Candle Lanterns for Captain’s Cabin

This item is very awkward to make, but if the guidance notes are methodically followed, it is achievable to create a working ‘Candle Lantern’. It is recommended that they are read through first, prior to starting. Attempt making prototypes before the final lantern is made, as both skill and patience is required.

The main items required are:

- BIC ‘Cristal’ Ball Pen, Medium Writing (Bar Code: 0 070330 130944)
- Lighter fuel
- 1 mm diameter metal rod (a braising rod was used)
- Clear Inkjet address labels
- Boots expert 0.4mm interdental brush
- Loctite Super Glue-3 Power Flex (Gel)
- Loctite Super Glue Precision (Liquid)
- Humbrol Matt Black (33)
- Dulux Difficult Surface Primer
- Very fine emery paper (1500)
- 00000 Dalon D77 Daler-Rowney Paint Brush
- Kitchen Foil
- ARALDITE Instant Clear
- Round toothpicks
- 0.75mm fibre optic cable. This can be found at: (http://www.microminiatures.co.uk/acatalog/Optical_Fibre.html)

The central component is the plastic tube, which forms the basis of the lantern; scale is critical so the plastic tube diameter is important. It should also be a little opaque and quite sturdy; but must have a hollow diameter of at least 0.75 mm for the fibre optic cable, The inside of a ‘BIC Biro’ was eventually settled upon, which is 2.97 mm diameter, equating to 225 mm or 8.9 inches. It is thought that the lanterns shown in “Master and Commander” are approximately this size.

Once the diameter is decided the correct proportions must be obtained, and to do this refer to Figure A1, below
Figure A1 – Candle Lantern (Master and Commander 01:23:43 minutes)

Figure A1 is printed and the dimensions are measured; these are shown in **BLUE**. Using the “BIC Biro” diameter, these dimensions are used to calculate the dimensions of the scale Candle Lantern, and are marked in **RED**. Please note that this is an approximate process as only the correct proportions are being obtained.
The cage surrounding the glass in the lantern needs to be considered; this was produced by using a transparent address label on which the image of the metal cage structure was printed. This was seen as the only way of achieving the very fine scale detail for the cage.

The circumference of the “BIC Biro” is calculated.....\(\frac{22}{7} \times 2.97 \text{ mm} = 9.33 \text{ mm}\), but add a little extra and make it 9.5 mm. The length of the “BIC Biro” is 4.97 mm, as taken from Figure A1 and the cage will be made up of 6 X 3 squares, Figure A2.

\[
\begin{array}{cccccc}
\text{0.7 mm} & \text{0.96 mm} & \text{3.31 mm} & \text{4.97 mm} & \text{9.5 mm}
\end{array}
\]

Figure A2 – Dimensions for lantern cage

This was created in Microsoft publisher in a larger scale, as shown in Figure A3; this image was then printed and scanned into Adobe Photoshop, or a similar program. The black and white image colour will need to be sharpened, and for this use the ‘flood tool’ to make the black blacker and the white whiter was used. The scanning process tended to grey the colours.

Figure A3 – Publisher image of the lantern cage

The image in Figure A3 was then reduced proportionally in Adobe Photoshop such that its width was 9.8 mm, the circumference of the “BIC Biro”, plus a little extra otherwise the ‘cage pattern’ will not meet at either ends, Figure A4. The height of the image will
probably be 5 mm, depending upon how the program reduces the image, but this slight excess can be reduced later when constructing the Candle Lantern.

**Figure A4** – Reduced image for the lantern cage

**MAKING THE CANDLE LANTERN**

The BIC Biro ink tube is removed from the body of the pen; remove the tube containing the ink and the ‘ball point’ end. Using the mouth and a tissue at one end, blow down the tube to partially remove the ink; lighter fuel can be used to flush through the remaining ink. With a small piece of tissue and the 1 mm metal rod, push the screwed up piece of tissue up and down the tube until all the ink has been removed, Figure A5.

**Figure A5** – Cleaning the ink from the Biro tube

Using a very fine emery cloth, slightly rub the outside of the surface of the BIC Biro tube to make it a little more opaque, so the fibre optic cable that will eventually replicate the burning candle will not be so easily seen.

