CPS Emitron TV Camera Cutout Card Model (1/12 scale)

Background

A note on usage: what is being constructed is officially the CPS Emitron Camera ***Head***: the imaging required the camera head which contained the lenses and the Emitron tube and associated scan coils and amplifiers, and an associated camera control unit contained in the studio engineering "gallery" (more often than not on the same floor level as the studio) to which the camera head was connected by a multi-cored cable. However, in these instructions, the part modelled is referred to as the "CPS Emitron Camera".

Why model the CPS Emitron camera?

The CPS Emitron Camera was the first post-war British television camera by EMI and used for the first time at the 1948 Olympic Games: This was a three-lens turret camera head. CPS Emitron cameras were the last in the line of development of the Emitron-based cameras, the first of which were used on the very first public regular high-definition television service from November 1936, from studios at Alexandra Palace (Ally Pally) in London. The Emitron tube – a variation on the basic cathode-ray tube – was used in the Marconi-EMI Television Co. Ltd cameras developed for the BBC and first produced in January 1934. The Emitron pick-up tube went through a number of iterations, culminating in the "Cathode Potential Stabilised Emitron", which was a significant step-change improvement, as the image target plate now became a sheet of glass with a signal plate on one side and a photo-electric mosaic on the other: all these elements were transparent and the target was placed at the front of the tube, so that the electron gun could be placed in-line behind – this made for a much more robust mechanical design (a real "tube" – a cylindrical design, some 14 inches long and 3.5 inches in diameter).

Later versions of the CPS Emitron camera head body allowed for a four-lens turret with an “integrated” set of lens hoods. This up-issued design was adopted by the BBC and the cameras (EMI 4499 CPS Emitrons) were introduced in 1956 initially for use in Lime Grove Studios D, G and possibly H – (Studio E gained them three years later) – and clearly the “powers-that-be” were pleased with them, as the new camera was introduced to the televiewing world by Richard Dimbleby in a “Panorama” programme in June 1956.

CPS Emitron cameras were the last studio turret cameras with the focus handle on the left-hand side (studio cameramen preferred to focus with the right hand (and with a servo-based zoom, to zoom with the left hand): Outside Broadcast cameraman preferred the controls to be the other way round (on Outside Broadcasts there was a higher zoom-to-focus ratio)).

The CPS Emitrons gave very nice facial tones, but there were some issues with them. If the camera was pointed at a TV Monitor in the studio, and if the image was a suitable size, this large amount of light could affect the camera tube response, and the monitor picture could fill the whole picture area. This characteristic made them very useful for standards conversion, where a television camera on one line standard looked at a monitor which was showing a picture of the other line standard.

Some Firsts from Lime Grove

CPS Emitron cameras were used on the first "Grandstand" 11 October 1958.

CPS Emitron cameras from Studios G and H (plus two Marconi Mk III cameras with Zoom lenses) were in Studio G, Lime Grove, on Election Night, Thursday, 8 October 1959, transmitting the result programme for what has been called " the first 'TV Election'". Some 59% of the population watched or listened to the result, the vast majority watching on Television, and two thirds of those watching the BBC (David Kynaston "Modernity Britain 1957 – 1962" Bloomsbury, London).

CPS Emitron cameras were used on the first series of "Doctor Who" – first ever episode broadcast on 23 November 1963.

“Panorama” October 1956

Before You Begin

CPS Emitron Camera Variants

There seems to have been many different variations of the CPS Emitron Camera body – each photograph shows some differences to the others. This model can not reflect every one of those variations, so this is more a “generic” Mk 3 CPS Emitron than an exact model of any one version.

As noted earlier, the term “CPS Emitron Camera ” is used throughout these instructions, as that is how this piece of equipment was always known in the BBC studios, but to be pedantic, this is a model of the Camera “Head” – there was the other part, the Camera Control Unit (or CCU), which was housed in the Studio Engineering “Gallery” – otherwise known as “Racks” because of the racks of equipment there.

Print Out the Construction Sheets

Print out the PDF construction sheets onto suitable printer card. This construction kit is not suitable for assembly using printed paper sheets.

Trial versions of this kit have used W.H. Smith Premium White Card 160 gsm matte card, which is thin and easy to cut. An alternative is 180 gsm Premium White card from Hobbycraft, which is thicker and a little more difficult to work: the edges can show more “fraying” - but this depends on the sharpness of the knife used to cut and trim it. The cut outs have been designed for use with 150 to 200 gsm card. If you use thicker card, you will have to adjust some of the folds for the glue tabs in order to accommodate the thickness of the card.

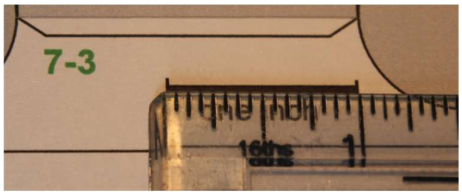
Please note that inkjet printer card is absorbent and soaks up PVA glue (and can then become soft and/or delaminate), so care in assembly is needed in those areas where you use this glue.

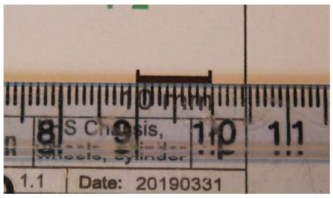
Decide on the level of detail for your CPS Emitron Camera.

This kit has been designed to allow all modellers to build a successful model. Extra parts have been included to allow more experienced modellers to create a more detailed version of the CPS Emitron Camera. In most cases it is possible to add the extra detail at a later stage, but this may not be easy for all the fittings.

Check your scale.

This kit had been designed to make a scale 1:12 model of the CPS Emitron Camera. The printed sheet of the kit contains two scale markers, one showing one Imperial Inch, the other showing 10 millimetres (or 1 cm).





You can adjust the scale if you wish: for example, if you print the sheets onto A3 size card, and check that the 1 inch maker is one half-inch long (the 10 mm marker is 5 mm long), you will have a model which is one-sixth full size (1:6).

Notes about the construction

Please remember that this is a ***card*** kit for the CPS Emitron Camera, and because of this it is not possible to replicate accurately every detail of the camera. . One particular area is the set of clasps which are used to hold the lift-up camera body sides to the main body. A set of optional items to cut out and assemble may offer a more "3-D" aspect to the side of the camera, but these are not essential.

Many of the cut-out parts have white edges: you can apply a grey or black marker pen to these edges. Please do **NOT** use a "Sharpie", as the ink spreads after it has been applied and can spoil the appearance . We recommend that you try your marker pen on a piece of waste card to see if the ink spreads or not. As an alternative, you can use a soft pencil such as a 2B (or softer) – to shade down the edges.

