PEAK OF FLIGHT NEWSLETTER

Issue 600 / May 23rd

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In This Issue:

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Kitbashing a Model Rocket in the Style of ILM

By Martin Jay McKee

This year I decided that it would be fun to kitbash one of our kits in the style of Star Wars for a May the Fourth (Star Wars Day) themed social media post. I selected the brand new Wayfarer kit (**https://www.apogeerockets.com/Model-Rocket-Kits/Skill-Level-1-Model-Rocket-Kits/Wayfarer**) as the rocket to base my model around, and I dug through the spare parts in the workshop to find some small wood to act as surface detail to make the fins more visually interesting. Rather than scratch building lots of parts, I decided to further strengthen the homage to the Star Wars franchise by using the ILM (Industrial Light and Magic) approach to surface detailing using mostly found parts. Since it was already looking like an interesting project in the planning stages, I decided it was worth recording and sharing here. Before outlining the methods used, however, some history and introduction of terms are required.

Beyond being an excellent starter rocket, the Wayfarer is a great canvas for your own designs.

To begin with, it is important to describe what is meant by the term kitbashing. Kitbashing is the process of creating a new model using parts from several different models. It is a term that comes originally from modeling, but it is entirely applicable to model rocketry as well. Any time one makes a modification to a kit by adding parts from another kit, it is kitbashing. The primary advantage of kitbashing is that it is possible to achieve unique results with minimal work as the parts already exist. Rather than spending time creating lots of new parts – as one might when scratch building, kitbashing allows the builder to spend their time in the creative decisions of what parts to use, where to put them, how to finish them, and, potentially, if the parts need some small modification. The ideal base kit for kitbashing is one that avoids – what is often termed in regards to software – particularly opinionated design. An opinionated design being one that dictates to the user how it should be used. As the whole point of kitbashing is for the modeler to impose their own design and stylistic choices onto the kit, the starting point should be a fairly neutral design. For this reason, the Wayfarer was an ideal choice as the base model. While the decals in the Wayfarer could be considered rather opinionated, it is otherwise a rather traditionally “rocket looking” rocket.

Next, it is important for us to understand the source of some of the methods that will be used in this article and a bit about their history. The style of kitbashing (and specifically surface detailing) that I introduce here was developed by George Lucas’ visual effects company Industrial Light and Magic (ILM) for the first Star Wars movie (now known as Episode IV: A New Hope) in the late 1970s. Prior to Star Wars, starships were generally smooth and almost pristine vessels – often with polished metal or brilliant white exteriors. ILM changed that for the dystopian story of the rag-tag Rebels fighting against the overwhelming force of the Empire by using weathering, and lots (and lots!) of random surface details. These surface details were parts taken from plastic model kits and in their new application as texture for visual effects shots, George Lucas dubbed them as Greeblies. Combined with panel lines and paint tricks, it is easy to achieve a generally “Star Wars”-esque style quickly and inexpensively. Of course, that was very much the point for a new visual effects house that had to tackle a movie stuffed with effects shots on a tight schedule. The methods here take advantage of visual tricks and parts that already exist to speed the process.

The only impediment to my goal of assembling an ILM inspired rocket was that I do not have a huge storehouse of plastic models to pull parts from. In this age of 3D printing, however, that needn’t be a problem. I did nab a handful of parts from an old damaged 1/72 scale

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Space Shuttle kit that I had in my closet, but most of my Greeblies were found on Thingiverse. Before even starting to assemble the rocket I printed a whole pile of assorted Greeblies with the expectation that I would decide where they went later. To be honest, I spent less time searching for Greeblies than I easily could have. There are likely hundreds of options available specifically intended for 3D printing. There are also libraries for kitbashing in digital models which could easily be repurposed for 3D printing. Interestingly, ILM was in the habit of casting hundreds of duplicates of the parts they used the most as it was much less expensive than buying dozens of kits just to use a few parts; so the mass reproduction of parts using readily available technologies is actually pretty typical of ILM as well.

The design of the Wayfarer is clearly visible in the finished model, but expanded upon, and transformed by the Greebles and paint.

