FineScale Modeler MAGAZINE

Tips and techniques for creating better models

LIGHTING STAR TREK MODELS

Illuminate the
• Klingon Cruiser • Voyger • Klingon Bird of Prey

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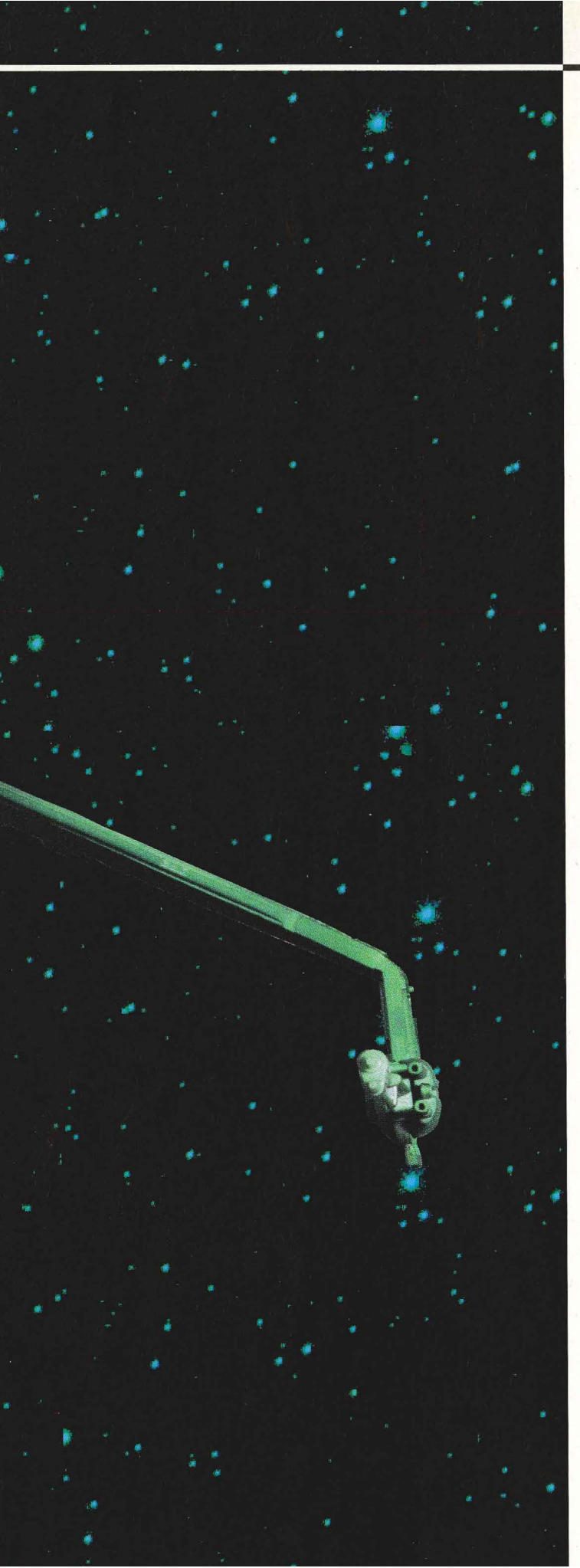
Lighting the Bird of Prey

Illuminate AMT/Ertl's *Star Trek* Klingon cruiser with LEDs, LightSheet, and fiber optics

Story and photos by Michael T. Jones



The menacing Klingon Bird of Prey makes its first appearance in *Star Trek III: The Search for Spock*. Following its dramatic introduction, the ship has appeared in several of the subsequent *Star Trek* films, as well as episodes of *Star Trek: The Next Generation*. It's by far one of the most popular starship designs in the *Star Trek* universe, and AMT/Ertl's version (kit No. 8320DO) is 1/650 scale, so it's right at home next to the company's *Enterprise* kit.

I decided to light my model after discovering the kit's clear engine unit and photon torpedo emitter. I knew I could light them with light-emitting diodes (LEDs) and LightSheet, both of which would require little battery power.

LightSheet is a thin, flexible plastic sheet coated with a layer of phosphor that glows like neon. It generates no perceptible heat, can be cut to any size or shape, and has a long life. I've used LightSheet on several starship models because of its neon-like properties – the starships look remarkably like the studio filming models.

The plan. As with any model you modify, planning is an essential first step. I decided to use LEDs to simulate the rotating light effect seen in the photon torpedo tube. I also wanted to add constant LEDs to represent the running lights on the upper and lower hull. For the spotlights on each wing, I'd use fiber optic strands illuminated by incandescent bulbs with lenses hidden inside the model.

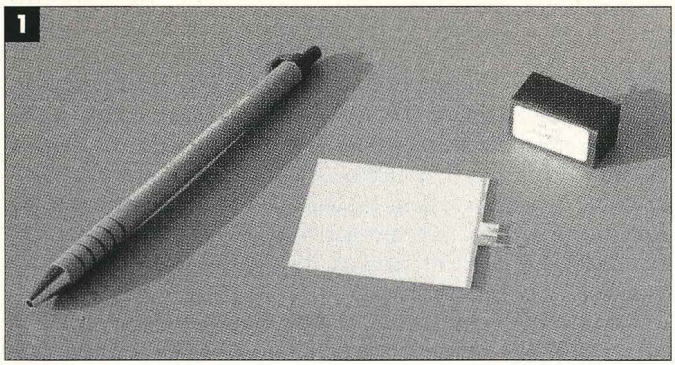
I knew I'd need a circuit board to drive the LEDs, and that the LightSheet would require a Lightdrive module – the module is a power inverter that converts the battery-supplied input voltage (usually 3-6 volts) to the 50- to 250-volt range that's required to illuminate the LightSheet. The Lightdrive module is small (approximately 1¼" x ⅝" x ⅝"), and I knew I could mount it inside the model along with the LED circuit board, **1**. I'd power the model with four AA batteries hidden in the display stand, and I'd route the power into the model through a 2.5mm headphone jack.

Modifications. The lighting system requires only minor modifications to the model. First, I opened up rectangles on the port and starboard hull panels (parts 9 and 10). To make room for the LED running lights, I drilled a 1/16" hole through the upper and lower hulls at the running light locations, then thinned the plastic from the inside. I also removed the engine unit's locating ridge at the rear of the upper and lower hull halves. To keep light from bleeding from inside the model, I painted the inside surfaces of the parts flat black, then followed that with a coat of silver, **2**.

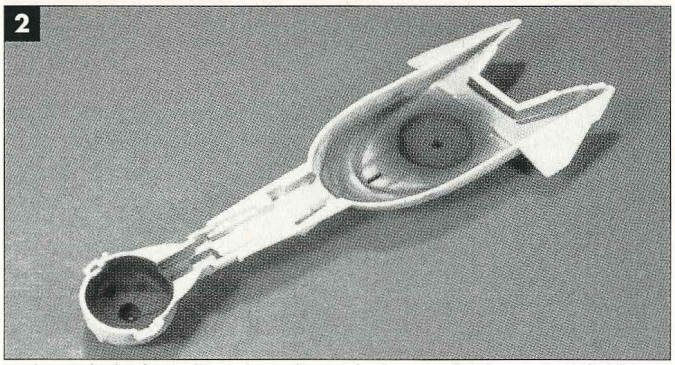
The photon emitter housing attached to the rear of the forward bulkhead is a round metal sleeve that was part of an old ballpoint pen I disassembled, **3**. The sleeve would house the torpedo LEDs.

LEDs. I soldered wires to each of the model's LEDs and used a heat sink at every joint to protect the delicate diodes. Always attach more wire than you can use; you can trim off the excess later. I use heat-shrink tubing to insulate the leads and wire, **4**. I used two rectangular red LEDs for the port and starboard hull panels and three yellow 1.6mm subminiature LEDs for the upper and lower hull running lights. To model the photon torpedo emitter, I arranged five 2mm subminiature LEDs in the

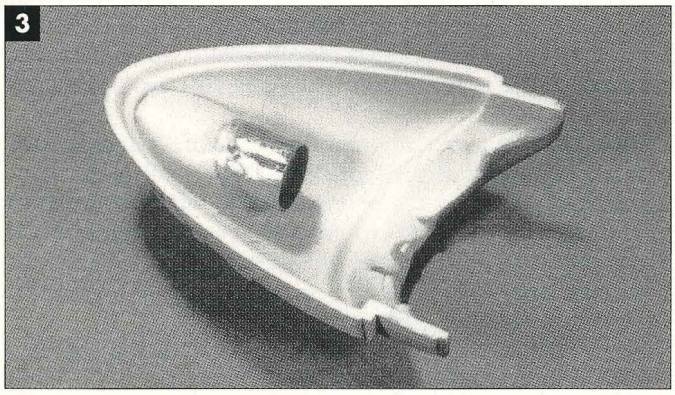
Red alert! Michael's Klingon Bird of Prey looks ready for a fight with its realistic lighting system glowing menacingly.



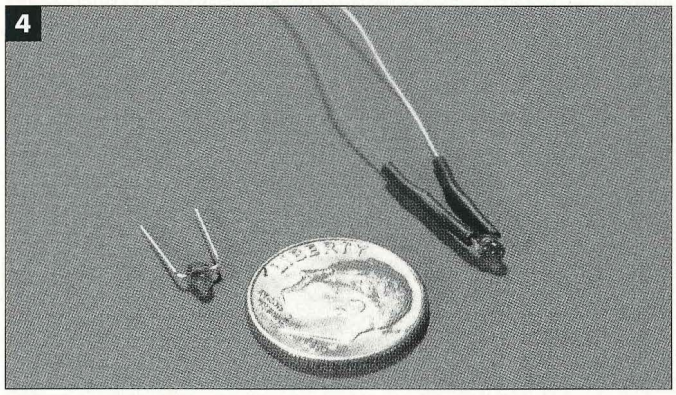
LightSheet is thin, flexible, and glows like neon. Its Lightdrive module (right) is small enough to hide inside the model.



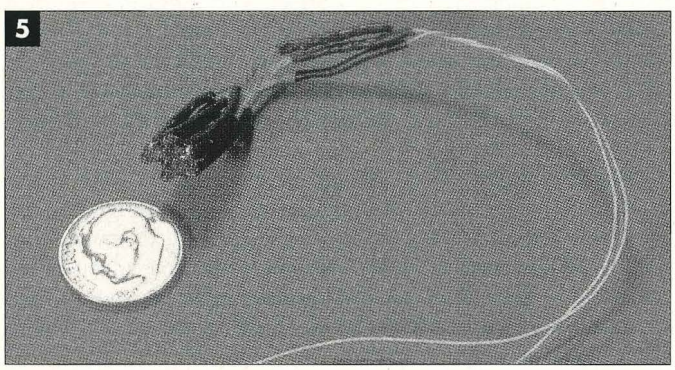
To keep light from bleeding through the model from the inside, Michael painted the inside surfaces of the parts flat black, then followed that with a coat of silver paint.



