

COMMAND DRONE

KIT ASSEMBLY INSTRUCTIONS



DOWNLOADABLE 3D CARDSTOCK MODEL

SCALED FOR USE WITH 28MM GAMING MINIATURES

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THE BASICS OF PAPER MODELING: TOOLS AND EQUIPMENT



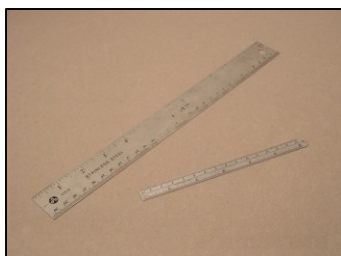
GLUE

There are a variety of glues and adhesives on the market, some of which are nicely suited to building paper models. White glue (also known as PVA glue), glue sticks, Uhu office pens, tacky craft glue, and sometimes even superglue (cyanoacrylate adhesives) all have their own uses. For the great majority of the time, however, you can get by just fine with white glue alone.



SCORING AND CUTTING TOOLS

You'll want to have, at the very least, a sharp hobby knife for cutting parts out of the printed sheet. Scissors are not recommended. For scoring, you can either gently drag the hobby knife across the fold (not recommended), or use specialty tools for scoring without cutting into the paper. Embossing tools such as the ball stylus, an empty ballpoint pen, a scrapbooking bone folder, or even secondhand sculpting tools with smooth and dull blades are great tools for scoring without breaking the paper.



STEEL RULERS

To precisely guide your cuts or scoring, steel rulers come in very handy. Unlike plastic or wood rulers, steel rulers are resistant to sharp hobby knives. You can get by with just a normal 12-inch steel ruler, but you may find that a smaller 6-inch steel ruler is a lot handier and easier to deal with when making small cuts. Along larger parts, steel rulers can also be used as a bending brake.



HOBBY TWEEZERS

Sometimes you'll encounter folds that seem too small to do with your fingers alone. In this situation, a pair of hobby tweezers like the one shown to the left is very handy. In effect, they act as a set of tiny fingers and a miniature bending brake, allowing you to crisply fold very small parts.



BLACK, GRAY, OR DARK GRAY MARKERS

When you cut parts out of the sheet, the edges are naked white. This generally results in a less than pleasing visual effect when the model is fully built, and this is dealt with by a technique called "edging". When edging parts, you will be doing two things: coloring the actual edge itself, and coloring in a portion of the glue tabs. The best marker to use for edging is one that has a soft chisel tip, and which doesn't bleed through thin cardstock. The markers pictured to the left are calligraphy markers with 2mm and 3.5mm chisel tips.



CUTTING PAD/MAT

A good self-healing cutting mat will help your hobby knife blades stay sharp longer, and protect your work surface from damage.

THE BASICS OF PAPER MODELING: TIPS AND TECHNIQUES

Basic Techniques

1. Scoring: Scoring is a technique used to make folding easier by pre-creasing the paper along a fold line. The most common method of scoring is to lightly drag a knife blade across the fold line, slicing through the upper layers of the paper. The recommended method is to instead use an empty ballpoint pen or a ball stylus tool to gently compress the paper along the fold lines. This prevents the appearance of unsightly naked edges and makes for a much stronger model.

2. Cutting: Cutting may seem to be a glaringly obvious technique, but a few pointers are essential. For the majority of cutting where paper models are concerned, a sharp knife and a steel ruler are far more precise and efficient than a pair of scissors. Save the scissors for separating individual parts or groups of parts from the rest of the sheet.

3. Burnishing: Often, you will be building parts that are composed of flat fold-overs. In order to ensure that they stay straight and do not delaminate after building, you will want to burnish the two halves together. You can use your finger, a smooth and flat tool, or even a little rolling pin. Burnishing forces the two layers in a flat fold-over together, spreading out the glue even further and squeezing it into the paper fibers for additional bite.

4. Edging: Edging improves the appearance of paper models considerably by hiding the naked edges of cut parts. Anything from color markers to soft pencils and various types of paints may be used to edge parts. However, in most cases, matching the color exactly is less of a concern than simply matching the contrast. For most purposes, three or four shades of gray from lightest to darkest will more than suffice.

5. Folding and Gluing: Depending on the thickness of the paper or cardstock used, some parts may be difficult to assemble with fingers alone. In this situation, a pair of tweezers is worth more than its weight in gold. Tweezers come in a wide variety of sizes and jaw shapes, and some of the more exotic shapes are fantastically useful for assembling tiny parts. Tweezers can be used to fold tiny flaps and clamp them in place while the glue sets, as well as making it much easier to attach small parts to other parts.

Special Notes

1. Gluing Tabs: This model includes integral gluing tabs for joining certain parts together. However, the utility of gluing tabs decreases proportionally as the thickness of the paper or cardstock increases. Thick cardstock or paper can be used for printing this model, but it is recommended that you try a test assembly before committing wholly to assembling a model. If the gluing tabs won't fit or otherwise throw off the tolerances of the finished test assembly, leave them off the parts entirely and cut your own gluing tabs out of scrap cardstock.

These separate gluing tabs should overlap both of the parts to be joined, and glued to the unprinted surface along the joining edges of both parts. This is called "backing", and a side effect of this is that parts will fit more or less flush. Backing parts with separate gluing tabs also generally yields better modeling results, but the integral gluing tabs are retained for the convenience of beginners and those who prefer to use thinner media for their paper models.

2. Sealing: In most cases, sealing the model with varnish or other form of spray sealant isn't necessary. However, if you want to add further detail to the model with decals or paint, you may want to seal the model with several light coats of a waterproof glossy clear sealant first. This will protect the model from a moderate level of moisture, and the smooth surface will facilitate the application of decals. You can also apply a final coat of a matte clear sealant to kill the gloss afterwards. Keep in mind that the simple act of sealing a model does not necessarily render it waterproof, and that any application of waterslide decals needs to be done with great care.

