STAR WARS MILLENNIUM FALCON

BUILD THE MODEL – EXPLORE THE GALAXY



ROLL, PITCH, AND YAW

F219FSC012

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CEC'S LIGHT FREIGHTER VARIANTS

YT-1300FP

MIXED TRANSPORT & CARGO CARRIER

Always eager to cater for every possible market, CEC was quick to produce its own 'stock' version of the hybrid passenger/cargo carrier that many of its customers created for themselves.



The YT-1300's economical, flexible load space was ideal for ferrying people or cargo around the galaxy. The hold of the *Millennium Falcon* was adapted for smuggling, with few unnecessary embellishments.

The YT-1300's early basic freight and passenger models both sold very well, but CEC soon noticed that many of those who bought the YT-1300f customized the dedicated cargo carrier with extra space for paying passengers. Conversely, many buyers of the YT-1300p added cargo capacity to its basic spec, ending up with more or less the same result as those who started with the other base model. Keen not to lose any customers who might not want to have to do their own modification, CEC responded by offering a third standard layout, the hybrid YT-1300fp.

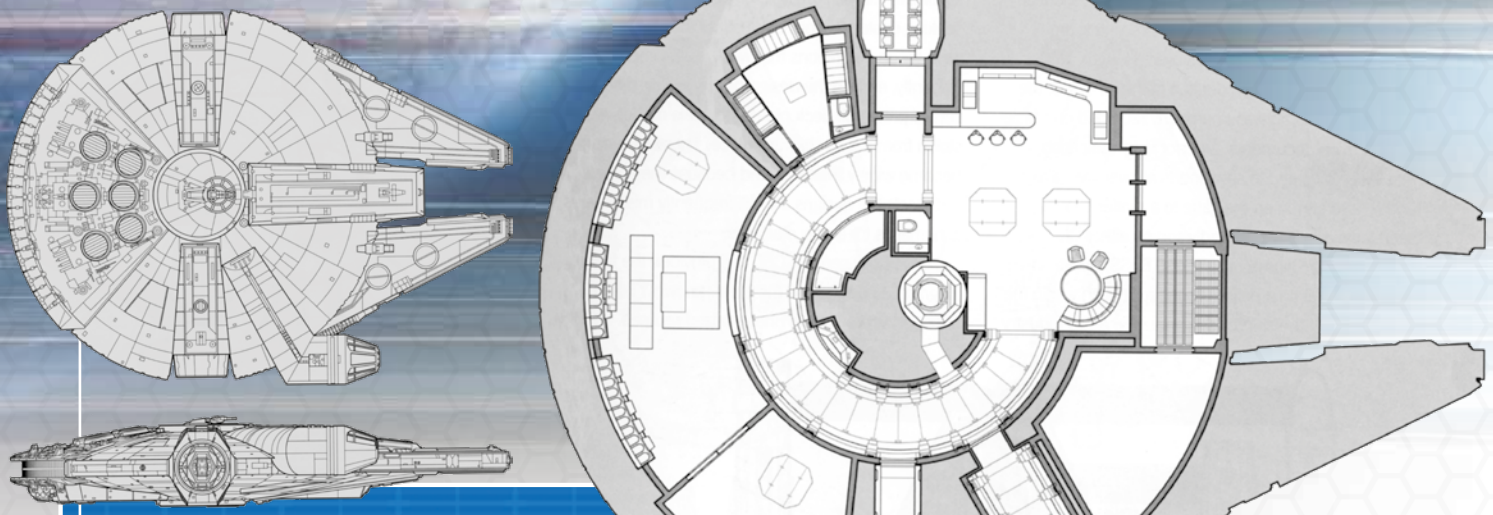
DESIGN COMPROMISES

Like all compromises, the fp variant missed out on some features that its sister ships offered. Its cargo capacity by weight was the same as the YT-1300f, but its holds had rather less space for bulky items, and it was slower to load/unload than the dedicated freighter. Similarly, the fp model offered far less space for passengers than the YT-1300p, and those who booked a berth would find that their quarters were somewhat less luxurious. This detail did not matter greatly from the operators' point of view, as those who bought the pure passenger ship rarely filled all their berths. As this would have meant charging higher costs per customer/light year, most of them already chose to cut down on passenger facilities and to add extra cargo space.