There are three main steps that I followed to complete this project: 1) applying panels, 2) applying greeblies, and 3) finishing. Each of these steps could easily be an article in itself (at least as far as the design possibilities are concerned) but I would never pretend to be expert enough in any of these techniques to be the best source. When it comes to the process of applying ILM-like panels to a vehicle, it is difficult to do much better than one of the many videos that Adam Savage has uploaded to the Tested channel on YouTube (e.g. [1] or [2]). Not only was Savage a model maker at ILM for some of the Star Wars Prequels, but he is an accomplished teacher and model maker otherwise. He covers both the application of panels and of greeblies. That is, he covers the first and second steps of this article (to be fair… he also covers finishing in other videos). He covers these steps in much greater detail, however, and he provides fascinating history surrounding some of the design choices in Star Wars. While Savage uses sheet styrene for the panels (as well as the base build), I decided on using Bristol board for panels as it is easier to get it to hold a curve and adhere to the cardboard tube of a rocket. Either would work well for this process, however, so anyone who would like to use modeling styrene would have no issues doing so.

The second step – that of applying greeblies to the model – is also covered by Savage though he does not talk much about sources for said Greeblies outside of plastic models. If one has lots of models that they do not mind parting out, they are doubtless an excellent source. As expensive as such kits are getting now, however, they are not a good choice if one wants to simply try one or two rockets in this style. Hobby shops sell extra parts of various sorts for models. There are photo-etched metal parts, cast metal parts, injection molded plastic parts, and many others. Moreover, the model railroad section of the hobby shop provides a glut of interesting options. On the Apogee website, you'll find vacuum formed wraps that are an excellent option as well (Generic VacForm Wrap Set). Other potential greeblies that are easy to get are the assorted styrene shapes offered by Evergreen Scale Models ([3]), small dowels or wood sticks, and parts of other rocket kits. Finally, as mentioned, there are an endless selection of 3D models that can be printed at a scale appropriate for use as greeblies.

The final step is finishing. For this project, I used primarily acrylic paints. I did use lacquer clear coats at a couple of points to protect the acrylic in the following steps of the build. However, the same thing could easily be done with all acrylics, all lacquer, all enamel, or any combination thereof. If choosing to pursue a project of this sort, it makes the most sense to stick with the paints that one is most familiar with. Having access to an airbrush, however, is invaluable when it comes time to weather the model. While possible, it would be a real challenge to achieve a finish of the kind found on Star Wars vehicles with just a brush and rattle can paint, though I suppose it's possible! It is also very handy to have some of the purpose made weathering washes available, though I simply used the same acrylic I was using otherwise, thinned down substantially. In addition to the paint, supplies such as brushes, paper towels, and cotton swabs, are useful for spreading and lightening the application of weathering. So, with an outline of the steps and materials out of the way, let's get to building!

Materials:

1. A rocket kit (in this case the Apogee Wayfarer)
2. Medium CyA Adhesive

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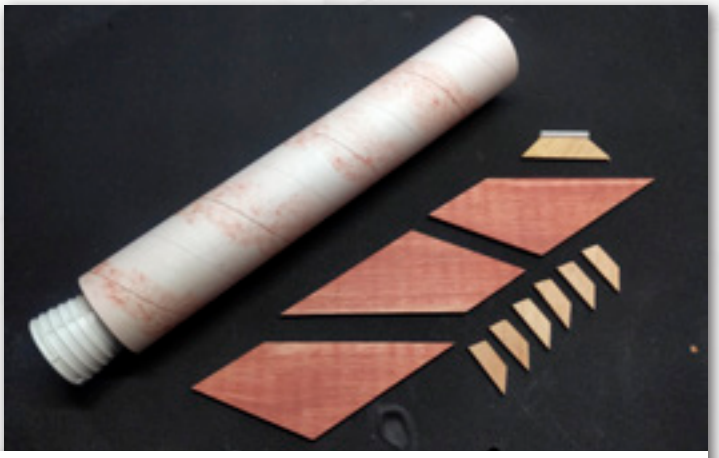
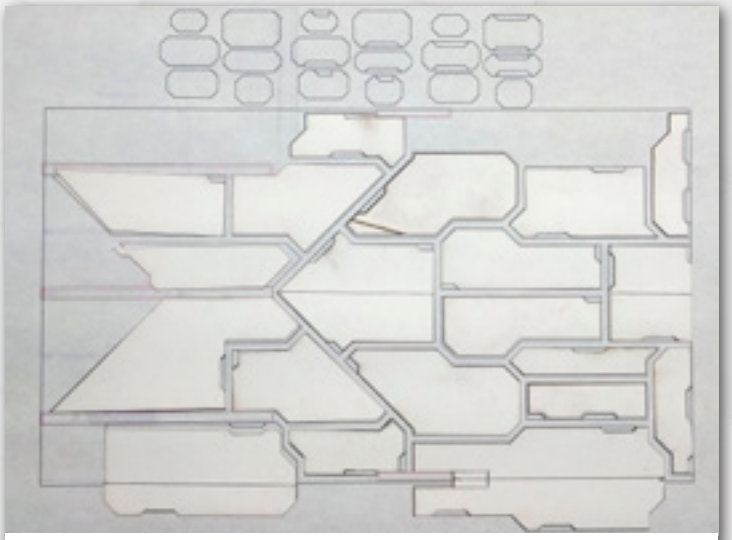
3. Bristol Board
4. Assorted small parts, dowels, etc. (Greeblies)
5. Primer
6. Paint for brushing and airbrushing
7. Weathering washes (or thinner for the available paints)
8. Paint brushes (of various sizes)
9. Cotton Swabs