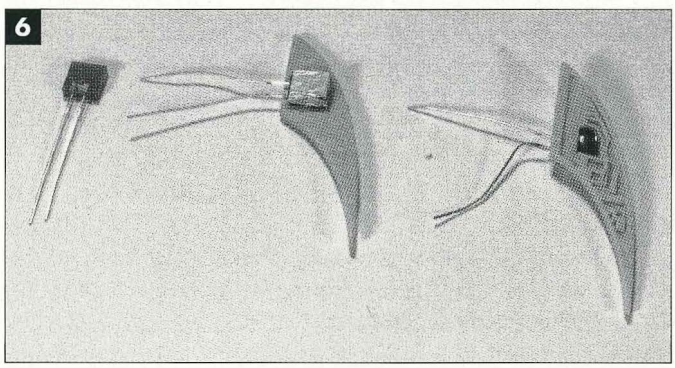
An old ball-point pen provided the metal tubing for the model's photon-torpedo emitter.



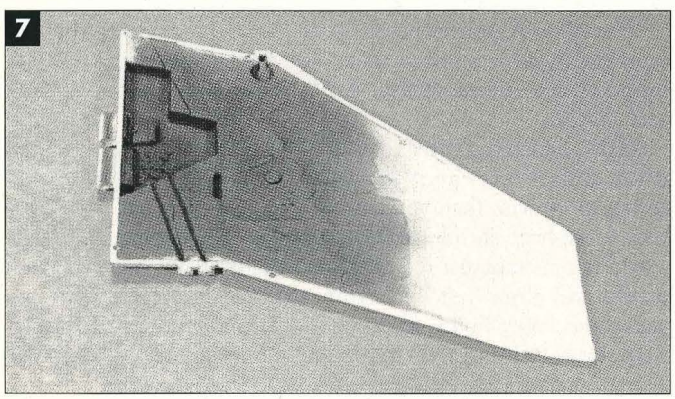
The electrical system's connections were insulated with heat-shrink tubing. It's a great way to prevent short circuits.



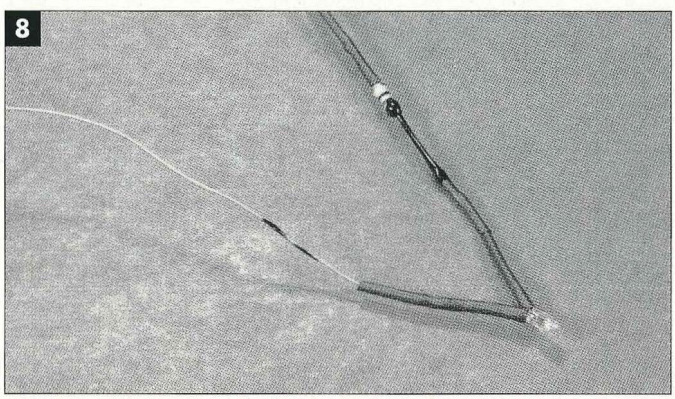
A bundle of five red LEDs simulates the Bird of Prey's photon torpedo emitter.



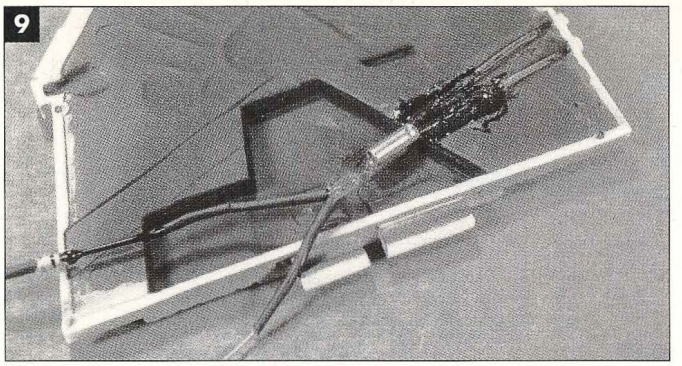
Aluminum foil acts as a reflector and improves the light output of the LEDs inside the model.



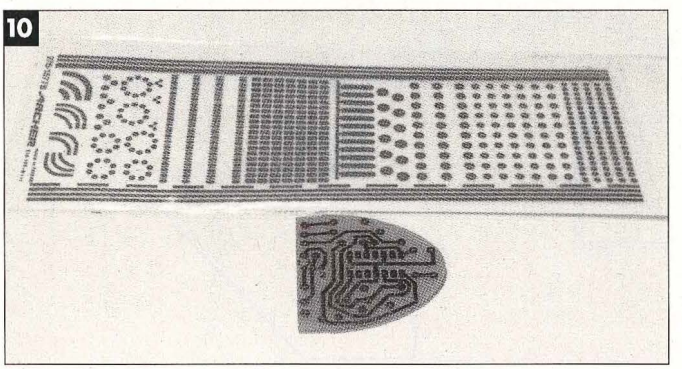
Fiber-optic strands help route light from the incandescent bulbs through the model's thin wings.



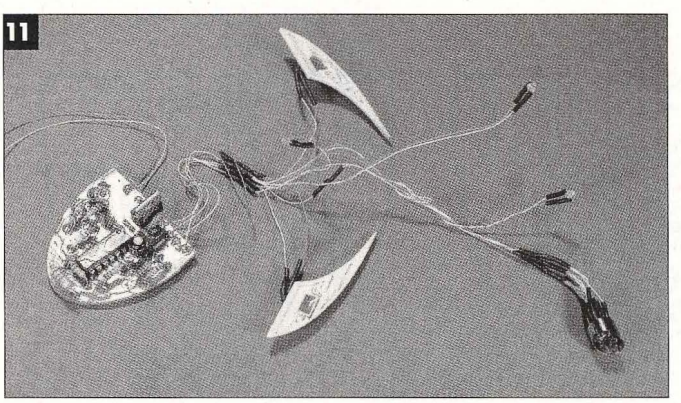
A 5-volt bulb hidden inside the model illuminates all the fiber-optic strands.



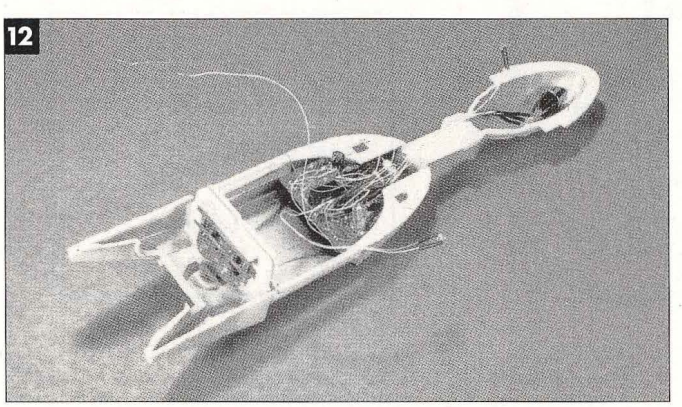
The fiber-optic strands and 5-volt light come together inside a short length of aluminum tubing.



Michael worked out the electronic circuit paths, then transferred that pattern to the circuit board's copper cladding using direct-etching dry transfers.



After installing all the circuit-board components, Michael tested things carefully before installing the board in the model.



The completed circuit board was glued in place in the front of the upper hull.

form of a cross and epoxied them together, **5**.

With all the LED wires soldered and insulated, I could begin installing them inside the model. I glued the red LEDs over the holes I made in parts 9 and 10 using epoxy. Turned sideways, the LEDs cover the holes nicely.

The yellow LEDs weren't quite tall enough to protrude through the holes I'd drilled in the model, so after I glued them in place, I put small drops of epoxy on each LED to form a "lens" and build up its height.

After all the LEDs were epoxied in place, I covered them with aluminum foil from the inside. The foil acts as a reflector and improves the light output, **6**. The foil can cause a short-circuit, though, so make sure your connections are well insulated before adding the foil. Test all the LEDs frequently during assembly to make sure you don't have any broken connections.

Wing illumination. To fit the .040" fiber-optic strands through the wings, I drilled holes in the front of the bottom half of each wing and cut two grooves to the inside of the model. Careful test-fitting during this process is key. After I was satisfied with the modification, I painted the inside surfaces flat black, then silver, **7**, as I did inside the main hull.

The fiber-optic strands would be illuminated by a 5-volt bulb with a lens hidden inside the model. I soldered a 51-ohm resistor to the bulb, then insulated all the connections with heat-shrink tubing, **8**.

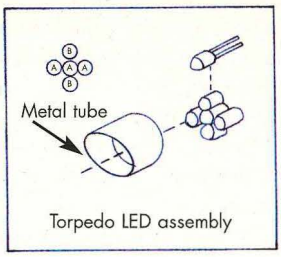
I epoxied the fiber-optic strands into the wing grooves then gathered the other ends inside a ½" length of aluminum tubing. I installed the bulb into the other end of the tube, **9**, and powered up the light to check each fiber-optic strand for output. I routed the wires to the inboard edges of the wings, then finished building the wings as the instructions indicate.

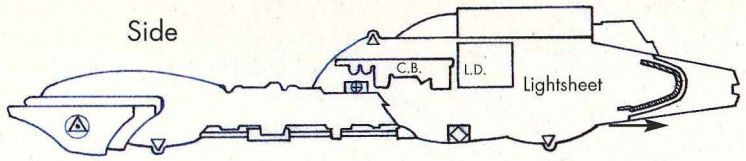
The printed circuit board. Making a custom circuit board starts with a blank board; it's coated with a thin cladding of copper on at least one side. I worked out the circuit paths, then transferred that pattern to the copper cladding using direct-etching dry transfers, **10**. Since the board needed to fit into a relatively small area within the model, I used a double-sided board to fit everything onto it. When I finished applying all the dry transfers to the first side of the board, I drilled out all of the component mounting holes, then flipped the board over and used the holes as guides to lay out the other side of the board with the dry transfers.

When I was satisfied with the layout of the conductors, I was ready to etch the copper with a liquid etching solution. I placed the board in a shallow nonmetallic tray and poured in enough solution to cover the board. I rocked the tray gently for about 20 minutes. This process removed all the exposed copper from the circuit board, leaving only the paths that are underneath the dry transfers.