At any rate, any compromises did not affect the fp model's market. It quickly outsold both of the more dedicated versions and soon became known as the 'stock' version of the YT-1300. The only compromise that did raise a few eyebrows (and also caused a minor run-in with the regulators) concerned the access to the ship. A single

TECHNICAL SPECIFICATIONS

TYPE	YT-1300fp
CREW	2
PASSENGERS	6
CARGO	100 tonnes
LENGTH	34.75m
MAX SPEED IN ATMOSPHERE	800km/h
HYPERDRIVE	Class 2
HYPERDRIVE BACKUP	Class 12



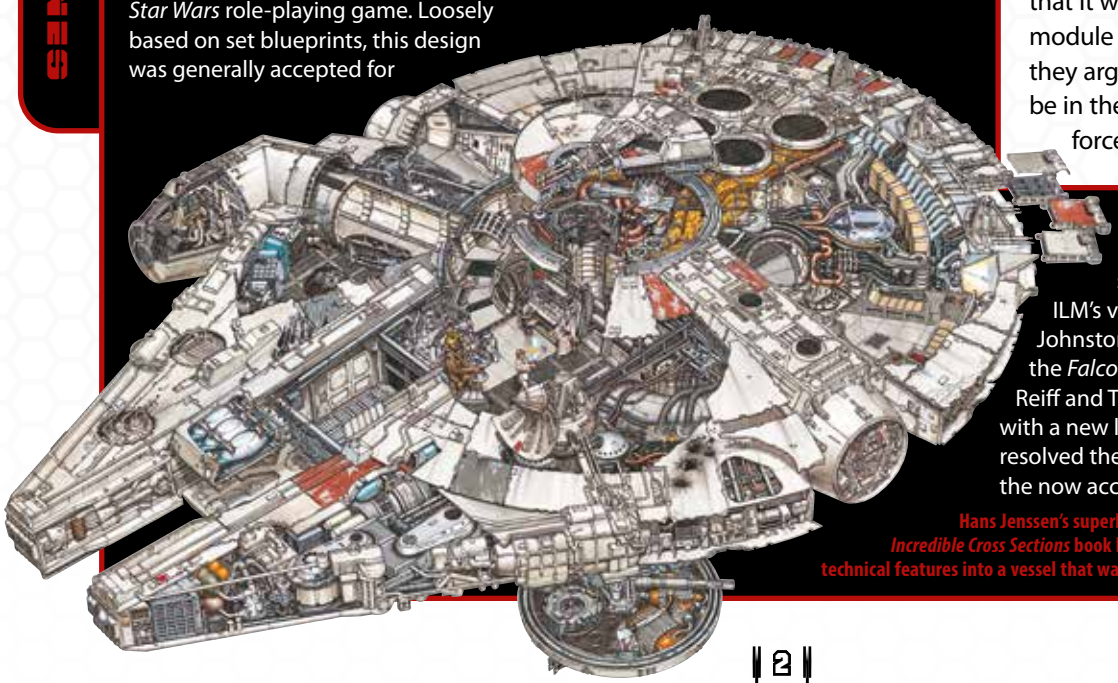
YT-1300FP TRANSPORT

Although no two YT-1300s are ever identical, comparing the floorplan of the stock model fp with the *Millennium Falcon* reveals just how radically Han Solo's ship was modified. Detailing all the changes would take almost as long to describe as they took to create, but most noticeably, the port escape pod was replaced with an airlock, with an extra ring corridor and circuitry bay filling the area that was normally occupied by a comfortable crew lounge.

BEHIND THE SCENES

QUESTIONS OF SCALE

As soon as *Star Wars* fans started mapping the layout of Han Solo's ship, they discovered that it was almost impossible to fit the interior features seen in the studio sets for Episodes IV and V inside the external dimensions defined by the ILM models. A key problem was that for many years, the *Falcon*'s official length was 26.7m. One of the earliest attempts to illustrate the floorplan of the YT-1300 was published in 1987 by West End Games in *The Star Wars Sourcebook*, the basis of the first *Star Wars* role-playing game. Loosely based on set blueprints, this design was generally accepted for years, but it became increasingly clear that it did not stand close inspection. Ten years later, the *Falcon*'s interior was redefined by the highly detailed exploded view in Dorling Kindersley's *Star Wars: Incredible Cross Sections* (1998), and a cut-away poster from SciPubTech. However, the illustrators of both had to resort to a number of compromises to make everything fit inside the *Falcon*'s shell. The scale issues were finally resolved when artists Chris Reiff and Chris Trevas researched the *Falcon* for *Star Wars Blueprints: The Ultimate Collection*. A key source was a 1976 illustration by ILM's visual effects director Joe Johnston, which compared the size of the *Falcon* with X- and Y-wing fighters. Reiff and Trevas were able to come up with a new length of 34.75m, which resolved the scale problem and became the now accepted standard.



Hans Jenssen's superbly detailed cut-away illustration from the *Incredible Cross Sections* book had to cram the ship's accommodation and technical features into a vessel that was somewhat smaller than is now accepted.

boarding ramp on the starboard side gave easy access to the cockpit corridor, and, as with the YT-1300f, when this was raised, it became the floor of the passage leading to the starboard docking tube.

Again, as with the YT-1300f, the space taken up by the ramp (and its need to retract) prevented the installation of escape pods in this area. Instead, CEC provided a single Class-6 pod at the end of the port passage tube. This came in for some criticism on safety grounds, as it placed the pod at the furthest point from the cockpit. However, the designers successfully defended this feature on the grounds that it was close to both the passenger module and the lounge area where, they argued, people were most likely to be in the event of an emergency that forced them to abandon ship.

