PUBLISHED WEEKLY
UK £8.99 IR €10.99 INC VAT

ISSUE 4

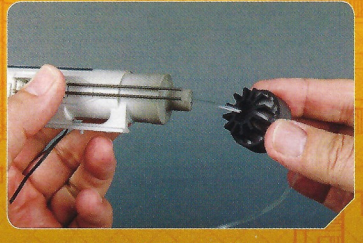
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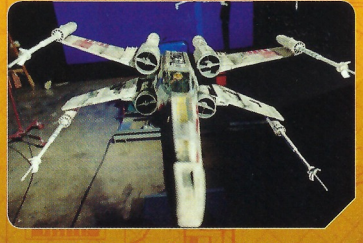


A SUPERB MODEL OF LUKE SKYWALKER'S 'RED FIVE' STARFIGHTER

ALSO INSIDE



BUILD THE X-WING
FINISH THE LASER CANNON



CREATING A STARSHIP FLEET
FILMING THE X-WING ACTION SEQUENCES

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STAR WARS
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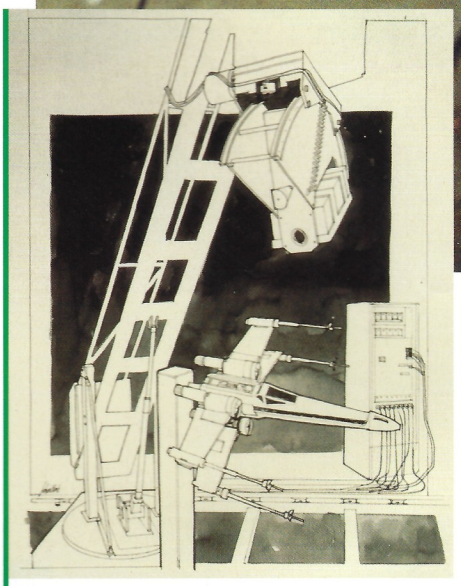
CREATING A STARSHIP FLEET 3
FILMING THE X-WING ACTION SEQUENCES

A look at the visual effects techniques that Industrial Light & Magic developed to bring its model starships to life on screen.

BUILD THE X-WING 8
COCKPIT FRAME, CANNON AND ASTROMECH DROID (R2-D2)

This issue completes the internal cockpit frame, laser cannon and R2-D2 – including the lighting effects of the latter two.





A digitally controlled motorised arm and camera system was created by special photographic effects supervisor John Dykstra and his team. This rig made it possible to film multiple identical passes around model spacecraft mounted on a bluescreen background.

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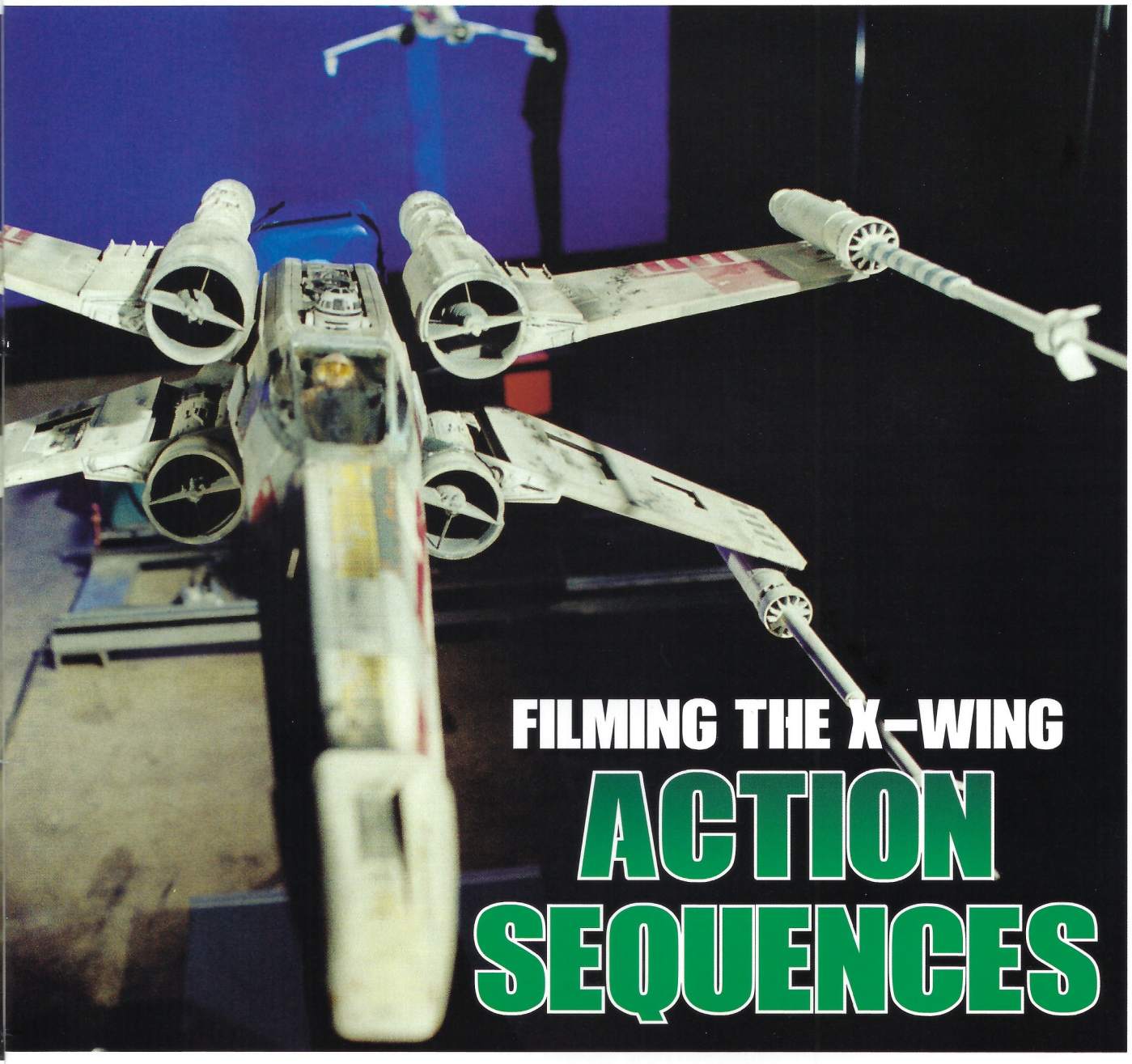
ISBN 978-1-4439-4610-0 BYOXWN04 19 01 16 Printed in the UK
Editorial and design by Continuo Creative, 39-41 North Road, London N7 9DP

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Published by De Agostini UK Ltd, Battersea Studios 2,
82 Silverthorne Road, London SW8 3HE, UK

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FILMING THE X-WING ACTION SEQUENCES

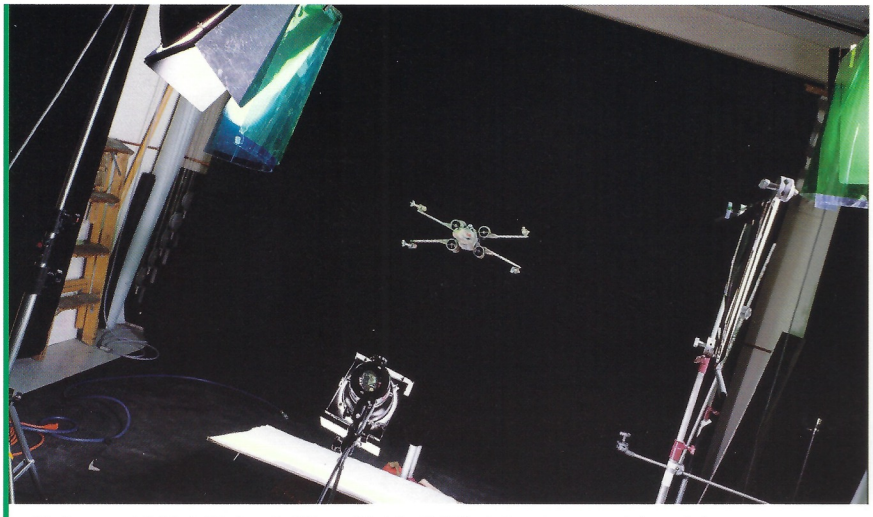
When George Lucas was putting together a team to create the visual effects for *A New Hope*, he approached Douglas Trumbull, who had played a key role in the landmark cinematography of *2001: A Space Odyssey* (1968). Unable to work on *Star Wars* himself, Douglas suggested Lucas should talk to John Dykstra, who had helped to create visual effects for Trumbull's *Silent Running*.

Dykstra would lead the development of the digitally controlled motion-capture camera system that helped to make many of the movie's groundbreaking effects possible. Although the result was dubbed the 'Dykstraflex', it was really a team effort: Al Miller and Jerry Jeffress shared the Academy Award for Technical Achievement, while Bill Shourt, Dick Alexander and Douglas Trumbull's father Don were among those who contributed expertise.

