactor. Line up the impactor's A and B letters with those on the bus when you dock the two together.

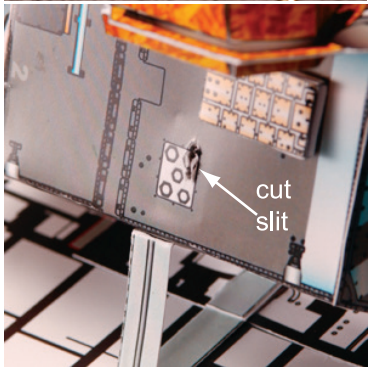
Model Stand

You've done it—you've built the Deep Impact flyby spacecraft and its impactor! Display your model by hanging it or mounting it on a stand. Here's one way to build a stand:

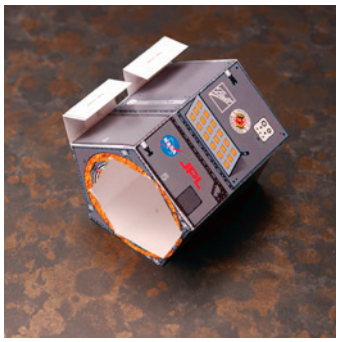
Start with a 1/16-inch diameter brass tube, about 10 inches long (available at hardware or hobby stores). Uncurl one end of a small paper clip and wedge it into the tube as shown. Secure the other end of the tube in a block of wood or other material for a stable base. Glue the model label on the base.

Cut a 1/4-inch slit in the bus where shown. Cut a small square of cardboard and make a 1/4-inch slit in it. Glue the cardboard inside the bus, aligning the slits. This strengthens the area where you'll insert the paper clip.

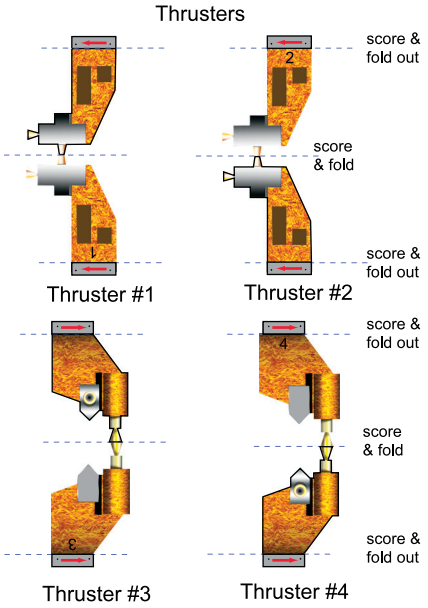




A. Flyby Spacecraft Bus



Thrusters



Leave some white space around thrusters as you cut them out (see instructions).

Impactor

BEFORE cutting out the bus, reinforce the back of this section with tape. Cut out the hole on the green dotted line AFTER you've glued the bus together.

