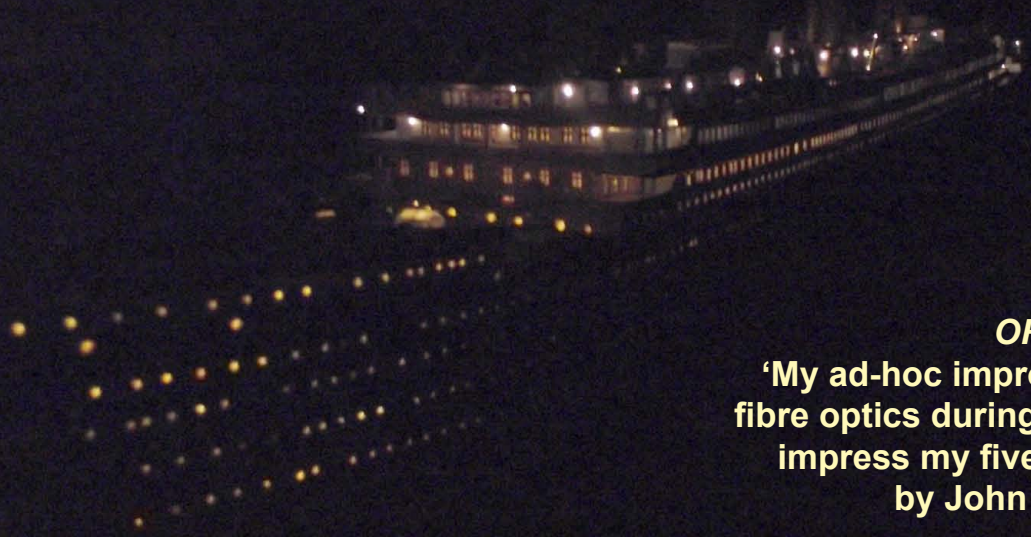
The Dark Art of installing fibre optic lighting into a Minicraft 1/350 Titanic



OR

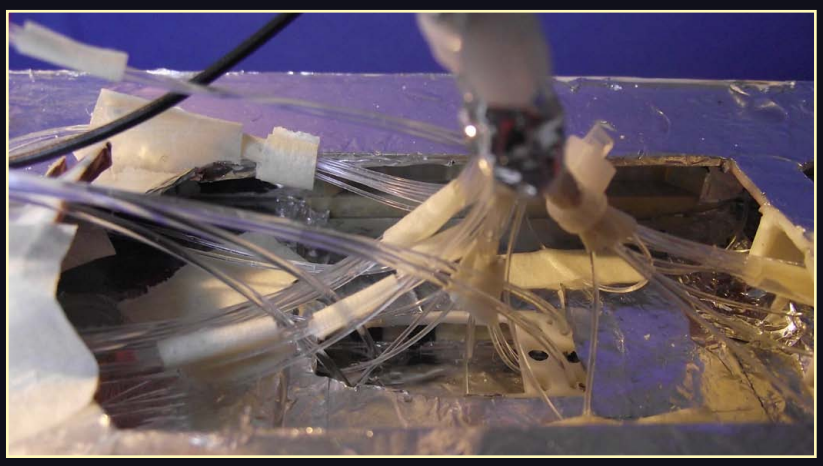
'My ad-hoc improvisations with fibre optics during a dark winter to impress my five year old son'
by John Hodge

Nothing brings a model to life – almost quite literally – more than lighting it. The flat-painted textures in daylight are replaced in darkness by a form defined by many points of light, which throw realistic shadows and shapes around the ship's details.

Here is a recap of the methods I used in the two aspects of lighting this model: illuminating all portholes and exterior windows by lighting the interior of the ship, and using fibre optic cable to put a point of light where there were light fittings on the external and upper decks of the real thing. (My model is a Minicraft 1/350 Titanic, but the methods would probably apply to most similarly sized models.)

The process of lighting all portholes and exterior windows of the ship - ie drilling out portholes, placing lights in the hull and light-proofing the model – is something that different modellers achieve using several approaches, and it's possible to see photos of others' efforts on the TRMA forum. But putting exterior lights to the visible parts of the ship is a separate matter, and not much informations exists on the web let alone the TRMA site about it. The most obvious approach at 1/350 scale is fibre optic cables. For the purposes of this guide I will fast forward somewhat through how I lit the hull - because mine is just one approach of several - and concentrate more on the fibre optic part of it.

While the results I achieved using these methods were mostly very good, I will point out that since initially releasing this document other modellers have suggested instances where a known modelling product or method may have been preferable to what I did. I will go over these as they arise during the text. Having said that - on a lighter note - part of the fun of modelling is improvising and concocting novel solutions to problems using whatever is at hand. What I can do here is talk you through what you're bound to come up against – and what I did - and each modeller can use this information to do the job in their own inimitable way.

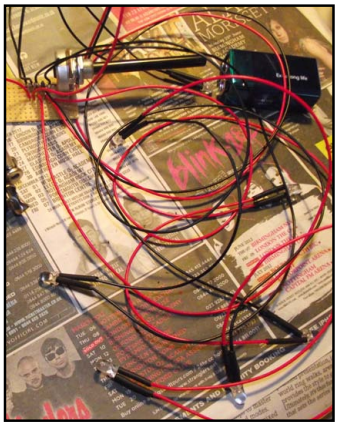


For more information about lighting, other aspects of modelling the ship, or indeed even the ship itself, see the TRMA site and its forum, which is a great place to get prompt advice from experienced modellers and experts, as well as being a very useful searchable archive.

* See http://titanic-model.com

Let's start with lighting the base of the ship

How you approach the whole process of lighting will depend a lot from the outset on what power supply and types of lights you choose. Many modellers have a cable running out to an external power supply, which allows a specific voltage to be fed from an external power source depending on lighting configuration. The light choices include individual LEDs, strips of LEDs, or strips of CCFL. This is what I chose to do:



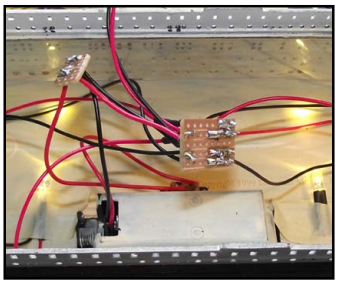
A trial circuit of LEDs, using a potentiometer to experiment with resistor strength.

POWER SUPPLY

Because I didn't want a cable coming out, that meant an internal battery box. Options included 4.5vdc or 9vdc; I went for 9vdc rather than 4.5vdc because a 9v battery is more compact than 3 x 1.5v AA batteries. I sourced a 9v battery housing cheaply online (£4) originally designed to go into an acoustic guitar for a pickup.

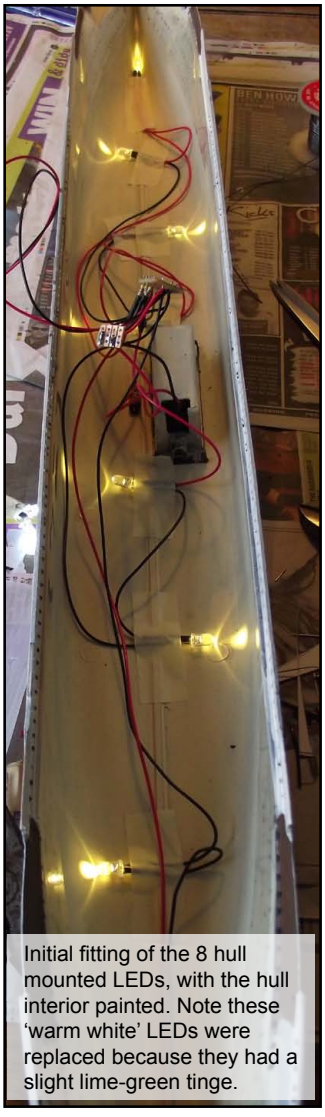
LIGHTS

I elected to go for individual round 5mm 3.4vdc LEDs - and used 16 of them in total. I selected these rather than CCFL strips because they use less power and LEDs last 3 times longer than CCFL (according to online research). I didn't look at LED strips because I wasn't sure about the hue of light they would give, also I wasn't sure how you'd attach fibre optic bundles to them (see NB1 below).



The wiring around the battery box. The larger 'stripboard' on the right carries all the resisters for the hull mounted LED circuits.

The LEDs were soldered as pairs of 3.4v warm white round LEDs in series with a 1k resistor (see diagram page 14). Eight lights are in the hull of the ship, eight are bound onto bundles of fibre optic (FO) cables which are mostly attached to the separate upper superstructure assembly. Resistors are necessary with LEDs, and I kept the hull and FO lighting as separate circuits in case I wanted to adjust the light balance between the two.



Initial fitting of the 8 hull mounted LEDs, with the hull interior painted. Note these 'warm white' LEDs were replaced because they had a slight lime-green tinge.