Please Note that there are a few places where the construction sheets have been modified since the build photographs were taken: these improvements have been made to make it easier for you to construct the model or to improve the accuracy of the model.

Where possible, card assemblies are used for appropriate parts of the model, but a competent modeller may well be able to substitute everyday objects for some of the components, or to provide additional detail. (Where a suitable everyday object can be substituted, this is noted in the instructions).

In every modelling project, there seem to be some parts which are too small to handle (and some parts which seem to be too big for the available tools!). This kit is no exception: there are a lot of small parts. In some places, there are alternative construction suggestions to allow the assembly to be quicker and easier.

Some dimensions have been approximated to make it easier to construct: one example is the focus handle. This is a rather delicate and fragile item. An experienced modeller may be able to slim down elements of the focus handle once everything is dry and solid.

The focus handle is constructed from two pieces of card which are glued together: it is recommended that PVA glue is used for this. The card-glue-card sandwich provides a stronger item. You might find it useful to place this glued item under a heavy weight while the glue dries, in order to keep the arms straight and true (make sure that there is no glue leaking round from the edges of the card pieces, or your delicate part might end up glued to the weightier item!

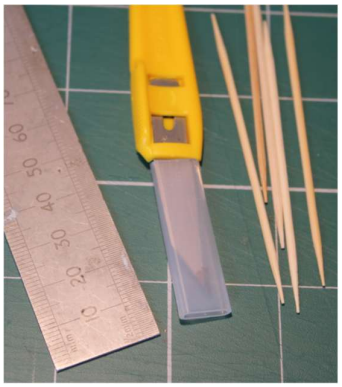
For some of the items, it is recommended that you use cocktail sticks, bamboo skewers, round craft sticks (or even scent diffuser reeds). These are approximately the correct diameters – but they are not exact. Please be aware of this.

There are many folds in this kit: most of these are fold **downs** (sometimes called "hill folds"). In common with all card construction kits, we suggest that you score along the fold line for a hill fold using a very light touch with a craft knife: this usually produces a crisp, sharp corner. However, in the CPS Emitron Camera Head there were very few sharp corners on the external metalwork of the bodywork: most of the metalwork was radiused over a crease or fold. Therefore, for the main camera body part of this kit, we suggest that you place a ruler **behind** the fold (hill fold) and crease the card down over the edge of the ruler. This should round the fold or bend satisfactorily.

Please note that all Fold Down lines (hill folds) are shown as grey lines , so that the fold instruction line is not too prominent in the finished model. The Fold Up lines ("valley folds") are shown as dotted lines.

You will need

- Steel ruler
- Sharp craft knife
- "All purpose" adhesive (strong)
- PVA Wood glue
- Wooden cocktail sticks (*note*: manicure sticks are generally too large in diameter)
- Thin wooden burger/sandwich skewers (rods)
- Safety pin
- Steel paper clips (that is, paper clips with no plastic coating).
- Acrylic paint to touch in exposed areas (optional)



Any glue used should be one which dries clear. We recommend two different glues: a standard all-purpose adhesive (which acts as an impact adhesive on non-porous surfaces) and a PVA wood glue. The glues have different characteristics which can be used to help make the model construction easier, or to make the model stronger.

For gluing most of the model parts, a suitable “all purpose” adhesive should be used. A small amount is applied to the joint, and the two surfaces brought together immediately.

(If the card used is not very absorbent, the glue can be allowed to become tacky (just a few moments) and then the joint is made when the two surfaces are pressed together.).

(*Other suppliers of all-purpose glues are available*.)

For some parts of the model, we recommend using PVA Wood Glue as this dries strong and clear. The glue adds strength to the card construction: for example, if you construct the focus handle by glueing two cut-outs together: it adds a plastic layer between the card layers, creating a sort of laminate. If some glue gets on to the surface of the model, it can be wiped clean before it dries, and in any case, it should dry clear (although the PVA glue can affect the inkjet dyes and cause them to run or discolour).

Please Note: the PVA glue soaks into the card, and this makes the card more pliable, which can be of benefit, especially where the card needs to be “formed”.
However, this glue can soften the card too much and/or cause it to delaminate, so should be used only where most appropriate.

(*Other suppliers of PVA wood glues are available*.)

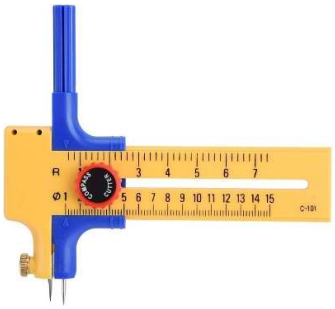
This kit can be constructed using alternative adhesives, such as a “dot and dab” glue gun. This produces a quick and satisfactory joint and is useful for some parts of the assembly. However, as the glue melts with heat, an assembled part may become unstuck if another part is added close by. It can also sometimes be difficult to place the dab of glue in a precise location.

In all cases, we recommend that you glue just one glue tab (or just a few tabs on the lens turret) at a time, and as you do this, that you make sure that everything is in line (or squared up) for the glue tab and the item it joins to. In a number of places, it is difficult to hold the items in their correct position if there is a lot of glue around, particularly on the circular items.

If you need to touch-up the model after assembly, we recommend using acrylic paints as these use a similar formulation to PVA wood glue, and help fasten the kit pieces together as well as strengthening the card (once dry)

A number of parts need holes made for pivots and mountings. You can cut out these holes quite successfully with a craft knife, but you may find it easier to use a simple hole punch as used for making holes in leather belts – this item can be had for less than £6 (post free) online (March 2025).

There are a number of large circular items to be cut for this model, all relating to the lens turret. Again, you can cut out these holes quite successfully with a craft knife. You may find it easier to use a circle cutting tool: these cutting tools for card and paper are readily available, and using them should make the job easier.



Part Numbering

All components have a part number, shown in green, inside a green circle. Minor parts attached to a major part have the main part number, then a hyphen, then the part number.

You are now ready to construct your CPS Emitron Camera!

Construction

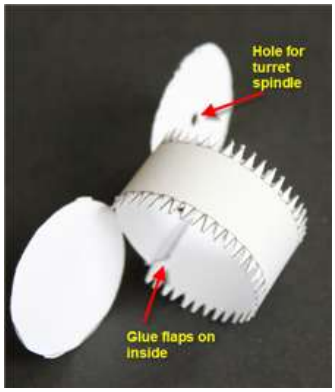
Lens Turret

This version of the CPS Emitron was manufactured with an integrated lens hood as part of the lens turret. This made it very difficult to change the actual lenses used, and to all intents and purposes impossible to mount a zoom lens under studio conditions. The model just shows the lens hoods on the turret, and does not attempt to represent the lenses actually mounted on the turret.