S-Band Antenna

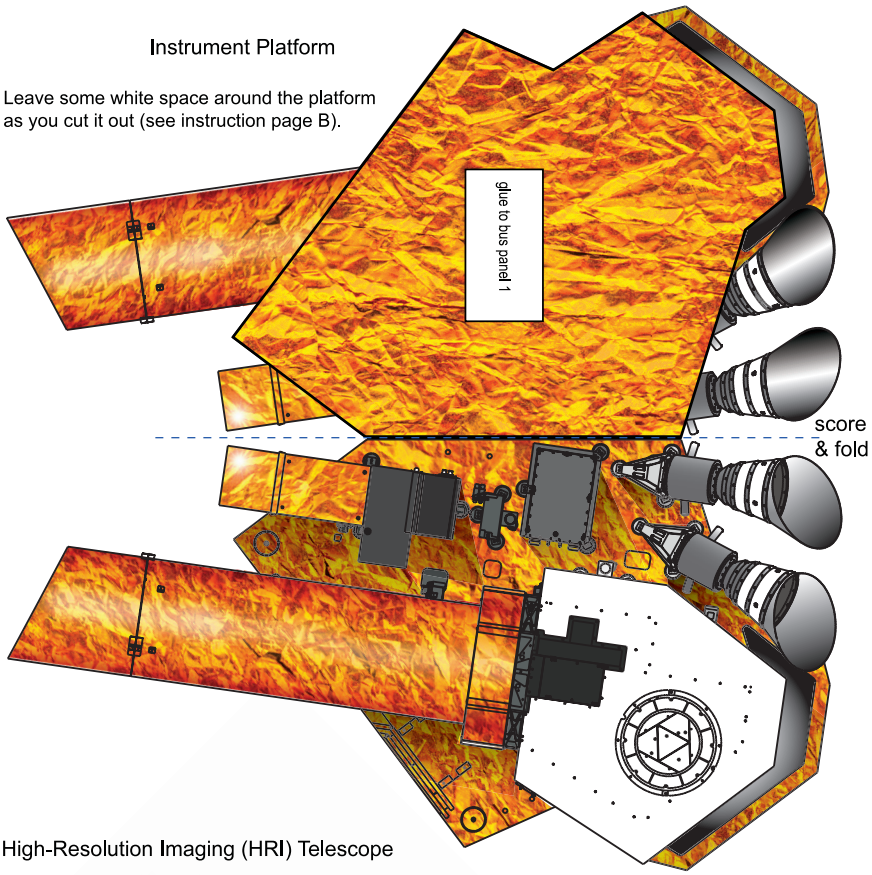
Battery Box

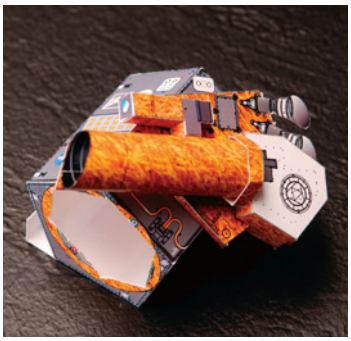
D1288_Bus_02/04

B. Instrument Assembly

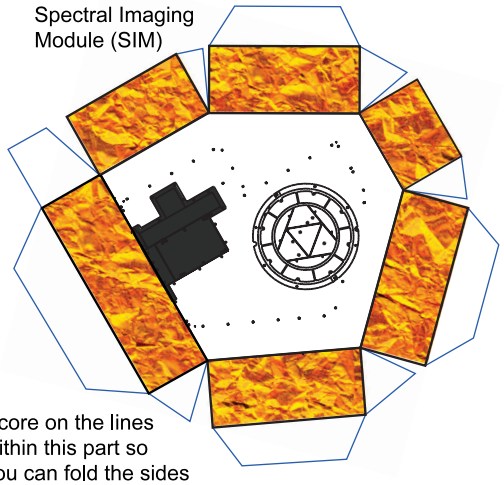
Instrument Platform

Leave some white space around the platform as you cut it out (see instruction page B).



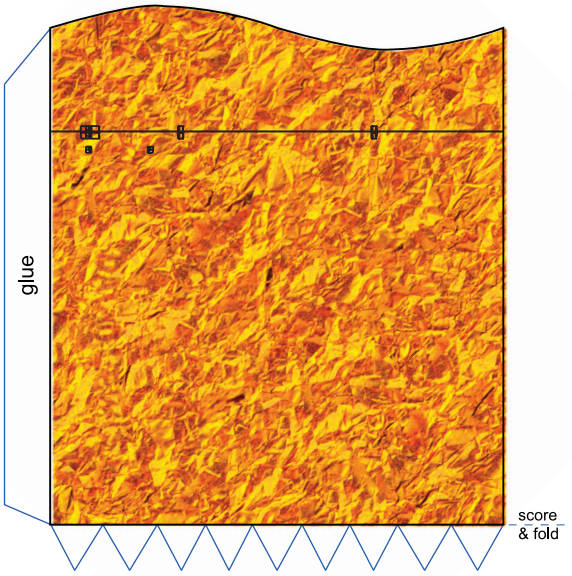


Spectral Imaging Module (SIM)