NB1 – there are different types of 'warm white' LEDs: You want the light in the ship to look like incandescent light - so don't use white LEDs - they look too white, even a bit blue-ish. Use 'warm white' LEDS - but be careful because there's different types of 'warm white': Some look like incandescent light with a nice creamy hue, while others look a bit too yellowy bordering on lime green. In the UK I found that the warm white LEDs Maplins sell were best (albeit not the cheapest).

NB2 – My LED wiring was pairs in series (with a resistor) because that was appropriate for 9vdc. If you are using another voltage – say 4.5vdc or 6vdc you may wire them individually (each with a resistor); if you were using 12vdc you may need to wire them as trios in series. And this may decide how many LEDs you end up using - for instance, if you were using 12vdc, you would probably use 15 or 18 LEDs (multiples of 3), as opposed to my 16. This weblink helps you plan LED circuits and resistor values.

USING FIBRE OPTIC CABLES FOR DECK LAMPS

Information is available to describe where external deck lamps appeared on the Titanic (I chose to refer to Peter Davies-Garner's indispensible book *RMS Titanic: A Modelmaker's Manual*), and in many instances the (Minicraft) model has nubs in the bulkheads which indicate a light fitting (though some are wrong). You can aim to get a FO cable to almost all the obvious upper and external deck lights, though when it comes to the A Deck (Promenade Deck), it is not practical to reproduce the numerous lights the ship had, and you need to be selective (In fact you can overlight the promenades – scale effect is lost, and you inadvertently emphasise that there's absolutely nobody or nothing on your ship – unless of course you have deckchairs and people on board!). I ended up using around 200 separate lengths of 0.5mm FO cable, around 20 metres in total. It could have had more, but actually this was a reasonable number to get the right affect (as well as achieving some accuracy).

0.25mm or 0.5mm Fibre Optic Cable?

There are pros and cons - one is more accurate, the other easier to use: At 1/350 scale 0.5mm is 175mm, 0.25mm is 87mm - so obviously 0.25mm is closer to the size of a light bulb. Throughout this model I have used 0.5mm: because I felt 175mm could be taken as a lamp plus reflector dish, plus it would be easier to work with than the thinner cable. It's a choice I have second thoughts about now, but I would say use 0.5mm if you'd prefer a less fiddly job, use 0.25mm if you are confident and want better scale-effect. Or use both.

This tutorial assumes 0.5mm, but if you are working with 0.25mm most aspects of the process would be largely the same, albeit at a much finer scale. Instead of bunching 15-20 0.5mm cables to a LED you could probably put 20-30 0.25mm cables onto each LED. If you found that the thinner FO cables were casting too little light you could experiment with brightening the LED by lowering the resistor ohmage.

Internal Lighting

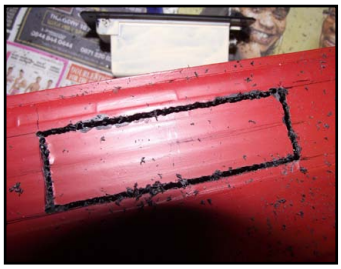
While this tutorial is mostly about FO lighting, I will go over the basics of hull lighting, with the methods I arrived at...

Rounded corners of plastic milk bottles were cut out as initial baffle for the LEDs, these also served to provide a platform for the horizontal sheet of opaque plastic.

1 DRILL OUT THE PORTHOLES (OBVIOUSLY)

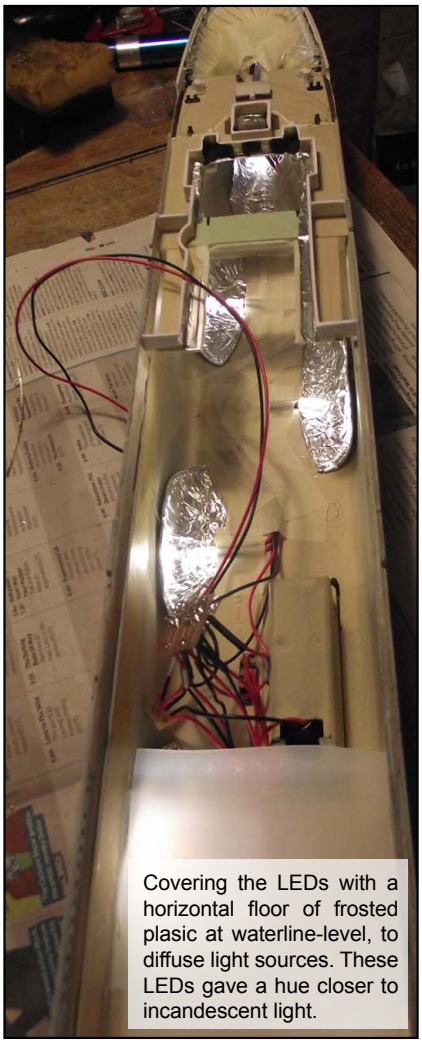
There is a diagram on the TRMA site indicating what diameter to drill the different hull portholes. Use a larger drill bit to de-burr and countersink the inside of the holes, which opens up the angle that light can go outward from (or else you end up with the bad effect that you only see porthole lights when you are perpendicular to them). Recommended is to fill the holes from behind with Kristal Klear - I didn't use this on the hull, but rather a thin plastic paper which was frosted and yellowy in colour - it diffused the light sources well, and gave the right hue of light.

2 BATTERY HOUSING



Making the cut. Note battery housing in background.

The 9vdc battery housing I sourced sits nearly flush, and a section of the bottom of the hull came out to take it. It's black - I didn't paint it hull red because that would make it more visible. Once the battery housing was in, the top of it was roughly at waterline level, internally. Also a small square aperture needed to be drilled for a switch (fantasies of floating it in the bath now long gone!)



Covering the LEDs with a horizontal floor of frosted plasic at waterline-level, to diffuse light sources. These LEDs gave a hue closer to incandescent light.

3 PAINTING INTERNALLY FOR LIGHT REFLECTION

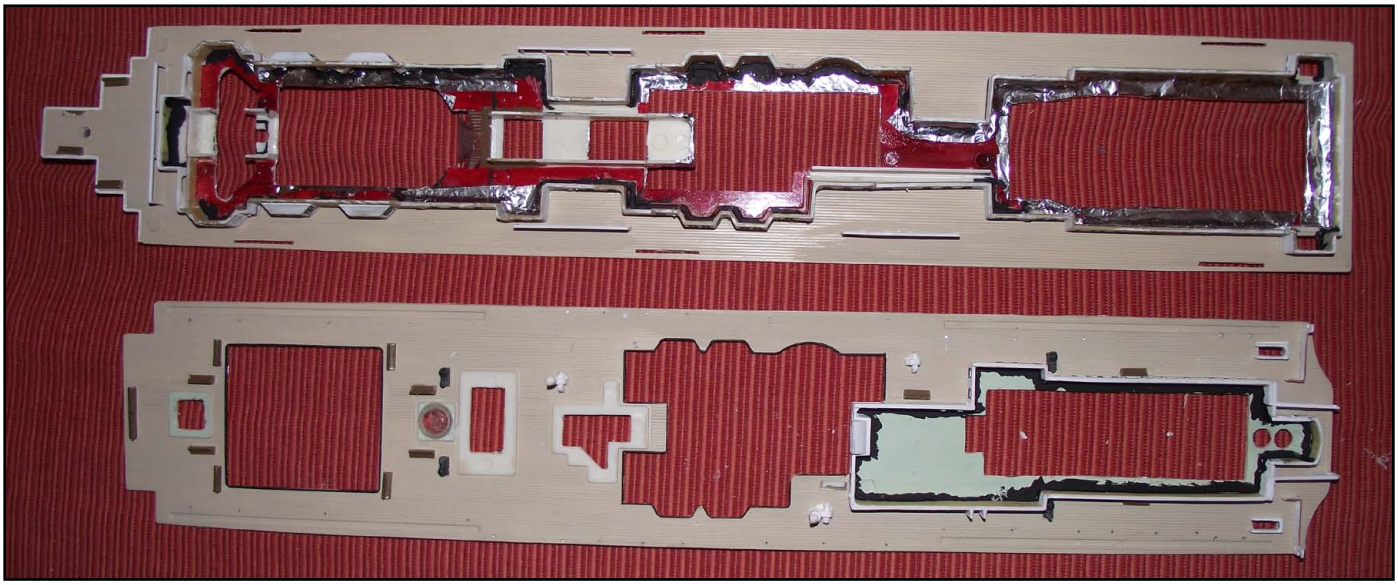
I painted the inside of the hull, and the battery housing, with a creamy colour to promote light reflection and give a warm tone.

4 INSTALLING LEDS

I wired in the eight LEDs to the power supply and mounted them along the hull, with wires taped down with masking tape, helped by some contact cement. I used some round aluminium foil pie-bases under each LED to reflect light upwards. Once lights are installed and working you can begin to experiment with diffusion, and the problem of light leakage presents itself.