The assembled body tube, fins, and subfins – sealed and filled.

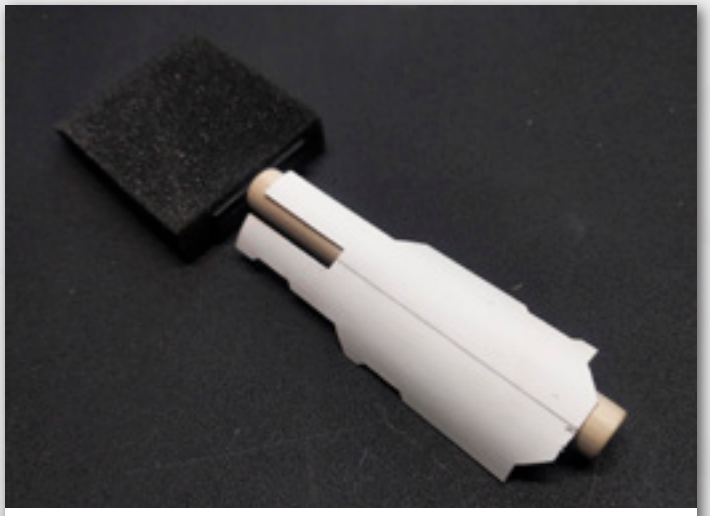
I started with assembling most of the rocket except for installing the fins and the launch lug. As the Space Shuttle kit I was working from had the large RS-25 (Space Shuttle Main Engine) bells and they fit the AT-41.5 (BT-60) tube of the Wayfarer so well, I decided early that I would use one of the bells as the engine of my design and glued it into place with medium CyA adhesive after trimming the part so that the motor mount tube would fit through. I then filled the tube spirals and fins with automotive spot putty, and mounted the launch lug on a standoff as I intended a modification of the nose cone that would impede the launch rod in the stock position.



The main panels laser cut and arranged in preparation for application.

Panels on the top and bottom of the body installed to make alignment of the rest easier.

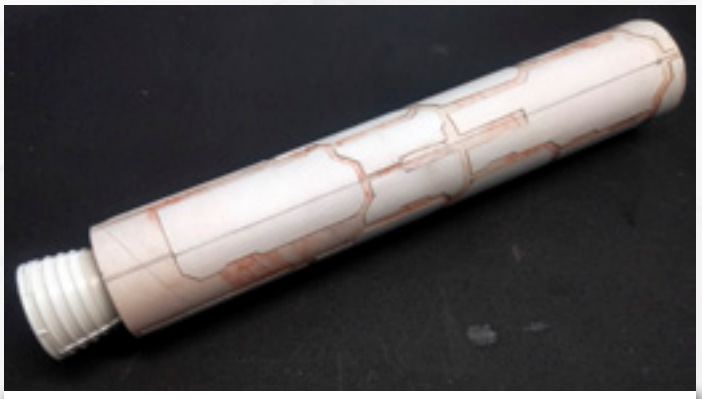
I prepared the pattern of panels on the main body on the computer and laser cut them out of Bristol Board. To ensure correct panel alignment, I marked the body tube with the positions of the fins, launch lug and a line (opposite the launch lug) down the back. Next, I installed the panels that straddled the top and bottom of the tube.



Shape the body panels around a dowel or other round object before installation to prevent the panels from lifting.