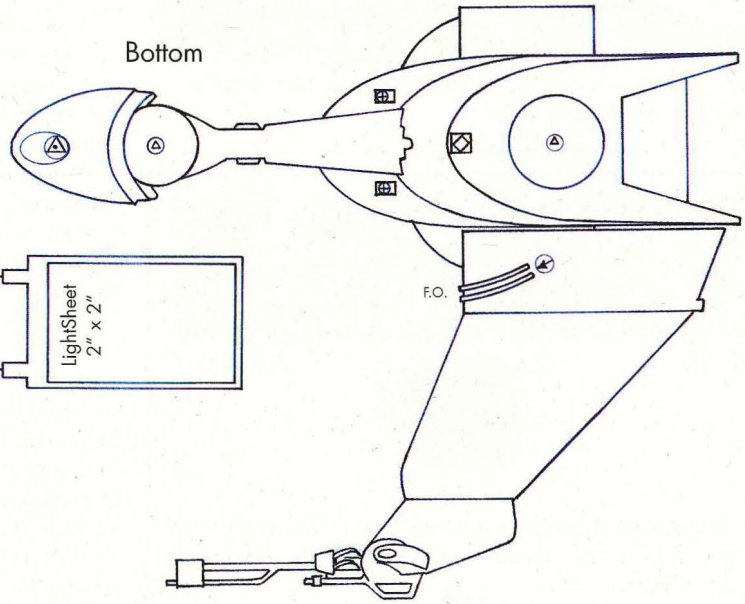
The solution needs to be handled carefully; wear rubber gloves and eye protection when you're working with it. I removed the etched board from the solution and washed it under running water for at least 10 minutes to stop the etching process. I removed the dry transfers with nail-polish remover, then polished the board with a plastic kitchen scouring pad.

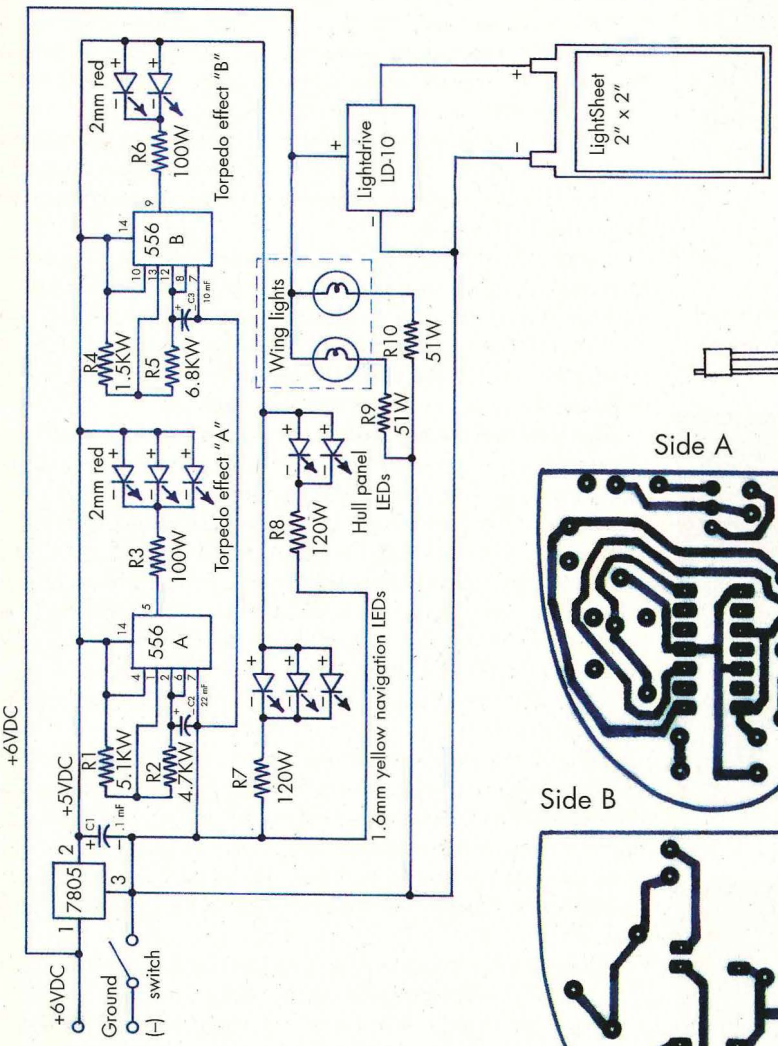
I soldered all of the electronic components into place on the board, using a heat sink whenever possible to protect them. Make sure you orient the timer chips properly before soldering them in place. I attached all the LED wires to the board, then installed the input voltage wires. Now is the best time to apply power to the circuit board and test things – if the LEDs fail to illuminate, recheck all of your connections, **11**.





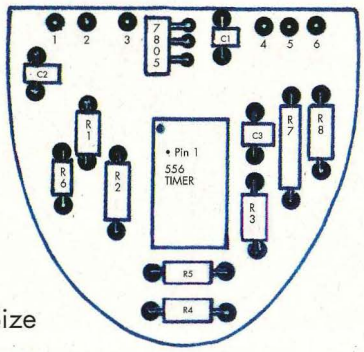
△ – 1.6mm yellow LED
◬ – 2mm red LED torpedo bundle
⊕ – Rectangular red LED
◇ – 2.5mm female jack
↙ – Incandescent lamp
F.O. – Fiber optic strands
C.B. – Circuit board
L.D. – Lightdrive module





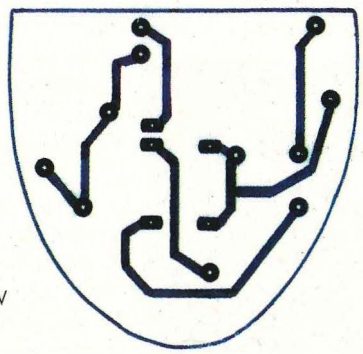
Component mounting
Side A only

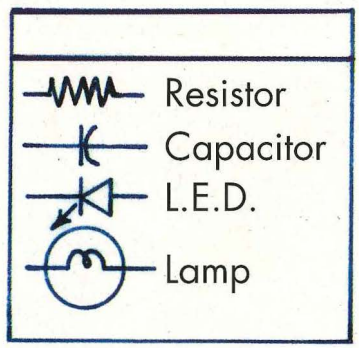
Side A



Actual Size

Side B

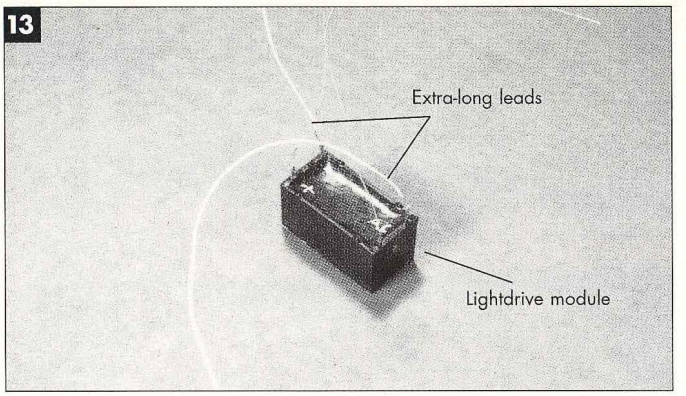




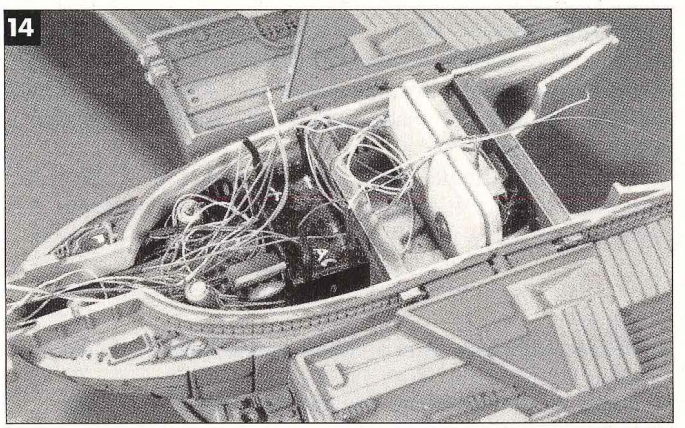
Parts list
- 1.6mm yellow LED
- .2mm red LED
- Rectangular red LED
- 556 dual timer
- 7805 voltage regulator
- 10 and 15 mF electrolytic "radial" capacitor
- .1 mF ceramic disc capacitor
- ¼watt resistors: 51W, 100W, 120W, 1.5KW, 4.7KW, 5.1KW, 6.8KW

LightSheet Systems components
- 5VDC lensed microlight
- Lightdrive module LD-10
- LightSheet (2" x 2")

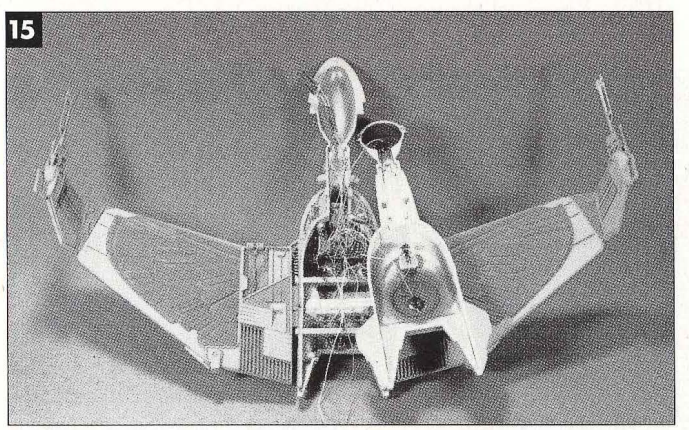
Connections
1 - Torpedo effect "B"
2 - Battery (-)
3 - Battery (+)
4 - Torpedo effect "A"
5 - Navigation lights (-)
6 - Hull panel lights (-)



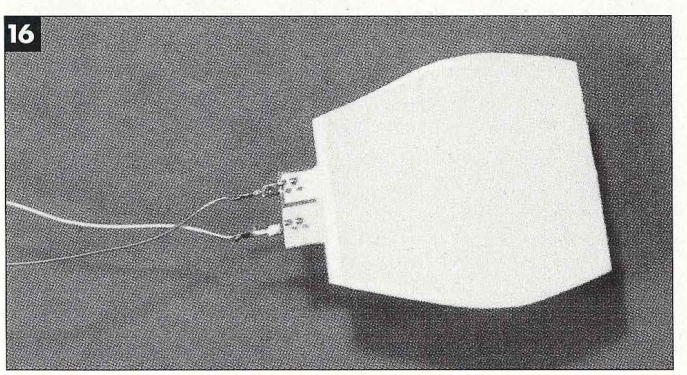
The LightSheet system's Lightdrive module with extra-long leads attached.



Michael epoxied the LightSheet system's Lightdrive module inside the model just behind the circuit board.



All the circuits were tested before they were closed up inside.



The LightSheet panel is thin and flexible, and it glows like neon.