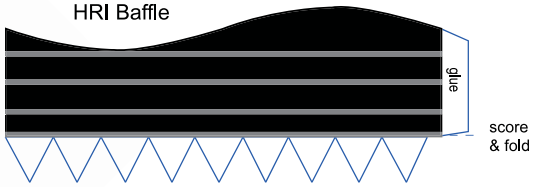


Score on the lines within this part so you can fold the sides and tabs down.

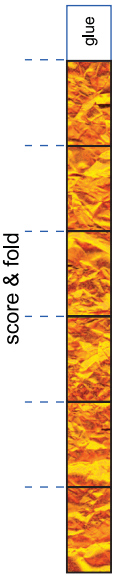
High-Resolution Imaging (HRI) Telescope



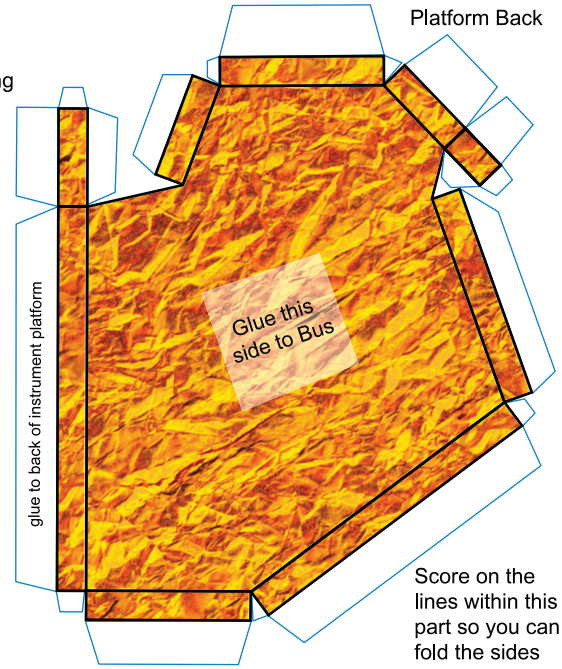
HRI Baffle



Support Ring

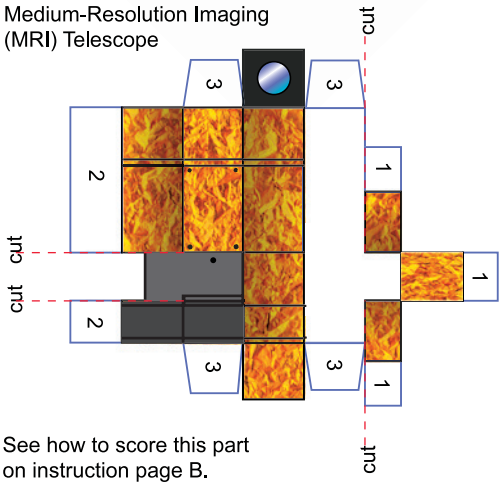


Platform Back



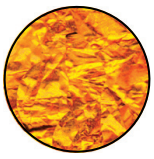
Score on the lines within this part so you can fold the sides and tabs down.

Medium-Resolution Imaging (MRI) Telescope



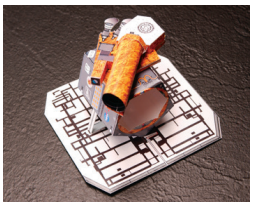
See how to score this part on instruction page B.