5 LIGHT BAFFLE

Plastic milk bottles served as light baffle for the LEDs. The rounded corners from bottles were cut out and stuck over each LED, providing a platform for horizontal sheets of opaque plastic that sat more or less at the waterline, stuck together with contact cement. This, combined with the off-white inner walls and yellowy opaque plastic behind the portholes created a uniform warm light which didn't have obvious source points.



Boat and A Deck with decking removed to allow light to reach the top of the ship's interior.

6 CUTTING INTERNAL DECKS

For the purposes of lighting you need to remove internal decks to allow the light to get to the upper deck windows.

B Deck: Most of the central section of the B Deck is cut out, leaving virtually only the parts of the decks and bulkheads which are visible front and rear ajoining the Well Decks. The rear is more complicated with the promenades and cafes which extend down the sides.

Taking this deck out solves the problem of the deck blocking the C Deck portholes, as it does on the Minicraft model. For this same reason the floors of the Parisien Cafe area need to be cut 2-3mm inwards from the outer wall so as to not block portholes (see pic); this lets in light which these spaces need - not that there's anything to see in my model - but it does lend a uniformity of light along the side of the ship. I don't think that losing the centre part of the B Deck affects the integrity of the structure because slotting the A Deck into the hull brings it into shape (though I suppose you could put thin struts across).

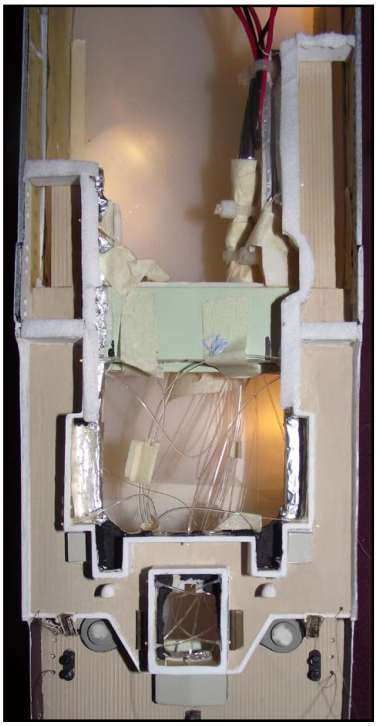
The B Deck was reduced down to these fore and aft sections (plus the Private Promenades), with the middle open to let as much light as possible into the upper decks. On the aft section, below, you can see the 0.5mm thick foam strips which are on top of the inner bulkheads - these are to light-seal them against the A Deck above.

The 1st class Private Promenades glued to the underside of the A Deck, with translucent floors so they are lit almost as brightly as all adjacent portholes (plus they have two FO lights in them).

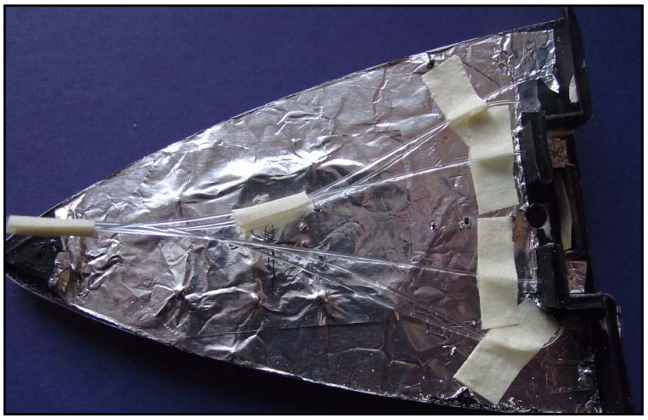
With the B Deck gone, the 1st class private promenades no longer have floors. I stuck their bulkhead mouldings to the underside of the A Deck, and to let enough light into them so they weren't just blocks of dark portholes either side, I made floors with the same yellowy opaque plastic sheet used behind portholes (doubled over), as opposed to styrene.

A Deck and Boat Decks: a knife was taken to sections of interior floor (see photo). With the A Deck don't cut out too much or it will lose its shape, and it needs some of the structure under the 3rd funnel to help light-seal around the funnel housing. The forward grand staircase has to go, but it wasn't visible anyway.

Well Decks: I took off most of the deck which was hidden under the Forecastle and Poop Decks, mainly to give more room for the cabling, but also with the Forecastle to let light reach the crew galley skylight.



7 LIGHT PROOFING



Underside of Forecastle showing three types of light-proofing: aluminium foil, black paint, and some pieces of light-proof plastic sheeting. Note six FO cables which will light the Forward Well Deck entrances.

Apart from the black hull, all the plastic in the model is partially translucent, and light from behind can make parts glow brown-orange. Then there's light cracks where parts don't meet properly. Light proofing is a laborious process of elimination.

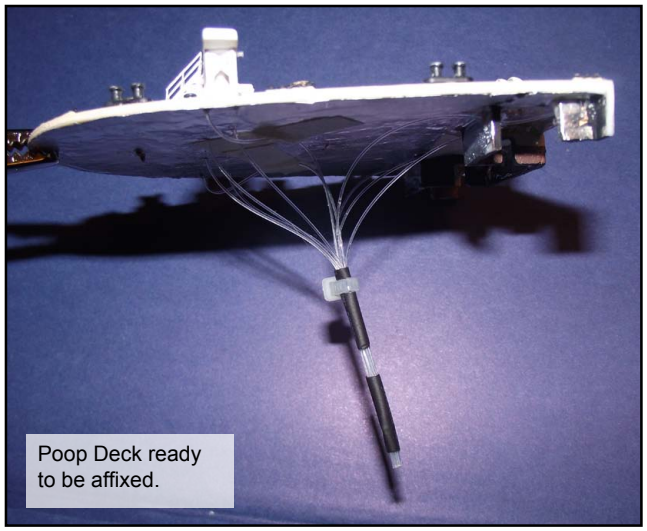
* For light-proofing larger flat areas like the underside of decks I used aluminium foil; for irregular areas I used several ad-hoc solutions including cheap black acrylic paint, Squadron modelling putty, shims of plastic to fill cracks, and a (very handy) sheet of white light-proof plastic paper from a broken laptop screen.

* Sometimes you need a crack to be filled by something flexible or compressible – I used a roll of double-sided tape, the kind which has 1mm of foam between the two adhesive surfaces.

Al Foil Vs Mr Surfacer: Other modellers on TRMA have questioned my use of Al Foil, and suggest a product called 'Mr Surfacer', a quick-drying lacquer-based liquid filler which has light-proofing qualities (though apparently has strong vapours and requires ventilation). If I'd known about this product at the time I may have ended up using it, but Al Foil worked well and has some advantages: firstly it is readily available and cheap! If glued with an unbroken film of contact cement it dries quickly into a solid surface which won't lift away and trims to shape very easily. Also because I am using the minimum amount of LEDs in my model, its high reflectiveness helps bounce and circulate light around internally.

At this stage you have an internally lit ship – now onto the upper decks...

Fiber Optics



Poop Deck ready to be affixed.

You quickly get a feel for working with FO cable. It's very springy and has a smooth and slippery outer casing. But it is easily damaged by various adhesives and chemicals. Here's some pointers...

* For a 1/350 Titanic you will probably need at least 20 metres of FO cable, and don't scrimp on it or make individual pieces just that bit too short! I bought it cheaply (in UK) off Ebay – for less than £1 a metre. It's better to buy by the metre than getting one of those novelty FO lamps, because you don't want to be limited by length.

* FO cable is easily dissolved by several types of adhesives including contact cement and CA glue - I used white PVA woodwork glue - it doesn't hold it well but it doesn't ruin it. Test any glue or paint on off-cut FO cable before applying it. CA glue or Epoxy can probably be used on straight cabling, but it's on sharp bends that FO cable becomes more vulnerable to chemical damage.

* Presuming you're using 0.5mm FO cable: drill with an exactly 0.5mm bit - in other words make it so the cable is a snug fit in the hole so it doesn't come out at an angle or wobble, also it helps to grab the cable and stop it from sliding or springing out of its hole.

* FO cable is springy and bouncy - find ways of holding it into position: cable-tie it into bunches, wrap tape around it to hold it to surfaces, use white PVA woodwork glue to affix it. Once there are a lot of cables around in a tight space, you need to keep them in order by bunching or bracing them somehow. Also, if it's all tied together like a wiring loom, it becomes one stable mass and helps to keep individual cables in place.

* To actually light the FO cable: bunch about 15-20 (assuming it's 0.5mm) cables tightly together with tape and trim the ends till they make a flush surface, then point the LED straight down them. To attach them to-

gether wrap masking tape around LED and bundle, possibly wrap al foil around to prevent light leakage, and secure it all with cable ties.