ROLL, PITCH, AND YAW



The *Millennium Falcon* was able to roll into a vertical position to minimize its horizontal profile and slot through a narrow gap.

Every pilot has to master the three basics of flight control: roll, pitch, and yaw. But piloting a speeding spacecraft through tight turns, often while climbing or diving at the same time, demands a cool head, quick reactions, and an instinctive ability to think in the three dimensions through which the ship is moving.

Although flying a spaceship has a lot in common with flying a skyhopper, which is designed to work in a planetary atmosphere, the way in which the two ships are controlled differs greatly. Heavier-than-air craft achieve lift by harnessing air pressure through the forward motion of the wings, and can turn, or go up and down, by using control surfaces to redirect the airflow past their wings and fuselage, increasing the drag on one side or the other.

Starships can do something similar when they are flying in low orbit, and good pilots know how to minimize atmospheric drag and harness it to their advantage in tighter maneuvers. But aerodynamic effects fall off as the atmosphere thins out at high altitude, and once their ships leave a planet, pilots need other methods to achieve control.

GRAVITATIONAL EFFECTS

Space is a nearly perfect vacuum. Beyond a planet's atmosphere, there is no air to produce lift or drag. Gravity is the main force acting on a spacecraft, so a combination of thrust and anti-gravity (repulsorlift) drive technology allows it to maneuver.

Repulsorlifts are normally assembled in arrays or clusters of micro-coils, so that varying the balance between them will provide a means of directing the anti-gravitic force and steering the ship. But, just as aerodynamic effects depend on an atmosphere, repulsorlifts only work within a gravity well, as they need some mass to push against. For a typical habitable world with a solid surface, maximum antigrav range is approximately six planetary diameters. So, in the case of Coruscant (which has a diameter of 12,240km), a repulsorlift will gradually fall off in power, until it



Han Solo was a consummate pilot, using every advantage in battle. Here, he was able to swoop down on an enemy ship knowing that he would be hidden by the glare of a powerful light source behind him.

FLIGHT CONTROL: PART 2

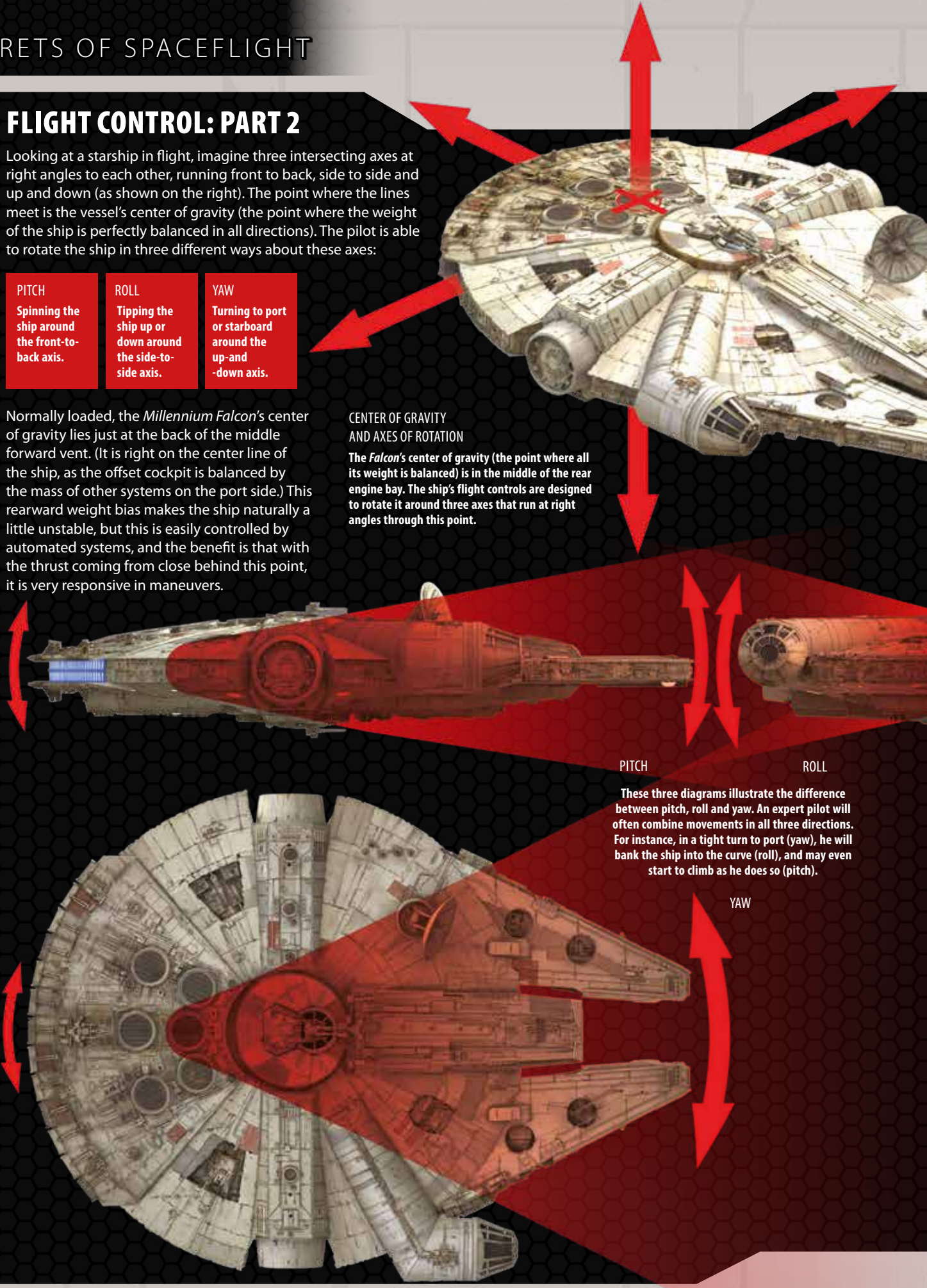
Looking at a starship in flight, imagine three intersecting axes at right angles to each other, running front to back, side to side and up and down (as shown on the right). The point where the lines meet is the vessel's center of gravity (the point where the weight of the ship is perfectly balanced in all directions). The pilot is able to rotate the ship in three different ways about these axes:

PITCH
Spinning the ship around the front-to-back axis.

ROLL
Tipping the ship up or down around the side-to-side axis.

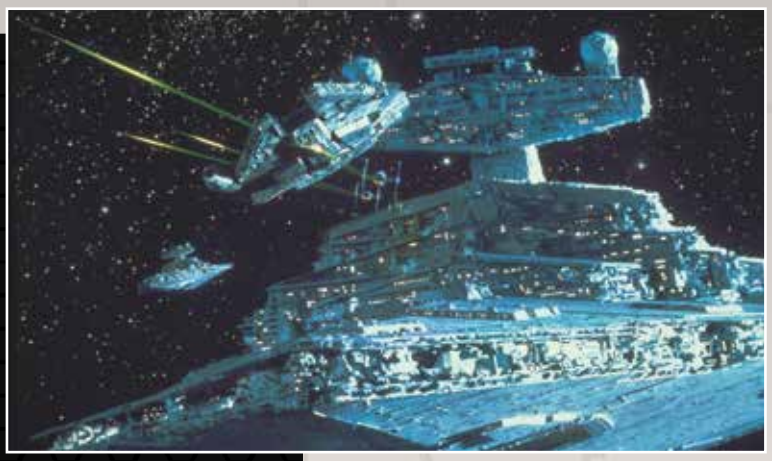
YAW
Turning to port or starboard around the up-and-down axis.

Normally loaded, the *Millennium Falcon*'s center of gravity lies just at the back of the middle forward vent. (It is right on the center line of the ship, as the offset cockpit is balanced by the mass of other systems on the port side.) This rearward weight bias makes the ship naturally a little unstable, but this is easily controlled by automated systems, and the benefit is that with the thrust coming from close behind this point, it is very responsive in maneuvers.

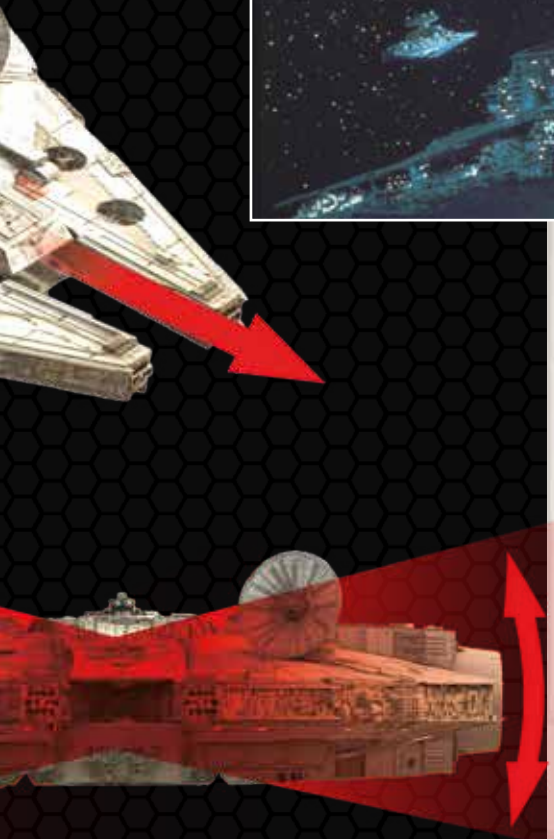


The *Falcon*'s center of gravity (the point where all its weight is balanced) is in the middle of the rear engine bay. The ship's flight controls are designed to rotate it around three axes that run at right angles through this point.