3. Reinforcing: At times you may need to reinforce large pieces, either to make them heavier or to increase their strength. To do this, you may wish to glue toothpicks, craft sticks, or other suitable items to the interior of a model.

4. Weighting: If you find that your models are too light, you can weigh them down by gluing various ballast items to the inside of the model. Some items that come to mind include pennies, ball bearings, and washers. Affixing these items to the unprinted side of a model before folding and gluing it into shape will give the model a significant amount of heft and weight.

DESIGNER'S NOTES

The Command Drone is a roving command node, managing a large number of attack remotes or other types of combat drones. Each attack remote or combat drone under its command is an extension of its senses and firepower.

One Command Drone is capable of tactically handling 256 slave units, which are often broken down into smaller maneuver groups. In practice, most Command Drones handle a smaller number of slave units instead, so the loss of any one Command Drone won't disrupt the network, since its slave units are then reassigned to other Command Drones to balance the network load.

Each Command Drone is often also slaved to a master Command Drone that handles an even larger tactical picture, and this hierarchy extends all the way up the ladder to the final operational command node, which is governed by human tacticians and strategists working in concert with even more powerful AIs. The operational command node usually remains in orbit.

The normal combat doctrine for a Command Drone is to let the slave units under its command handle any direct engagements with the enemy. Because a Command Drone isn't a front-line combat unit, and it is usually programmed to stay as covert as possible, its firepower is purely defensive. To that end, a Stinger remote turret, with two medium THEWVs that can be cycled between a rapid-fire antipersonnel mode and a slower antimateriel mode for use against harder targets, and two antitank missile pods for harder targets, is its sole armament. If the enemy stumbles across a Command Drone, that isn't accompanied by its usual defensive constellation of attack remotes or heavier combat drones, the Stinger remote turret allows it a chance to escape attack.

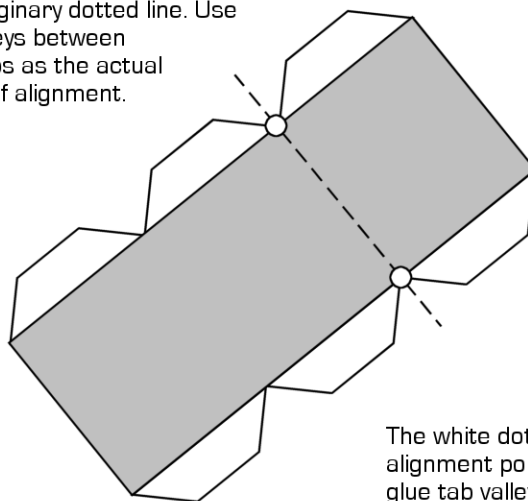
INVISIBLE FOLD LINES

This model has several invisible fold lines on certain parts. The purpose of leaving these fold lines off the model is to suggest a more curved, less angular aspect to the model, without resorting to modeling complex actual curves. For these invisible fold lines, cutting through the cardstock while scoring will completely ruin the effect and make hiding these fold lines completely pointless. So, to reiterate the relevant portion of the Scoring section on the previous page:

"The recommended method is to instead use an empty ballpoint pen or a ball stylus tool to gently compress the paper along the fold lines. This prevents the appearance of unsightly naked edges and makes for a much stronger model."

The diagram to the right demonstrates how to use the glue tabs to align creases along invisible fold lines.

Align your steel ruler so that its edge runs along the imaginary dotted line. Use the valleys between glue tabs as the actual points of alignment.



The white dots show the alignment points in the glue tab valleys.

A NOTE ON RARE-EARTH MAGNETS

What the heck is a rare-earth magnet?

Rare-earth magnets are small, very powerful magnets that are extremely useful for making parts modular, creating functional joints that can rotate, and allowing models to be created as separate sub-assemblies that can be taken apart. Our models will be designed to be as magnet-friendly as possible, and the following pages should help you find suppliers and choose the best sizes to buy.

To the right, the photos show some of the magnets that we're currently using. Rare-earth magnets come in a staggering variety of sizes, shapes, and strength, and because of that variety, there is no real way to specifically pin down a few exact sizes to buy. However, the following dimensions should be used as guidelines for buying magnets, since we will be designing models with interface areas that follow those guidelines.

The large majority of magnet-friendly interface areas on our models will be designed to accept magnets of up to 0.25 inches (6.35mm) in diameter, and up to 0.125 inches (3.175mm) in thickness, so any rare-earth magnets that fit within this size envelope will work.

The best shape to buy is the disc, because discs have a versatility well-suited for nearly all possible joint or connector configuration. Some models will be designed with ball socket joints, which will require a non-magnetic stainless steel ball and one or more ring magnets. The instructions for these models will specify any unique combinations, and will list the relevant suppliers as well.

The following list of known online suppliers for rare-earth magnets is current as of March 23, 2006:

Sources for Small NdFeB Disc Magnets

Amazing Magnets

<http://www.amazingmagnets.com>

Engineered Concepts

<http://www.engconcepts.net>

Force Field

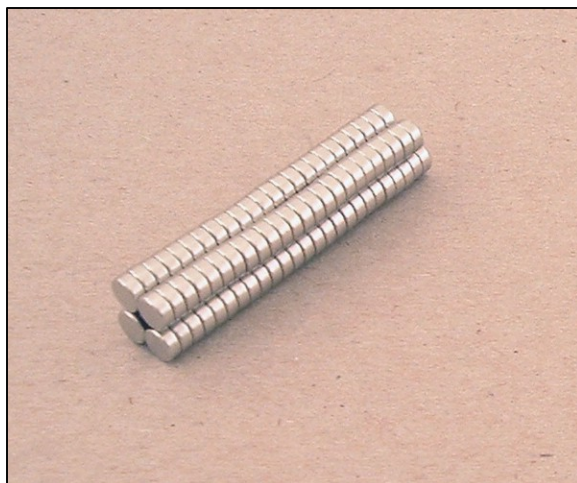
<http://www.wondermagnet.com>

K&J Magnetics

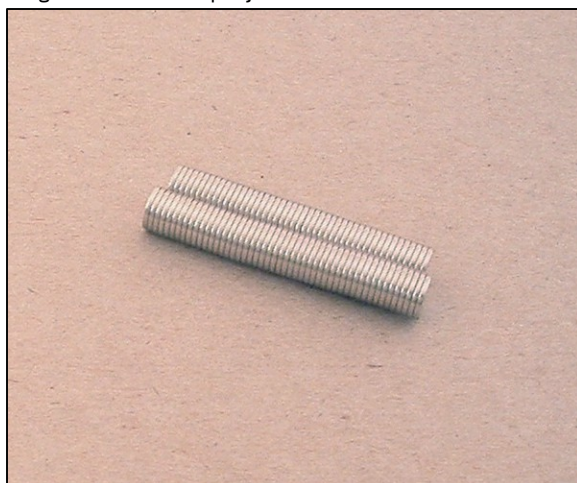
<http://www.kjmagnetics.com>

Rare-Earth Magnets

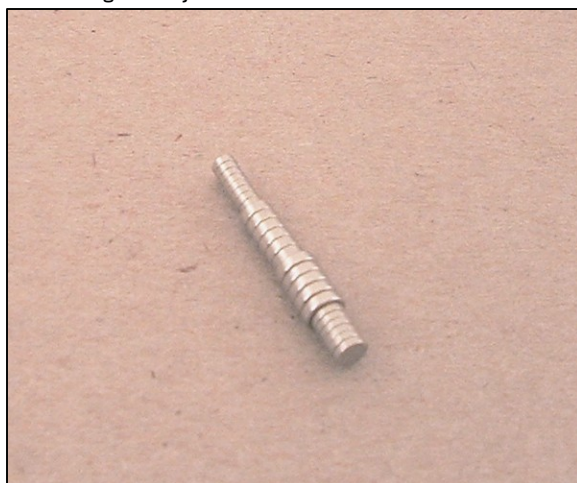
<http://www.rare-earth-magnets.com>



5mm diameter x 2mm thickness neodymium-iron-boron disc magnets, grade N40 (D1024, from Engineered Concepts)



6mm diameter x 0.75mm thickness neodymium-iron-boron disc magnets, grade N38 (D401, from K&J Magnetics)



Assorted sizes and thicknesses of neodymium-iron-boron disc magnets, from Engineered Concepts

USING RARE-EARTH MAGNETS

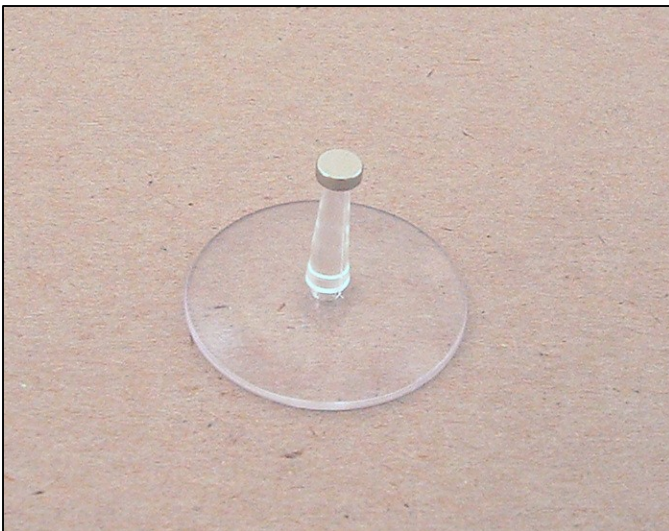


Modular Parts and Articulated Joints

The most fun you can have with these magnets is in using them to make turrets or limbs rotate, or in making parts easily swapped out.

In the photo to the left, thin disc magnets were used for the connection between the model's turret and body. Not only does the turret rotate easily, it can also be swapped out for other types of turret. If you wanted, you could take it even further and magnetize the weapon pods, allowing you to quickly customize the model's weapon loadout without needing to build a whole new model.

The connection strength is strong enough that parts do not fall apart, but you can still slide them apart at the joint with some effort.

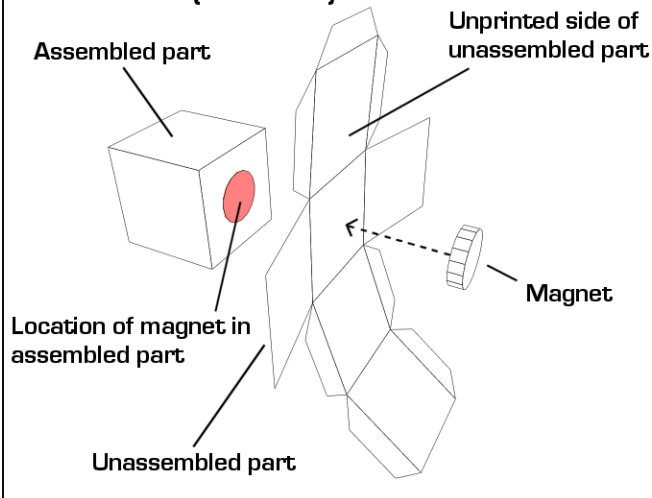


Magnetic Bases

Some companies like Games Workshop sell bags of 2-part clear plastic flight bases with wide bottoms and stems of varying lengths. For small models, these bases are extremely useful. Not only do they look better than a cardstock flying base, they're also much stronger than any base that uses transparency sheets. The small flying bases come 24 to a bag for \$5USD as of this writing.

The base shown in the photo to the left has had the peg shaved off, and a disc magnet glued into place. Now the base can be easily removed from the model, and the connection is strong enough that the model will not come off under normal use. To use magnetized flying bases, all you need to do is glue a thin disc magnet to the underside of the model.