As this is a lens "turret", the model has been designed to allow you to make the lens turret revolve by hand. To strengthen the turret for this operation, two "stiffener" pieces are included – and described in the instructions. If you do not intend to rotate the turret, these stiffeners can be omitted.

There are three parts to the lens turret: the turret front and back and the basic circumference of the lens hood assembly (part 1), and two stiffeners (parts 1-1 and 1-2).

Cut out part 1.This is to make up a cylinder with two ends. The plain end has a small circle marked – this is for the lens turret spindle, and it is much easier to punch out this hole now, or carefully cut it out, before you assemble the turret itself.



The glue flaps or tabs (either term is used in these instructions) fold down so that these glue tabs come to the inside of the cylinder when it is curved.

Curve or curl the "circumference" band. You can do this by running a sandwich skewer along the inside of each part of the curve while you hold the central part.

The two glue flaps at the end fold *inwards* and are glued together (this will not be seen in the completed model). You should now have a complete periphery for the turret.

Glue the front of the turret (this has position markers for the lens hoods) down onto the periphery. Make sure that this whole assembly is fully circular before the glue dries.

Parts 1-1 and 1-2 are two stiffeners for the lens turret: these are two white pieces which are drawn inside the lens turret body ring (coloured grey and marked as parts 2-9 and 2-10) on the construction card printout to save space. The stiffeners are there to prevent distortion when the turret is rotated or posed. If the turret is not going to rotate you probably do not need to use these stiffeners.

The stiffeners each have a small circle at their centre. Each hole should be punched out, or carefully cut out, while the card part is flat. Cut out the stiffener and cut out the slot shown: this is to accommodate the glue flaps used to form the cylinder periphery.

Glue each stiffener inside the cylinder – it should be a snug fit. One should be about one-third along the cylinder, the other about two thirds along.

The rear end of the cylinder can now be folded down and glued to the folded down glue flaps. Make sure that the rear circle is central on the cylinder before the glue dries.

If your turret is *not* going to be posable, you can omit the next step.

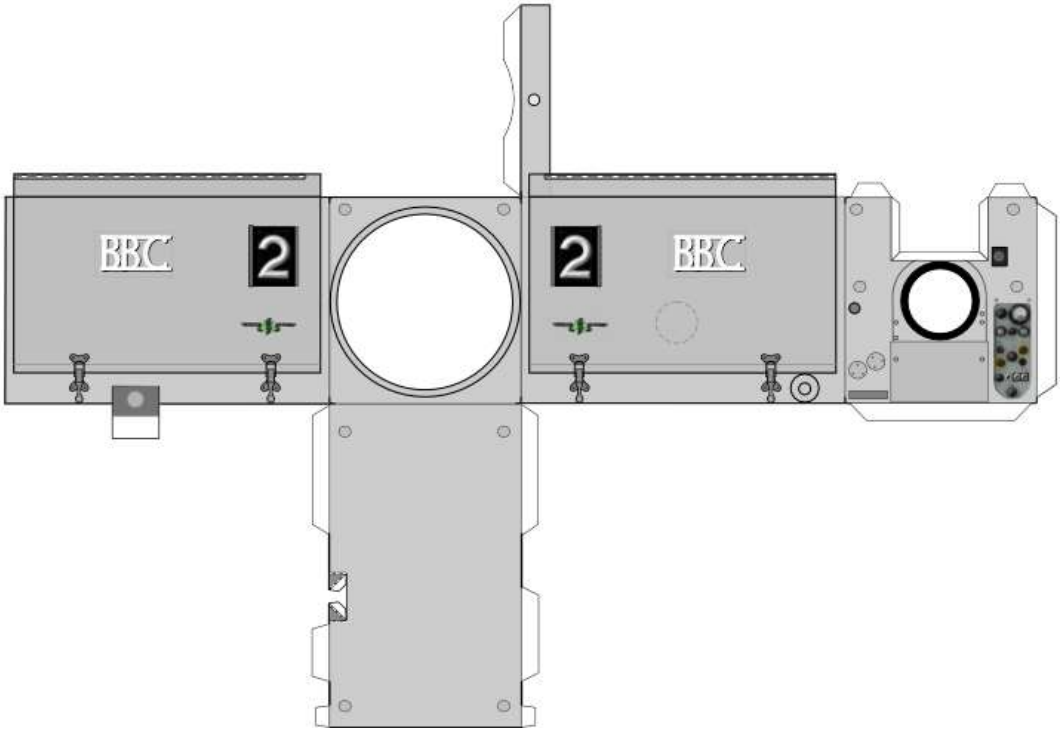
The lens change spindle is made from a bamboo sandwich skewer. The template for this is marked as part 1-7 on the card sheet. The sandwich skewer should already have a pointed end: the pointed end will go to the rear of the camera and attach to the lens change handle. Check that the three spindle holes in the centre of the turret are in line. Cut the skewer to the recommended template length, then apply glue and carefully insert the blunt end of the skewer through the rear hole in the centre of the turret and through the two holes in the stiffener pieces until the glued end is near the front of the cylinder.

Check that the spindle is positioned at a right angle to the front of the turret in all vertical planes so that it will act as an “axle”.

Note: we add the lens hoods to the turret at a later stage in the build.

Camera Body

Cut out the main Camera Body, Part 2:



Make sure that you have made the two small vertical cuts at the middle bottom of the camera's right-hand side (leftmost side as you look at the cut-out pieces). This is to allow the cable entry to be folded back later at an angle to the side.

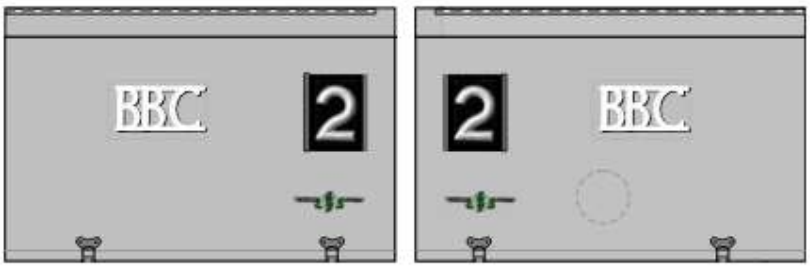
If you wish to add extra detail, it is best to add them at this stage with the body assembly flat and easy to work. These extra detailing parts are not essential to create your CPS Emitron Camera, as the various items are already marked on the camera body (as shown above). If you do *not* want to add any extra detail, please skip to the next section, "Assembling the Camera Body".