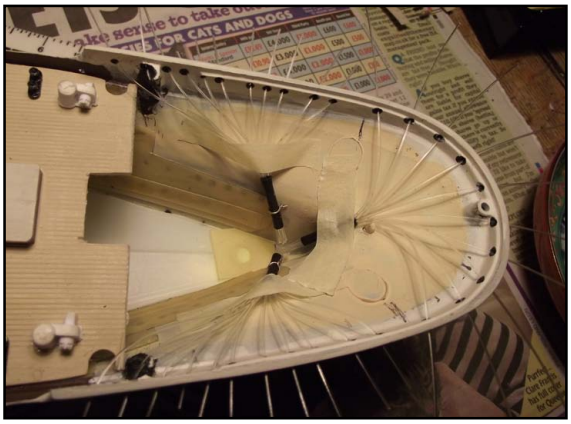
* I had around 0.5-0.8mm of FO cable protruding out each hole - ideally they would be flush but trimming them further risked the cable springing inwards and being lost inside the ship. The FO cable nubs really are quite invisible in daylight, even if they poke out a little. If the right adhesive was found to glue FO cables, it would be easier to trim the cables flush with the external walls without the risk of pushing them inwards.

* Use schematic diagrams or Peter Davies-Garners book to see where all the external upper deck lights are - and often there's little nubs on the bulkheads which indicate a light fitting. It's not impossible to get nearly all the Boat, Well and Poop Deck lights exactly right (which are the most visible parts of the model), but the lights going along the A and B Deck promenades - well - as stated, use your discretion (I put about 20 in each side, the real ship would have had many more).

* Front and rear mast lights - there are instructions on the TRMA site for putting a FO cable into a mast.

* The only area of the hull which had FO cables instead of general internal lighting were the 32 portholes around the back of the Poop Deck. The reason is so these portholes are visibly illuminated even when you aren't directly perpendicular to them, and glow whichever angle you're looking at the ship from (you'll see what I mean when you do this).

NB - not all of the portholes around the back of the Poop Deck would have been lit in the real ship because some of these rooms were unoccupied machinery spaces. Therefore lighting all of them is not strictly accurate.



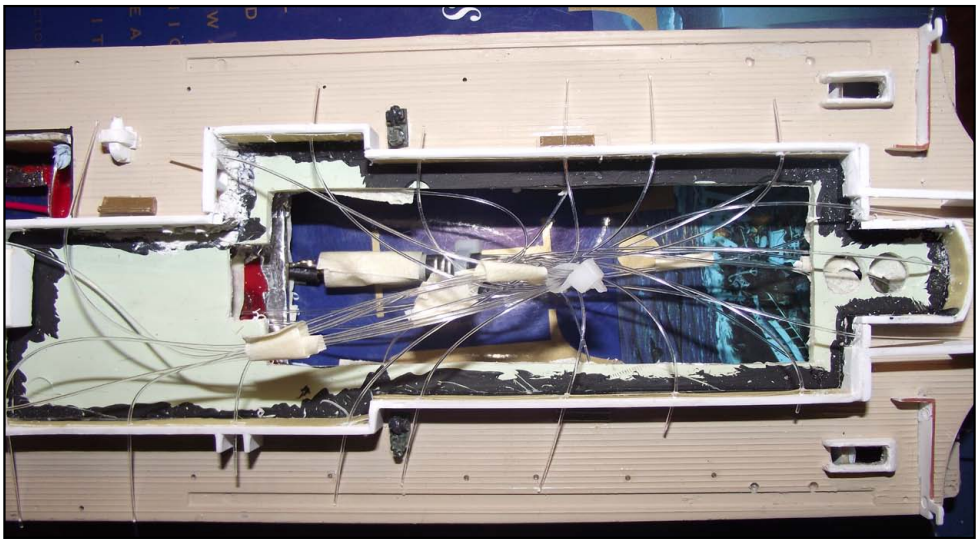
Portholes around the rear of the Poop Deck each gets a cable, so they are visibly lit even when you're not looking directly down them. The front doesn't need this because its equivalent portholes are divided down two fairly flat surfaces.

Installing FO:

Timing: As with several specific aspects of this model like rigging or railings, there are points during the ship assembly when the time is right to put various FO cables in. Do it too early and there's FO cable springing everywhere like a jack-in-the-box; do it too late and you just won't be able to thread the stiff cable through.

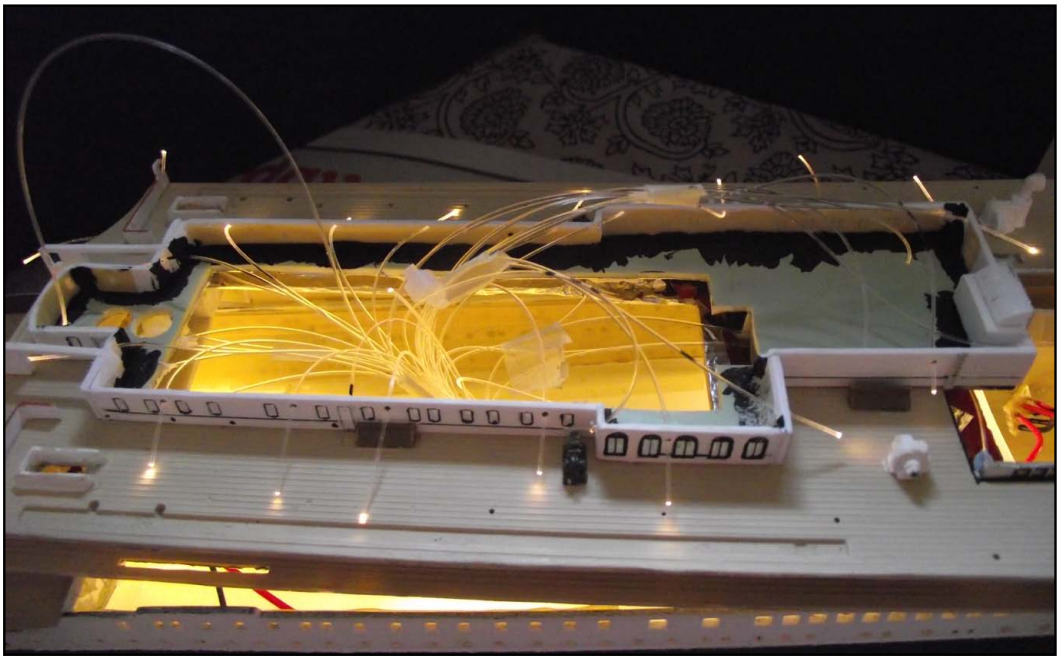
Your overall aim, as you build up the internal FO cable network, is to be feeding and cutting lengths of FO cable through the newly drilled 0.5mm holes in the wall/bulkheads, with 2-4cm poking outside, and around 10-15cm internally. Once you have some cables in, you will soon see that they want to slide out, so straight away to hold them in place you need to start gathering groups of cables and binding them together with masking tape, shrink-wrap insulation, or anything at hand - even if it's just temporary before you make the final bunches. Form small groups of 4-8 cables which poke through to the underside of A Deck, more-or-less along the centreline of the ship, and as you thead further cables in, plan to have groups of 15-20 cables which converge at various points underneath the A Deck, where LEDs will be. You will soon see that FO cable forms its own loops and arcs, and doesn't like being bent sharply - this will dictate which cables get bunched together, and which ones can be taped or braced against an internal surface.

NB - I reiterate: when in doubt, put extra length into the FO cables - it's very annoying trying to work with just-too-short FO cables.



Allowing each FO cable to form its own arc, binding small groups of cables into larger bunches to receive light from an LED below. Note black light-proof paint and filler to cut out the crack of light between the Officers Quarters walls and the boat deck.

Checking that all the FO cables going into the Officers' Quarters are showing fairly equal light before the roof is glued on. Note the lit FO cable coming from where the starboard bridge wing cab will be - to be coloured with green translucent paint.



The following assumes that the superstructure is being assembled separately from the hull...

NB – While accurate lamp placement is normally possible using reference material such as the Peter Davies-Garner book, the A Deck in particular (and the Poop Deck docking bridge) present a problem: they have overhead-mounted lamps, but to do so (at 1/350 scale) would mean drilling holes through the Boat Deck and having FO cables visibly strewn all over the Boat Deck above. To solve this I ended up substituting all overhead-mounted lamps on the A Deck (Promenade Deck), and others with this problem, with bulkhead-mounted lamps. This looks entirely in keeping with the rest of the bulkhead-mounted lighting on the ship, but is not accurate.