Bottom of HRI Telescope



Spider Ring

C. Solar Panel and Strut



score & fold

1

score & fold

glue to bus

score & fold

score & fold

glue to solar panel

glue 1 here

glue 1 here

When gluing the 1 tabs down, leave black area open so there's room for the bus to fit between them.

glue to solar panel

score & fold

score & fold

glue to bus

score & fold

1

Strut

glue hinges here

score & fold

Solar Panel

Label for model stand

DEEP IMPACT

BALL AEROSPACE

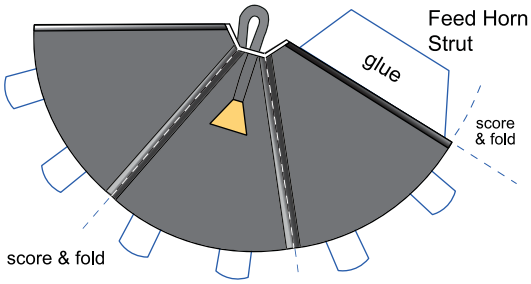
NASA · JPL · U of MARYLAND

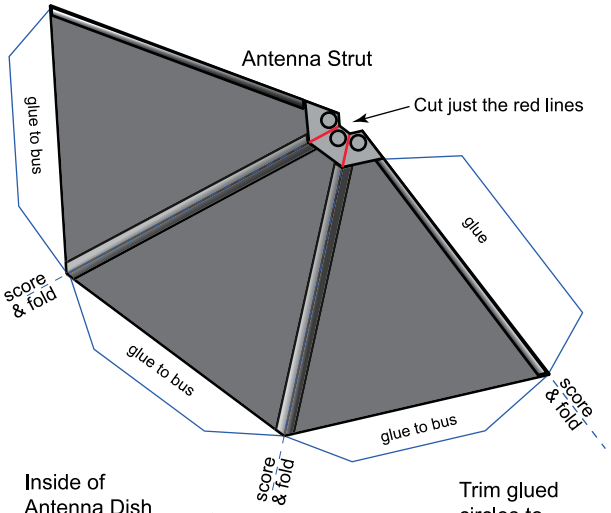
1/22 scale

Ball Aerospace & Technologies Corp.