Applying the extra detailing bits

As already noted, you will find it most convenient to attach all the optional pieces to the camera body **BEFORE** you fold and assemble the body. You do ***NOT*** need to add all the optional pieces – the camera will look fine without these, but these additional items can enhance the final model. The items to cut out and glue are the BBC identifiers on the sides, the catches which secure the side flaps to the main body, and the camera number, if cameras 1 or 3 are being modelled.

Side flaps

You do not need to do anything here, but if you want a super-detailed version of the camera, print out a second copy of the construction sheet and carefully cut out the side flaps.



These “flaps” gave access to the camera pick-up tube and the electronic items within the camera body and were reasonably prominent. Carefully glue these on top of the printed flaps on the camera side. For really extra “authenticity”, print out a third copy of the construction sheet and cut out the hinges: glue these on top of the printed hinges.

Please note that these additions have not been done on the reference model!

Side flap catches

The catches that held the side flaps down to the rest of the body were very prominent. The catches are printed on the main body piece, but there are optional cutouts that you can add.

Using a sharp modelling knife or scalpel, cut round each catch in the optional box. Trim off any fraying card and tidy up any rough edges.

Glue each catch on top of a printed catch on the side panel.

You have four catches to cut out and stick down.

BBC Identifier

You will need a very sharp modelling knife or scalpel and a very steady hand for this!

Cut round the two BBC identifiers in the option box: the identifier was moulded in white plastic, so cut around the black infill spaces.

Trim off any fraying card and tidy up any rough edges.

Glue each BBC Identifier on top of the printed identifier on each side panel.

You have two BBC Identifiers to cut out and stick down.

Camera Number

The CPS Emitron’s camera number looked as if it was constructed by fastening one of the then current car registration plate numbers to a black backing plate which was then slipped in

to slide channels mounted on each side panel. You can mimic this by using one of the alternative numbers provided: cut out the rectangle for the number (the number had a black backing) and gluing this on top of the existing number.

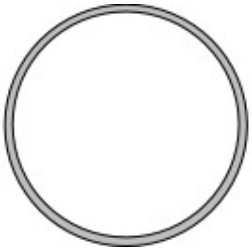
You can print out another two sheets onto card. From one sheet cut out the backing sheet and number, and from the other and carefully cut out only the number required. Stick the number in position on the backing sheet and then glue the backing sheet onto the body side panels – this will give you the full 3-D effect.

You have two alternative matching numbers to cut out and stick down.

Please note that these alternatives have not been used on the reference model!

Lens Turret Surround

There is an annular projection at the front of the camera surrounding the lens turret. Card parts are provided as parts 2-9 and 2-10: the two glued together (with a grey face showing) provide the necessary thickness. Glue into the position marked on the front of the camera.

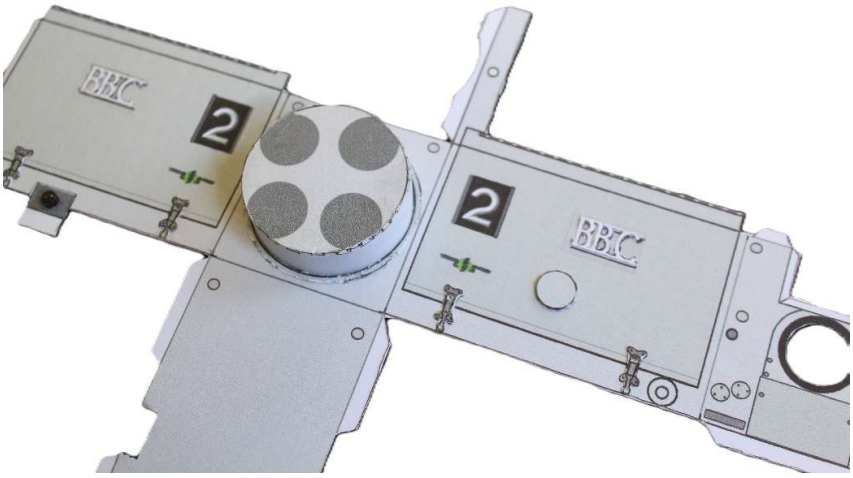


You are advised to use a circle cutting compass to cut out these circles (and it is best done *before* cutting out the turret strengtheners).

This lens hood surround is 31.3 mm inside diameter. As an alternative to using the card circles, you can get fibre washers of 32 mm inside diameter or an "0" ring such as Nitrile O Ring, 32mm ID x 1mm C/S. Also available are flat alloy metal welded buckles with a 32mm (approximately) inner diameter.

Glue this support circle (however sourced) to the camera front before folding and gluing the camera body.

It is worthwhile checking that the turret fits into the front with the lens turret surround in position – check the clearances and so on.



Assembling the Camera Body

Some items are best added *before* you fold and assemble the camera body. These items are needed whatever level of detail you are adding to your model.

Camera Number

If you want a different camera number, cut out the rectangle for the number from the alternative camera numbers which are provided. Glue the new number over the identifier for camera 2 on each of the side flaps.

If you are happy with camera number "2" you do not need to do anything.

On the CPS Emitron's left hand side, there was a round "bulge" to accommodate some internal part. (This shape was different on different builds of the camera body.)

Cut carefully around the two circles, part 2-8, and glue them together so that at least one face shows the main camera grey colour.

Glue this assembly onto the left-hand side panel: the location is shown as a dotted line.

Cue Light

The top front of the camera carries the cue light, and it is rather flimsy until the whole body is glued together. It is recommended that you cut a piece of thick card 33mm long and 5 mm wide, and glue this to the underside of the front top piece. This also makes it easier to punch the 2mm hole for the cue light.

The cue-light is whittled from a piece of the sandwich/burger skewer. A template is provided as part 2-ll. You may like to use some fine sandpaper to get a more exact shape. The cue-light is coloured red – a Sharpie felt pen is very useful for this. The cue light is glued into the hole in the top front.

The cue-light will look better if you can add some red glitter on top of the red of the cue light, to give a sort of "sparkly" feel.

The bottom of the cue light was in reality inserted into a chrome mounting – this can be approximated using a suitably sized washer (an alternative would be to cut this out of card).