The panels are easy to install using medium CyA adhesive once they are pre-formed. To pre-form

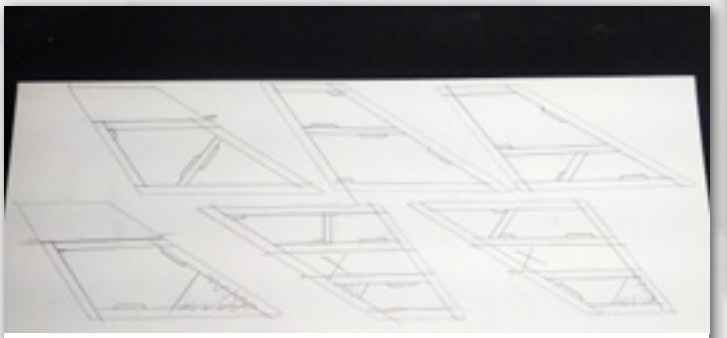
the panels, they can simply be rounded using a dowel or - as I did - the handle of a paint brush. I prefer using CyA adhesive for installing the panels over something like wood glue because it is a much faster process. Wood glue will cause the Bristol Board to curl and lift off the tube and thus requires you to hold each piece in place much longer. On the other hand, the final bond that wood glue provides will be even stronger than the CyA, so either type of adhesive could reasonably be used. I continued applying panels until



All of the main panels installed on the body.

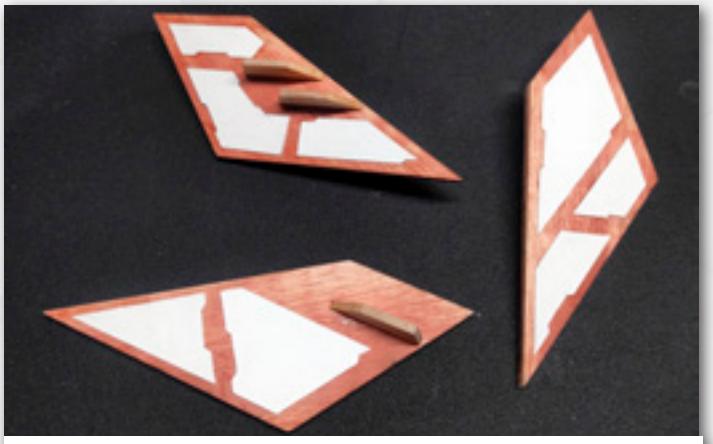
all the body panels were in place. The goal of the panels is to provide a generally uniform base of texture for the surface of the model. As such, much of the model should be covered in panels. Ideally though the panels should be of varying sizes and include cutouts, notches, and interesting corners so that there is variety in the surface.

While I designed the body panels on the computer, I designed the fin panels by hand on paper after simply tracing the fin outline. There is really no reason that any of this design needs to be done on a computer… or even planned ahead. I did so on the body to expedite cutting the panels out, but the tradeoff is that working on a computer makes it very easy to end up with an overly symmetrical



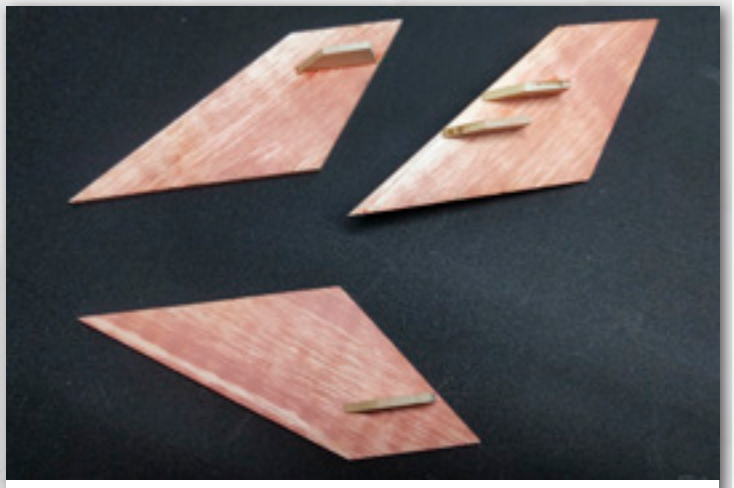
The fins were traced onto Bristol board and then sectioned by hand before being cut out.

and uniform design. The randomness of working by hand and one panel at a time is actually advantageous for this type of modeling. The same can be said of doing Steampunk decoration, like used on the Apogee Flying Machine (https://www.apogeerockets.com/Rocket-Kits/Skill-Level-4-Model-Rocket-Kits/Flying-Machine)



Fins with the addition of the panels.