These three diagrams illustrate the difference between pitch, roll and yaw. An expert pilot will often combine movements in all three directions. For instance, in a tight turn to port (yaw), he will bank the ship into the curve (roll), and may even start to climb as he does so (pitch).



Agility is affected by size. While the *Falcon* can easily outmaneuver a cumbersome Star Destroyer, tiny TIE fighters can twist and turn around it.



A series of instruments provide the pilot with information about the ship's motion and orientation with respect to any point of reference. These readouts (together with data from the ship's sensors) allow pilots to fly safely even when they cannot see their surroundings.

At the heart of most of these instruments is a very simple device: a gyroscope. This is simply a rapidly spinning wheel with a swivel mounting. Such a wheel tries to maintain its orientation, regardless of how its housing tilts, so it can provide a fixed plane of reference that does not change as the ship twists, turns, dives or climbs. A flight panel's heading and attitude indicators, and its turn coordinator, all rely on gyroscopes.

becomes completely ineffective at around 75,000km.

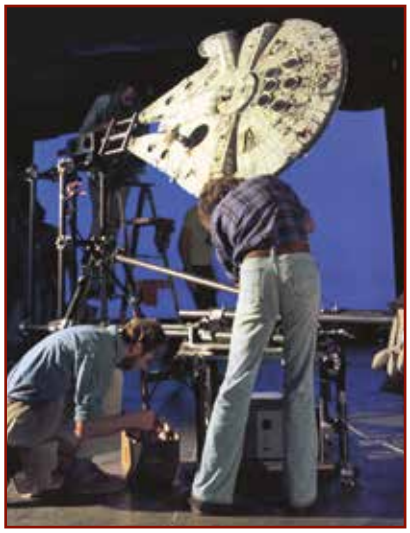
In practice, the thrust from a ship's sublight drives provide far more force than a repulsorlift, so these drives are normally engaged immediately upon leaving the atmosphere. Thrust vector plates provide steering by directing the energised exhaust gases.

THRUST VECTORING

In some designs, this is the only steering provided, while other ships use a combination of thrust vectoring and balancing the output from an array of engines. In the case of the YT-1300, with its curved 'wide bar' engine, the pilot can increase the thruster power to port or starboard, and, at the same time, use the array of multiple thrust vector plates to direct each jet up or down. At speed, an expert pilot can spin the ship in three dimensions at once, hurtling it through a change of direction in virtually its own length.

SCALE EFFECTS

Models have been used in film-making since the early days, but if a model is too small-scale, its movement will not look realistic. One solution is to move the camera around the model, but this technology only really became feasible in the late 1960s, and its large-scale application was pioneered on *Star Wars*. The film introduced fans to a level of reality that they had never seen before, but the ships still tended to move in a linear way, only turning or banking in a 2D fashion. As the storyboards for *The Empire Strikes Back* showed the *Falcon* moving with a new agility, halving the size of the model ship was an ideal compromise between it being practical to handle on set and looking 'real'.



Above: ILM's Steve Gawley, Bill Shourt and Lorne Peterson rig the original *Millennium Falcon* model from *A New Hope* for motion-control 'flight'.



Below: The smaller *Millennium Falcon* constructed for *The Empire Strikes Back*. Its armature included multiple mounting points for blue-screen filming.