With everything operating properly, I epoxied one yellow LED into the upper hull then glued the port and starboard hull panels to the fuselage panels. I installed the completed circuit board into the front of the upper hull, and glued the fuselage panels to the upper hull, **12**.

Painting. I painted the upper and lower hulls, as well as the wings and forward bulkhead using the kit instructions as a guide. After all the assemblies were dry, I routed the wires from the wings into the upper hull and glued the wings in place.

Lightdrive installation. I soldered extra-long leads to the LightSheet system's Lightdrive module then insulated the connections with heat-shrink tubing, **13**. I epoxied the module inside the model just behind the circuit board then routed the output wires to the rear of the model and out through the engine unit opening, **14**.

I epoxied the 2.5mm female headphone jack to the lower hull then soldered the all the power input wires to the jack. It was almost time to close up the model and hide all the wiring and circuits, so I tested everything thoroughly while I still had the chance to make adjustments, **15**.

I epoxied the two yellow LED running lights in place and routed the red LED bundle for the photon torpedo emitter out the front of the model. I glued the hull halves together, then touched up the seams and paint. After placing the photon torpedo LED bundle inside the tube on the forward bulkhead, I glued the forward bulkhead to the hull. I painted and assembled the remaining parts, and moved on to the engine unit.

Engine unit. To make a pattern for cutting the LightSheet, I placed a small piece of posterboard inside the engine unit and traced around it. When I was satisfied with the traced shape on the pattern, I placed it over the LightSheet panel and trimmed it with scissors. I sealed the cut edges of the LightSheet panel with electronics-grade RTV silicone sealant to protect the phosphor layer and insulate the exposed electrodes, **16**.

I masked the engine-unit areas that would be illuminated from inside and painted the framework flat black, then steel. After removing the mask, I cut strips of red and yellow translucent filter to fit inside and installed them using clear spray adhesive.

LightSheet is flexible, but it can be accidentally damaged during handling so I gently bent it to shape and installed it inside the engine unit using epoxy, **17**. I connected the LightSheet power lines and tested the circuit When I was satisfied everything was working properly, I glued the engine unit to the rear of the hull.

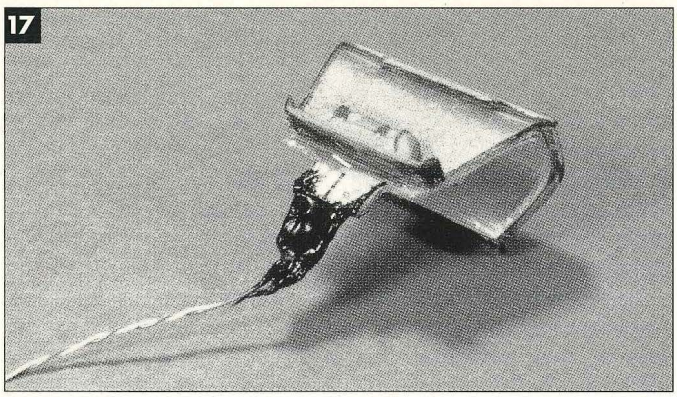
Base of operations. The in-flight Bird of Prey needed a means of support, so I bought an oval wooden plaque at a craft store. I picked one I could hollow out for the hidden batteries

Meet Michael T. Jones

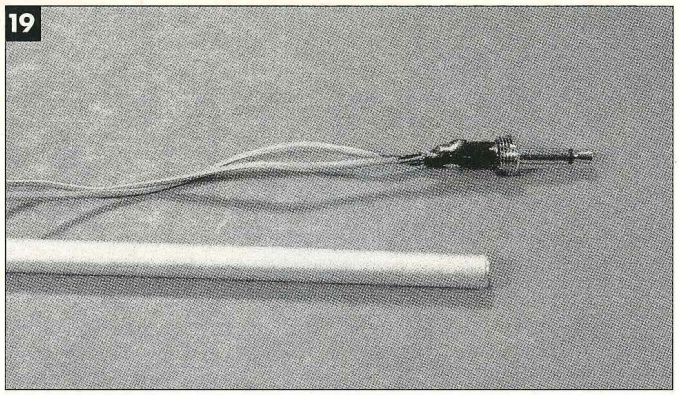
Michael T. Jones, a quality-control inspector for a heavy equipment manufacturer, lives in Dallas with his wife and two children.

Michael started modeling when he was 12, and although he's particularly interested in science-fiction and fantasy modeling, he also enjoys building 1/48 scale jets. In the last few years, he's been refining his scratchbuilding and lighting techniques.

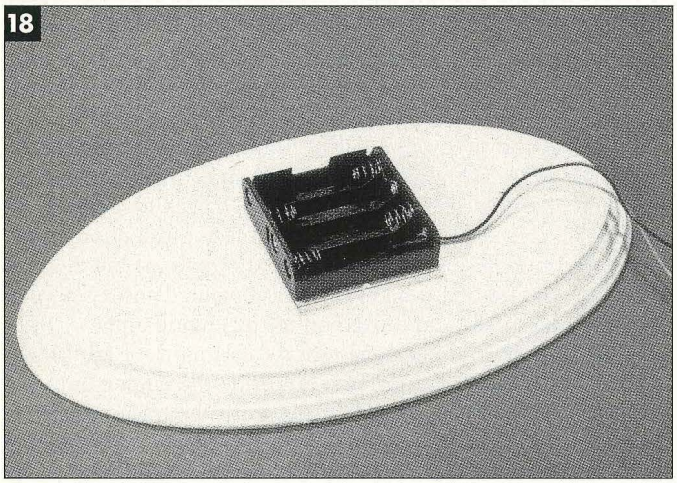
Michael's hobbies include painting and photography.



The LightSheet panel, wired and epoxied in place inside the model's engine unit.



A simple headphone jack routes the battery power from the display base to the model's electronic systems.



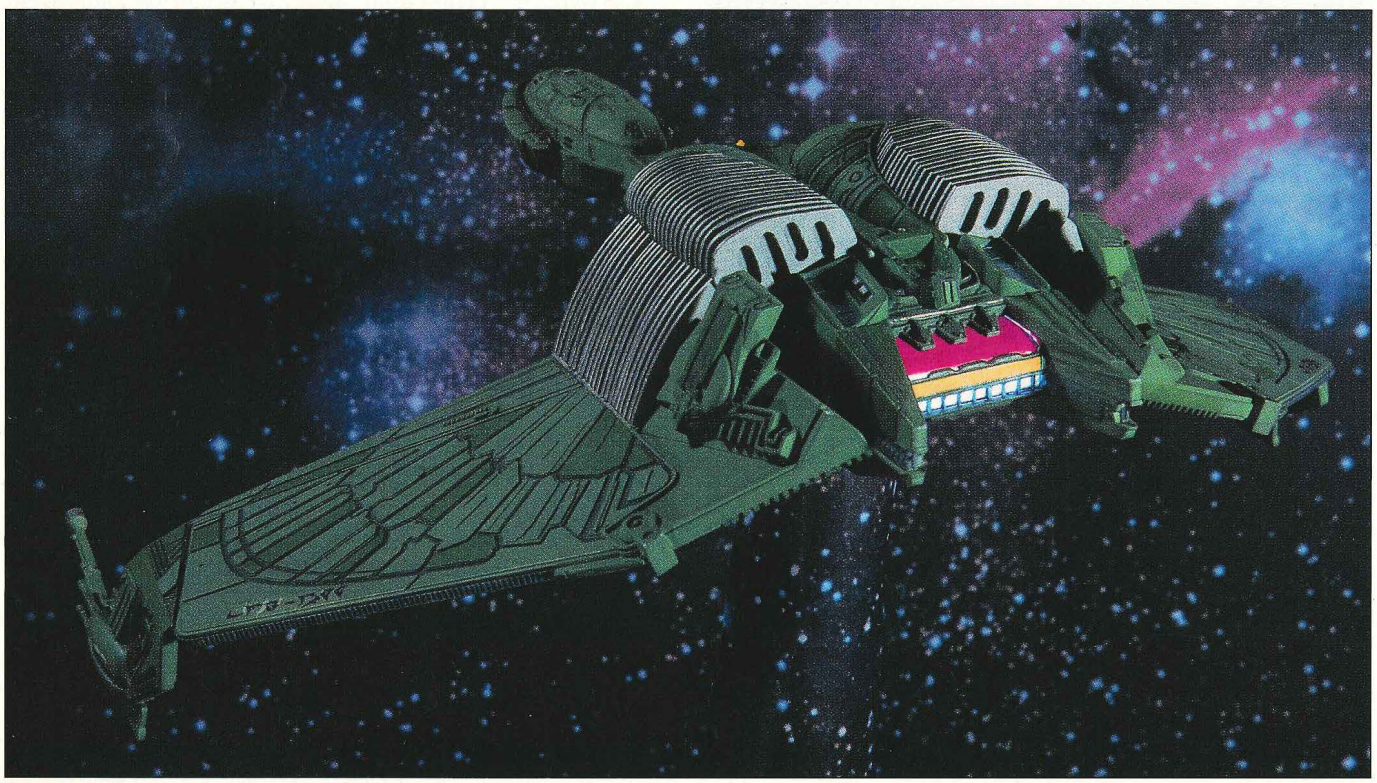
A trip to the craft store turned up the wooden base that supports the model and hides its AA battery power supply.

and a power switch, **18**. A 3/16" brass tube supports the model and provides a conduit for the wiring; the male end of the headphone jack is epoxied into the end of the tubing, **19**. I painted the tube support flat black, stained the base, and applied a polyurethane finish.