Print the image of Figure A4 print onto the transparent address labels, as shown in Figure A6. It was found that the printed image ‘smudged’ rather easily, and a hair dryer was used to ensure that the ink was 100% dry. Whether this was just the quality of the transparent labels used it is not understood however, applying a little heat seemed to solve the problem.
Figure A6 – Print candle cages onto transparent address labels

**NOTE:** The image of the candle cage will ultimately have a fibre optic light shining behind it, so the printed black image requires to be printed as dense as possible. As many of the print paper options need to be tested. For example the following selections were printed on different transparent label sheets using an ‘Epson Printer’. Epson Premium Semi Gloss; Plain Paper; Epson Matt; Envelope; Epson Glossy; Epson Ultra Glossy and Epson Premium Glossy.

From each sheet a candle cage image was cut and placed on the plastic tube as shown in Figure A7. It can be seen from the figure that there are several ‘shades’ of black.

Figure A7 – Testing the density of black ink for the candle cage

Looking from left to right on Figure A7 it would appear that images 4, 5 & 6 are the darkest. To find which would be best with a light shining from behind the image; in a darkened room, a fibre optic light was placed inside the tube and moved up and down, to
determine which was best to the naked eye. For this author, ‘Epson Matt’ paper quality gave the best result, but it should be stressed that this is not an exact science!

A single candle cage is cut from the address labels and then wrapped around the tube; leave approximately 0.5 mm overhang at the end as shown in Figure A8, for super gluing, which will be explained later.

The overhang should be no wider than the vertical section of the cage.

**Figure A8 –** Cutting candle cage image from the transparent address labels

The biro tube will need to be cut into 4.97mm lengths; use a printed cage image as a guide, as shown in Figure A9; ensure that it sits squarely on the plastic tube before wrapping it around, Figure A10.

**Figure A9 –** Candle cage on tube

**Figure A10 –** Candle cage wrapped on tube

The correct length of tube can then be cut; use a sharp craft knife and gently roll the tube back and forth until it is cut, Figure A11 & A12.
Figure’s A11 & A12 – Blade lightly drawn back and forth on tube, so cutting it

Figure A13 illustrates the tube having been cut to the length of the candle cage image.

Figure A13 – Tube cut to the length of candle cage image

The transparent label’s can be removed from the plastic tubes as shown in Figure A14. A greater quantity than what is required was cut so the tubes that look the best can be chosen; a simple check is to see which tubes sit squarely on both ends, Figure A15

Figure A14 – Cut plastic tubes  Figure A15 – Checking tubes are square
The 0.4mm interdental brush is taken apart and the conical fitting at the end is removed, Figure A16. Note; it is the wire from the interdental brushes that is used for the ‘Oil Lamp’ above the Captains Table.

Figure A16 – 0.4mm Interdental Brush taken apart

The top part of the candle lantern is 1.51mm, so approximately 1.6mm needs to be cut from the conical end component contained in the interdental brush. To do this the conical end needs to be put on the pointed end of a toothpick as shown in Figure A17, and then a very sharp craft knife is used to cut the end squarely, Figure A18. The toothpick provides support so a square cut can be made by gently rolling the knife around the circumference of the conical end.

Figure A17 – Toothpick providing support

Figure A18 – Approx. 1.6mm cut from end

Figure A19 illustrates the component that will now be used for the top of the lantern.
The material used for this part of the interdental brush is ideal as it is flexible enabling a good fit for the fibre optic cable. Due to its flexibility it can be easily positioned in the top of the plastic tube, as explained below.

A pointed end of a toothpick has some tape wrapped around its end, Figure A20 so the plastic tube can be centrally positioned with 2.00mm of the pointed end of the toothpick protruding through the plastic tube. The component shown in Figure A19 is then gently positioned on the end of the toothpick and just pushed into the plastic tube, as shown in Figure A21. It is imperative that no more than 0.50mm is pushed into the tube otherwise the bright pink colour will show in the lantern.
A drop of Precision Superglue is placed onto a piece of paper; a pin is dipped into the pool of superglue and then stroked between the conical end and the plastic tube. There will be a capillary action and the glue will run around the inner circumference of the plastic tube, as show in Figure A22.
The base of the lantern is made using a small section of a toothpick that has kitchen foil on one end to reflect the fibre optic light in the lantern; this is made as follows:

Araldite glue is mixed and then thinly spread on the non shiny side of a small piece of kitchen foil; unless this is done, it was found that the foil was not stuck securely. The toothpick ends are also lightly dipped into Araldite, then fixed to the kitchen foil as shown in Figure A23. **Note:** a variety of adhesives were experimented with, and this was found to be the best.