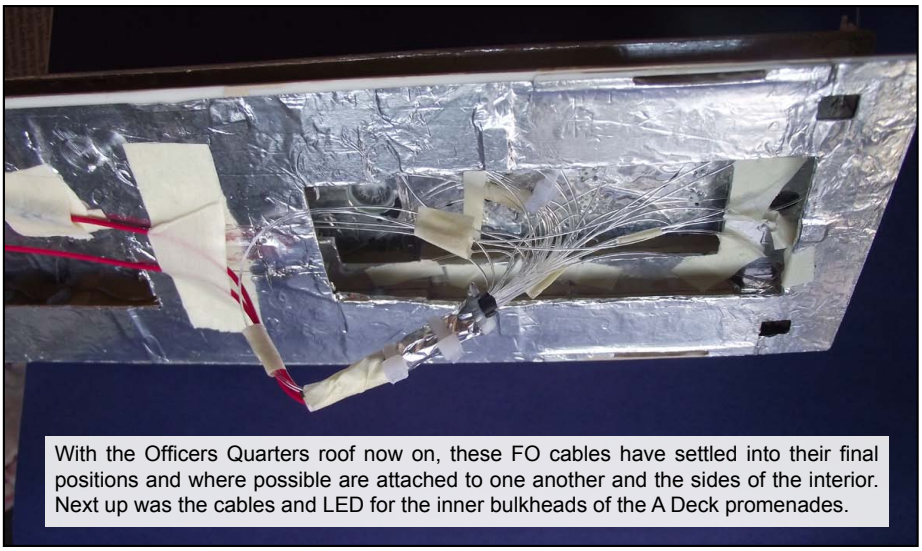
A: It is preferable to drill the FO cable holes into such pieces as the inner A Deck (Promenade Deck) walls, and the Officers Quarters bulkheads, before they are glued onto decks. However, it's still possible to change or add new holes to the inner A Deck walls, until the outer walls are glued, even once the Boat Deck is on.

B: When the A Deck inner bulkheads are glued to the A Deck, but the boat deck is not yet on, this is a good time to get cables into the promenade sides. As stated, tie them off into bunches of 4-10 and let them face downwards into the hull space – worry about attaching them to LEDs later.

C: Once the Boat Deck is on, the Officers Quarters bulkheads are drilled for FO then glued on (but don't attach the roof yet). Also at this stage the two raised 1st Class roof sections are not glued on, and neither are the four extra boat deck housings (tank room, 3rd and 4th funnel housing, 2nd class entrance). Feed, cut and bunch all the FO cables into these deck housings.

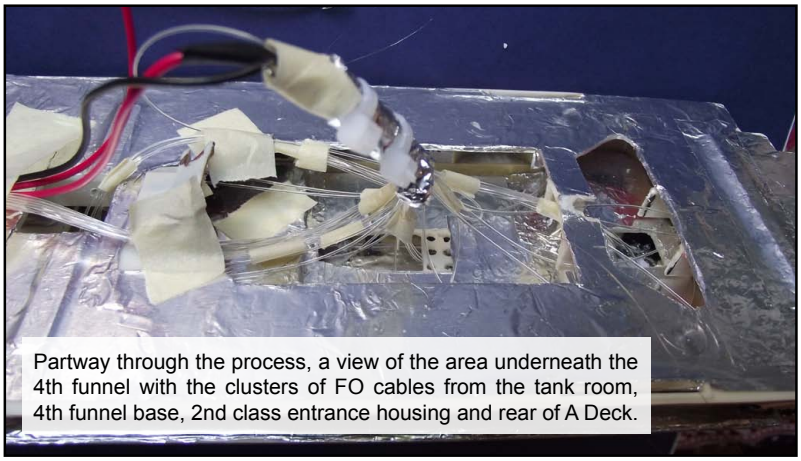
D: Once you are happy with the many FO cables into the Officers Quarters, glue its roof on, likewise with the two raised 1st Class roof sections. You may have to push against springy FO cables to glue these roofs down, but once they're on it actually helps contain the bunches of FO. Note once these roofs are on, things begin to get more fiddly because access is reduced.

E: The four extra boat deck housings each end up with a bunch of FO cables, which need to be put in before the housings are glued to the Boat Deck. I made the length of each bunch around 12cm long, because it wasn't yet clear how much length would be needed to reach each LED.



With the Officers Quarters roof now on, these FO cables have settled into their final positions and where possible are attached to one another and the sides of the interior. Next up was the cables and LED for the inner bulkheads of the A Deck promenades.

F: Once all upper deck roofing, and the four extra housings are glued down, you will find that the underside of the superstructure has numerous bunches of FO cable poking in different directions, and of different lengths. Begin to bring these together into larger bunches of 15-20, tie them together and trim the ends so they are flush. Keep these bunches down the centreline of the ship, but it really doesn't matter if they're a bit irregular, on different angles, or of different lengths.



Partway through the process, a view of the area underneath the 4th funnel with the clusters of FO cables from the tank room, 4th funnel base, 2nd class entrance housing and rear of A Deck.

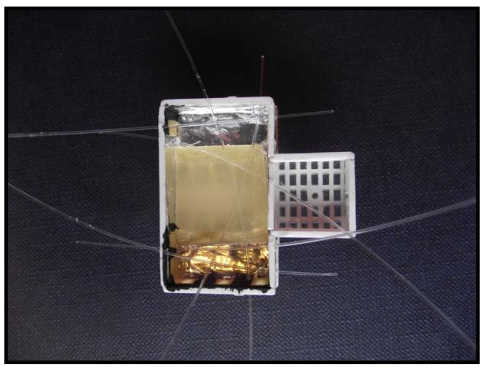
G: Once these larger bunches have emerged out of the chaos, you can begin to solder up LEDs to be tied so they are shining directly down the FO bunches. Don't wire the LEDs so FO bunches have to be overly stretched or bent to meet them – better to have it the other way around and give the LED wiring a bit of extra length. Make sure all the FO strands in each bunch are trimmed flush with themselves, so they get equal light, and make sure each bunch is held together tightly so it forms a circular shape.

H: Initially attach each LED / FO bunch union with a temporary wrap of masking tape, and switch power on, to check that each FO cable is equally lit; it might be that one of the FO cables is damaged or a cable end got lost in the bunch. Once you're happy that all the FO cables are being lit, you can begin to affix LED and FO bunch in a more permanent way. I used a tight wrap of making tape, then one wrap of al foil to stop light leakage, then more tape, and held together tightly with cable ties. Again, it doesn't make sense to try to line all the LEDs up neatly, instead orientate them around the FO bunches which will want to form their own shapes.

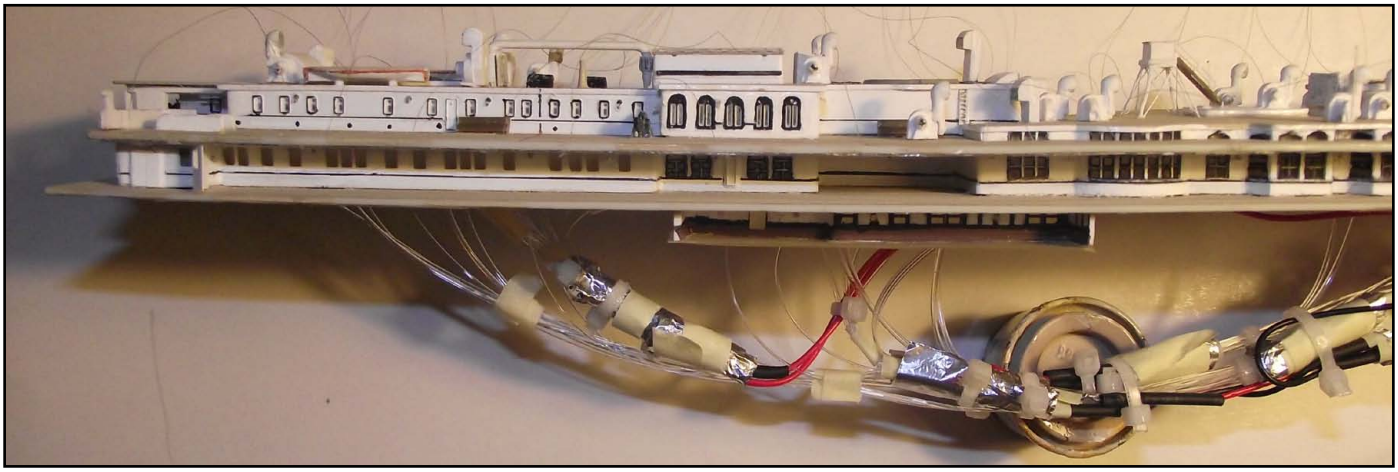
I: Not all of the FO-specific LEDs are in the superstructure – as part of the FO light circuit, two of these LEDs are in the hull because there are arrays of FO lights both fore and aft below A Deck: At the front are just a few around the Forecastle and Forward Well Deck, and the forward mast light. Aft there are many – all around the rear of the B Deck, the Aft Well Deck, and the Poop Deck. In fact there are too many FO cables in the aft section for one LED, so around 6-10 need to be long enough FO cables to reach the LED under the Forecastle.

NB – as stated earlier each of the 32 portholes around the rear of the Poop Deck has a FO cable; these are bound together and pointed close to, but not directly down the throat of, the LED which sits in the crevice where the central propeller shaft should be. This way they are roughly as bright as the other portholes. If they were directly in-line with the LED they would be too bright.