Cable Entry

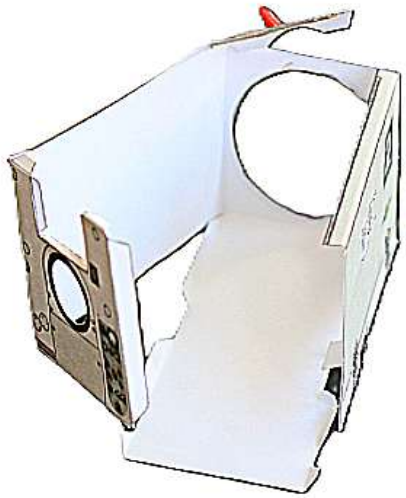
The cable entry is represented by a 2mm long slice from the end of the circular sandwich skewer (the template for this is part 2-7). It is easier to colour this black before making the slice – a Sharpie pen is suitable for this. The slice can be made by rolling the skewer along the cutting mat whilst pressing down with the knife or scalpel.

Glue the small slice onto the cable entry located at the middle bottom of the camera's right-hand side (leftmost side as you look at the cut-out pieces). The position of the cable entry is marked in a lighter grey. You need to colour the non-glued end of the cable connector.

You are now ready to put the camera body together!

The camera head body had somewhat rounded folds or bends where the outer casing metalwork was creased to cover the framework. It is recommended that you fold these bends in the card using the edge of a straightedge or ruler underneath the fold, rather than scoring the card to fold. You should still score the bends for the glue flaps and for the viewfinder recess, and then make these sharp bends or folds.

Fold down the various body parts and glue tabs. The cable entry is folded back at about 45 degrees to the body, and the glue flap again folded at an angle of approximately 45 degrees toward the inside of the camera body.



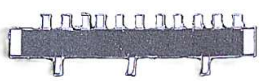
You now glue the bottom to the left side, the back and the front. The top carrying the cue light is also glued to the front.

Cut out part 2-1 and punch (or cut out) the 2mm hole in the centre – this is for the turret spindle. This part forms the rear of lens turret recess and the front of viewfinder recess (part of the camera body top). If you have used a piece of stiffening card under the top front of the camera for the cue light, you will need to allow for this on the fold at the top of the rear of lens hood recess card, so your crease will be a little below the marked point. If you have glued your cue-light "rod" to the top, and this "rod" protrudes below the bottom of the top, you will need to adjust the glue tab to accommodate this. So you might have to adjust both the size of the glue flaps and the position of the top fold.

This part is glued to the left side, bottom so that it lines up with the rear part of the cue light carrier top piece, and is square.

For part 2-2, the rearmost body stiffener and lens turret change handle cut-out, the cut lines for the recess surround are shown in WHITE. There are three of them displaced approximately 120 degrees from each other, and their positions are shown by black arcs on their outer edges. You may find it easier to complete the recess assembly if you widen out the slits to include part of the black arc used as a marker.

Before you can glue this stiffener in position, you have to make the handle recess surround and mount it on the stiffener. Part 2-3 incudes glue tabs which are quite fragile.



Carefully curve the recess surround to form a cylinder – you can "stroke" the surround using a sandwich skewer on the black coloured side of the cylinder .

Glue the glue tabs together – these are folded down so that they are located on the outside of the cylinder.

Insert the three tabs through the holes in the rearmost body stiffener. You will find this easier to do with NO glue on either part.

On the inside of the stiffener, the three tabs you have inserted can now be folded down and glued.

After inserting the tabs, run glue round the outside of the recess surround. Make sure that the recess surround is circular.

The many tabs to fix the surround to the rear of the camera body are very fragile, and you are advised to run some PVA glue round behind these flaps (which are now bent at a right angle to the side of the surround) and let this dry.

This rear stiffener fits at the rear of the camera body, inset from the camera body rear by the depth of the lens change handle recess. Apply glue to the tabs round the periphery of the lens change handle recess and to the tab for the left-hand side of the camera body and the camera bottom, and place in position.

There is an additional body stiffener (part 2-4). You only need this if you are making a model with a posable or rotatable lens turret.

Cut out the part and cut or punch a 2mm hole in the centre for the lens change spindle.

The stiffener is place where there are gaps in the bottom to left side glue tabs, and to the front of the of the bottom cut out and side supports for the cable entry.

Glue this in position.

Viewfinder Recess

The top of the camera incorporates a large recess into which the viewfinder is placed.

Cut out part 2-5 and fold down all the glue tabs. The recess is formed in the centre of the piece: fold down to make the side of the recess, then fold up (valley fold) to make the bottom of this recess. The next fold is a fold up (another valley fold) to make the other side of the recess, then there is a fold down to create the remaining section of the camera top.

The main glue tabs for this camera top and viewfinder recess are provided by the camera rear panel and the various strengthener pieces (but not the rear turret recess backing "strengthener") – all these have glue tabs for the recess and are folded down at right angles to the strengtheners. Glue the camera top and viewfinder recess piece to the top of the camera left hand side and to the rear of the lens turret recess backing strengthener. This piece sits in the channel formed by the strengthener pieces and the top is glue to these.

You can now glue the camera body right hand side to the camara top, the stiffeners, rear of camera and the camera bottom. The cable entry on the camera right -hand side bottom is folded down at approximately 45 degrees, and the glue tab for this is also folded down about 45 degrees. As the camera right hand side is offered up to the bottom, the cable entry is glued to the glue tabs which have been folded up (valley fold) from the cable entry supports, and the cable entry glue tab is glued to the camera bottom.

Fold down the top of each camera side panel and glue to the top of the viewfinder recess.

The main camera body is now complete. If you are making a static model, the lens turret can be glued into position at the front of the camera: one of the lens hood marker disks should be positioned at the centre bottom of the camera front (6 o'clock position).

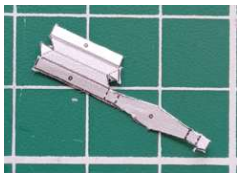
If you are making a posable or rotatable turret, the turret spindle is now inserted through the front of the camera and through the holes in the stiffeners – it should protrude through the rear strengthener in the middle of the lens change handle recess. Make sure that the turret can rotate, and that one of the lens hood marker disks is finally positioned at the centre bottom of the camera front (6 o'clock position).

Lens Change Handle

The lens change handle is made up from two very small parts, parts 1-8 and 1-9.

Part 1-8 is a a strenthener for the back of the main part, part 1-9, Cut out and note that there is a hole in the centre of the part – this should be made to be the same size as the diameter of the coned end of the lens change spindle as it is at the front of the lens change recess backing.

Using a sharp knife or scapel and a steady hand, cut out part 1-9. Make sure that the hole in the centre of the wide part matches the hole in part 1-8.



With the full handle face down, the "grab handle" is folded down to make a prism: the bottom of the prism is glued to the "top" side of the horizontal bar. The two side pieces are folded up.