The camera rig used a range of technologies that already existed, but Industrial Light & Magic (ILM) combined them in new ways. They used second-hand VistaVision cameras (which had high image resolution), but the real key was the availability of low-cost microprocessors. Using these, it was possible to turn a motorised camera boom into what was effectively a programmable 'robotic arm'.

OPTICAL COMPOSITES

In those days – before the invention of digital photography – visual effects were produced by combining pieces of film shot at different times to produce a



Filming a model ship in black and white enabled the lighting to be set up accurately, and also created a mask that could be used for the optical effects which would be added in later.

composite image. The more elements that were brought together, the more chance something could go wrong – as it was vital for each one to align perfectly with the others. It was technically challenging to achieve this, and the sequence could easily fail completely if anything went wrong during the process of projecting the elements on top of each other to create an optical composite.

While optical composites had been used in movies for more than 70 years, the *Star Wars* action sequences would break new ground because the camera had to move its viewpoint dramatically during the action. That meant the separate elements would only line up if the exact path of the camera (and every change of focus) were duplicated during every take. If the motions varied even slightly, parts of the composite scene would jump about relative to each other, and any sense of reality would disappear.



Multiple X-wings and other model ships would be brought together to film the epic space battles.

The beauty of Lucasfilm's digital control system was that it could direct the movements of a motorised camera dolly and boom in seven axes (pan, track, traverse, tilt, swing, boom and roll), while the camera lens, shutter and film take-up were operated remotely. Most importantly, all these actions could be duplicated precisely in multiple takes.

BREAKING DOWN THE ACTION

The inspiration for many of the space battles in *Star Wars* came from black-and-white footage of World War II dogfights. A typical sequence might show a Mustang fighter moving from left to right, rolling and diving away, while the camera panned behind to reveal a Mitsubishi Zero entering the frame in pursuit, firing at the Mustang. This would become the basis of an X-wing versus TIE fighter chase.

To capture the action, the footage was translated into storyboards that showed the flight of both aircraft in terms of shots that could be filmed with miniature rebel and Imperial ships. First, the X-wing was fixed on a nose-mounted stand that allowed it to roll about its own axis and crab to the side. The camera was set in the start position for the shot, and the stand and background were covered in bluescreen material so they could be isolated later.

The movement of the camera and subject were then programmed so that



The team that put together the programmable motion-control camera was led by visual effects specialist John Dykstra (second right in the inset picture, with George Lucas, far right, and Richard Edlund, far left).

the starfighter appeared to move away from the camera and down the frame while the X-wing itself rolled on its axis, giving the impression of the camera banking to follow the ship. Finally, the action was shot at around half speed to give more precise control of the movements, although the film would later be run at the correct frame-rate.

MULTIPLE TAKES

The X-wing had to be filmed three times, and each take had to be repeated precisely. The first shot was in black and white, to enable the team to check the light balancing and create a mask for the background; the second shot captured the fighter in colour; and the third shot was needed to film the

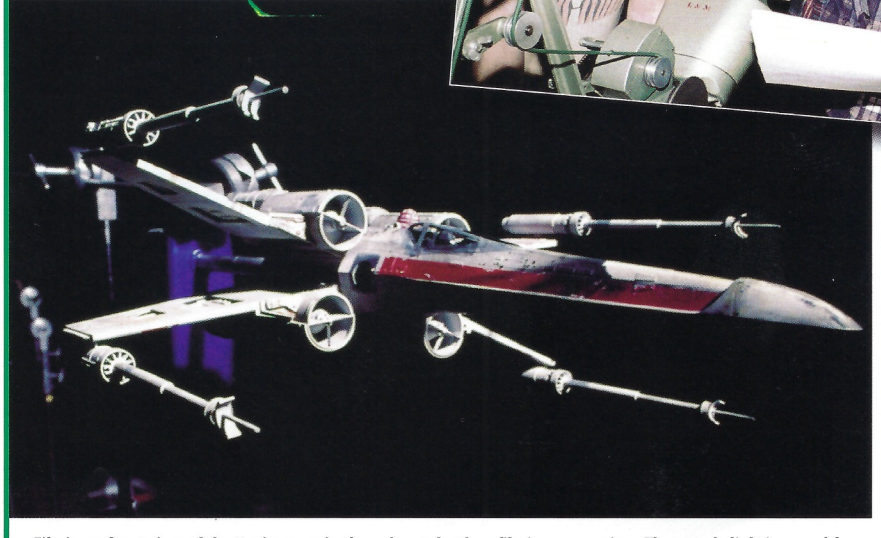


"I think we all strive to look for ways to do new things... new ways to create the image."

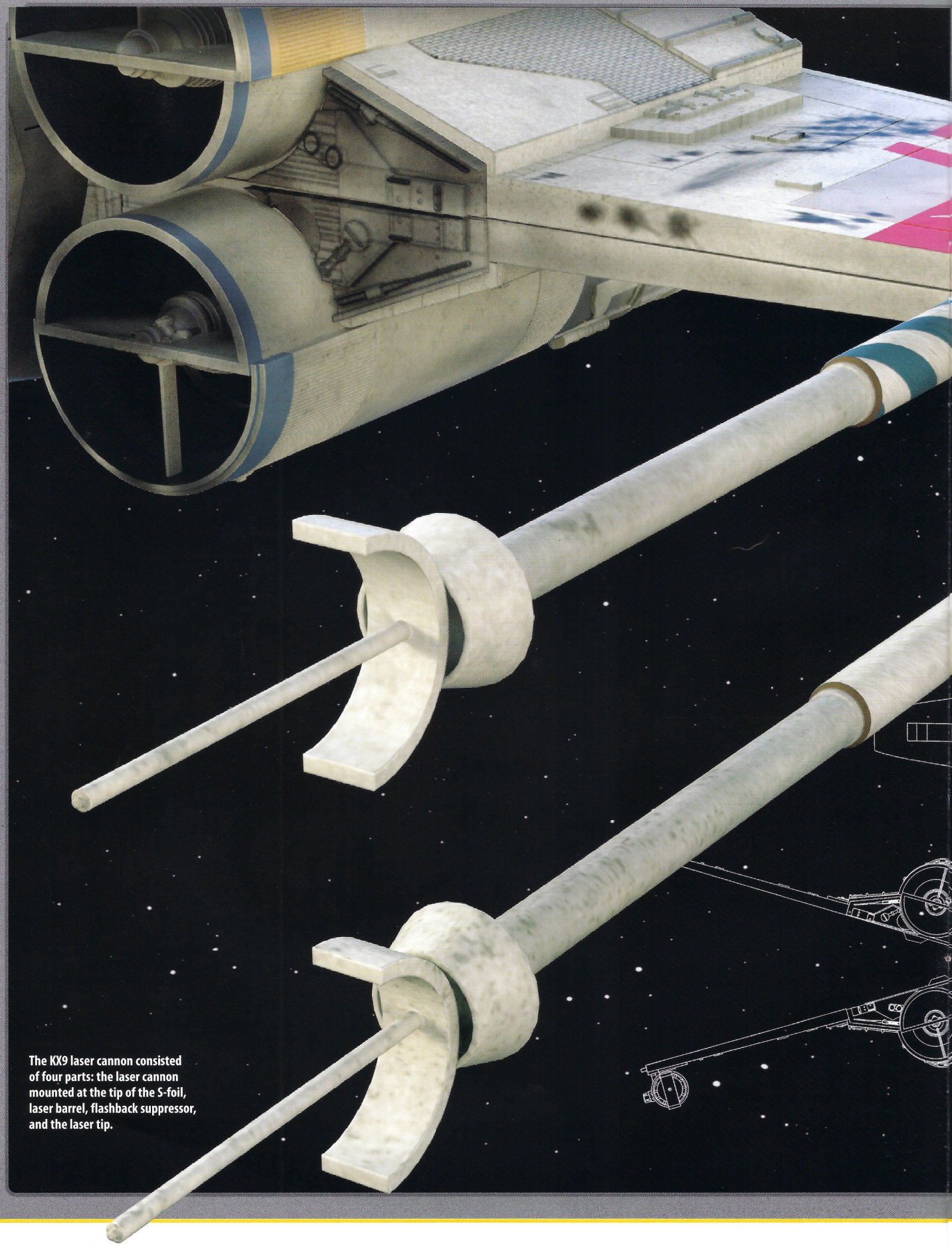
John Dykstra

X-wing from the rear because the engine lights were not bright enough to show up against the ship, and their glow had to be filmed separately.

These multiple passes were only possible because of the motion-control system's ability to precisely reproduce the positions of the camera and model; this way, the glowing engines would match the colour footage frame-by-frame and the black-and-white negative would provide a mask for cutting out the ship. These first three elements were then ready for compositing, while the camera and background could be reset to record the TIE fighter in a similar way. All that remained was to record the star-field background, the final element to be composited into the shot (the laser blasts would be added later).