The finished model snaps into place on top of the base's brass-tube support. It's a good time to dim the house lights and power up the ready-for-action Klingon Bird of Prey! **FSM**

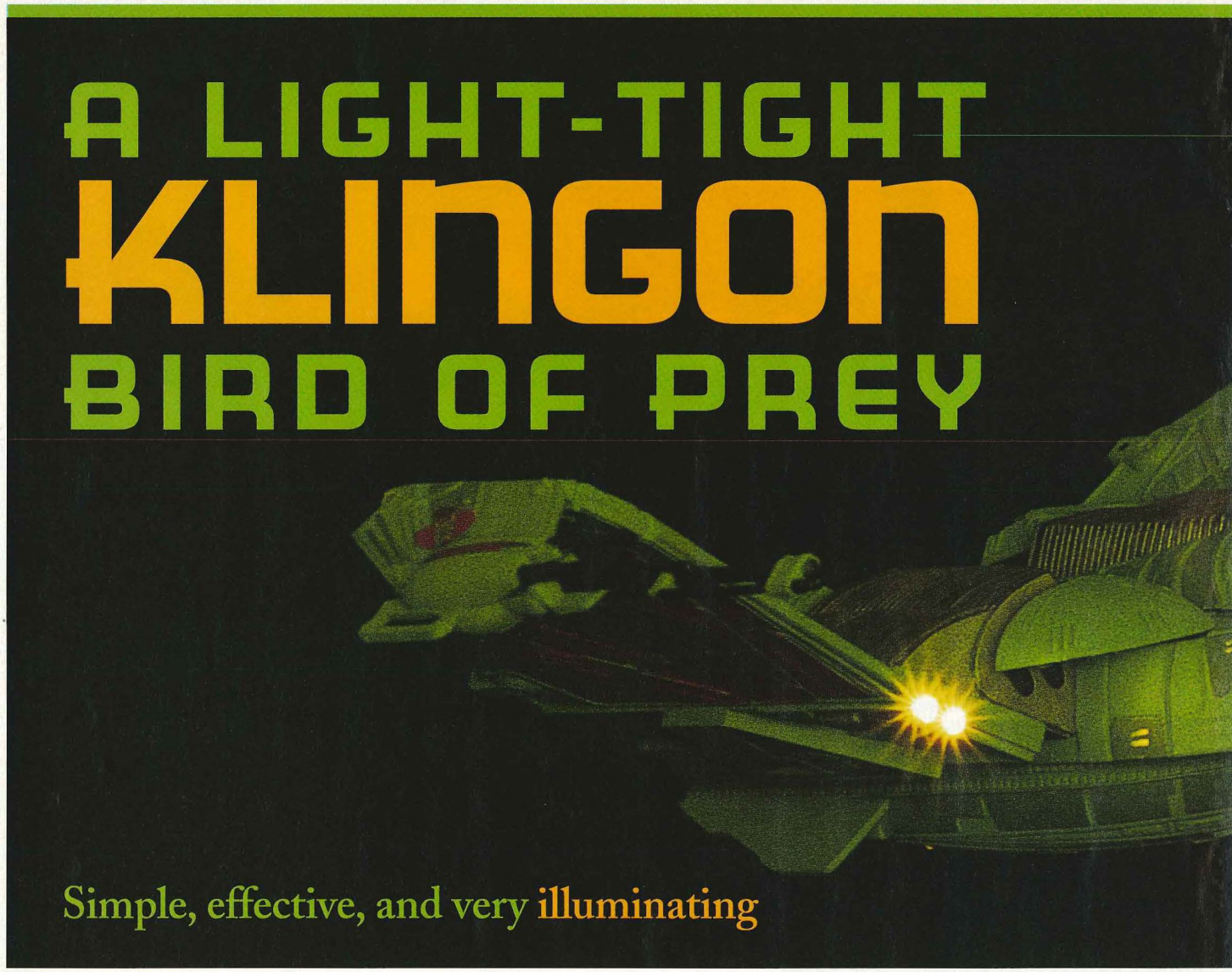
SOURCES

LightSheet, Lightdrive, and 5-volt miniature bulbs LightSheet Systems, 319 Dunstable Road, Nashua, NH 03062
PC board kit, direct-etching dry transfers, and RTV silicone sealant available at Radio Shack
Fiber-optic strand and color filters Edmund Scientific, 101 E. Gloucester Pike, Barrington, NJ 08007
LEDs and general electronic components All Electronics Corp., P.O. Box 567, Van Nuys, CA 91408



Introduced in *Star Trek III: The Search for Spock*, the Klingon Bird of Prey has become a popular mainstay of the Star Trek universe.

A LIGHT-TIGHT KLINGON BIRD OF PREY



Simple, effective, and very illuminating

By Scott Shirley

Show-quality lighted models create more interest than those that live in the shadows, and they can be made easily and inexpensively. Forget transformers, fluorescent tubes, and fiber optics. And you don't need to be an electrical engineer.

I'll walk you through construction and lighting of AMT/Ertl's "Star Trek" Klingon Bird of Prey, and I bet you'll get ideas for lighting many models, not just sci-fi subjects.

Preparation. You'll be lighting all the windows, torpedo-tube perimeter lights, landing lights, navigation lights, and engine. But before drilling any holes, glue the photon emitter housing to the forward bulkhead, then glue that assembly to the lower hull. Use ample glue to seal all seams. Then cut away most of the edge of the front of the lower hull on the inside.

For the windows in the hull, make starter holes with an .0325" bit in a small hand drill. Then carefully cut out the entire area with a new blade in your hobby knife. Do the same for the photon torpedo-tube perimeter lights and navigation lights, **1**.

Carve out the landing light holes in the wings with the knife. Part of the light bulb will be exposed; that's okay for now. Also cut a hole in the top wing for wiring the landing light later, **2**. Next, drill a 1/4" hole in the hull bottom for the base stem.

After cutting and drilling all these openings, wash and dry the parts thoroughly.

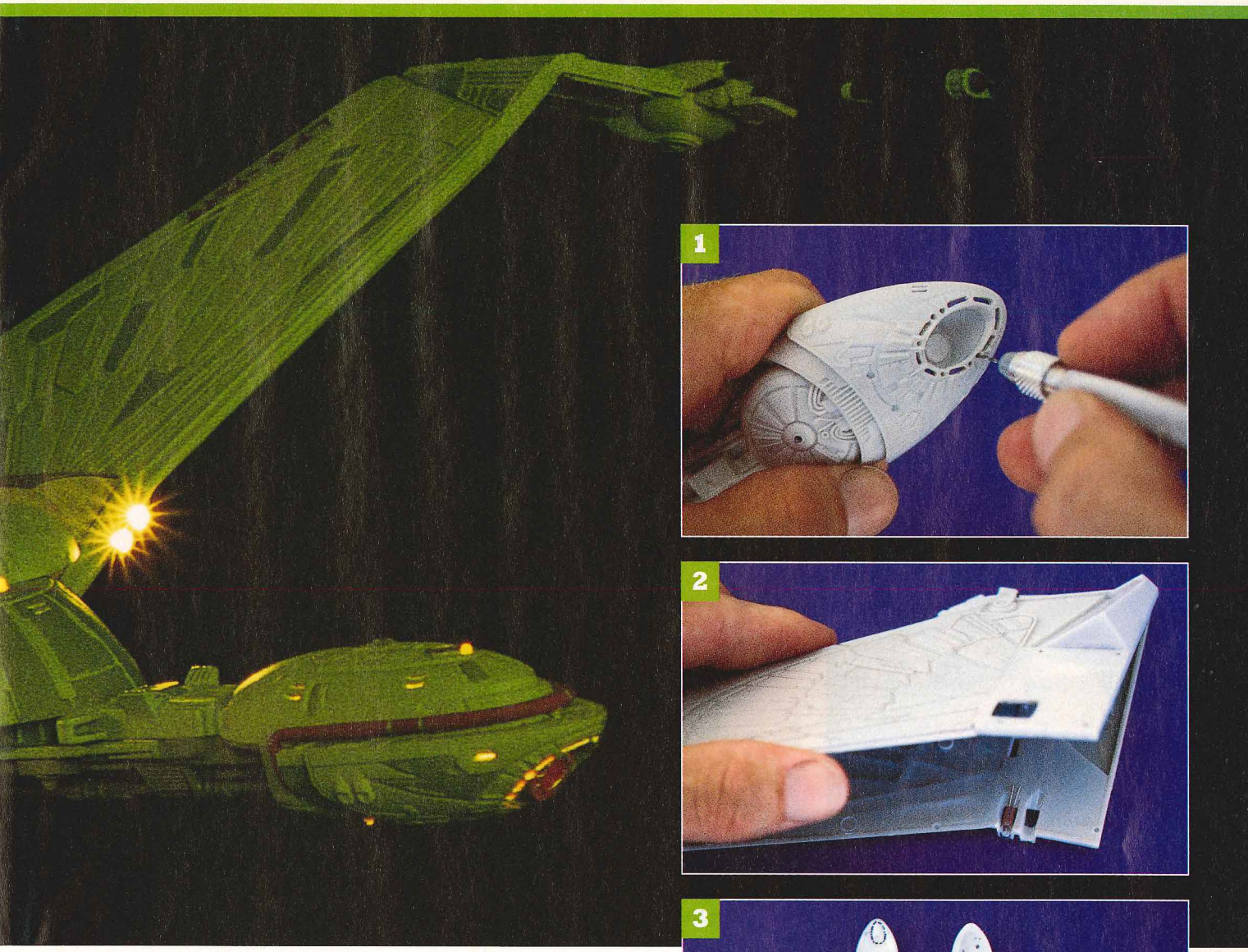
Light tight. The most important step in crafting a lighted model is to mask all the areas where you don't want light to leak through. Since all the windows, navigation lights, photon torpedo-tube lights, and engines will be illuminated with just two internal light bulbs and not dozens of fiber-optic strands, the ship must be made light tight.

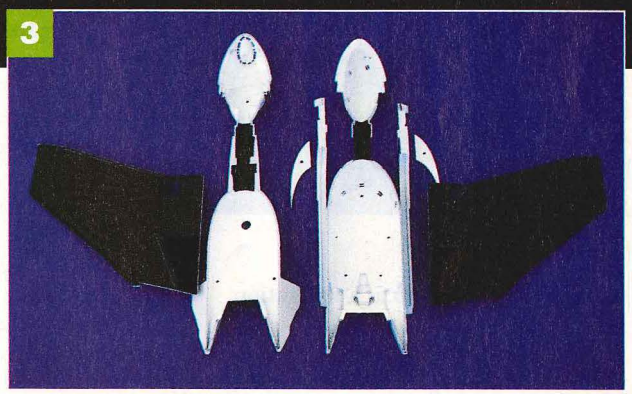
Areas of thin plastic can glow, and loose seams can leak light. To prevent this, first spray all inside model surfaces – whether they house lights or not – with gloss black paint before major assembly. A spray can works fine. Paint with a brush where the spray can't reach. Do this after all holes and windows have been cut to avoid a halo effect around their edges.

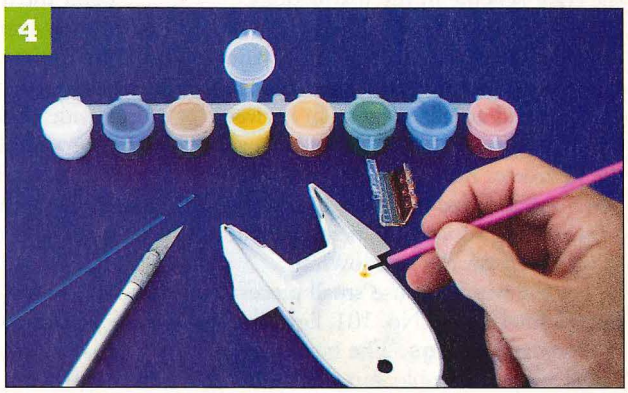
After allowing the black paint to dry for an hour (longer if the humidity is high), spray the areas that will have windows with gloss white. Scrape the paint from edges to be glued, **3**.