Part 1-8 is glued to the rear of part 1-9, matching the shape and the hole, using PVA glue as this will add stength to the card “sandwich”, the sides are folded at right angles to the base and are glued to the side pieces of part 1-9. It is recommended that you use PVA wood glue for this to make a stronger part.

Fold the combined parts so that the prism is on top separated from the bottom part by the two side pieces, then glue the “free” side piece glue tab to the underside of the prism.

If you are not making a posable or rotatable lens turret, you now glue the completed lens change handle into the lens change handle recess, making sure that the handle is horizontal. You miss out the next steps (proceed to “Viewfinder”).

If you are making a posable or rotatable lens turret, firstly check that the end of the lens turret spindle will not foul the underside of the prism when the lens change handle is place into the recess. The length that may need to be cut off depends on how far the spindle was originally inserted into the turret.

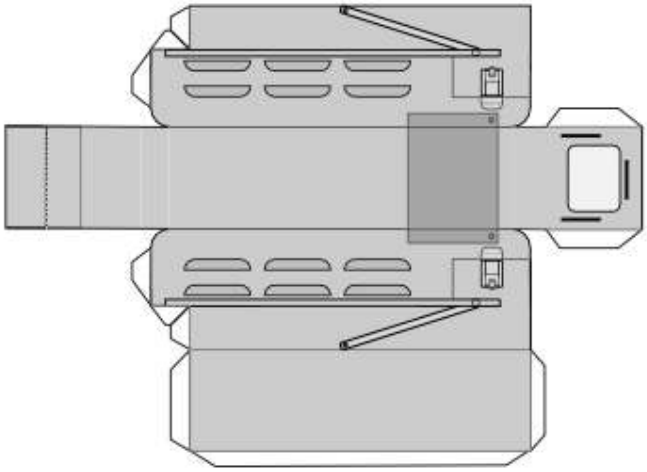
Make sure that the turret is positioned so that one of the lens hood markers (a dark filled circle) is located squarely at the centre bottom of the camera front, and check that it will not accidentally move during the remainder of the procedure. Turn the camera so you are working at the rear.

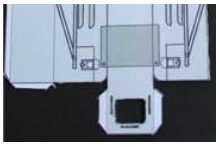
Carefully insert the base of the lens change handle over the lens change spindle – you may need to ease this part down with the end of a modelling knife (blade upside down so you do not risk cutting thas part!) or the end of a small screwdriver. The “grab handle” (prism) part of the handle should be flush with the camera rear panel.

Glue the lens change handle onto the spindle. Make sure that the turret can rotate and that the lens change handle rotates with it (and is not stuck to the back of the recess)..

Note: You may find it best to place a drop of cyanoacrylate glue (superglue) onto the pointed end of a cocktail stick and gently place this droplet onto the junction of the spindle and the lens change handle base. This is how the reference build for this model was constructed and it worked well.

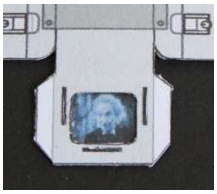
Viewfinder





Cut out part 3.

Make sure that you also cut out the viewfinder screen rounded rectangle.



Eight suitable viewfinder pictures are included on the construction sheet as part 3-1. Select one of these pictures and cut it out with a margin of 2mm all the way round. You can of course use your own preferred viewfinder picture: it should be 10 mm by 8mm with a margin of 2mm all round (yes, this gives a ratio of 5:4 rather than 4:3).

Glue the selected picture behind the viewfinder piece so that it shows in the aperture.

Cut the three slits (one on each side of the "screen" and one at the bottom) to accommodate the glue tabs of the viewfinder hood.

Make sure that you cut through the viewfinder part and the selected viewfinder picture. It will be easier if you widen these slits: there is a thicker cut line marked. It has been found much easier to insert the viewfinder hood if these slots are eased.

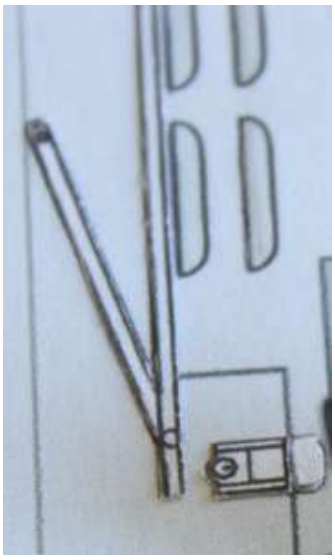
If you are making a basic model, you can now jump to the section for the Viewfinder Hood.

If you are making a more detailed model, there are some optional steps shown here.

Some versions of the CPS Emitron had air vents along the side of the viewfinder – not all versions had these. To represent these air vents, cut along the bottom straight lines of the vents, and then gently press out the vent from the inside, supporting the main body on a ruler, for example. The outdent does not have to be very pronounced.

Along the side of the viewfinder there was a supporting bar, and various levers for the viewfinder tilting mechanism – these

levers are too thin to make practical in this card model, but they can be represented by a card overlay.



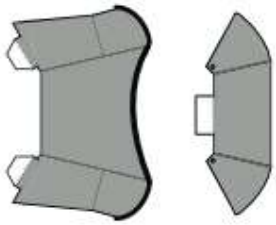
Cut out the two optional side support and lifting lever pieces and colour the cut edges grey using a pencil or a suitable pen – please do not use a Sharpie as the ink spreads through the cut fibres. Glue these fragile strips over the similarly marked pieces on the viewfinder side.

The top part of the viewfinder casing was fastened to the main body using a latch. Cut out the optional latch pieces, again toning down the cut edges with pencil of pen and glue the latches into position on the viewfinder sides.

Please note that the cut edges of these pieces have not been toned down in the reference build.

Viewfinder Hood

Cut out the viewfinder hood (part 3-2) and the bottom part of the viewfinder hood (part 3-3).



Colour the inside of these two pieces using black paint or felt tip pen. Please do not use a Sharpie as this will bleed though the card and make the main surface look blotchy.