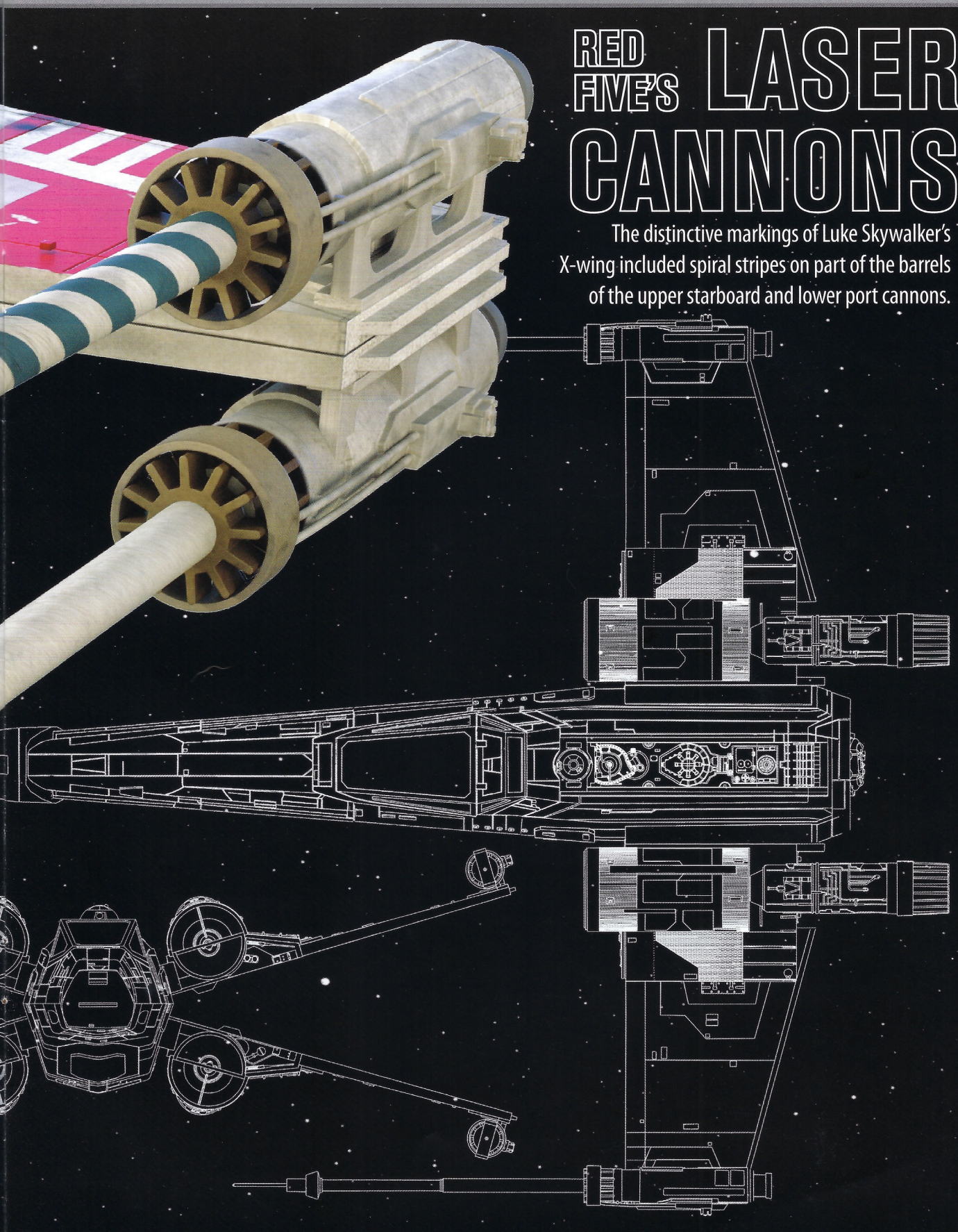
Filming a front view of the X-wing required one less take than filming a rear view. The moody lighting used for the action scenes meant that sequences needing to show the glow of the starfighter's engines were shot twice, as the model's internal lighting effects required a different exposure from the surface of the ship.



The KX9 laser cannon consisted of four parts: the laser cannon mounted at the tip of the S-foil, laser barrel, flashback suppressor, and the laser tip.

RED FIVE'S LASER CANNONS

The distinctive markings of Luke Skywalker's X-wing included spiral stripes on part of the barrels of the upper starboard and lower port cannons.

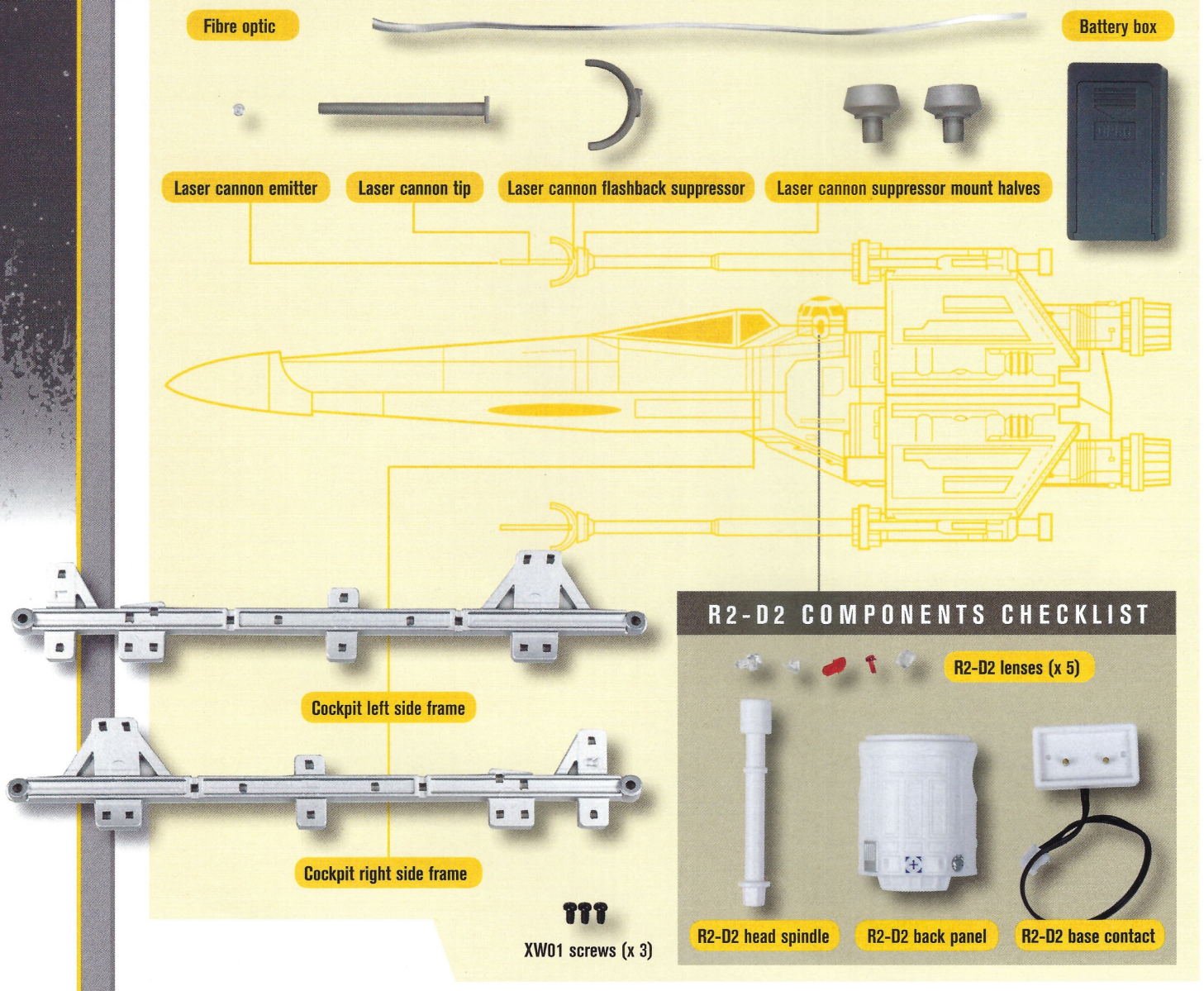


Cockpit base, astromech droid (R2-D2) and laser cannon

This issue includes the final parts for the three sub-assemblies you started in earlier stages: the cockpit base, R2-D2 and the upper starboard laser cannon. You also have a battery box, which can be used with two batteries (not provided) to test the lighting effects inside R2-D2 and the cannon. The cockpit base and laser cannon will be fitted to the model in later stages.