YOUR NEXT PARTS

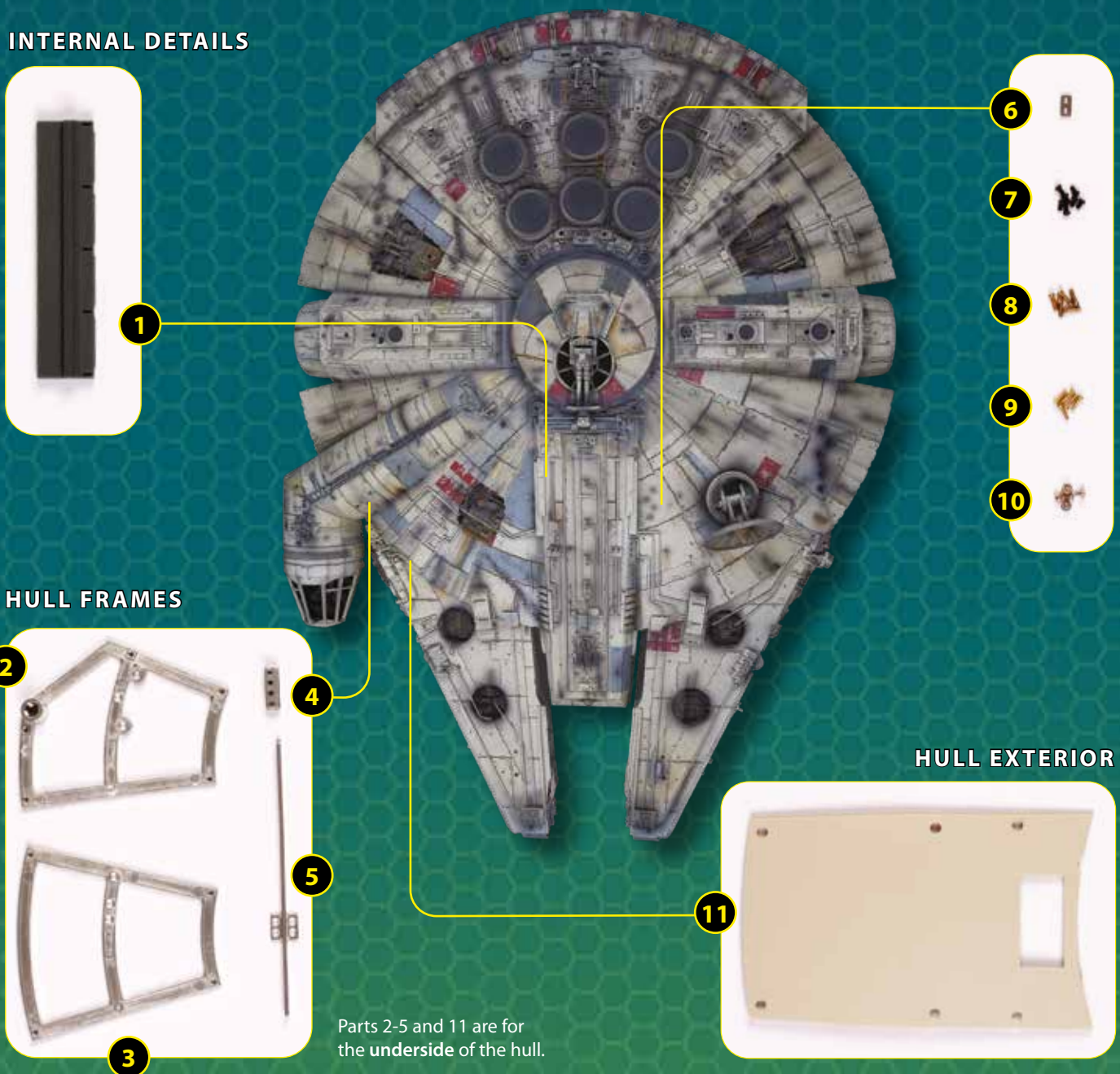
COMPONENTS CHECKLIST

1. Main hold pipe support
2. Hull frame BF-12
3. Hull frame BF-15
4. Rib connector
5. Radial stiffening rib
6. 2-hole connector
7. Fixing screws (x 6, plus spare)
8. Fixing screws (x 4, plus spare)
9. Fixing screws (x 4, plus spare)
10. Fixing screws (x 4, plus spare)
11. Hull plating BP-8

This issue includes another detail for the hold, which you will be adding next time. You also have more parts for the bottom of the hull, so it's time to assemble a complete modular section, as shown on the following pages.

Now that you have all the supporting parts (including the radial stiffening ribs), Stage 12 of the assembly sees you putting together six of the frames to make a full 60 degrees (one-sixth) 'slice' of the circular hull. Start by collecting the necessary components from the last three issues, as shown overleaf.

WHERE THE PARTS FIT



Parts 2-5 and 11 are for the **underside** of the hull.

ASSEMBLING THE BOTTOM FRAMES

The six frame parts and stiffening ribs shown here go together to make a substantial section of the bottom of the hull.



The frames shown have BF numbers (shown in red) cast into them for identification. The photo above indicates how they fit together, and the small diagram (right) identifies this area on the blueprint.

COLOUR-CODED SCREWS

Your model is assembled with six types of screws, color-coded for easy identification. It is important to choose the right ones, as they have different heads and thread patterns:



Black button-head screws fix frame sections together.

Brass screws are used to assemble the cannons and radial frames.

Take the two bottom frame parts provided with this issue and the four from Issues 9, 10 and 11, and lay them out as shown following the frame numbering. To complete the section of the frame indicated, you also need the radial ribs and connectors from this issue and Issues 10 and 11. There are two different types of radial ribs: the inner halves have a flange with four holes, while the outer radial ribs have flanges with two and four holes. Finally, you need 19 short black button-head screws to fix the frame sections and 8 long brass screws to join the radial ribs. Both types are shown in close-up (above).



01



Referring to the photo above, take frame number 10 and an outer radial rib. Align them as shown.

02



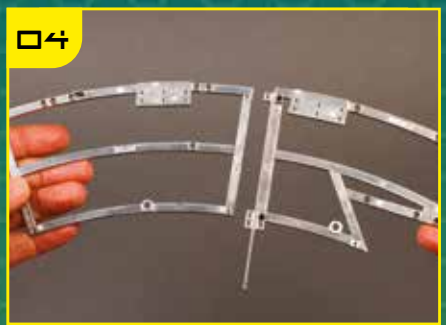
Insert a screw in the outer (2-hole) flange, but do not tighten it fully yet.