Prior to applying panels to the fins, I added the first of the greeblies in the form of subfins (parts which were taken from some failed laser cuts of Antares Explorer kits). These subfins provided for some amount of asymmetry to design the panels around and then designing and cutting the panels out, I added even more. As with the body, the panels are applied using medium CyA



The fins with the subfins (first real Greeblies) installed.

adhesive to hold them in place. The result, like with the body, is a generally uniform distribution of

surface detail. At this point, there should not be any areas of the design that stand out. Such highlights come later. These panels are simply providing a base that provides a sense of scale to the rocket.

Once the rocket has been covered with a first – overall – layer of panels, the next step is to apply a second layer of panels. This is done in exactly the same way as before – pre-shaping the panel and gluing in place – but as an additional layer on the already applied panels. The purpose of this second set of panels is to begin to form specific points of interest on the model. The panels should

A random selection of panels that can be applied to the model.

be of random shapes and sizes and distributed unevenly across the surface so that different areas catch the eye of the viewer and inspire them to look from one place to another. Since I was laser cutting the majority of the panels on the body anyway, I simply cut a whole stack of potential small panels to choose from. The advantage with this is that I was able to "play" with different panels very easily by simply pulling them out of the pile and placing them on the rocket then taking a small step back to view the effect.

Some secondary panels applied to the surface of the model.

Don't get caught up in getting the panels right the first time and simply try different options until they work. Also keep in mind that this is very early in the development of the "look" of the model. There will be more surface detail and all the finishing steps, so nothing has to be perfect now. In fact, an out of place panel can tell a story. Perhaps the panel is a repair to the ship and it should be cleaner and "newer" than the panels around it. Or, perhaps the panel hides a modification and has a totally different paint job than the remainder of the ship. These are the little details that make the ILM "look" feel so authentically realistic. After placing all the secondary panels, I had a ship that was certainly beginning to take shape.

The model with the fins mounted and some small Greeblies attached.

Having installed the panels, I also had some ideas as to where I wanted large greeblies placed (beyond the blasters I knew I wanted on the wing tips!), it was time to do the final assembly of the rocket. The fins were glued into place using wood glue and standard fillets were applied. Despite the extra weight that the ILM treatment is going to add to the rocket, there's no particular reason that this rocket cannot be flown so it makes sense to continue treating it as one would any other model rocket. I also began cutting out small sections of the body tube that would contain details that sit below the surface. I also marked the approximate location for some dowels to be attached. All that needs to be done before the model receives its finish is to apply any remaining greeblies. And this is where things really get fun. Just as I had with the secondary panels, I had a nicely sized pile of greeblies that I could choose from. Most of the greeblies were 3D printed, some were dowels I had lying

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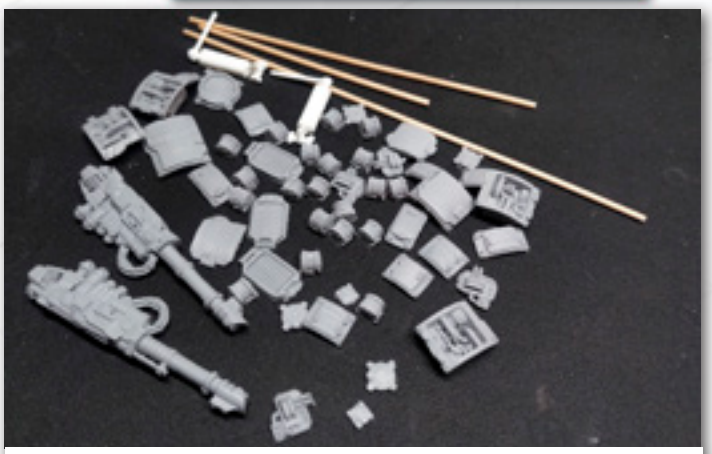


A bunch of different Greebles that can be attached to the model.

around, and a few were from the same Space Shuttle kit that had donated the engine bell. This is where it becomes important to really break the symmetry of the design and push the non-uniformity of the distribution. Some areas should have fairly dense surface detail while other areas remain generally open. Remember, there is no correct way to do this. It is an artistic pursuit, and entirely up to your aesthetic predispositions. I did find, however, that keeping some thought of what different details "did" within the world of the model was helpful to applying them in a manner that felt consistent and rational.