COMPONENTS CHECKLIST

Use this guide to check what parts you have received and where they fit on the model

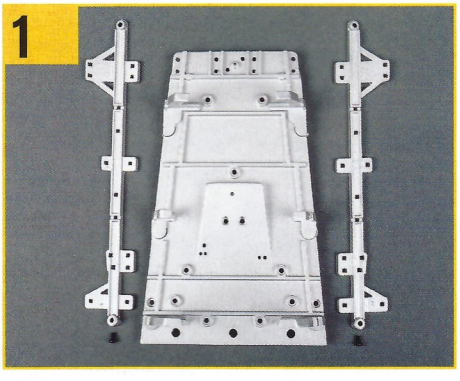


R2-D2 COMPONENTS CHECKLIST

COMPLETING THE COCKPIT BASE

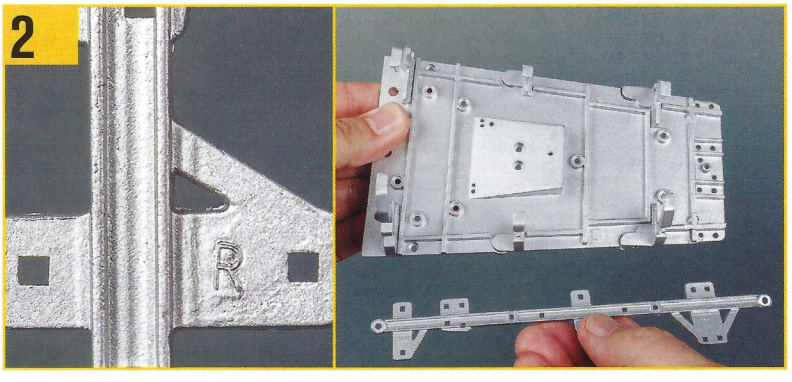
You fitted the upright frames to the cockpit base in Stage 3. Adding the two side frames provided this time will complete the base, to which you later add the seat, instruments and controls.

1



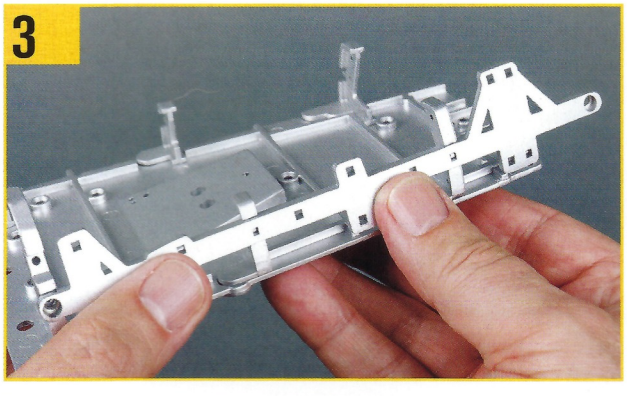
Take the cockpit base from Stage 3, together with the side frames and two XW01 screws.

2



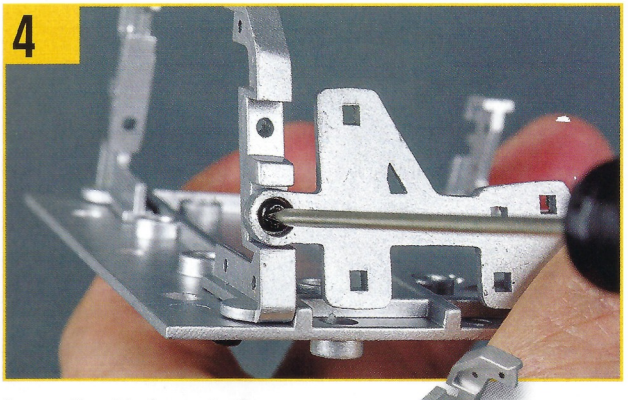
One of the frames has an 'R' for 'right' moulded on the triangular brace near one end. Position the frame alongside the base, this way round.

3



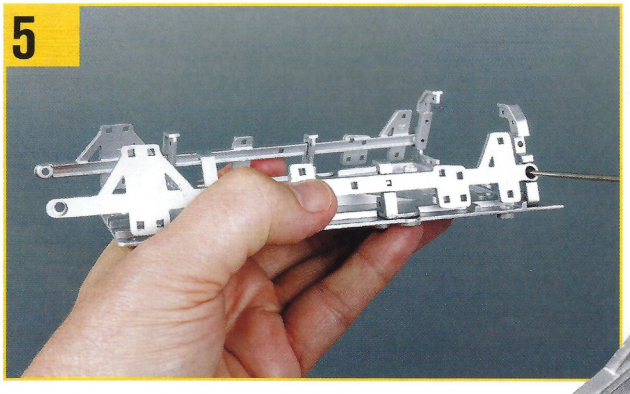
Fit the side frame into the notches in the upright frames.

4



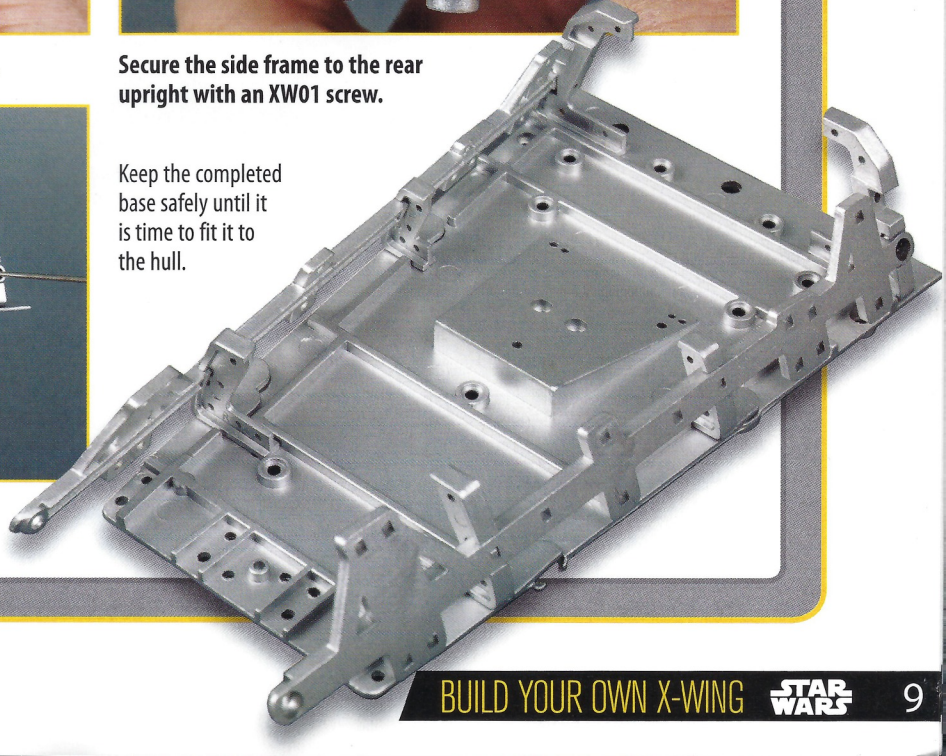
Secure the side frame to the rear upright with an XW01 screw.

5



Repeat Steps 2–4 to fit the 'L' for 'left' frame on the other side.

Keep the completed base safely until it is time to fit it to the hull.



COMPLETING R2-D2

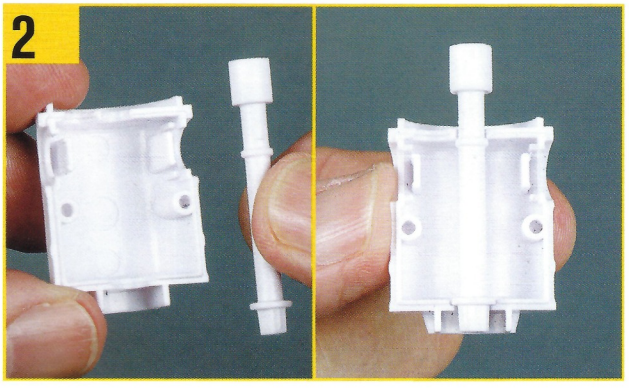
R2-D2 is a self-contained miniature, but when he is fitted into the X-wing's droid socket he will come alive, thanks to the internal drive spindle that makes his head turn and the base contact that turns on his lights. You can test the latter effect using the battery box provided.

1



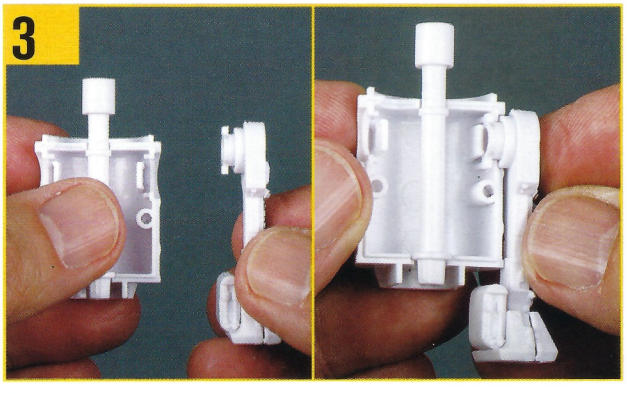
Take the parts provided with Issue 1 and this issue, together with the head dome and two legs you have already assembled.