Glue generously during assembly and paint all dried seams first black, then white with a brush.

Another trick to making a model light tight is to leave the sections without win-







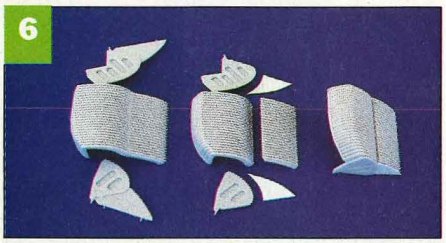
dows black. If a seam is not perfectly sealed, the leaking light will not be as obvious.

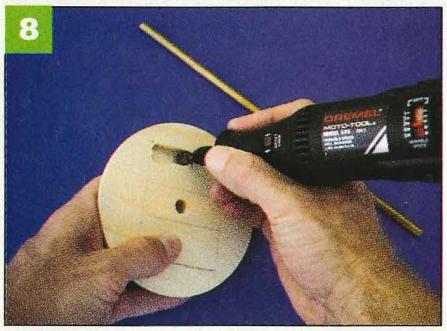
Finally, paint all exterior surfaces (except the baffles) pale green. Unfortunately, Testor does not manufacture pale green in a spray can, so if you want to stay with Testor, either paint with a brush or use a different spray color. I brushed on the pale green because I like the color and the way the brush strokes give the exterior a textured, worn look.

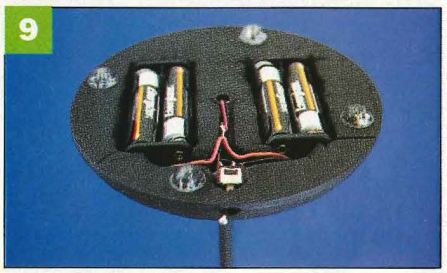
This light-tight technique eliminates the need to mask windows as would be required with fiber-optic lights.

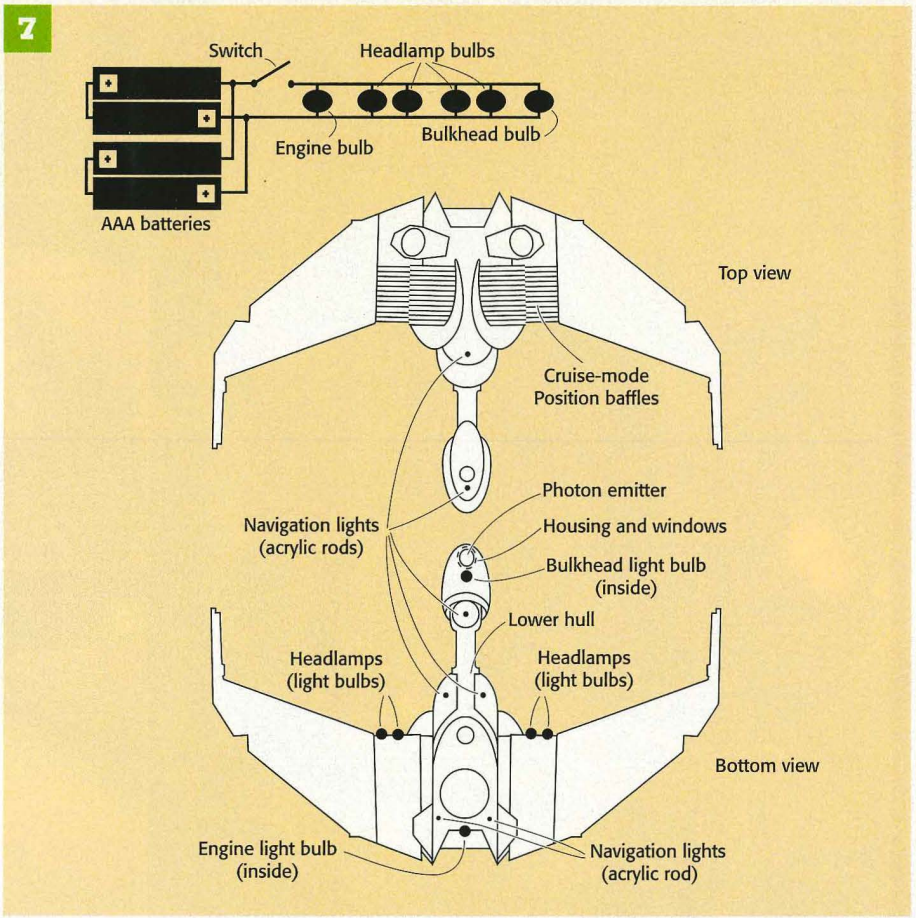
Apply glass stain and filters. Clear acrylic rods make better navigation light "bulbs" than fiber optics. Cut 1/16"-diameter acrylic rod into 1/4"-long sections. After sanding one end round, super glue each into its hole, leaving about 1/8" protruding into the body cavity. The rounded end should be on the outside.

The author threw the switch on all the lights you see here with just six bulbs – four headlights in the wing roots, one in the front pod, and another in the hull's rear (not visible). The secret is making the model light tight. Photo by David Auer.









All the window, navigation, engine, and torpedo-tube lighting comes from only two light bulbs. Two AAA batteries will power the Bird of Prey's lights, but a second set in parallel will increase run time.

Give the inside tip of each navigation light a dab of yellow stain, **4**.

Paint the inside of the engine with red, yellow, and white glass stain according to the color scheme in the instructions. Move quickly to avoid streaking, as the stain dries rapidly. After staining, paint the outer engine features steel color.

Cut a red acrylic filter to fit between the photon torpedo-tube light bulb and the perimeter holes. (I chose No. 25, orange-red.) Glue the filter in place with a fast-setting super glue, being careful not to cover any nearby windows, **5**.

For the windows, use small pieces of a frosted filter (I like No. 101, light frost).

Position wings. The box says the wings are positionable, but that's not to say they're movable. They must be fixed in one of two positions – either down or straight across. But I wanted my model's wings to be up. I cut each wing's cruise-mode position baffles apart where they meet, shortened the half that is attached to the wings with an electric sander, reattached it to the other half, and reconstructed the front and rear baffle covers with .030" sheet styrene, **6**.

Paint the baffle recesses gunmetal, then the edges and covers steel. Glue the baffles to the upper wing halves. Glue a strip of .030" sheet styrene to the exposed underside of each baffle and paint it steel. Do not assemble the wing halves yet.

Wire the lights. Carefully solder wires about 18" long to the four landing lamps, **7**, but don't connect the wires to the batteries or switch yet. Install the light bulbs into the landing-light holes, going easy on the quick-dry epoxy. When the glue is dry, route the landing-light wires through the hole in the upper half and through the baffles. Now glue the wing halves together.

Paint the exposed rear areas of the bulb gloss white, then gloss black, then pale green so that only the front tips are left exposed. This will make the landing lights a bit brighter as well as light tight.

Next, drill holes in the upper hull (only as big as necessary to keep the hull light tight) where the baffles are attached. Route the wires into the hull and glue the wings to the hull.

Solder 18"-long wires to the two interior hull light bulbs, referring to **7**, but do not connect them to the batteries or switch yet. Leave enough wire to reach through to the base. In the lower hull, secure one bulb close to the photon torpedo tube and one close to the engine with quick-dry epoxy.

The AAA batteries won't run the AA light bulbs for an extended period. However, I prefer the smaller batteries because they allow a smaller, more attrac-

Compare the kit-built version to the custom-lighted version – what a difference! Photo by David Auer.

tive base. To increase their life, simply wire two sets of batteries in parallel.

Base construction. A 4.5"-diameter wood clock face or plaque, available from most art and craft stores, makes an excellent base. Use an electric drill to make a 3/16" hole about 1" deep in the side for the switch. Drill a 1/4" hole all the way through the center for the base stem. (The base I recommend in "Sources" already has this hole). Drill from the top down to avoid splinters.

After tracing the outlines of the battery holders, use a motor tool to carve out areas in the base for the battery holders and switch, **8**. Be careful not to carve all the way through to the top of the base.

Sand the top, bottom, and side with fine-grit sandpaper. Next, glue a 9 1/2"-long, 1/4"-diameter brass tube stem into the base with quick-dry epoxy. When the epoxy has dried, spray all surfaces flat black and add rubber feet.

Final assembly. Run all the light-bulb wires down through the lower hull's base stem hole, then epoxy the ship's lower hull to the base stem at a slight upward angle.

Next, solder the light wires to the batteries in the base, **9**. Test the lights to make sure they work.

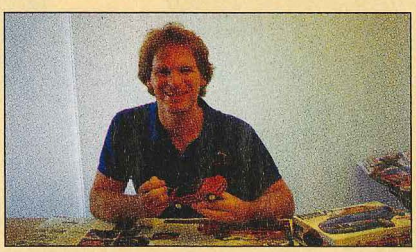
Scrape the paint from all upper and lower hull edges, glue the halves together, and install the engine.

Detailing. And now the test. In a dark room, turn on the Bird of Prey's lights to locate light leaks. Use modeling putty and gloss black paint to seal any openings, then touch up with the pale green finish coat and detail colors.

I followed the kit instructions for color and detail, and I didn't bother with an overcoat. Most final sprays I've used tend to yellow, and the subdued paint effect on the Klingon Bird of Prey just doesn't need a top coat.

Enjoy! As you can see from the lighted model, the craft is more impressive than a gloomy one built straight from the box. And no high-tech, expensive materials or laborious methods were required.

I've tried this simple light-tight technique on several models, always with good results, so don't hesitate to add life to your next model with simple but effective lighting! **FSM**



MEET SCOTT SHIRLEY

Scott, a Tempe, Arizona, resident, began modeling 30 years ago at age 4 with dinosaurs and spaceships and worked his way up. Now his main interest is lighting sci-fi ships and cars, which fits nicely with his career in engineering.

SOURCES

1/4" brass tube
K&S Engineering, 6917 W. 59th St.,
Chicago, IL 75011-7824

Sheet styrene acrylic rod
Plastruct, 1020 S. Wallace Place,
City of Industry, CA 91748,
✆818-912-7016

Switch (No. 275-645)
Battery holders (No. 270-398)
22-gauge wire (No. 278-1224)
Cushion feet (No. 64-2365)
Radio Shack

Light bulbs: Mini MagLight AA Replacement Lamps
Mag Instrument
1635 S. Sacramento Ave.
Ontario, CA 91761, ✆714-947-1006

Light filters
Roscolux – book of 100 1.5" x 3.25" acrylic filters (No. S39 417)
Edmund Scientific Company
101 E. Gloucester Pike
Barrington, NJ 08007, ✆609-547-8880

Wood base: Round clock (4.5" diameter x .75" thick), No. 53210
Walnut Hollow
Route 2
Dodgeville, WI 53533

Glass stain
Kelly's Crafts,
Ross, OH 45061

Lighting Monogram's "STAR TREK"

A little surgery and innovative electronics put on an awesome light show

By John Eblan

VOYAGER'S realism can be attributed to the talented staff of Paramount Pictures. The filming model is about 5' long, and since Paramount's model represents a ship smaller than the *Galaxy*-class USS *Enterprise* NCC-1701D, more detail was achieved.