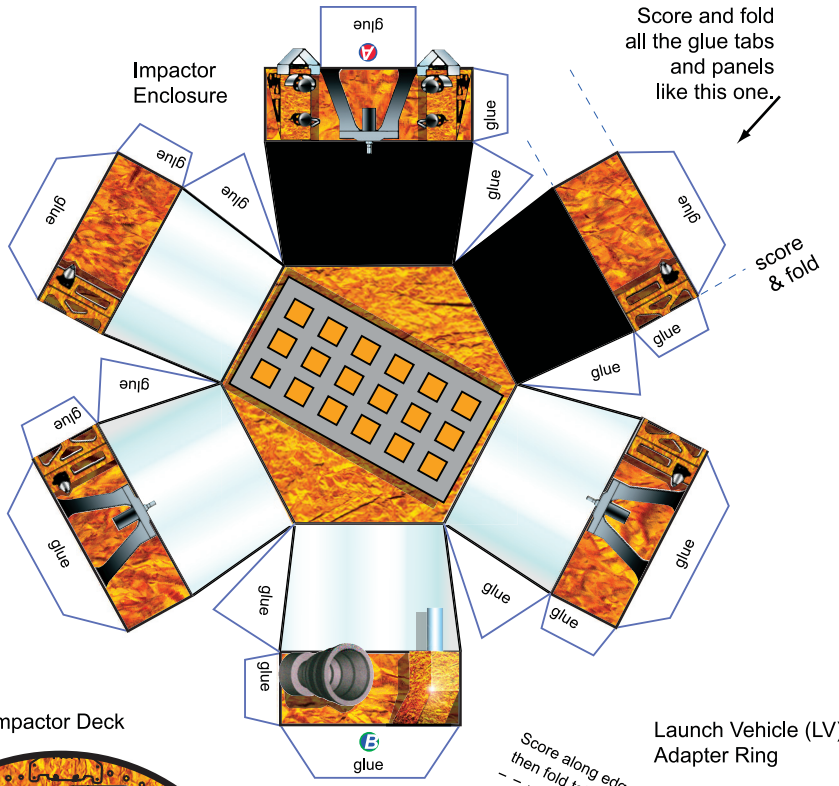
Ball

D. High-Gain Antenna

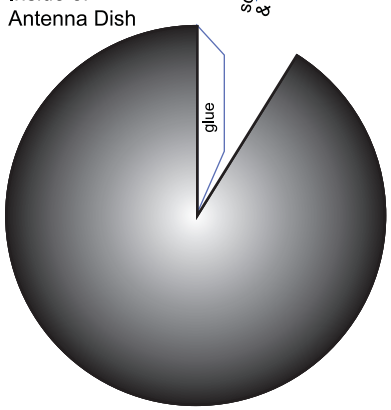




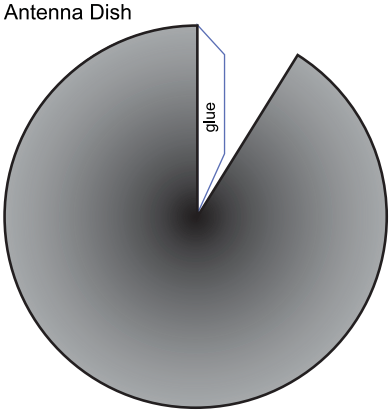
E. Impactor



Inside of Antenna Dish

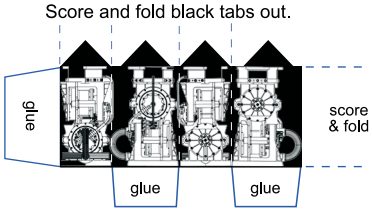


Outside of Antenna Dish



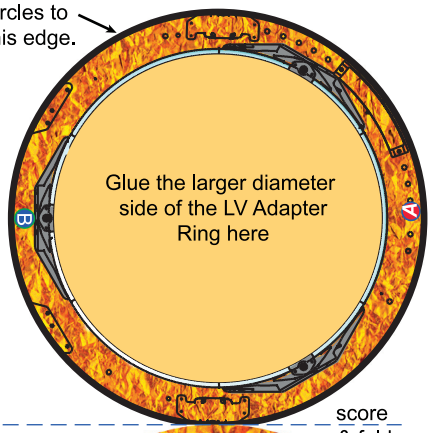
Gimbal

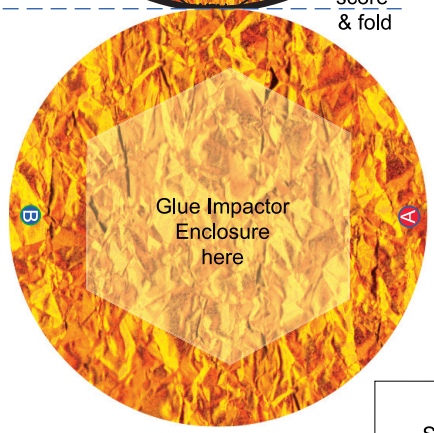
Score and fold black tabs out.



Trim glued circles to this edge.

Impactor Deck

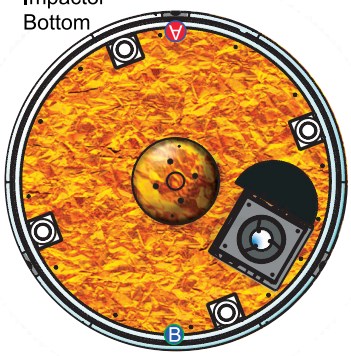




Leave some white space around the impactor deck as you cut it out (see instruction page E).

When gluing, align the letters on the deck with those on the impactor bottom.

Impactor Bottom



Launch Vehicle (LV) Adapter Ring

Score along edge, then fold tabs

Fold pointed tabs in toward middle of ring.

S-Band Antenna