MAGNETIZING (INTERNAL)



Hiding Magnets

Sometimes you may not want the magnets to be visible, or perhaps the model cannot be assembled with external magnetic joints. In this case, the solution is to glue the magnets to the unprinted side of the relevant parts while building. The diagram to the left illustrates an easy way to keep the poles straightened out.

First, position the second, unassembled part so that the correct part of it is mated with the part that you want to magnetically connect it to. Next, position the magnet over the spot and release it. The new magnet will then snap to the proper polar orientation, and will be held in place by the other magnet.

Finally, place several tiny drops of cyanoacrylate gel around the perimeter of the magnet, then gently smooth the drops around the magnet. Once the glue sets, remove the part and assemble it.

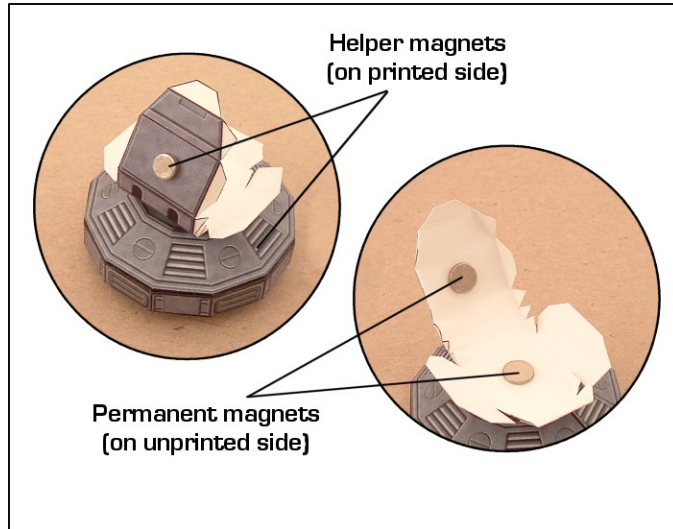
PRACTICAL MAGNET TIPS

Minding the Poles

All magnets have a north-facing and a south-facing pole. Opposing poles attract, while matching poles repel. Thus, keeping the poles sorted out is important, because a mistake would result in parts that simply do not want to be friends.

Since rare-earth magnets in multiple quantities tend to clump together in “sticks”, you can use a black permanent marker to mark one end of the magnet stick. When removing individual magnets from a stick, do so one at a time from the marked end, and immediately mark the next one down with the marker. This way, you can keep track of which end of the stick magnets are taken from, and thus indirectly keep track of the polarity.

Then, during assembly, you will know that the marked side attracts the unmarked side, and vice versa.



Helper Magnets

During assembly, you will often need to place a magnet precisely on the unprinted side of an object. The easiest way of doing so is to use a second magnet on the printed side as a helper.

Moving the helper magnet will also move the magnet attached to the unprinted side, which allows you to do all of your alignment on the printed side. Once you're satisfied with the placement of the magnets, you can then apply several tiny drops of cyanoacrylate gel glue around the circumference of the magnet on the unprinted side, and then smooth the glue towards the magnet with a toothpick..

Once the glue sets, you can then remove the helper magnet, leaving the permanent magnet in place.

Using Other Parts as Helper Magnets

Loose helper magnets are best used when attaching the first magnet to the model. After that point, the best thing to do is to use the previously magnetized parts as helper magnets. The “Hiding Magnets” section on the previous page touched upon this subject briefly.

Using previously magnetized parts as helper magnets has the primary benefit of making sure that the poles are properly oriented from part to part, and better assures parts compatibility between different models. The photo above also demonstrates how a previously magnetized part is being used as a helper magnet for the next part in the chain.

Safety Tips

Rare earth magnets are not usually dangerous, but they should be kept away from unsupervised small children, people with pacemakers or other magnet-sensitive medical implants, televisions, monitors, microwave ovens, computers, credit cards, floppy disks, Zip disks, Jaz disks, magnetic data storage tapes, videotapes, digital cameras, and small furry aliens from Betelgeuse. In general, anything that could possibly be adversely affected by rare earth magnets needs to be kept away from these magnets.

ASSEMBLY INSTRUCTIONS



LOWER DISK, STEP 1

The lower disk consists of 5 parts, 4 of which form the upper and lower slopes of the disk, with the remaining part being the central part of the disk.

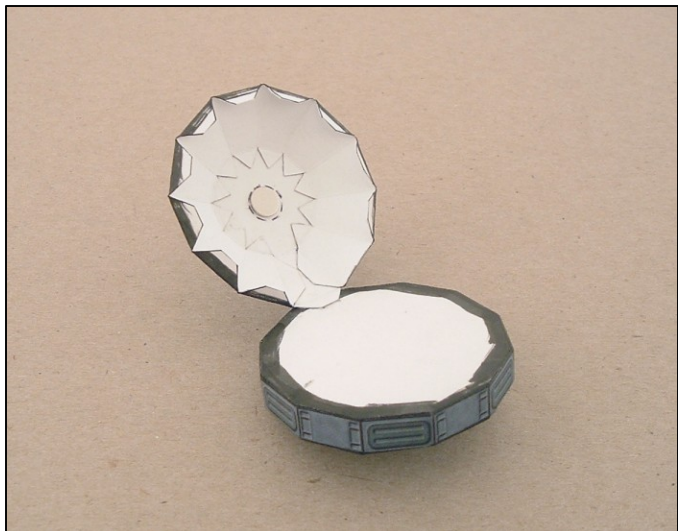
Glue Parts 07 and 08 together to form the upper third of the lower disk. Next, fold up Part 15 to form the center of the lower disk. Glue one tab of the upper third of the lower disk to the assembled Part 15 as shown to the left.