Monogram's *Voyager* kit is well detailed, too, and measures 20 1/4" long. Its clear windows, clear engine panels, and abundant interior space provide an opportunity to create a lighted model without a lot of trouble.

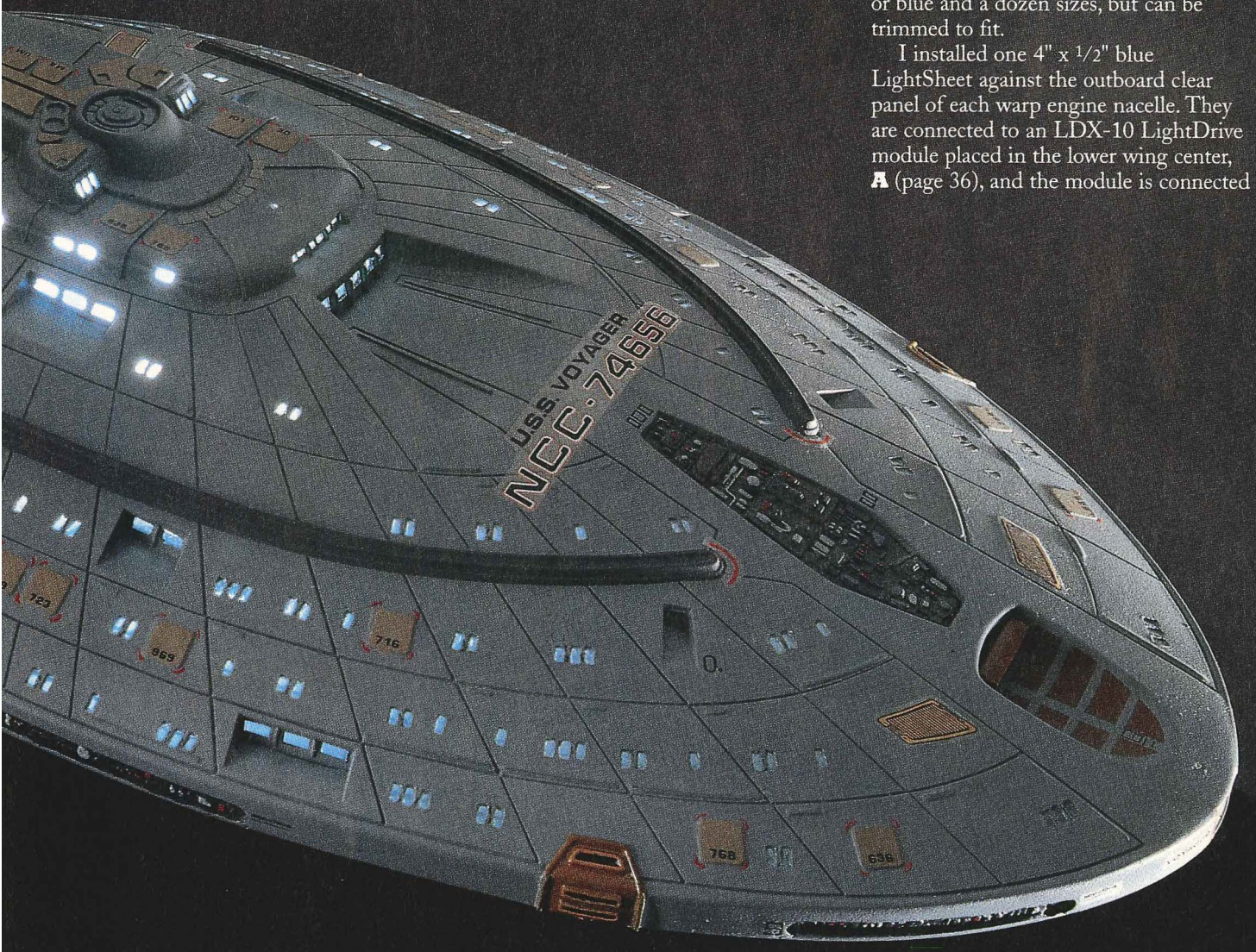
Monogram's Voyager is large enough to hold several light systems with startlingly realistic results. FSM photo by Rebecca Saliture.

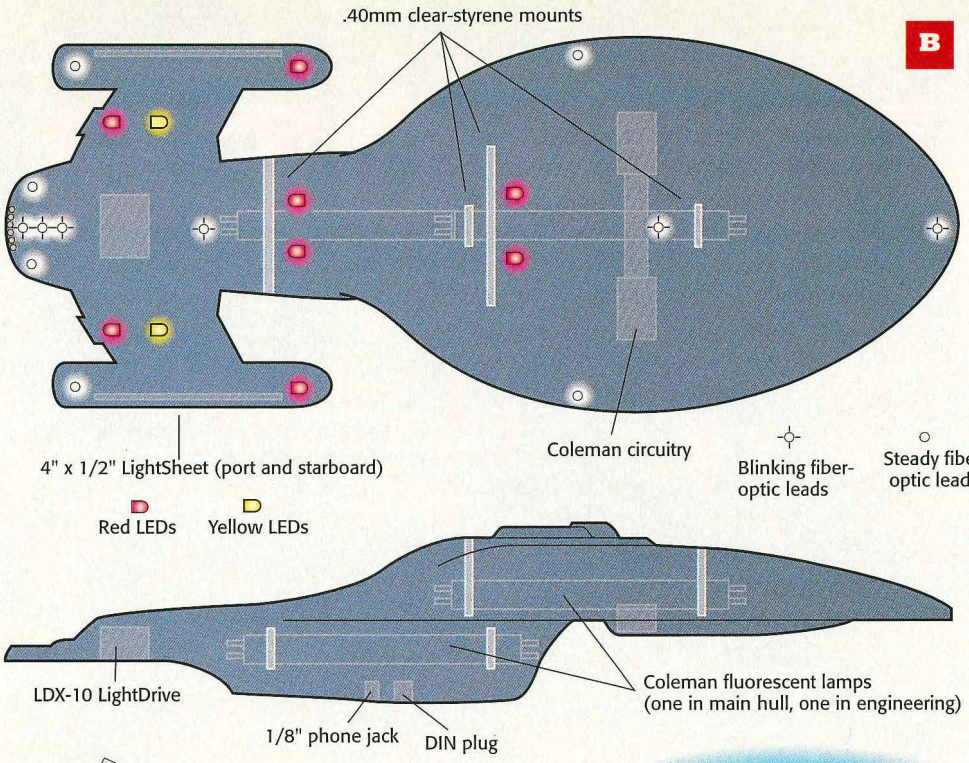
VOYAGER

1 Strange blue light. Since warp technology is still centuries away, I faced a dilemma creating the blue glow of the warp nacelles. Incandescent lights wouldn't do, and fluorescents would be too bulky for the nacelles. LightSheet, the material used by the visual-effects teams producing the "Star Trek" television series, would be the perfect answer.

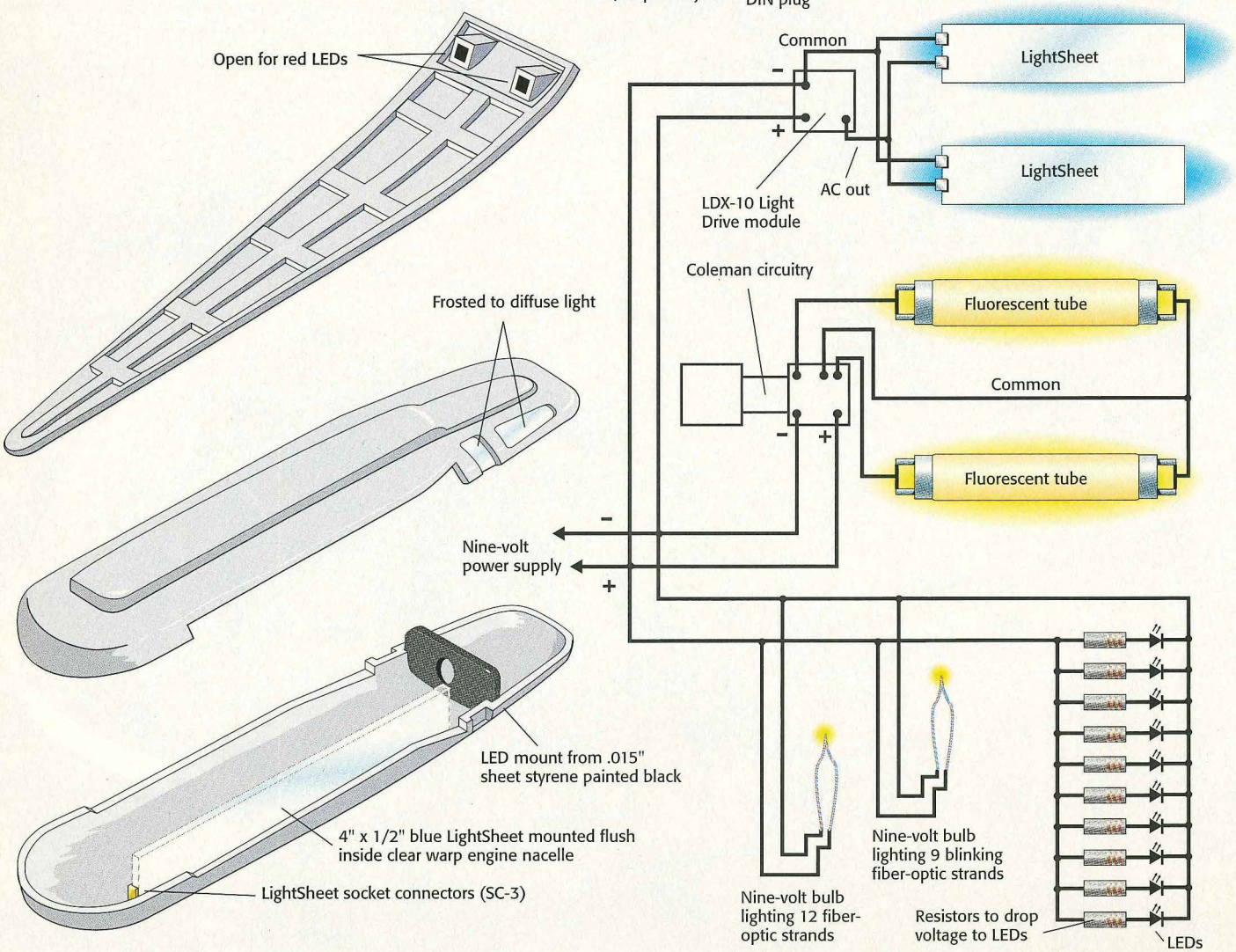
LightSheet is a flexible plastic material that glows brightly when connected to an electrical power source. It comes in white or blue and a dozen sizes, but can be trimmed to fit.