03



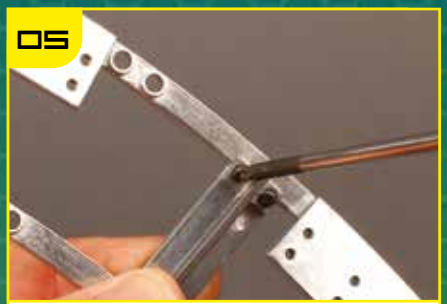
Insert a screw in the inner (4-hole) flange as shown. Tighten both screws fully.

04



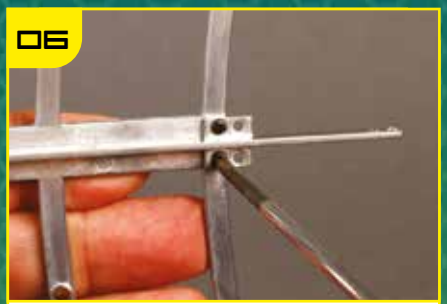
Take frame 13 and align it as shown.

05



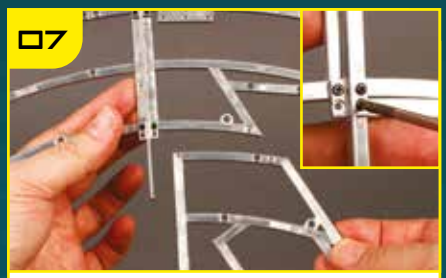
Insert a screw in the outer (2-hole) flange, but do not tighten it fully yet.

06



Insert a screw in the inner (4-hole) flange as shown. Tighten both screws fully.

07



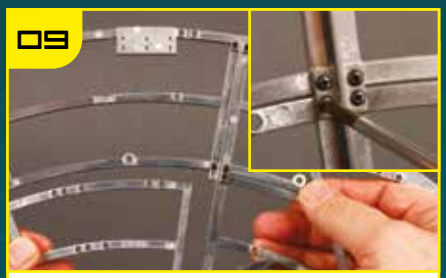
Take frame 11 and align it as shown. Insert a screw into the 4-hole flange in the rib.

08



Screw a 2-hole connector in place to join the outer edges of frames 10 and 11.

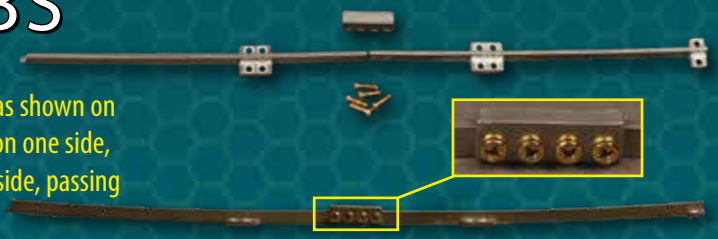
09



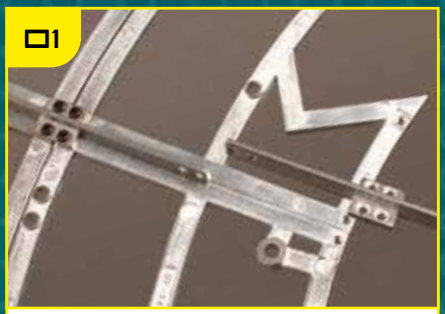
Take frame 14 and align it as shown. Insert a screw into the 4-hole flange in the rib.

JOINING RADIAL RIBS

The radial ribs are used to strengthen the hull framework. They are provided in two halves, which are joined by a connector with four holes, as shown on the right and in the steps. Note that the holes in the connector are plain on one side, and threaded in the other. The screws have to be inserted from the plain side, passing through the rib, and then be tightened into the threaded holes.

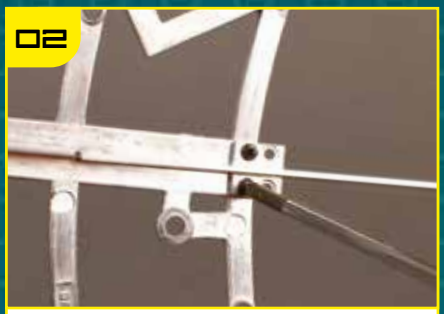


01



Take an inner radial rib and align it with the assembly as shown.

02



Screw the 4-hole flange to the holes in frames 10 and 14.

03



Fit the connector over the joint between the two halves of the rib.

04



Insert a brass connecting screw through the connector from the side with the plain holes.

05



Screw all four brass connecting screws through the connector.

06



Align frame 12 with frame 11 and the inner rib as shown.

07



Insert a screw in the 4-hole flange to secure frame 12.

08



Screw a 2-hole connector in place to join the outer edges of frames 11 and 12.