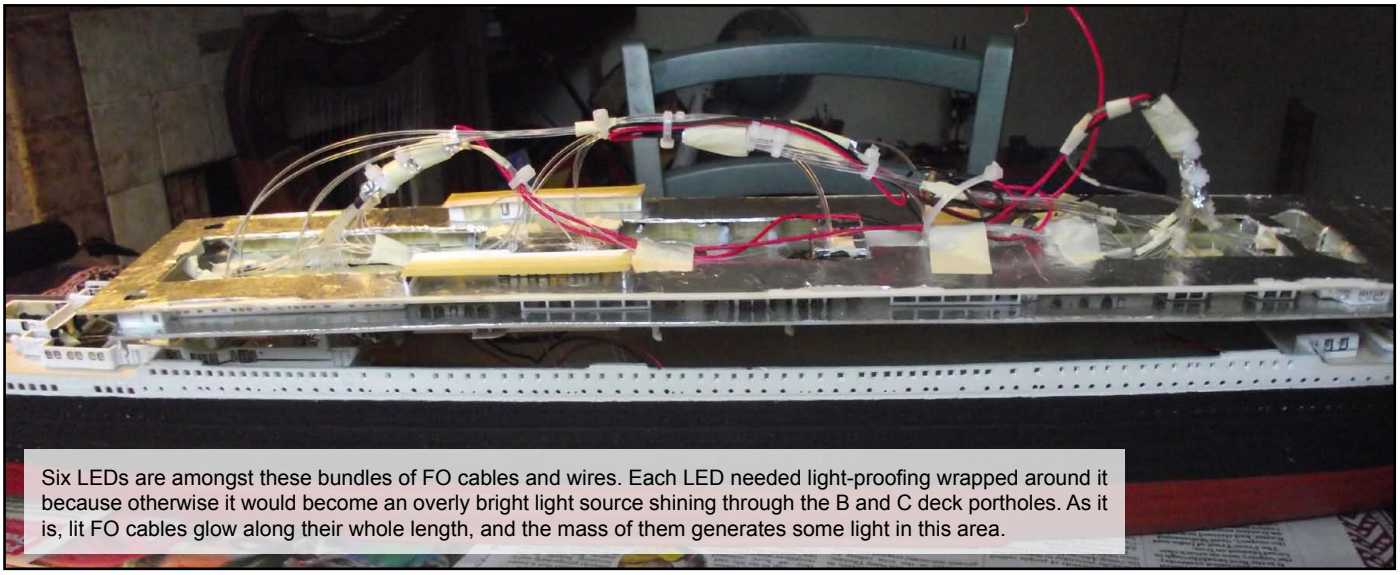
J: Once all the cables are affixed internally, finally trim off the excess cable poking out the holes.



Underside of tank room with FO cables about to be bound into a group.



With the outer walls of the A Deck about to be glued on, nearly all the FO cables and LEDs are in place here. At this stage the more the FO cables and wires can be bound and cable-tied together, the more it becomes a single loom, protecting individual FO cables from springing out of position.



Six LEDs are amongst these bundles of FO cables and wires. Each LED needed light-proofing wrapped around it because otherwise it would become an overly bright light source shining through the B and C deck portholes. As it is, lit FO cables glow along their whole length, and the mass of them generates some light in this area.

TIPS DURING THIS PROCESS...

A: Ways to bind FO bunches: masking tape, cable ties, copper legs from LEDs or resistors coiled around, or electric-cable heatshrink (without necessarily shrinking with heat).

B: It's invariably easier to feed cables from the outside in, rather than from the inside out, so it's rarely more convenient to pre-make FO bunches which are to be fanned out into holes from the inside.

C: It is likely that there will be FO lights which needed re-doing, for whatever reason, or you missed ones. It could be a good idea, when binding FO bunches to LEDs, to leave one LED in the loom free for these extras, or at least make one LED so it's not permanently bound until the last minute so you can add FO cables to it. It's a pain having to undo a bound and light-proofed LED/FO union just to get one more FO cable in.

D: When the LEDs are wired in and it's all in place, use extra cable ties and other means to brace the FO cables into one mass, like a car wiring loom. Use PVA glue and masking tape to affix any FO cable which is resting against a surface. This will turn the FO loom into a fairly robust, unified structure that is firmly attached to the inner walls of the model and prevents individual FO cables from springing out.

E: Test that equal amounts of light are coming through each FO cable in a bunch before permanently binding them to an LED or gluing decks and roofs down onto them. It could be that a FO cable is damaged, or one of the cable ends is lost further back in the bunch.

F: Only trim the outside ends of the FO cables once it is all in place, and after there is a dob of white PVA woodwork glue inside and preferably outside where the FO cable goes through the bulkhead. And be careful of a FO cable springing inwards and getting lost in the ship if you trim it too flush to the wall - the act of cutting with scissors or trimmer can flick them away and into the interior. (Once a cable is lost inside, it can be very hard to thread it back through the hole from the inside, particularly if it's on an angle and access is poor).

Looking down on the front half of the boat deck (minus funnels and other fixtures, with rigging hanging loose). This photo shows the way pools of light pick out detail on the deck - the lifeboats and other details will look great once in position.

NB - Visible are the four points of light I have placed beneath each funnel to cast light up them (hidden under the Fidley grills for funnels 1-3). An idea borrowed from the Cameron film, these lights did not exist on the real ship and therefore are not included in the diagrams for this tutorial.

Accuracy? Well, er, (cough cough)...

Any half-serious modeller is striving for accuracy within the limits of known information, and despite inaccuracies in the model itself.

The Poop Deck partway through completion. The FO cables running up underneath the docking bridge rise upwards from the deck, and are bent over at sharp right-angles and glued to the underside of the bridge. The cables need to be light-proofed, and take the place of vertical struts under the bridge. Note that I have erroneously overlit this area, and would recommend instead using the diagram on page 12 to light the docking bridge. Also what appears to be a glowing aft flagpole is in fact an FO cable which will be cut to become a rear-facing, rail-mounted lamp. NB - Fibre optic cable is actually good material for this flagpole because it bounces back to position after being pushed or knocked.

You can approach a *relative* accuracy at 1/350 scale with this material. Using reference sources to place the lamps correctly (where possible) and giving them the right hue and intensity with 'warm white' LEDs - and the correct resistors - gives very good results. But, as I found, some compromises had to be reached such as substituting overhead-mounted lamps on the A Deck with bulkhead-mounted FO cables. And the lamps under the Poop Deck docking bridge were a challenge (see right).

It's been pointed out to me that I've made a 'builder's model'. I take this to mean a model which is a clean representation of a design, like a scale model a shipbuilder may make to demonstrate a new ship. This is as opposed to depicting it 'realistically' with such details as weathering, or underway with passengers and crew onboard in a diarama. Indeed never in the short life of the ship would all lights have been simultaneously ablaze as I have it (and in fact some portholes could never have been lit - like those around the back of the Poop Deck). It did occur to me at one point that this uniformity of lighting was improbable, and I experimented with making some portholes duller than others, thinking this might lend realism. What it did was make my modelling skills look patchy!

So therefore the parameters of 'accuracy' are on those terms: this was not about recreating a hypothetical scenerio, but rather, engaging in one further aspect of the ship - its external lighting - and going about trying to reproduce this.

The Titanic police don't cruise around looking at peoples' models and issuing infringements for flagrant transgressions such as bright yellow instead of White Star Buff, but at the same time if you're going to bother you may as well get it right.

Having said all that, there is a difference between being 'realistic' and 'lifelike' - and there's no doubt that this model, lit in a darkened room, does amaze people by eerily appearing to come alive!

The as-yet unfinished model dry-assembled (hence the light leakage under A Deck).

Conclusion

Lighting has more than doubled the time taken to make this model. Other than the FO cabling itself, light-proofing was an onerous task, to say the least. A lot of the internal decks needed cutting into which you wouldn't otherwise. The point before you can glue the superstructure to the hull seems to be prolonged interminably. Cost wasn't a major factor versus the sheer amount of time involved – it added less than £50 in dribs and drabs to the total cost of the build.

Hopefully this tutorial can put modellers on the path to installing FO lighting with a lot of questions already answered. It's not a guide to the 'definitive' way of doing it, but rather something to bounce off, as other modellers launch into their own approach to the same task. I would recommend buying Peter Davies-Garner's book at the outset, to take a lot of guesswork out. (This applies to every facet of the model, not just lighting.)

In some regards, looking back, my work here has the hallmarks of a first attempt, but this has its advantages.

Of course I can already think of ways to improve on it, which invariably involve tighter planning and greater levels of detail. But the virtue of this method is that it's relatively straight-forward and do-able (considering how complex this could be); it doesn't get overly bogged down in minutiae and it doesn't require too many expensive modelling products. By all means add any extra layers of complexity you like, but what I've got here works.