2



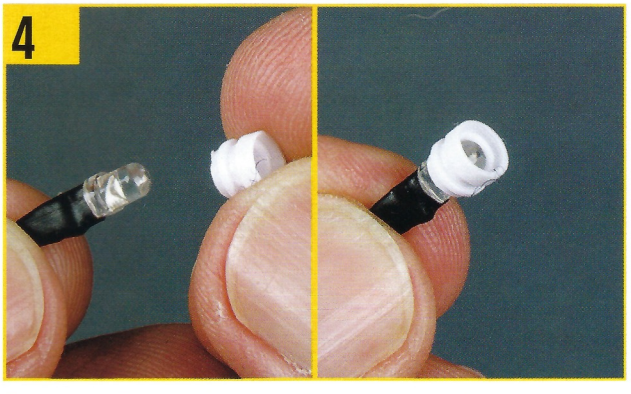
Take the back panel of R2-D2's body and fit the spindle into the semi-circular notches at top and bottom.

3



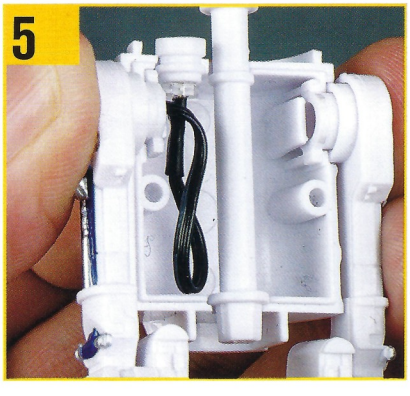
Fit the left leg into the semi-circular notch on the right shoulder.

4



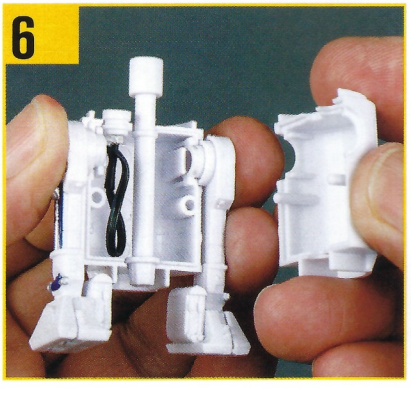
Press the LED mount onto the LED fitted in the right leg, making sure it goes the right way up.

5



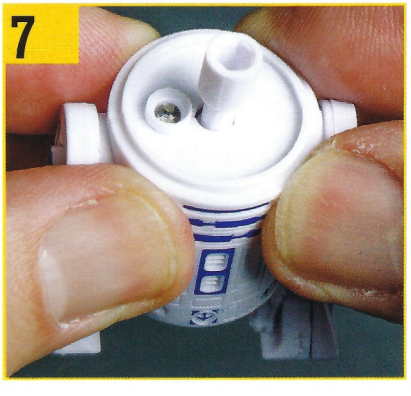
Fit the right leg in a similar way to Step 3, looping the wiring round so you can fit the LED into the notch at the top of the body.

6



Line up the pins on the front panel with the four holes on the back, making sure the wires are not trapped.

7



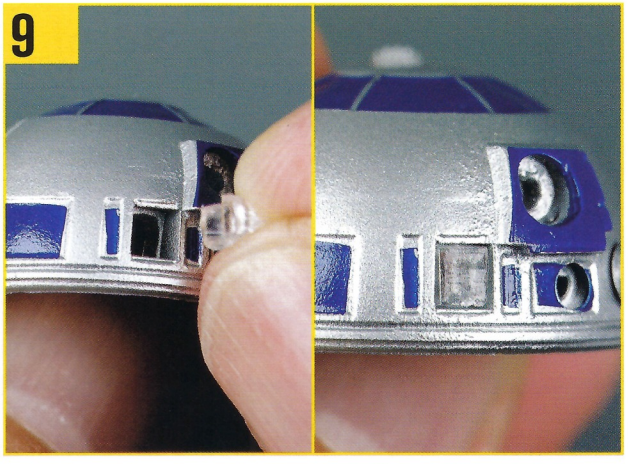
Press the front panel into place, making sure that the legs, spindle and LED fit into the notches provided.

8



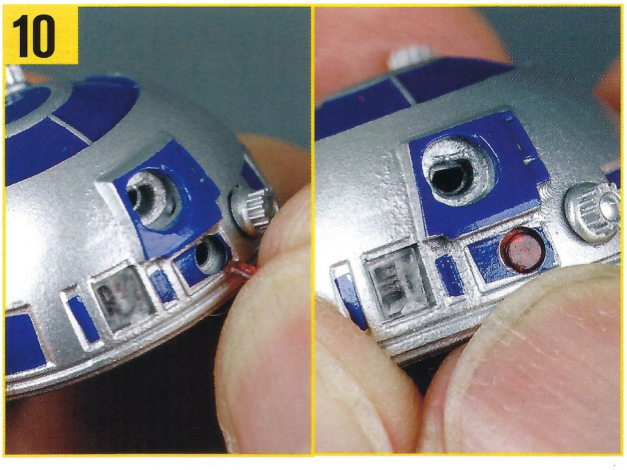
Identify the six clear and coloured lenses provided with this issue. They are very small, so be careful not to lose them. Only five are used for R2-D2 – the smallest (1) is needed for the laser cannon.

9



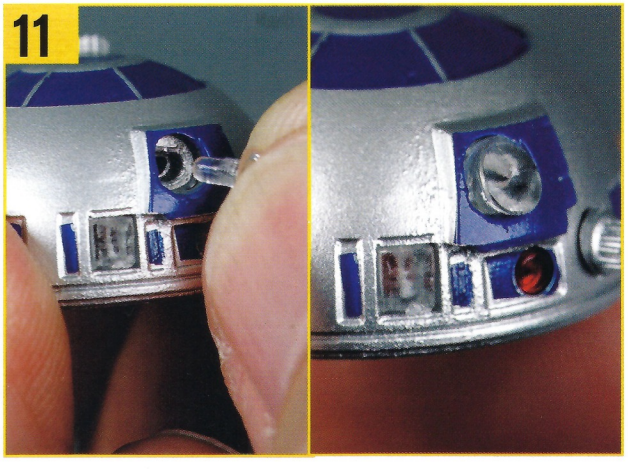
Take the square clear display lens (3) and press it into the square hole at the front of R2-D2's head.

10



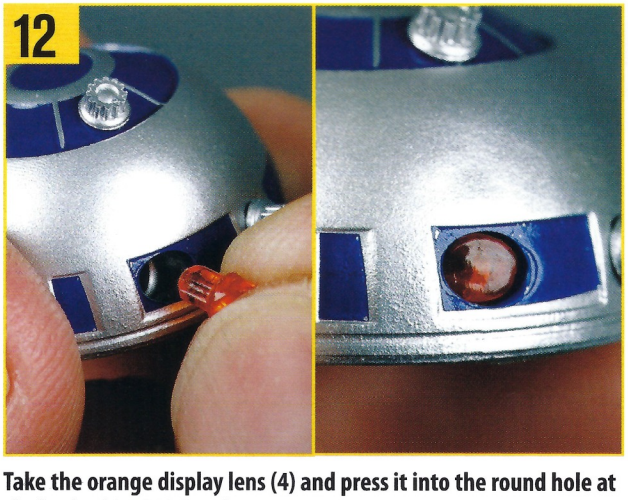
Take the red display lens (2) and press it into the small round hole at the front of R2-D2's head.

11



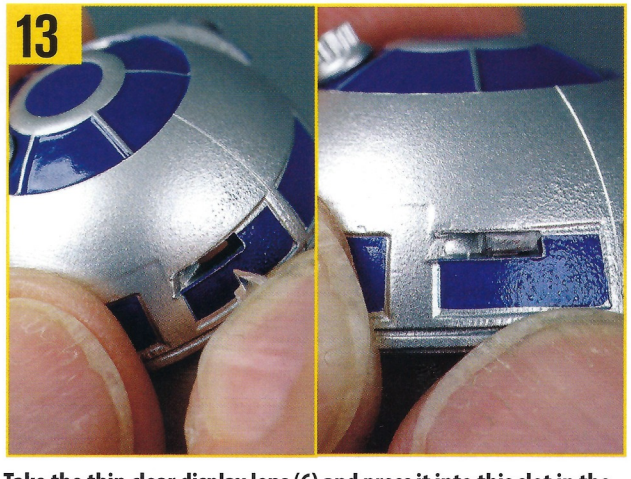
Take the round clear display lens (5) and press it into the large round hole at the front of R2-D2's head.

12

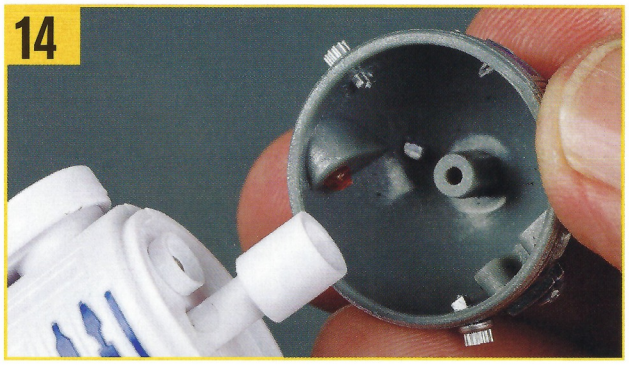


Take the orange display lens (4) and press it into the round hole at the back of R2-D2's head.