Using a helper magnet on the outside of the upper portion of the disk, position a permanent magnet in the center of the unprinted side as shown to the left. Once centered, glue the permanent magnet into place with a few drops of cyanoacrylate gel spaced evenly around its circumference, smoothing it towards the magnet with a toothpick.



LOWER DISK, STEP 2

Apply glue to the remainder of the tabs on the upper third of the disc, and then fold it into place as shown to the left.



LOWER DISK, STEP 3

Glue Parts 05 and 06 together to form the bottom third of the lower disk. Repeat the same magnetization process described in Step 1 for the bottom third of the lower disk.

ASSEMBLY INSTRUCTIONS



LOWER DISK, STEP 4

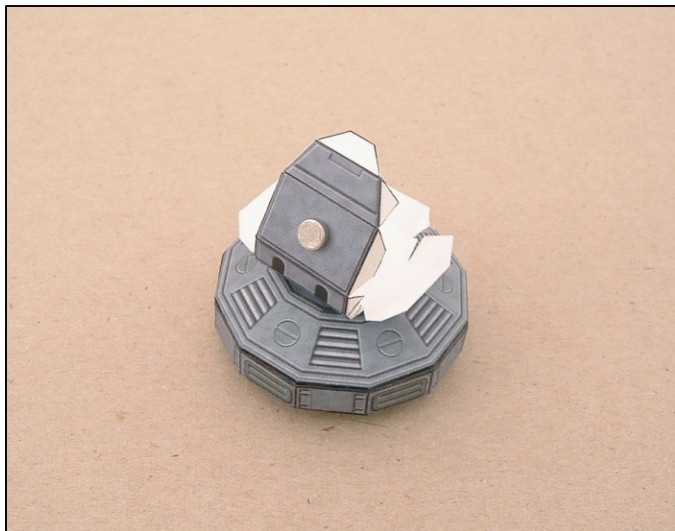
Apply glue to the remainder of the tabs on the bottom third of the lower disk, and fold down as shown to the left.



STINGER REMOTE TURRET, STEP 1

Trim out and pre-fold the remote turret (Part 09). Using the bottom of the lower disk as a helper magnet, position a permanent magnet in the center of the unprinted upper side of the remote turret, as shown to the left.

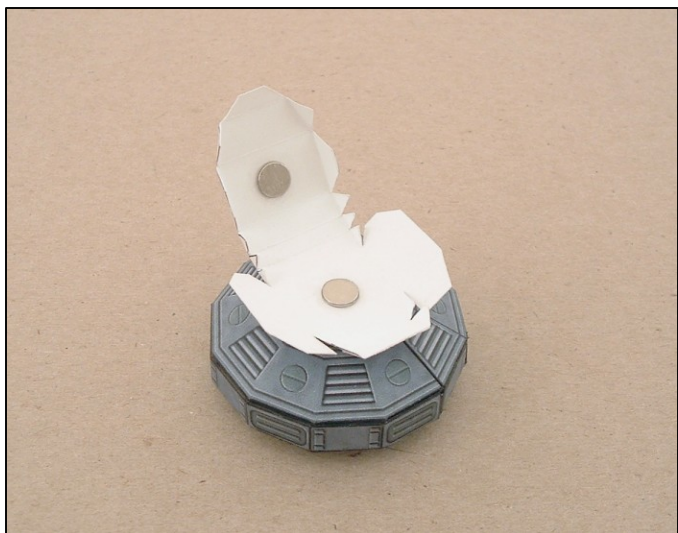
Once satisfied with the position of the permanent magnet, glue it into place with a few drops of cyanoacrylate gel spaced evenly around its circumference, and smoothed towards the magnet with a toothpick.



STINGER REMOTE TURRET, STEP 2

Attach a loose helper magnet to the printed side of the lower turret face as shown to the left, along with a permanent magnet on the unprinted side. Use the helper magnet on the printed side to accurately center the permanent magnet.

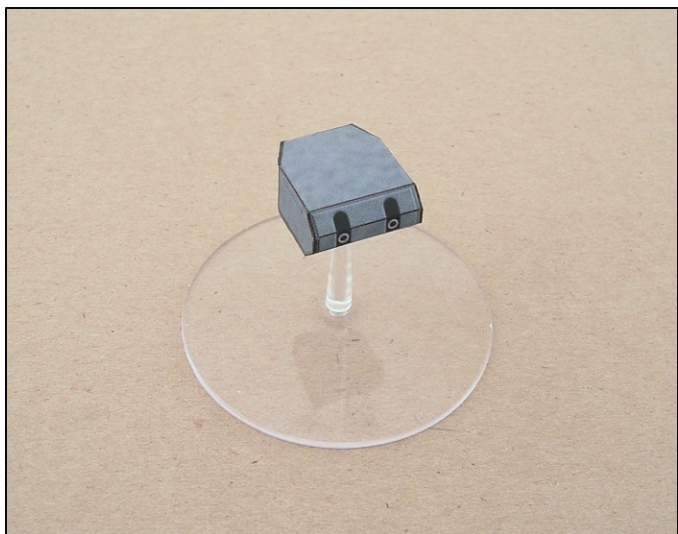
ASSEMBLY INSTRUCTIONS



STINGER REMOTE TURRET, STEP 3

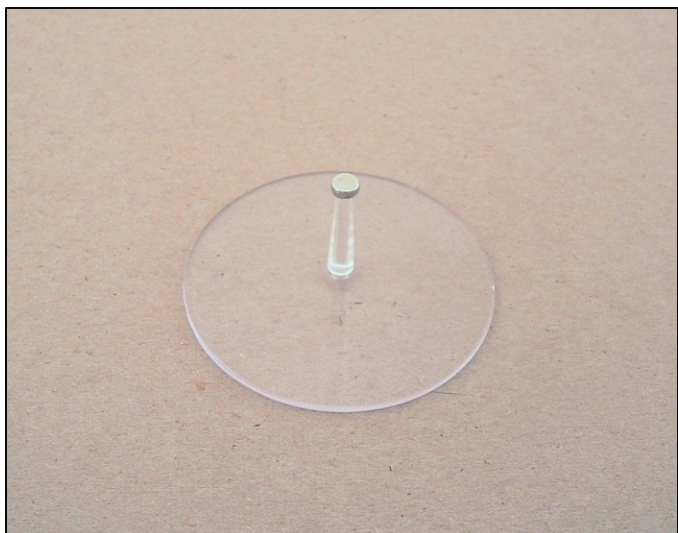
Once satisfied with the position of the permanent magnet, glue it into place as previously described. Once the glue sets, slide the remote turret off the lower disk, and set the lower disk aside.