Examples of how I'd do it differently? There are so many refinements you could make... such as putting a potentiometer for each lighting circuit in the bottom of the hull to allow fine-tuning of light balance. But more fundamental design improvements could include keeping the internal decklamp FO cables on separate - and duller - LEDs from the external cables, so areas like the Promenade Decks could have a much greater amount of (softer) lamps, which would be more scale-realistic. Another big change to consider would be using 0.25mm FO cabling instead of - or in combination with - 0.5mm.

Like every other aspect of this model, it's up to you how much time you are prepared to put into adding extra finesse and detail (even if your long-suffering partner can't tell the extra degrees of accuracy which added months to your project!) What I've put in this tutorial takes it to a reasonable level; I look forward to seeing how far beyond this point some of the extraordinary modellers on TRMA are able to take it!

Next up - an embedded audio device playing a looped soundscape of engine noise, waves lapping, string orchestra music, people chattering and glasses clinking... Any takers?

When this model is finished, hopefully a revised version of this PDF will be published featuring some high quality photos of it. In the meantime here it is in a partially completed state to give you an idea of how it will look.

Light Plan

Given that some of the published reference sources differ over one or two lights, I have elected to base this lighting on diagrams in Peter Davies-Garner's Modelmaker's Manual. While the following deckplans are fairly accurate, for the purposes of 1/350 scale, I would suggest using a reference source for exact locations rather than solely relying on these diagrams.

A marker denotes where each FO cable appears externally, but there's little point in trying to map the maze of cables inside - it doesn't matter where they go as long as one end appears out of the hole and the other end is on an LED.

A **RED** marker indicates a light which directly corresponds to a fitting in PDG's book. **BLUE** are bulkhead-mounted lights in lieu of, and as near as possible to, overhead-mounted lights which weren't doable with FO cables*. **GREEN** are lights which are clearly inaccurate, but give the effect of lights which were impossible to recreate.

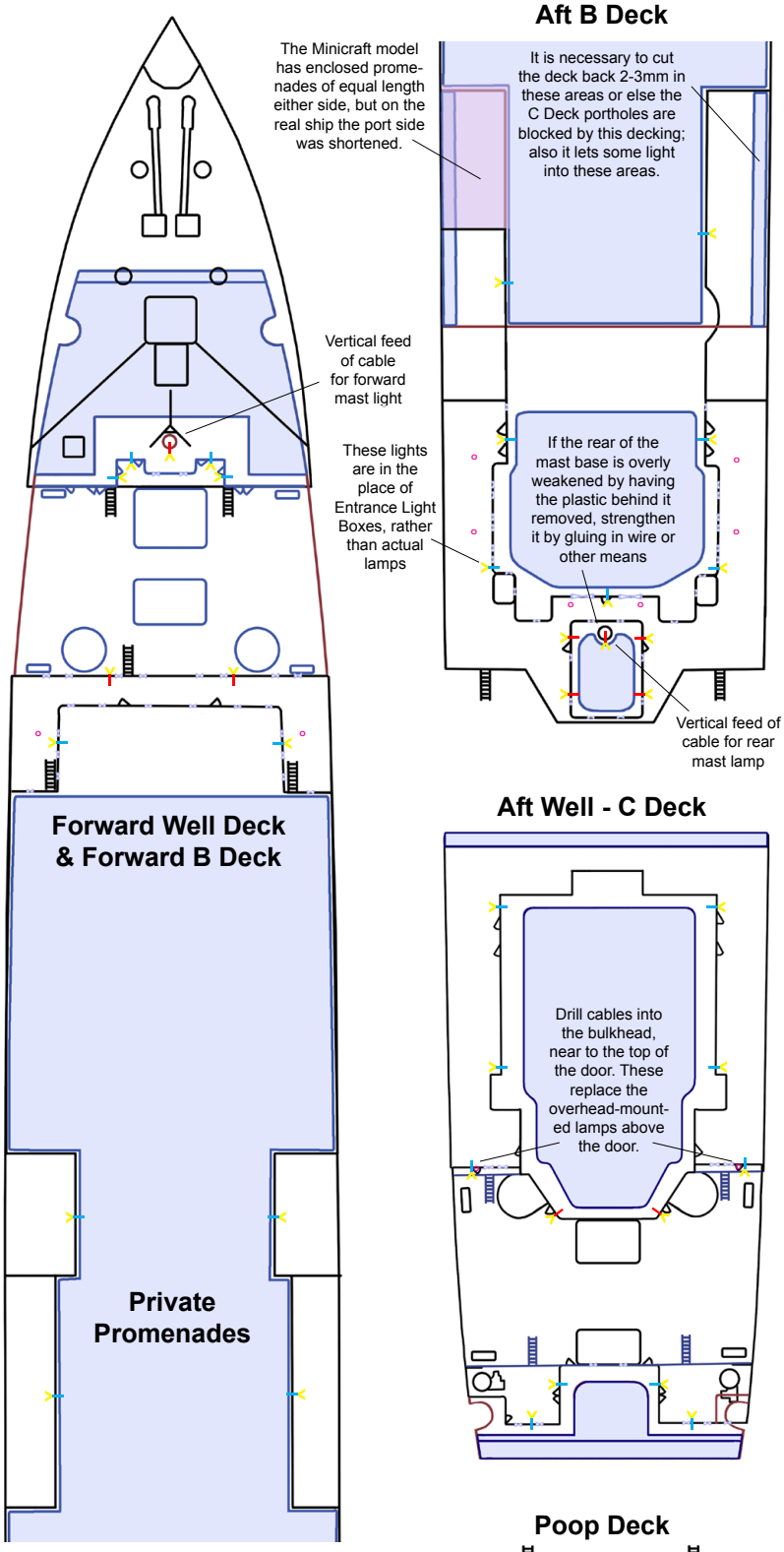
Some of the light fittings (particularly around the Officers' Quarters on the Boat Deck) had semi-circular shrouds - Rivet Counters have a guide to where these are, and how to make them see here.

NB Some of the light locations differ between the following diagrams, and photos of the model in this document. Work from the diagrams: some of the wrong lighting in the model had not been corrected when the photos were taken.

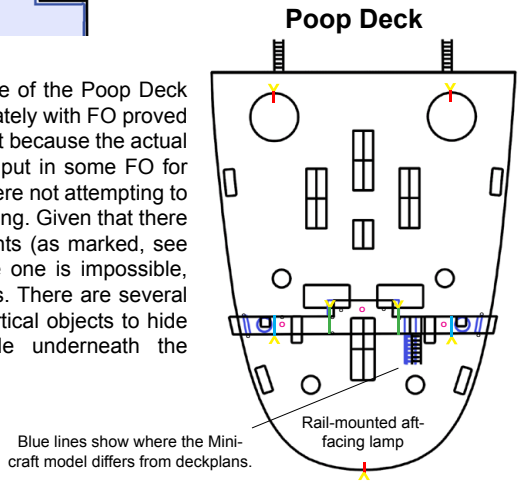
Indicates areas of decking cut away to allow internal light to circulate

◦ - External overhead-mounted lamps on the actual ship, locations sourced from Peter Davies-Garner's book.

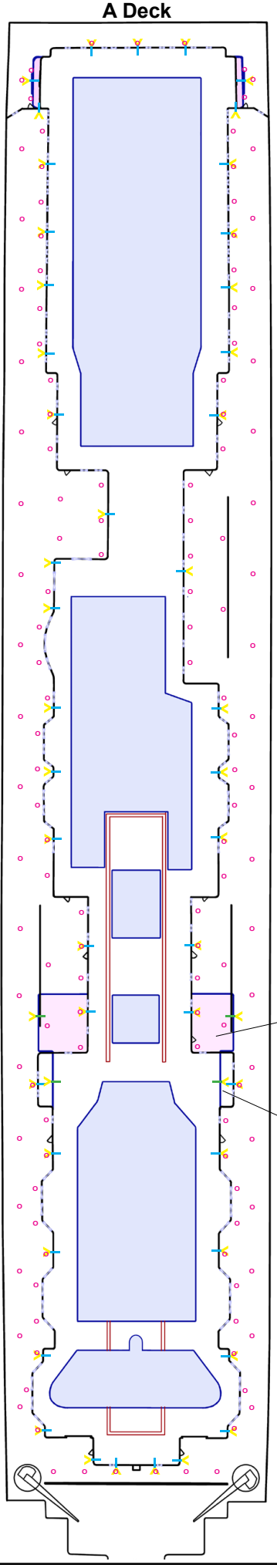
* Considering that in my schema one bulkhead-mounted FO light replaces about 3-5 overhead-mounted lamps in such areas as the Promenade Decks, another way to approach lighting these areas would be to use more FO lights, but grouping these specific cables together with LEDs which have higher ohmage resistors and are much duller. In other words many more points of light, but each one duller, would be more realistic than what I've done. It's probable that in the real ship these internal lamps were lower wattage than the external lamps anyway.