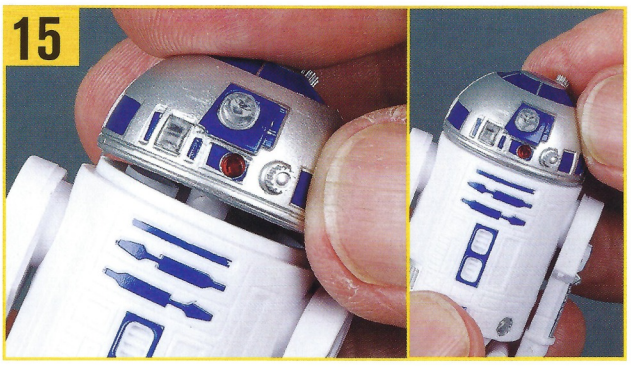
13



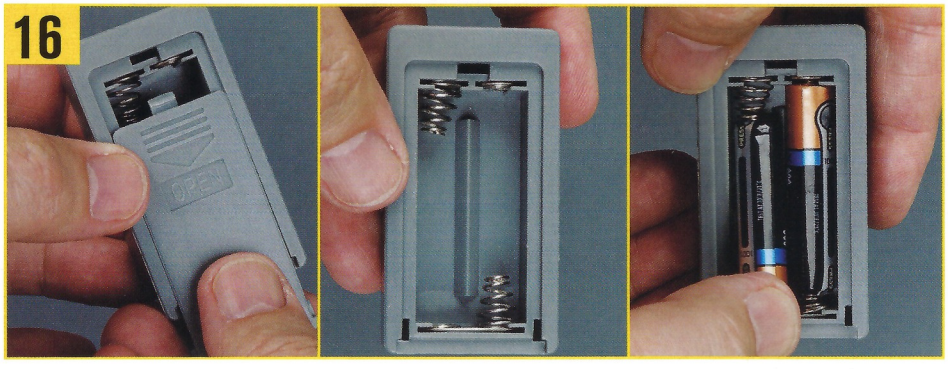
Take the thin clear display lens (6) and press it into this slot in the side of R2-D2's head.



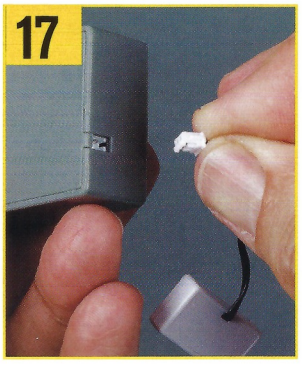
R2-D2's head has a central mounting post with six ribs that fit into a matching hexagonal hole in the drive spindle.



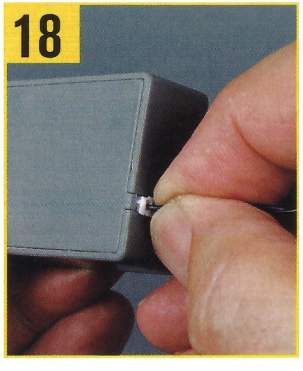
Line up the mounting post and press R2-D2's head all the way onto the spindle.



Press and slide the lid of the battery box to open it so you can install two AAA batteries, which fit in opposite directions, as shown. Refit the lid.



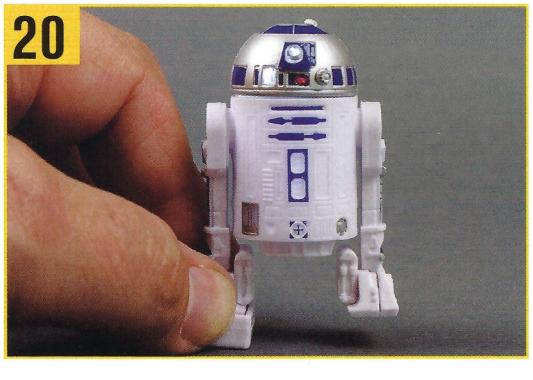
Take the lead from the base contact.



Plug it into the battery box.



Place the base contact on a flat surface and line up R2-D2's right leg with it.

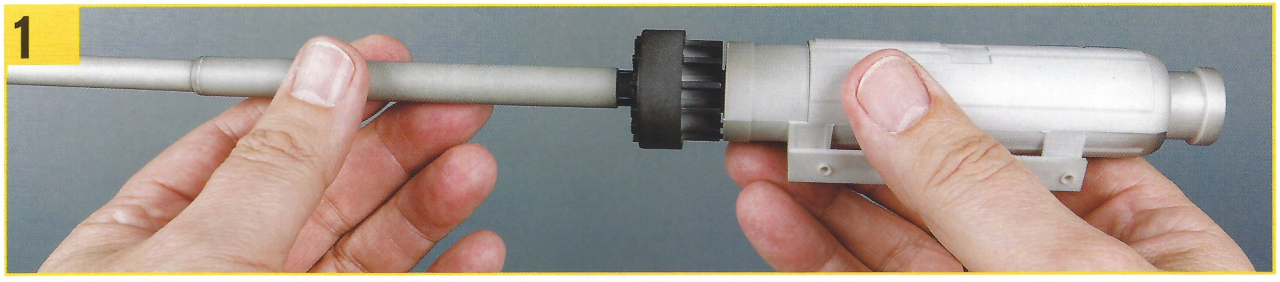


Stand R2-D2 on the base contact and his lights should come on.

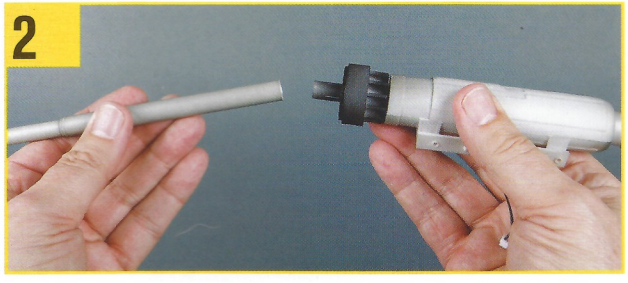


COMPLETING THE FIRST LASER CANNON

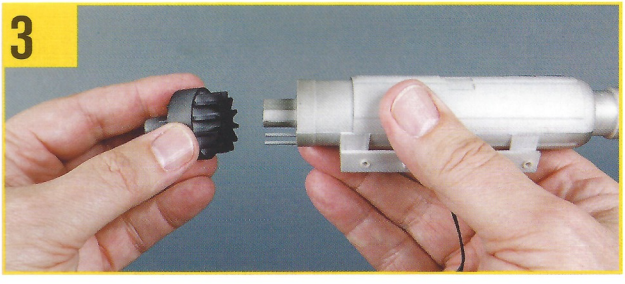
The fibre optic provided fits inside the laser cannon assembly to conduct the light from the LED to the emitter on the tip, which is also supplied with this issue.



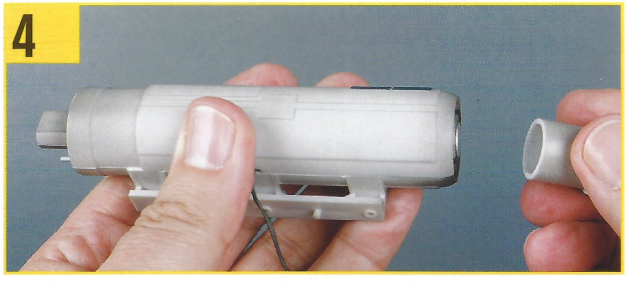
Take the cannon assembly from Stage 3.



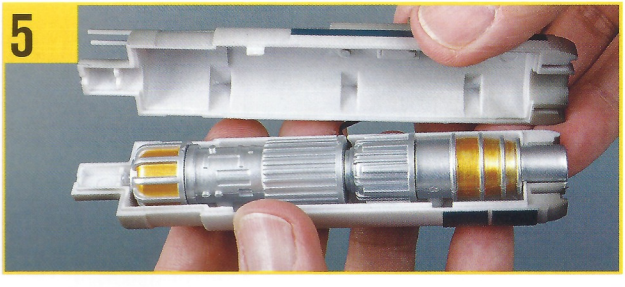
Remove the barrel assembly...



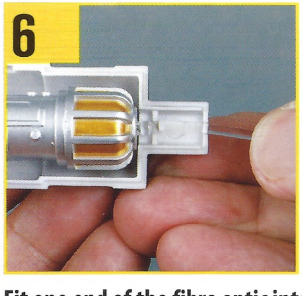
... the front cap...