Fold and glue the remote turret together. Leave the helper magnet on the bottom in place.



FLYING BASE, STEP 1

Take a standard large plastic flying base as shown to the left, and shave off the peg at the top of the stem. Apply a small drop of cyanoacrylate gel to the top of the stem, and gently glue the helper magnet used in the previous step to the top of the flying base's stem, using the assembled remote turret as a handy positioning aid.

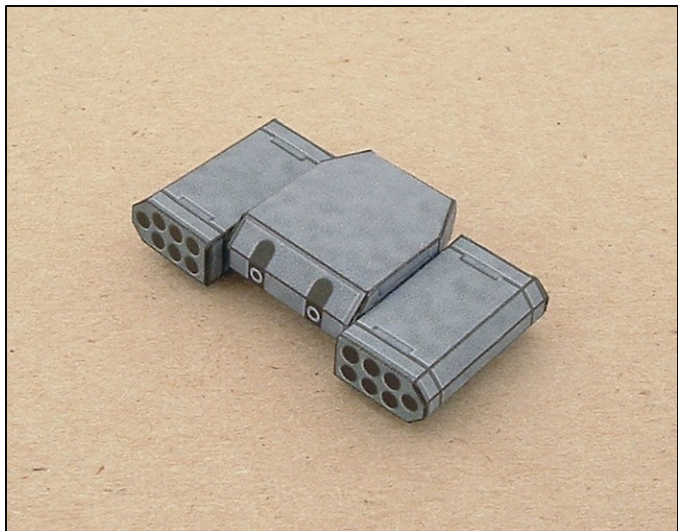


FLYING BASE, STEP 2

Once the glue on the stem-to-magnet interface has set, slide the remote turret off the stem. Your flying base should look like the one shown to the left.

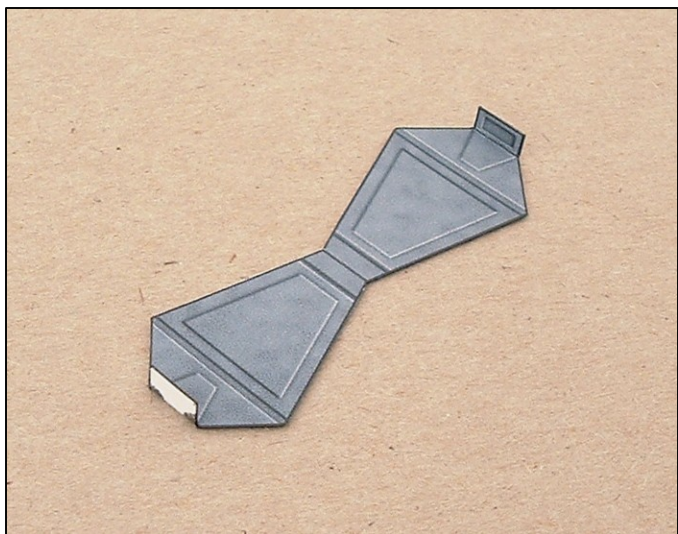
Set the flying base aside for now.

ASSEMBLY INSTRUCTIONS



STINGER REMOTE TURRET, FINAL STEP

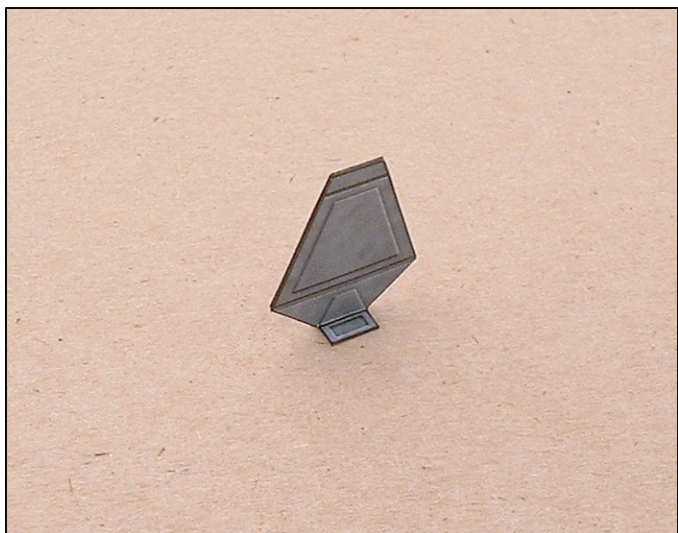
Glue the left antitank missile pod (Part 16) and the right antitank missile pod (Part 17) to the sides of the remote turret as shown to the left.



VANES, STEP 1

There are six vanes on the lower disk. Half of them (Parts 18a, 18b, and 18c) are right side vanes, and half (19a, 19b, and 19c) are left side vanes. Keep the groups separate during this step.