Lighting the underside of the Poop Deck docking bridge accurately with FO proved to be very difficult. But because the actual Poop Deck was lit, I put in some FO for this purpose which were not attempting to recreate the real lighting. Given that there were three actual lights (as marked, see right), but the middle one is impossible, I've put in four cables. There are several upright struts and vertical objects to hide FO cables alongside underneath the docking bridge.



A Deck

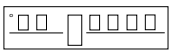


The bridge is worth lighting well because of its instruments. The two forward lights make for long pieces of protruding FO cable - if they don't stay in position through their own rigidity, they may need affixing to the bridge ceiling (in the standard Minicraft moulds they have channels to sit in either side).

Pink areas on this deck denote areas where the Minicraft model differs from the actual deckplans. The two sections of the 1st Class Entrance which jut out are too far forward on the model.

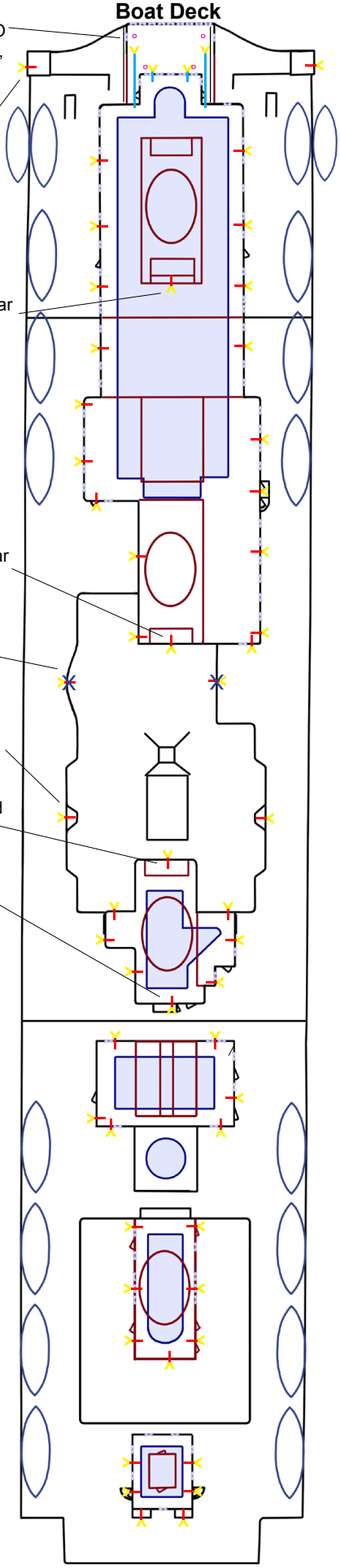
Green indicates light placements if the Minicraft bulkhead has not been corrected.

Suggested height of the bulkhead- mounted lamps which replace overheading-mounted on A, B and C/Well Decks.



Because these lights are replacing overhead-mounted lamps, it may make sense to drill them at the top of the bulkheads. However I would suggest drilling them at a uniform height consistent with other bulkhead lamps and it's not just so they look in keeping with the rest of the ship: assuming that a deck or roof will be glued onto the top of the bulkhead, you need to keep the FO cabling away from the adhesive involved.

Boat Deck



Wing cab navigation lamps need colouring red and green - but test any paint you are using on scrap FO cable beforehand incase it damages it.

Decklamp top centre, rear facing 1st funnel vent

Decklamp top centre, rear facing 2nd funnel vent

The two crossed out lamps were not possible with FO at 1/350 because they are rail-mounted, and there is no way to hide the cable behind the light point.

These two lamps are rail-mounted, and are possible because of the cowl vents immediately inboard which the FO cable can hide beside.

Decklamp top centre, forward facing 3rd funnel vent

Decklamp top centre, rear facing 3rd funnel vent

These deckplans were drawn by the author, and are a composites from many sources.

Wiring Schematics

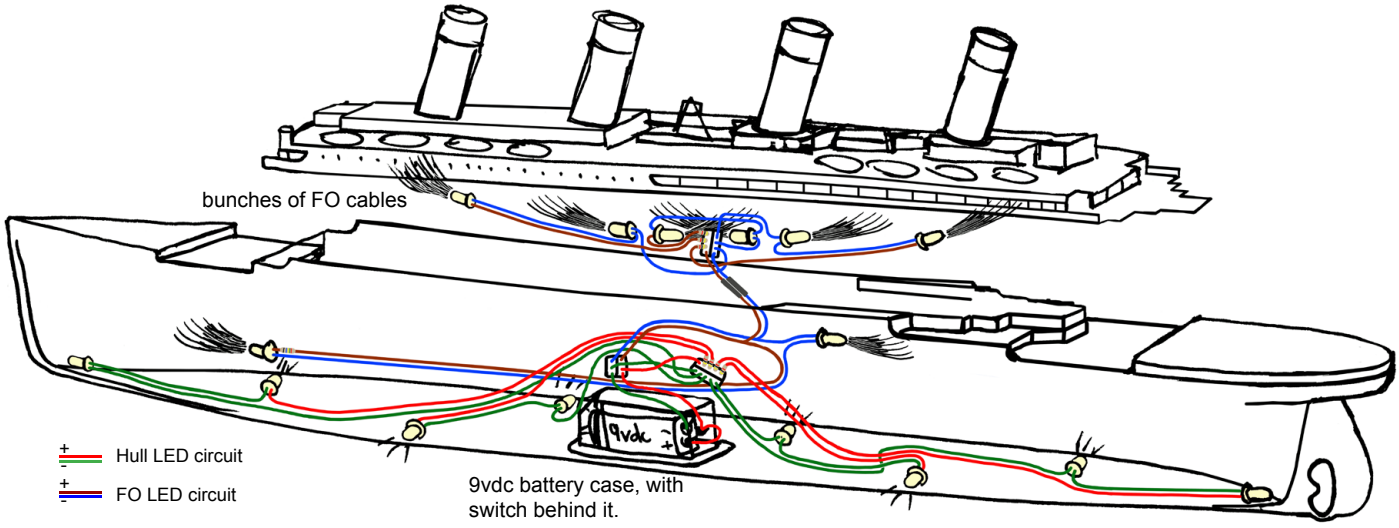
The drawing below shows the LEDs more-or-less where they are within the model. All LEDs are connected in pairs in series with themselves and a 1kΩ 1/4w resistor. The pairs are wired in parallel into two separate circuits keeping the hull LEDs apart from the FO LEDs, allowing either circuit to be dimmed independently with an extra resistor if the light balance is out between the two. I used a small piece of electonics stripboard to make this divide, and wired it in close to the battery box, because once the superstructure is glued on the only way to access the wiring is underneath through the battery box hole.

It would have been more convenient if the whole FO LED circuit was in the separate superstructure, but given that there are many FO lights below the A Deck, front and rear, part of this circuit needs to be within the hull section. This is not a problem, you can still have it so just a pair of wires is all that connects the two pieces of the ship - though give it about 5-6cm of slack between so you can access the wire joints before attaching them.

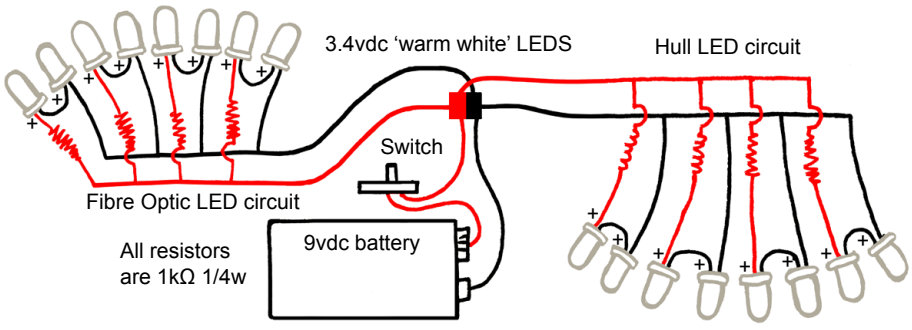
When soldering the wires to the LEDs, use cable heatshrink to insulate any exposed wires at the back of the LEDs, and any other part of the circuits, to prevent short circuits. If you short circuit one LED, the other LED in its pair immediately fries because suddenly it's getting too much current (as I found).

Regarding the ohmage of the resistors: You need to put a resistor into each LED circuit or else the LEDs will blow, and if you use a LED circuit calculator website like this one, they will suggest a 270Ω or 470Ω resistor. After experimenting I decided that 1kΩ resistors were giving the right level of brightness, even though this causes an otherwise unnecessary minor drain on the battery. Of course if you are using something other than 9vdc into pairs of LEDs, you will probably have to use a different configuration of LEDs and resistors - the website mentioned is a very useful aid for this.

*NB - **Pulse Width Modulation:** a much more energy efficient and clever way of dimming LEDs involves a circuit which pulses the power supply off and on so fast that there is no perceptible strobing effect. I couldn't find an off-the-shelf PWM circuit kit online, but may re-investigate this idea at a later point. For more information about this click here.*



Not-to-scale schematic diagram



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