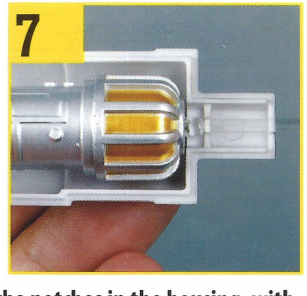


... and rear cap from the laser generator housing.

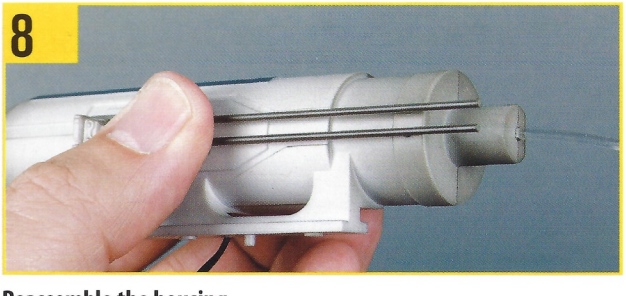


Separate the generator housing.



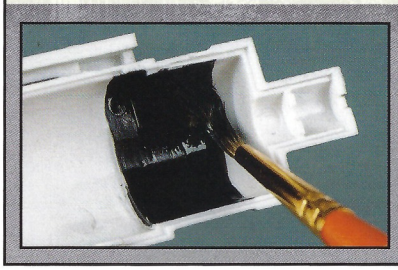


Fit one end of the fibre optic into the notches in the housing, with its tip in contact with the LED in the generator.



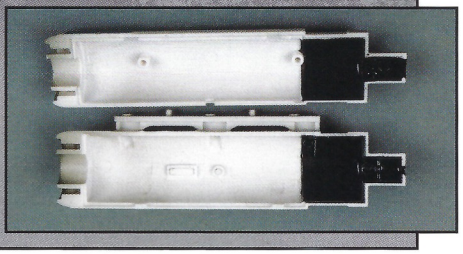
Reassemble the housing.

Expert Tip

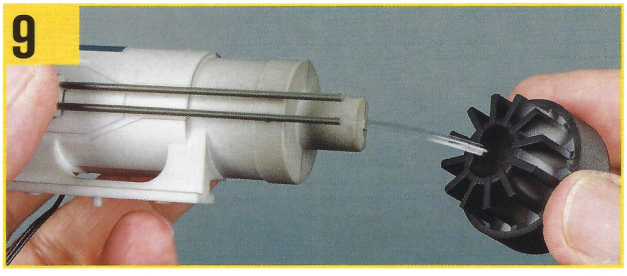


1. As the light source is housed in the laser generator, you may notice a slight glow from this area when the cannon 'fires'. If you prefer to conceal this effect, apply a coat of matt-black modelling paint.

2. Paint the whole of the areas shown, and allow both halves of the housing to dry before reassembling them.

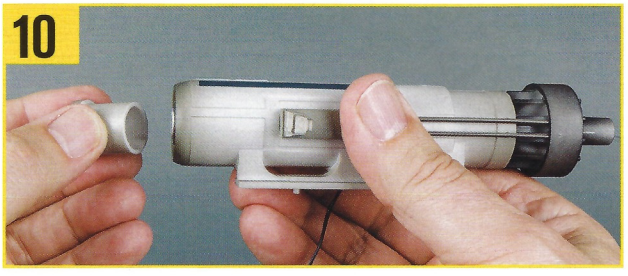


9



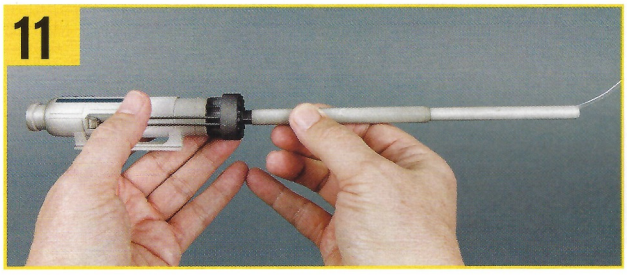
Slip the front cap over the fibre optic and onto the housing, remembering to cover the ends of the side tubes.

10



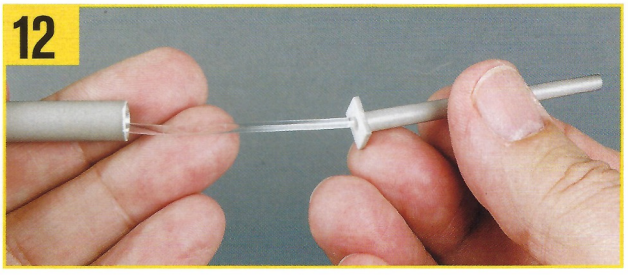
Fit the rear cap back onto the housing.

11



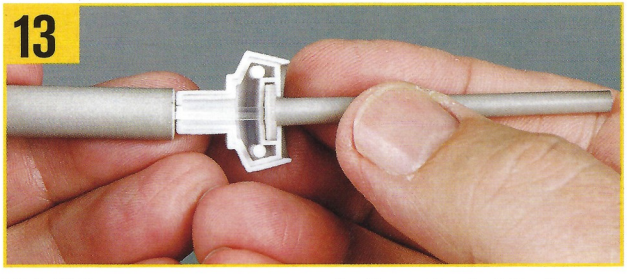
Slip the barrel assembly over the fibre optic and onto the front cap.

12



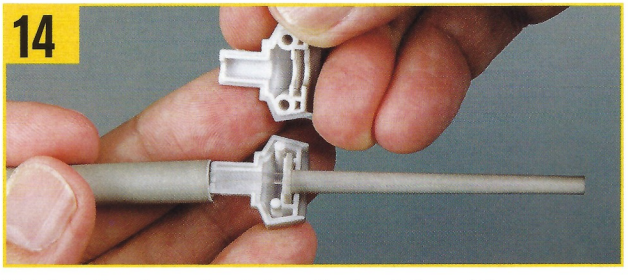
Slide the tip onto the end of the fibre optic, flanged end first.

13

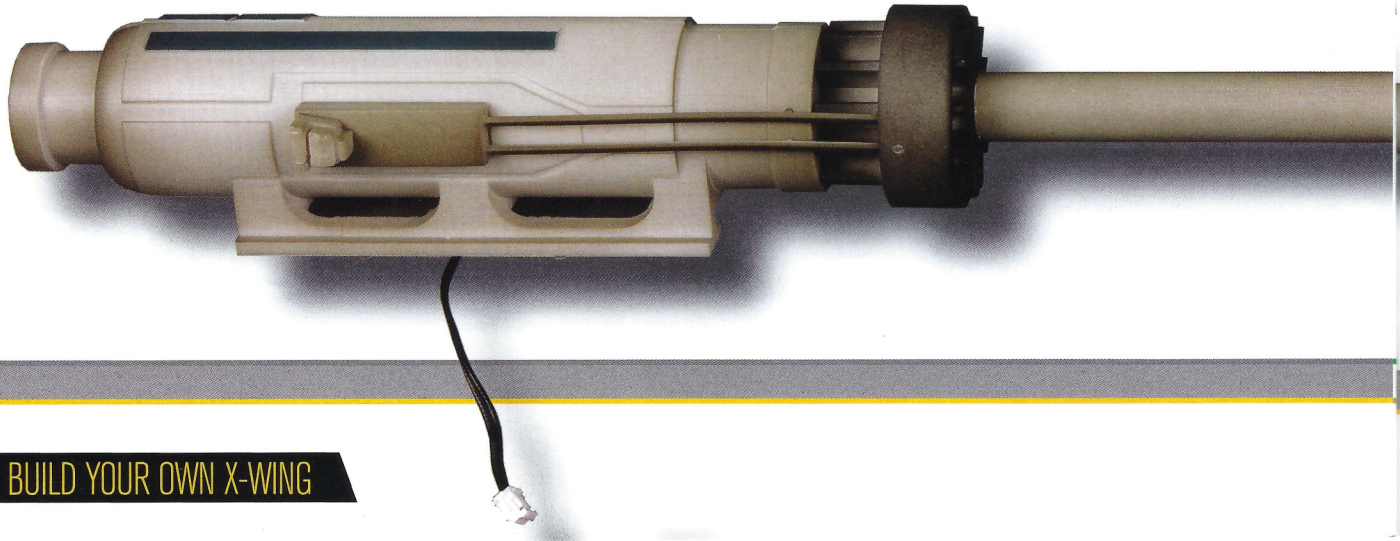


Fit half the suppressor mount over the flanged end of the tip.

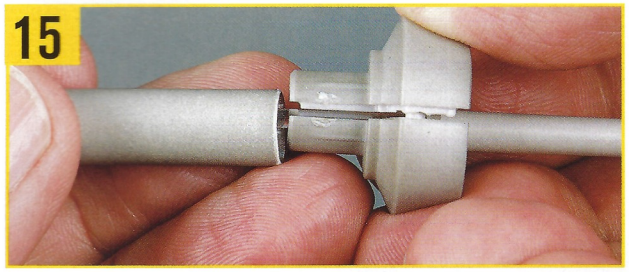
14



Match up the pins and sockets on the two halves of the suppressor mount.