I installed one 4" x 1/2" blue LightSheet against the outboard clear panel of each warp engine nacelle. They are connected to an LDX-10 LightDrive module placed in the lower wing center, **A** (page 36), and the module is connected



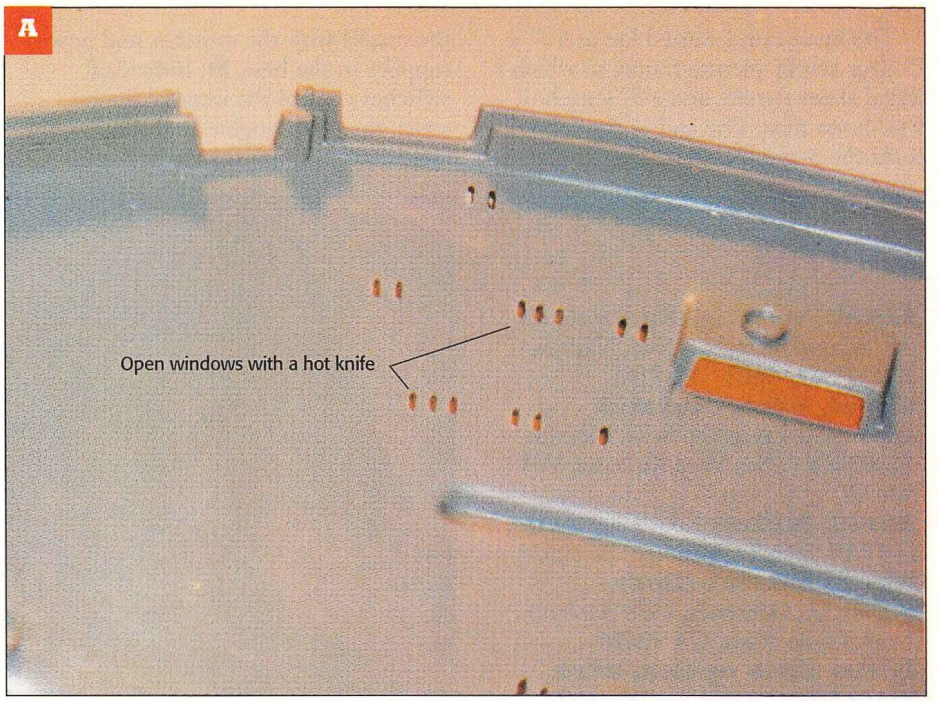


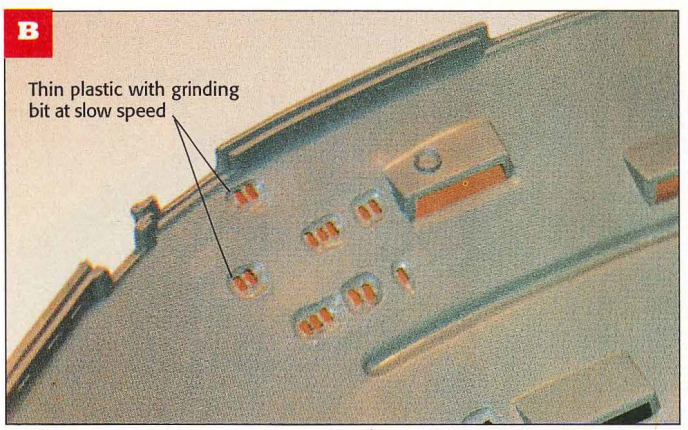
to a nine-volt battery inside the stand base with a five-pin DIN jack. When the power is switched on, the LightSheet glows like the original. Drawing **B** shows the electrical schematic for my *Voyager*.

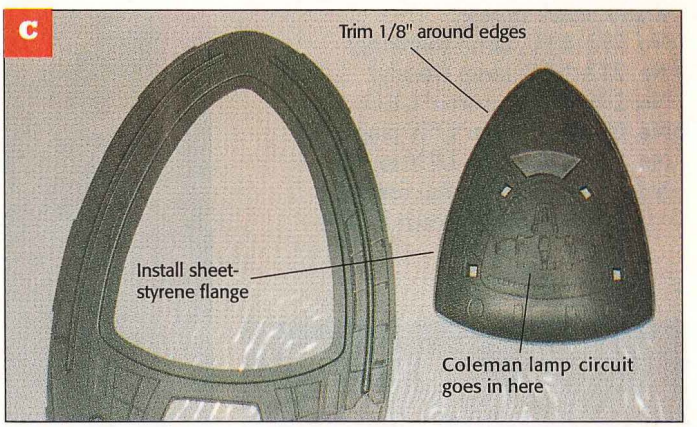


2 Somebody's home. Although the basic model includes clear inserts for 34 windows, this does not come close to the 466 windows in the film model. I opened as many as I could with a hot knife, **A**, thinned the plastic from the inside with a grinding bit, **B**, then carefully squared each port with a micro-file. I filled them with Microscale Kristal-Kleer after the model was painted and assembled.

Internal lighting for the hull was achieved with a Coleman twin-fluorescent tube lantern (catalog No. 5344D703). After carefully removing both tubes and the circuit board from the lantern, I mounted one tube in the main hull, the other in engineering. I used clear styrene (mounted before painting) to secure the lamps. The circuit board was mounted to the removed hull plate, **C**. Another nine-volt battery powers these bulbs.



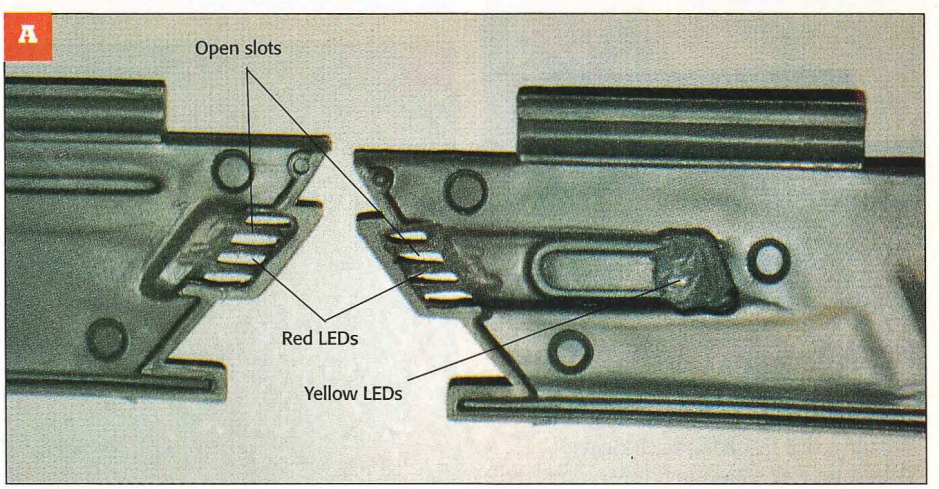




3 LED there be light. Red light-emitting diodes (LEDs) provide the glow of the impulse drive and the front and rear photon torpedo launchers. Jumbo red LEDs glow behind each of the frosted bussard collectors in the nose of each warp nacelle.

Yellow LEDs were installed on the upper side of the wings forward of the impulse drive, **A**. Resistors wired into the circuit regulate the proper voltage from the battery.

To keep weight and power consumption to a minimum, I used .40mm fiber-optic strands for the steady and blinking formation lights. The light source is a pair of nine-volt incandescent bulbs in the upper hull. By carefully applying the tips of each running light strand to a candle flame, I was able to create slightly larger "lenses."



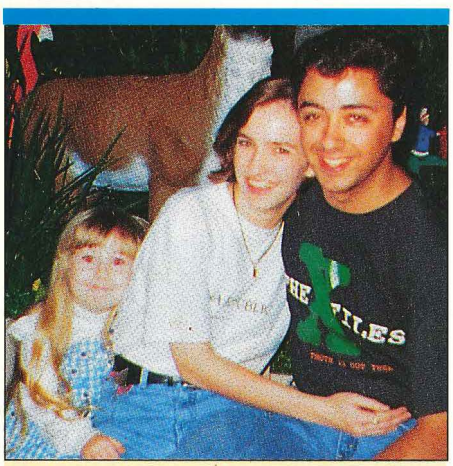
I added four lifeboat hatches to the rear of the dorsal side of the main hull (about deck four, the bridge being deck one). They are 1/4" round-corner squares cut from .010" sheet styrene, **B**. I painted them light tan. I also added eight strips of .010" x .010" for "structural integrity ribs" to the exterior of deck two, **C**.

The basic stand started life as a 5" x 7" clear acrylic picture frame, to which I added sheet styrene and a 5" length of 9/16" brass tube. The end of the tube holds the 5-pin DIN jack that connects the model with the switches and power supplies in the base, **D**. Individual switches control the internal fluorescents, the warp-engine LightSheets, the incandescent bulbs that light the fiber optics, and the LEDs.

With all the lights and windows, my *Voyager* looks like its bigger counterpart used to film the TV series. **FSM**

SOURCES

LightSheet LightSheet Systems, 319 Main Dunstable Road, Nashua, NH 03062, ©603-595-7146
Sheet, tube, and rod styrene Evergreen Scale Models, 12808 NE 125th Way, Kirkland, WA 98034
Brass tubing K&S Engineering, 6917 W. 59th St., Chicago, IL 60638
Micro Kristal-Kleer Microscale Industries, 1570 Sunland Lane, Costa Mesa, CA 92626
LEDs, fiber optics, wire, resistors, and switches Radio Shack stores:
No. 272-1097, lamp (blinking)
No. 272-1098, lamp (steady)
No. 276-1622, assorted LEDs
No. 274-003, 5-pin DIN plug
No. 274-005, 5-pin DIN socket
No. 271-1313 220-ohm resistor (1/4-watt – one for each LED)



MEET JOHN EBLAN

John, his wife, Phyllis, and daughter, Brittany, live in Orlando, Florida. When he isn't modeling, John is a motion-picture-technology major at the University of Central Florida. From the looks of his *Voyager*, John may have a future in his field of study.