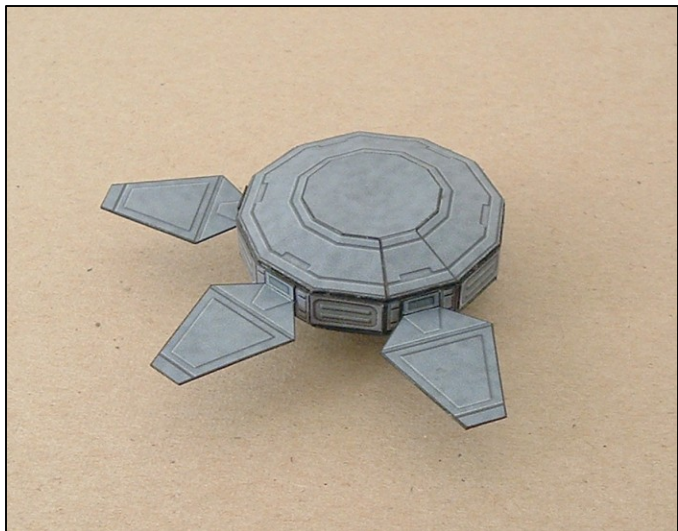
Trim out the vanes, folding up the tabs as shown to the left.



VANES, STEP 2

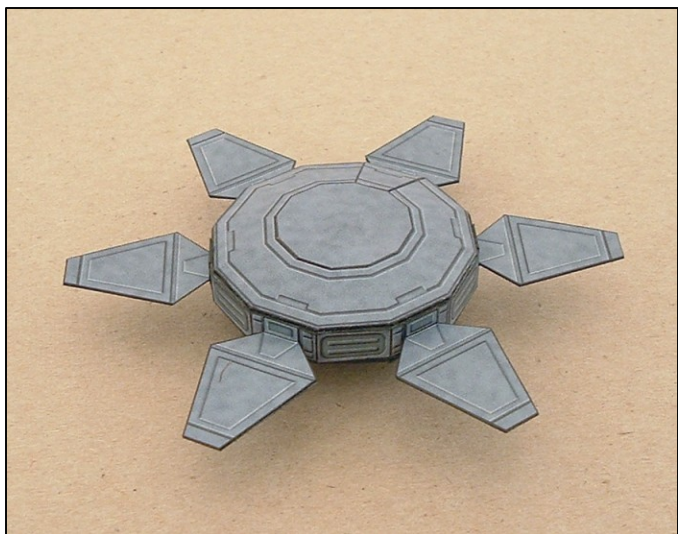
Fold up each vane so that it looks like the one pictured to the left.

ASSEMBLY INSTRUCTIONS



VANES, STEP 3

Glue the left side vanes into place as shown to the left, making sure the panel highlights are facing towards the left and front. (The back of the lower disk is where the seams are located.)



VANES, STEP 4

Glue the right side vanes into place as shown to the left, making sure the panel highlights face towards the right and front.

The lower disk assembly is now complete.



UPPER DISK, STEP 1

The upper disk is composed of 5 base parts that assemble in a practically identical manner as those of the lower disk, except the seams face towards the front.

Glue Parts 03 and 04 together to form the bottom third of the upper disk. Using the lower disk as a helper magnet, position a permanent magnet in the center of the unprinted side of the upper disk's bottom third. Once satisfied with the positioning of the permanent magnet, glue the magnet into place as previously described.

Once the glue on the magnet has set, slide the upper disk's bottom third off and set the other assemblies aside.

ASSEMBLY INSTRUCTIONS



UPPER DISK, STEP 2

Fold up and glue Part 13 to form the center portion of the upper disk. Glue the bottom third of the upper disk into place as shown to the left, using the same sequence detailed below for the upper third.



UPPER DISK, STEP 3

Glue Parts 01 and 02 together to form the upper third of the upper disk. Glue one tab to the center third of the upper disk as shown to the left, then apply glue to the remainder of the tabs and fold the entire upper third into place.



UPPER DISK, STEP 4

Glue the top half of the sensor cluster (Part 10) to the top of the assembled upper disk as shown to the left.

ASSEMBLY INSTRUCTIONS



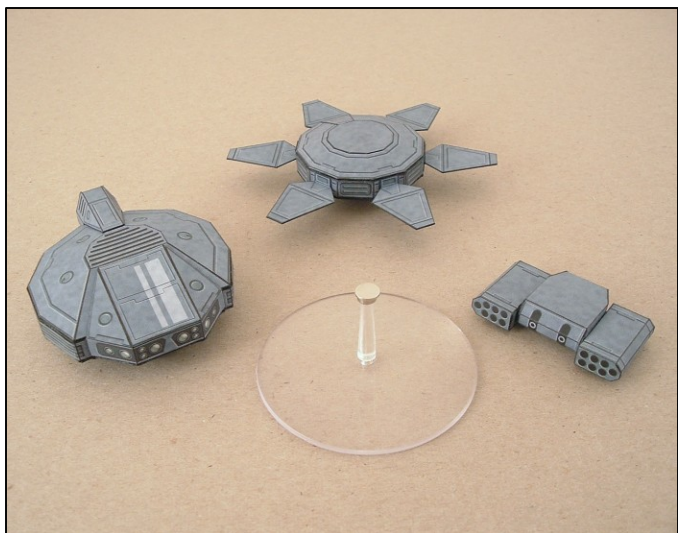
UPPER DISK, STEP 5

Glue the lower half of the sensor cluster to the bottom of the upper disk, as shown to the left.



UPPER DISK, STEP 6

Glue the rear boom (Part 12) to the back of the upper disk as shown to the left.