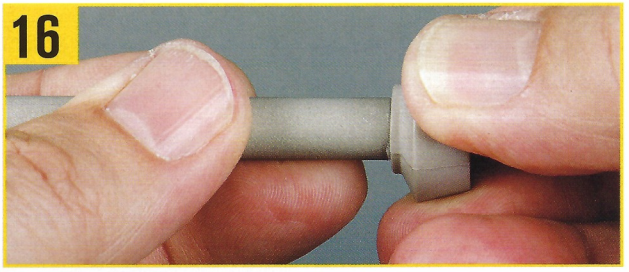


15



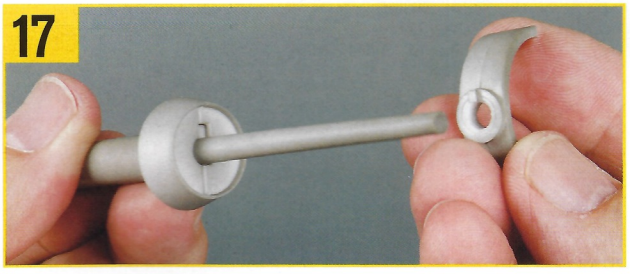
Press the suppressor mount together.

16



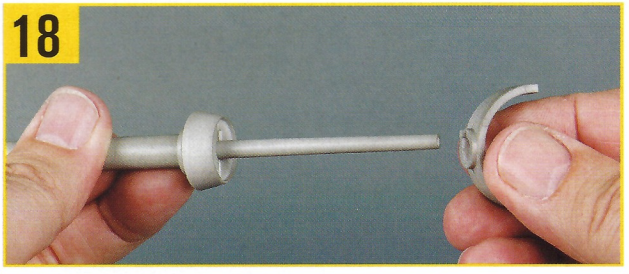
Push the suppressor mount into the cannon.

17



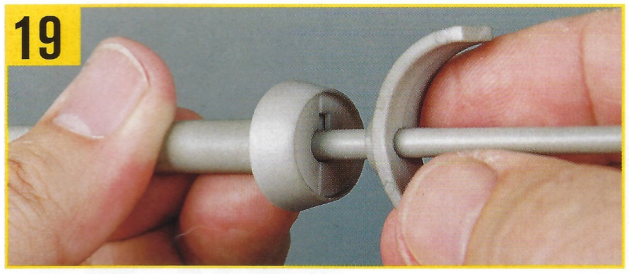
Line up the lug on the flashback suppressor with the slot in the suppressor mount.

18



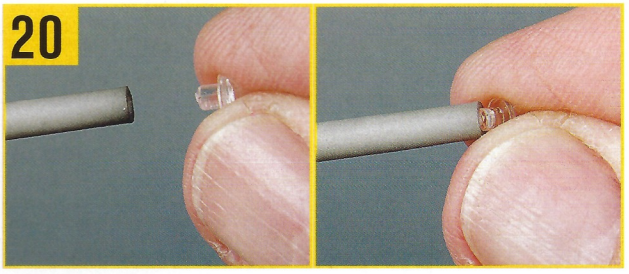
Fit the flashback suppressor over the tip of the cannon.

19



Press the suppressor all the way into the mount, then rotate the assembly to align it as in the large photograph below.

20



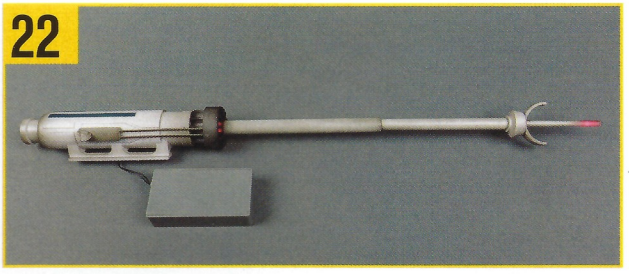
Press the smaller end of the clear emitter (1) into the end of the cannon's tip.

21



Take the battery box you used to test R2-D2. Unplug the base contact and plug in the lead from the laser cannon in its place.

22



The internal LED should come on, illuminating the tip of the cannon via the fibre optic.

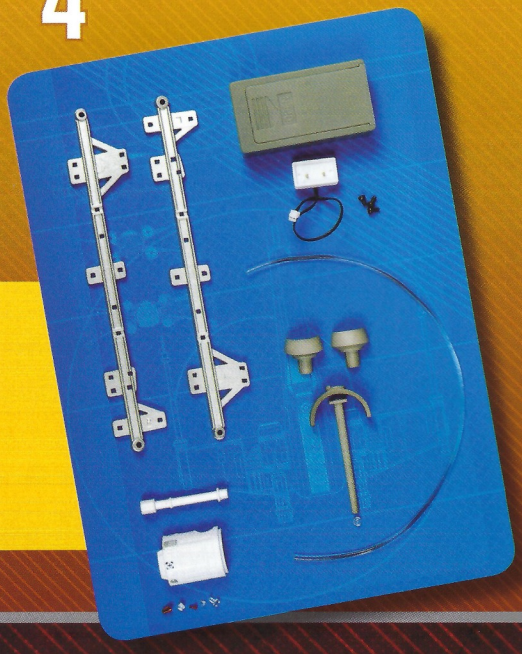


Keep the completed laser cannon ready to fit to the ship later on. Don't be tempted to glue the parts, as you will need to align the cannons accurately once they are fitted to the tips of the S-foils.

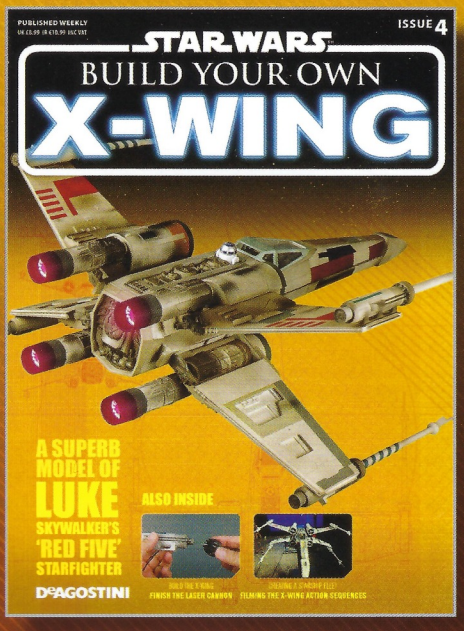
DON'T MISS OUT!

ISSUE 4

Creating a Starship Fleet
Filming the X-wing action sequences



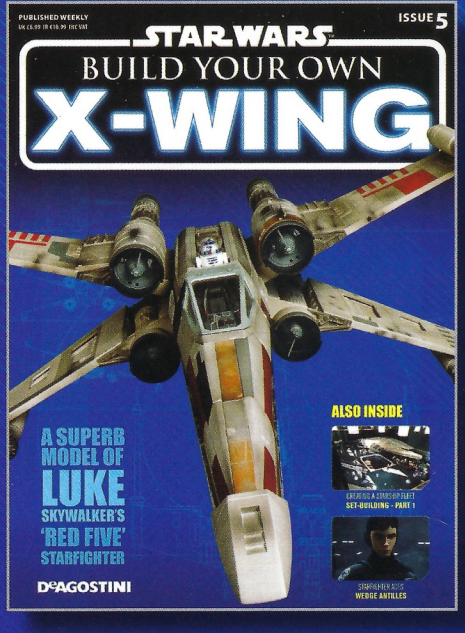
- Cockpit frames
- R2-D2 parts
- Battery box
- Laser emitter and flash suppressor

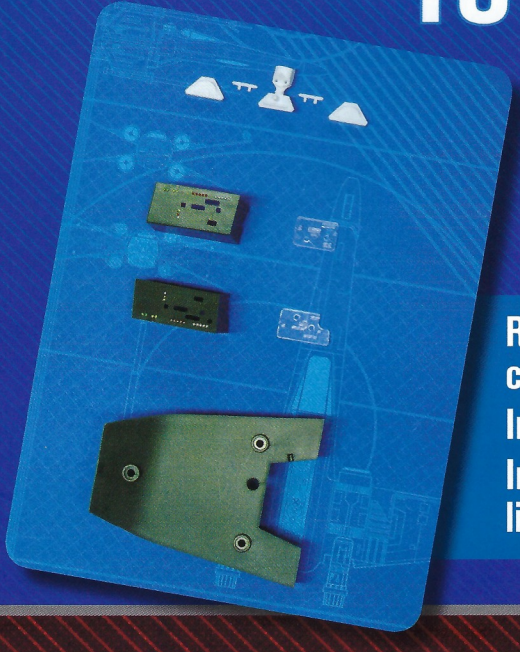


ISSUE 5

Creating a Starship Fleet
Set-Building - Part 1

Starfighter Aces
Wedge Antilles





- R2-D2's centre leg
- Instrument panels
- Instrument lighting displays

Items may differ from those shown.

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