![Figure 23 – Toothpicks stuck on kitchen foil with Araldite](image)

Leave for at least 24 hours to ensure a good bond before cutting away the excess foil from each toothpick end, as shown in Figure A24, prior to finishing on the grind stone.

![Figure A24 – Kitchen foil on end of toothpick](image)

The toothpick and foil are lightly ground, Figure A25, so it easily fits into the bottom of the plastic tube; the foil is inside the lantern which will both form its base and act as a reflector.
A number of toothpicks were made as the next operation is quite difficult and practise is required. Approximately 1.00mm needs to be cut off the end which has the foil; this is done by gently rolling a craft knife; (a new blade is recommended for this operation), around the circumference of the toothpick, as shown in Figure A26.

The base of the lantern has then to be glued into the bottom of the plastic tube; a piece of clear tape is placed onto paper. The base is placed onto the clear tape as shown in Figure A27.
A drop of Precision Super Glue is put onto the tape; a point of a pin is dipped into the superglue and then gently put around the base whilst it is still on the tape, as shown in Figure A28. The lantern is then placed over the base and slid off the clear tape; this is possible as the superglue does not immediately adhere to the shiny surface of the tape. Figure A29 illustrates how the base should look in the bottom of the lantern.

Figure A28 – with pin superglue is placed around base
A small length of 0.75 mm fibre optic cable is fully inserted into the top of the lantern, Figure A30. This is used to support the lantern whilst the top and bottom is painted with the ‘Difficult Surface Primer’, Figure A31; do not paint the side of the tube.
After the primer has been applied, the fibre optic cable needs to be partially pulled out of the lantern so the wet primer does not dry onto the fibre optic cable, Figure A32. If this is not done, when the primer dries and the fibre optic cable is pulled from the lantern, the primer will pull away from the top of the lantern.

The lanterns are then stuck via the fibre optic cables onto a piece of hanging sticky tape to dry, Figure A33.
**Figure A33** – Lanterns fixed and hung from sticky tape to allow the primer to dry

A fresh candle cage image is cut then carefully positioned onto the lantern; it is important that the image is positioned squarely so the two ends of the lantern cage perfectly meet, Figure A34.

**Figure A34** – Image of cage wrapped around Lantern
A drop of Superglue Gel is put onto a piece of paper; a pin point is dipped into the Gel and then ran along the clear edge of the image, as shown in Figure A34. The idea is to use as little Gel as possible; if it could just be seen, then it is sufficient. The image was then rolled down, Figure A35; this is to prevent the image from unrolling. This operation took many attempts before the end result was satisfactory, so alot of patience is required!

Figure A35 – Cage image glued at ends to prevent unrolling.

A short length of 0.75mm fibre optic cable is fully inserted into the top of the lantern; the base and the top of the lantern is painted with Humbrol Matt Black (33). When finished the fibre optic cable is partially pulled out so the black paint does not adhere to the cable, Figure A36.

Figure A36 – Lantern base and top painted black
The item now looks perfect in daylight, however when viewed with the fibre optic light inside, it could still be improved, Figure A37.

![Image](Light shines through)

**Figure A37 –** Candle Lantern lit

However, it should be remembered that Figure A37 is larger than actual size; Figure A38 illustrates the actual size of the lantern, and the light that can be seen through the base is slight, so it could be acceptable considering it will not be directly viewed in the cabin.

![Image](Actual size of Candle Lantern)

**Figure A38 –** Actual size of Candle Lantern

This author has chosen to paint the top and bottom sides of the lantern. To keep it stable whilst being painted, a toothpick and chuck Figure A38, was used to keep it steady; the chuck was rotated whilst the paint was being applied.

![Image](Candle lantern placed on end of toothpick and held in chuck)

**Figure A39 –** Candle lantern placed on end of toothpick and held in chuck
Figure A40 shows lantern with additional paint to the top and bottom. Figure A41 is actual size of lantern.

**Figure A40** – Additional paint to lantern

**Figure A41** – Actual size of Candle Lantern

**NOTE ON FIBRE OPTIC CABLE:** There is a thin reflective film on the outside of the cable, and it is this that reflects the light down it. The tip of the cable can therefore be dressed to give different types of lights. For example the cable could be lightly ground to a pencil point, Figure A42, or cut at right angles so it is like a hammer head Figure A43.

**Figure A42** – Pencil point end

**Figure A43** – Hammerhead end

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