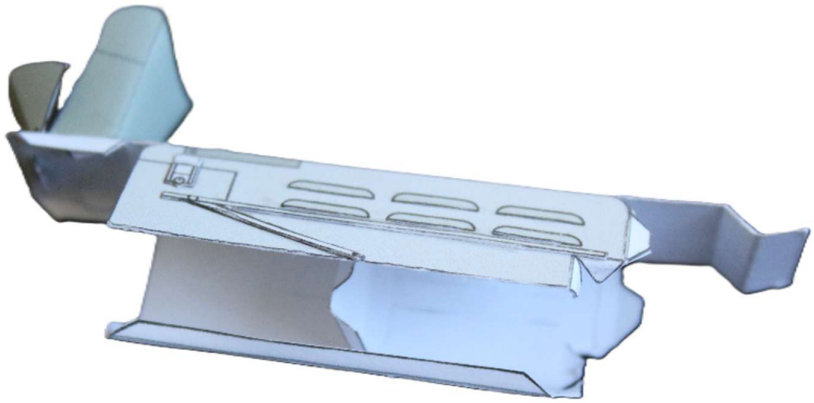
Fold the side “cheeks” of the viewfinder parts down at right angle to the top and bottom.

Make sure that the top of the viewfinder hood is towards the top of the viewfinder assembly, insert the two side tabs into the vertical slots at the side of the screen.

With the bottom part of the hood facing the bottom of the viewfinder part, inset the bottom glue tab into the horizontal slot

Make sure that the top and bottom parts of the viewfinder hood are fitted snugly against the viewfinder screen surround. Carefully run some glue around the inside of the hood pieces. On the inside of the viewfinder piece, the side cheek glue tabs and the rear hood glue tab can now be folded over and glued into position.

These is a strengthener piece, part 3-4. You may not need this if you are making a static model. Cut out part 3-4 and fold down the glue flaps. The right-hand side has a slightly shorter glue tab, as this is to allow for the glue tab of the viewfinder bottom. Glue the strengthener to the top, left hand side and right-hand side, positioned approximately mid-way along the viewfinder length, in between the rearmost two air vents.

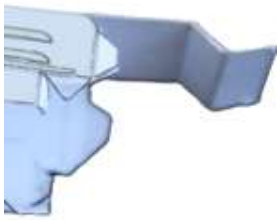


Fold up the bottom piece and glue to the strengthener (if used) and to the bottom of the viewfinder right hand side piece.

The top, at both the front and rear of the viewfinder, is curved round. Use a cocktail stick as a former and gently curve the top at each end so that the curves you form match the curves cut into the sides. Be careful not to crease the card when you make these curves.

The glue tabs on the rear part can be folded down and the rear glued into position. The curve of the roof is also glued to the curve in the side panels, but this is a simple butt joint and care is needed not to spread the glue – wipe off any excess glue immediately.

The front of the viewfinder has two folds – a fold down, at right angles to the front, and a fold up (valley fold) at right angles to this fold. Together these make an indent in the lower front of the viewfinder.



Carefully fold down the front and glue to the side tabs. Fold the indent into position and glue to the appropriate glue tabs.

On the top, towards the rear of the viewfinder, there is a lifting flap: this is marked out on the construction sheet. You can add extra detailing to your viewfinder by cutting out the optional viewfinder lifting flap (located on the left-hand side of the construction sheet), Fold down the two side pieces and glue over the marked item.

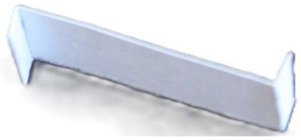
You have now completed your viewfinder. If you are making a static model, you can glue the bottom of the viewfinder to the camera top, into the viewfinder recess.

Viewfinder Tilt Mechanism

As mentioned earlier, it is not possible to model in card the actual tilt mechanism used for the CPS Emitron viewfinder, as the parts would be too small and fragile. So there is an alternative approach, totally unprototypical, but which achieves much the same result and allows the viewfinder to be posable.

Part 3-5 is a rectangle of card, with a fold at each end Cut out part 3-5, fold down one end and fold up the other end to make an elongated "**Z**" shape.

Glue the fold-under part to the top of the camera in the position marked with a dotted line. Glue the folded-up part to the bottom of the viewfinder, again onto the dotted maker – this is near the front of the bottom piece.

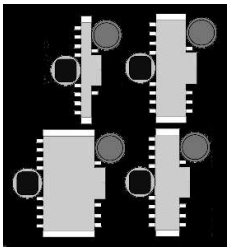


Your viewfinder can now be posed – tilted up or tilted down.

All Builds

The rear of your CPS Emitron camera should look something like this:

Lens Hoods



There are four lens hoods, parts 1-3, 1-4, 1-5 and 1-6.

Cut out the lens hoods, taking care with the glue flaps: these are the rectangles sticking out from the main grey rectangle of each lens hood.

Each lens hood is made up in the same way.

The lens body is a basic cylinder with an extension beyond the rear.

Carefully roll the card to form a cylinder – do this by stroking the card using a sandwich skewer stem, pressing gently on the opposite side with a finger or thumb. It should curve easily.

The two white glue flaps at the ends of the cylinder body are folded down and glued together to lie inside the cylinder.

Fold down the rear circular end of the cylinder. This is the solid-coloured disk, and it fits onto the four glue tabs – there is a projection of part of the cylinder body past this disk. Make sure that the lens hood is perfectly circular and that the end fits snugly in place.

Now fold down the 8 glue flaps at the front of the lens hood, make sure that the folds are not proud of the cylinder front (otherwise they will be very visible).

Fold down the front (which has a black rounded quadrilateral marked on it) and glue in position, making sure that the lens hood is perfectly circular.

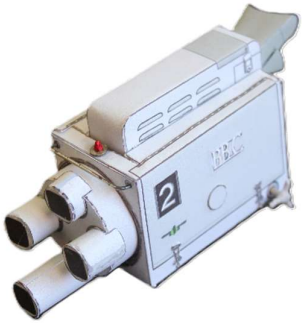
It ***is*** possible to cut out the rounded rectangle at the front of the lens hood – this was done on one of the trial builds. It makes the assembly of the lens hood much more difficult. First paint the inside of the lens hood pieces with black paint, then, as you assemble the cylindrical body of the lens hood, make sure that the glue flaps, folded down from the rear of the cylinder, are glued carefully to the rear sold disk (end) of the cylinder and that the assembly is perfectly round at this end and along its length. This solid-coloured cylinder end is now very important as this gives the shape to the lens hood, as the front is very flimsy. The 8 glue flaps for the front have to be reduced in size to about a quarter of their marked length, and now carefully glued to the open front (this is now more like a butt joint).

Once your lens hood is assembled in this way, you have to then fabricate something to fit inside to look like the front element of the lens: you may like to use the self-adhesive clear sparkly “jewel” items available from hobby stores.

On the trial build, cutting out the front of the lens hood as described did not seem to confer much benefit in relation to the effort needed!

With each lens hood built, the hood can be glued to the turret.