FINAL ASSEMBLY

Stack the magnetized components in the following order, from bottom to top:

Flying Base

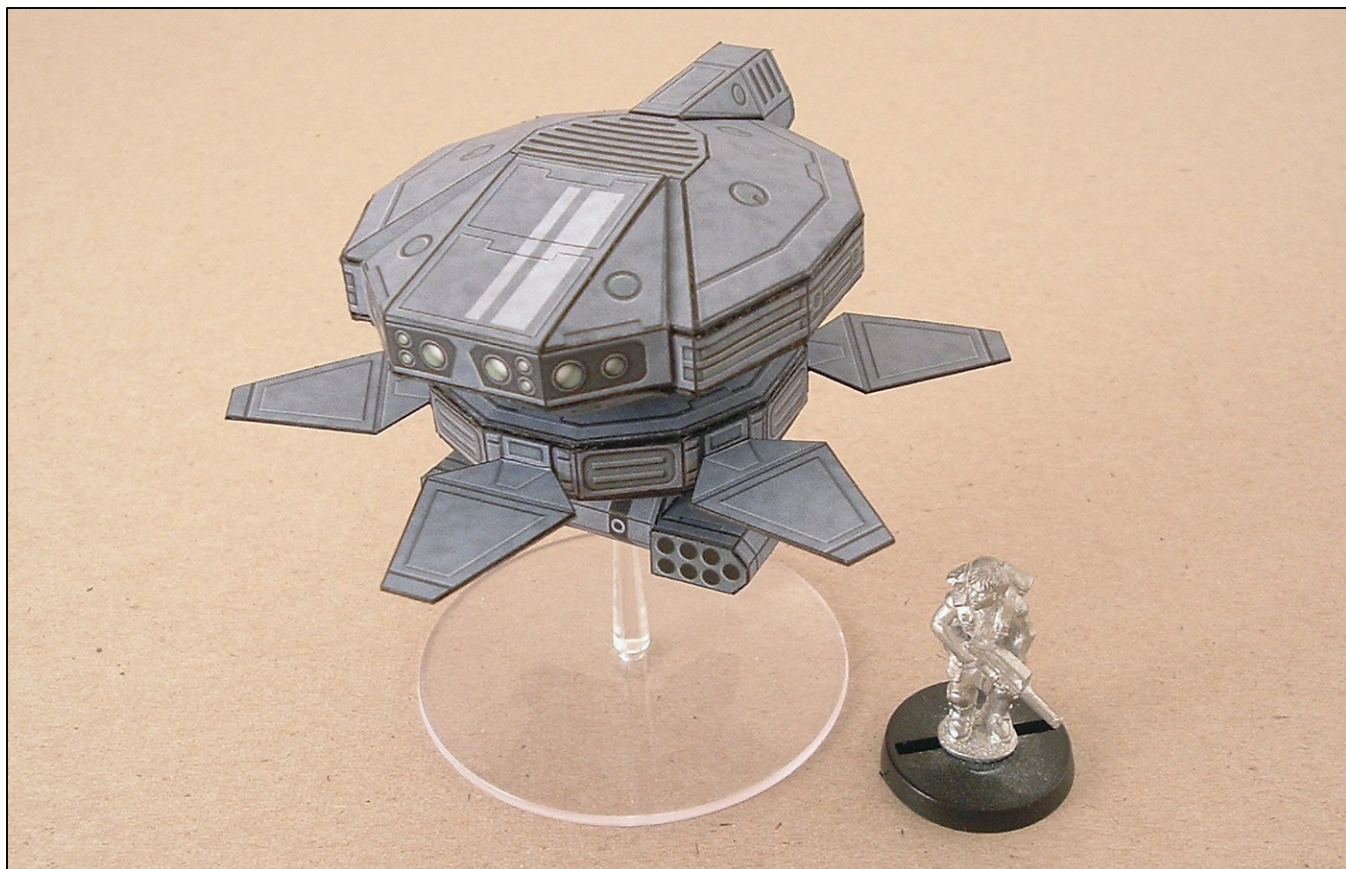
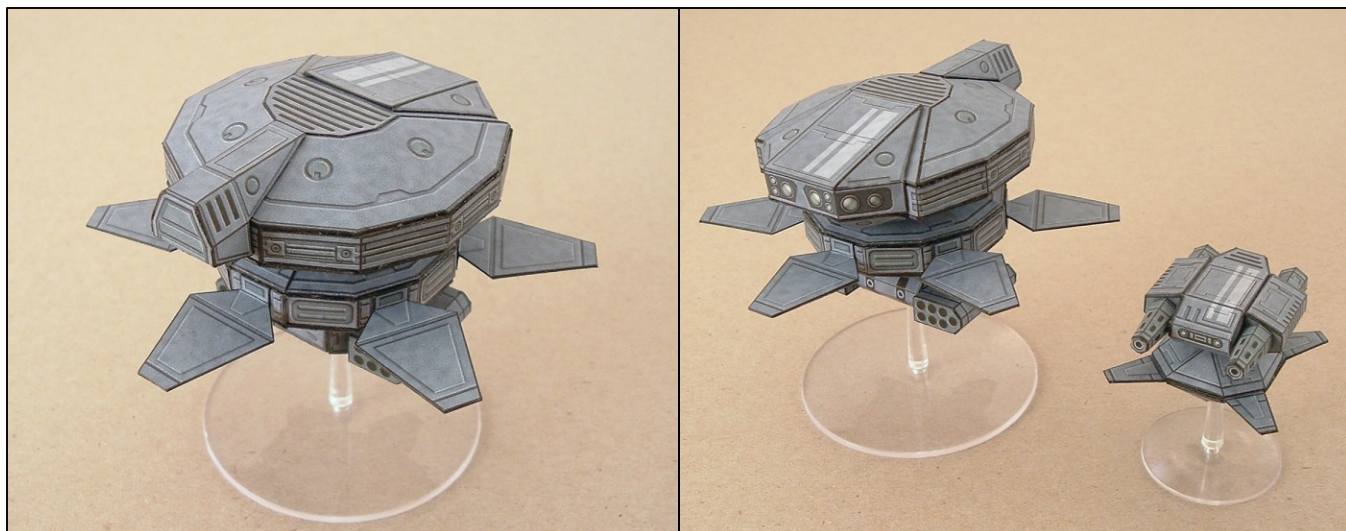
Stinger Remote Turret

Lower Disk

Upper Disk

The model is now complete.

REFERENCE IMAGES AND NOTES



28mm Copplestone Castings "Future Wars" figure shown for scale.