The model – ready for finishing – with all the desired Greebles and the modified nose cone installed.

At this point, the base details are applied and the model is ready for finishing. Since the plan was for this rocket to be photographed with a strong backlight and composited ("photoshopped") into a high contrast scene, I knew that my finishing job would need to be high contrast as well or it would get lost. For a desk model in normal room lighting, the weathering could easily be more subtle. Again, this is a place where preferences are king. Finish the model in a way that works for you. The first step of finishing is to put a primer coat on the model. Adam Savage has commented that this is the "magical step", and I can't disagree. Before

After a coat of primer, the model ends up looking much more unified and intentional.

priming, it is easy to believe that the model is going to be a complete disaster. It's covered in a bunch of random pieces, in different colors and textures, with discordant levels of detail and (likely) many small mistakes along the way. A simple coat of primer unifies everything we've done to this point and makes it feel much more purposeful (it's worth noting that I actually used both gray and silver primers in this step rather than a single uniform color). Indeed, if you have been worried about how things are progressing, now is a good time to sit back and marvel at the work you have done. It's going to work out.

A white coat of paint provides a base for all of the finishing steps to follow.

After primer, the rocket should be painted in a base coat of paint. I used white paint, as I was going for a Rebel forces inspired paint scheme (Red Squad, in fact). Since I was already intending some areas to be painted silver (the wing mounted blasters and the engine nozzle, in particular) I did not apply a solid coat of

paint to those areas and simply left them in the silver primer I had already used. I did not mask these areas either as there would be plenty of time to sharpen paint lines later. This is honestly one of the very best parts of the weathered ILM-style finishes as it is unnecessary to be overly precise about getting a perfectly uniform, glossy, and smooth coat of paint on the rocket. It should be noted that it was around this point that I realized that the "antennas" I had on the rocket were a terrible idea for a flying model rocket. The little plastic antennas were guaranteed to break on the very first flight so I replaced them with music wire. With a traditional "glossy car" rocket paint job, I would have had to start over on my finishing, but not so on this model! The non-uniformity in the finish was entirely appropriate. Up to this point, rattle-can spray paint would be perfectly usable. For most of the rest of the finishing, however, brushes and airbrushes become much more useful.

Once the basic paint has been applied, begin adding details. Some of the greeblies were painted with a dark metallic paint, then light metallic highlights were added on top of that. Other details like changing the color of some of the panels (I painted some of them a light gray) and adding different colors to make specific greeblies stand out again (I know, we just made them all uniform with primer!) were applied. These base details are the first step to creating a feeling of utility in the model. Different parts are made of different materials and they exist for different purposes. It is beneficial to highlight those differences as a way to make the model feel more realistic.

Some of the Greebles are going to end up metallic, so a dark metallic base color is applied.

The next major addition is adding any insignia or other markings that may be desired to the surface. I added mine (in yellow and red as per the Rebel Red Squadron) by quickly masking the model and airbrushing them into place. As has been mentioned before, do not become overly precise with applying these markings. Such markings are often hand painted or painted with stencils on full-scale vehicles so they are never perfect. As such, a little bit of overspray

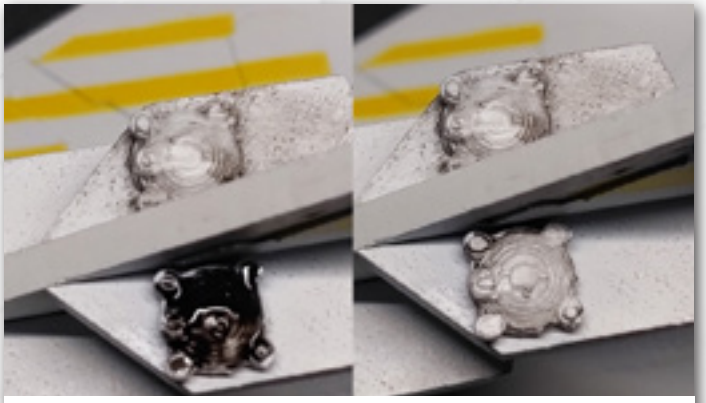
Once the base color, metallic details, and markings are complete, the model is covered with a gloss clear coat to protect the paint during the weathering step.

or a slight wobble in a line won't cause any trouble. Continue adding detail with highlights, markings, and so forth to complete a reasonable approximation of the sort of paint scheme the vehicle would have had when "new". Once that is complete and has been given a chance to dry entirely, spray the model with a gloss protective clear coat. The clear coat should ideally be of a different "type" to the paints being used. As I was working with acrylic paints, I sprayed on a solvent-based (lacquer) clear coat. The purpose behind spraying a clear coat that uses different solvents is to allow working with wet layers on top of the paint that is already there without potential to lift them. Gloss clear in this step is important as the slick surface makes it much easier to move the weathering around without staining the underlying surface unnecessarily.