Make sure that the turret is positioned such that there is a black circle in the centre bottom (6'oclock position) – and if the turret is rotatable, make sure that the rear grab handle is horizontal.



Glue the longest lens hood in this 6'oclock position: note that the lens hood extension overlaps the turret cylinder.

The shortest lens goes directly opposite, at the 12 o'clock position.

Of the two remaining lens hoods, the longer one is glued at the 9 o'clock position and the shorter one at the 3 o'clock position. Check that the lens hoods are mounted at right angles to the turret.

Focus Handle

There are two recommended ways to make the focus handle, both covered as part 2-6.

Method 1 is the more accurate of the two ways. Youi need access to some micro drills and a means of rotating them. Both can be obtained from hobby shops or on-line retailers. In the shank of a sandwich skewer, drill three holes spaced 120 degrees apart: the template gives a rough idea of the depth needed. The holes should be drilled at a slight angle "outwards", as the focus handles were inclined to the vertical. Cut three pointed ends from wooden cocktail sticks, approximate 4.5 mm long, and glue the pointed ends into the holes drilled in the skewer. Paint the assembly to represent silver – there is an artist's acrylic tube of "silver" available, or you can use one of the modeller tinlets of silver paint. When all is solid, and dry, part off the end of the skewer with the handles, and glue in position at the bottom rear left-hand side of the camera body.

Method 2 is easier to make. Cutout the two focus handle templates from the construction sheet, and glue them together back-to-back using PVA glue – this adds strength to the assembly.

Cut the pointed end from a cocktail stick – this should be approximately 13 mm long. Glue the thick end of the cut-off pointed cocktail stick to one side of the assembled focus handles.

On the other side, glue some 2mm diameter circles. These can be cut from the card or punched out from thicker card using the leather hole punch.

With a brush, coat the whole assembly with PVA wood glue and let it dry. With care, flare out the "spokes" of the handle, so that these spokes are at an angle to the vertical.

When this coating of glue has dried, check the angles of the focus handles and adjust if necessary. The top of the handle should project beyond the end of the focus handle spindle (the part with the additional card disks).

Paint the assembly with silver paint. If you use an acrylic silver paint (as sold as part of artist's acrylic range), you can mix in some wood PVA glue and brush all over the assembly: Let this dry thoroughly

Use the point of the safety pin to make a small hole in the centre of the concentric circles at the bottom rear left-hand side of the camera.

Apply glue to the pointed end of the focus handle assembly, and insert the point into this hole. Push the focus handle into the camera body so that the handle is about 1.5 mm away from the body.

There is a third method, using a 4mm scale ("00" gauge) 6-spoke plastic wagon wheel. Cut off the rim and remove every other spoke. Trim the axle to about 1.5 mm long. Shape the result to make the spokes cylindrical (or, properly, an inverse cone shape), paint silver and glue (using superglue) the result to the centre of the concentric circles at the bottom rear left-hand side of the camera body.

Unfortunately, none of these methods provide a focus handle which is "practical", that is, it can be posable. To make it posable would need some mounting inside the camera body into which the focus handle spindle could locate and rotate (without falling out, so it would have to be captured), and all this would have to be done before the camera body's right-hand side was finally glued into position.

Carrying Handles

The last job to do is to make the camera carrying handles, used in the full-sized camera to carry the camera from one camera mount to another. Part 4 shows the templates for these handles. If you want to make them from card, cut out the templates – each one is double thickness, so the mirrored pairs fold in the middle and the two "wings" are glued together. The two shorter handles are located vertically on the back panel. Use the point of the safety pin to make a hole in the centre of the mounting circle, and insert the ends into the holes and glue. One of the longer handles goes across the front of the camera, the other two fit on the bottom – again the locations are marked.

It is recommended that you make the carrying handles from chromed paper clips. Unfold a paper clip and match it to the required template. In this case, only one half of the template is used. A 32 mm long paper clip has a long side which is nearly the length needed for the longer carrying handle.

Bend the paper clip using a small pair of pliers: take care as the curves for the templates are sharper curves than those already formed in the paper clip.

Clip off the excess ends of the paper clip using the side cutter function of the small pliers, making sure you have sufficient length to go through the holes in the camera body.

Use the point of the safety pin to make a hole in the centre of each mounting circle, and insert the paper clip ends into the holes and glue using superglue.

There are 5 handles to fabricate: The two shorter handles are located vertically on the back panel. One of the longer handles goes across the front of the camera (as shown), the other two fit on the bottom – again each of the locations are marked.

A refinement is to add a suitably sized small washer (external diameter 2mm, internal diameter 1mm) to the camera body as the handle is inserted and glued: unfortunately, this has not been done on the reference build.

You now have a complete CPS Emitron Camera Head model to 1/12 scale.

Completing Your Model

Your model CPS Emitron Camera needs a camera mount to make it into a complete model.

The camera mount would typically have been a Vinten pan and tilt head: the pan and tilt television camera mount was specifically designed for television cameras such as the CPS Emitron which used a “turret” of four different focal length lens. In this camera, the lens turret and the camera pick up tube were both moved (in opposite directions) to focus the picture. The Vinten pan and tilt head changed the centre of gravity as the camera was tilted to compensate for the weight of the camera and position of the turret and pick-up tube.

A suitable pan and tilt head and a suitable television camera pedestal are available as part of a complete kit for the Vinten 419 hydraulic pedestal and the EMI 2001 colour camera, available here: http://tech-ops.co.uk/next/emi-2001-vinten-ped-construction-kit/

A card kit for the Vinten Heron camera crane is here: http://tech-ops.co.uk/next/vinten-heron-cutout-card-model-1-12-scale/.

I personally can not recall seeing a CPS Emitron Camera mounted in a Vinten Heron: it was more usually mounted on a Vinten Motorised crane in the Lime Grove Studios in the early 1960s. But who knows? I am sure someone does!

Acknowledgements

For photographs of the various versions of the CPS Emitron Camera, thanks are due to all the contributors to the BBC Television Tech Ops website (www.tech-ops.co.uk).

For information about the CPS Emitron Cameras in use, there is a wealth of information about the use of cameras in theatrical style multi-camera as-live television production on the BBC Technical Operators website (www.tech-ops.co.uk).

Lastly, I have to acknowledge the contribution of Bernie Newnham, who set up the BBC Technical Operators website to encourage the sharing of memories of BBC Television Production, and who, in course of discussions, suggested that we could make available a card model of the CPS Emitron Camera Head.

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Changes from Previous Version

The lens hoods have been redesigned so that the joins along the length of the lens hood "cylinders" now face into the centre line of the turret.

Alec Bray

version 4.0