The final step – and the one that gives the most life to the final model – is weathering. There are a few methods that were used to weather this particular model. I applied dark washes (both black and dark brown) to highlight edges and recessed details, I added bright metallic areas for paint chipping, and I also applied airbrushed "dirt" across large portions of the model. The methods that I used are the merest tip of a very large iceberg when it comes to modeling techniques in the area of weathering. A few interesting videos that demonstrate a great cross section of techniques are included in the references to this article ([4], [5], and [6]). Weathering is "easy" in that anyone can get started and if you applied the clear coat as suggested in the last step, much of the weathering can be removed… if it all goes horribly wrong. There is no need to fear this part.

A basic weathering

technique uses the application and subsequent removal of washes which are essentially just paint that has been thinned to the point that it resembles water. Washes are applied heavily and then wiped back off to leave paint only in the corners and deep details. Modeling suppliers



A heavy wet application of the weathering wash can be simply wiped off to leave weathering in the cracks and edges of the model.

sell ready to use washes, but I simply used the same acrylic airbrush paints that I had been using and diluted them around 50:50 with thinner. Apply a heavy coat of the wash to the area to be weathered, then use a cotton swab, paper towel, or tissue to remove most of the paint. What remains in the crevices will add substantial depth and interest to the surface. Continue applying the wash to surfaces, corners, edges, etc. As seen in some of the videos, it is possible to basically flood the entire surface of the model with the wash and wipe off the majority. This can be a messy step, but it doesn't have to be difficult. And remember, the wash can still mostly be pulled off again with a cotton swab and a bit of water.

Colored washes were applied to the engine bell to simulate the effects of heat.

I added further detail by painting colored washes on the engine bell to simulate heat treating in the metal due to differential heating, and I also added some large

Silver paint added to simulate areas that have lost their paint.

areas of "missing" paint to simulate paint chipping. Since I was rather tight on time (May the Fourth was approaching!), I didn't add quite as much detail as I might have otherwise, but the ultimate goal is to ensure that each part on the model appears to belong. Sometimes that requires only being covered in a color that visually unifies it with its surroundings. At other times though, it is actually important to make a part stand out. So keep pushing the detail back and forth until the overall look of the model approaches your vision.

Many people will apply overall dirt in the wash pass above. I chose to separate that out into its own pass and I did it with an airbrush. This gives additional control, but it's very much a question of personal preference which approach is better. Spray the "dirt" onto the surface in a pattern that approximates where dirt might naturally sit. Target low sections, the bottom of the ship, around the edges of chipping paint, and behind panels (that is, on the "back" edges of panels). Work until the surface of the model looks as worn and "beaten" as desired then allow the model to dry and apply a final matte clear coat to protect the paint.

My goal with this article was not to make anyone a master modeler. Rather, I have been writing in the hope that others might be inspired (as I was) to try something outside their normal rocketry endeavors, just for the fun of it. No matter how seriously we take our hobbies, they are hopefully – if nothing else – fun. Building and painting the Rebel Wayfarer was a process of learning and the result was a rocket that can be flown or sit proudly for display. I learned about applying the panels, the source of the term Greeblies, the development of the Star Wars look, some new weathering techniques, and increased my skill with an airbrush. The project also gave us

here at Apogee the ability (with the addition of some computer magic) to post some silly Star Wars Day content to our social media stream. A successful project all around… and one that I hope more people tackle at least once.

Combined with a digitally rendered starfield and laser blaster shots, the model seems in its element.

About the Author:

Martin has been designing and building rockets for as long as he can remember. After originally toying with the idea of pursuing a career in Aerospace Engineering, he did a double major in Computer Science and Fine Art then spent a decade working in K-12 math and science education. Only recently did he land at Apogee Components as the Product Designer.

Martin Jay Mckee

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