09



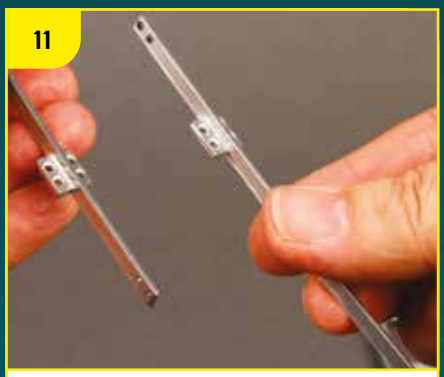
Align frame 15 with frame 14 and the inner rib as shown.

10



Insert a screw in the 4-hole flange to secure frame 15.

11



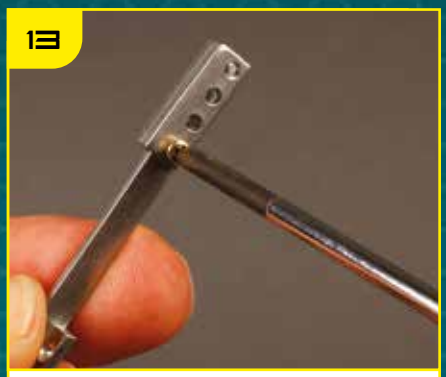
It is easier to join the other inner and outer radial ribs before fitting them.

12



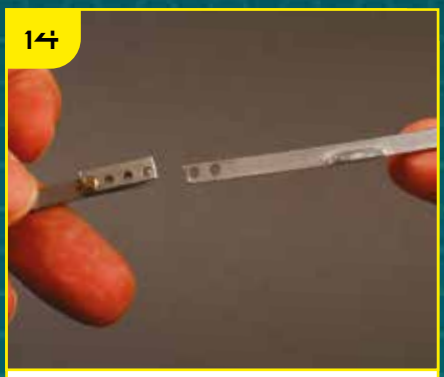
Take the remaining rib connector and fit it over the outer rib, ensuring that the flanges are on the lower edge.

13



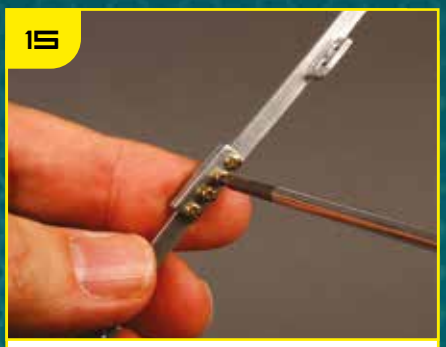
Screw the connector to the rib with a single screw in the outermost hole.

14



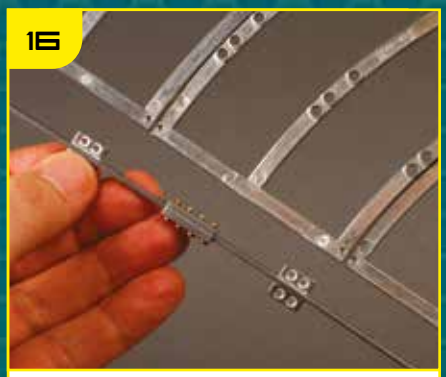
Line up the inner rib, ensuring that the flange is on the lower edge.

15



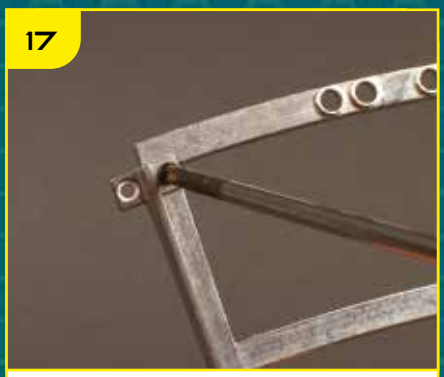
Tighten the remaining three brass connecting screws through the connector.

16



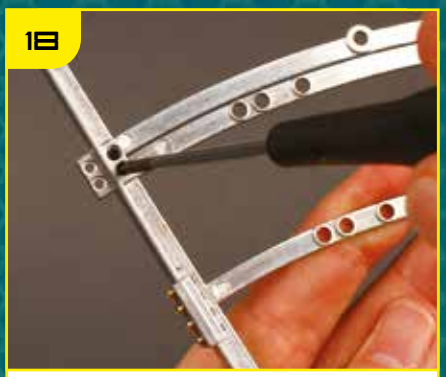
Align the complete rib with the edge of frames 13, 14 and 15.

17



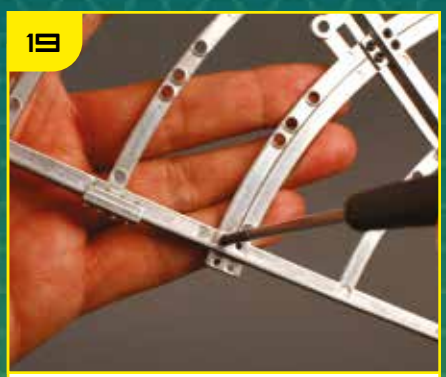
Screw the outer 2-hole flange in place, but do not tighten the screw fully.

18

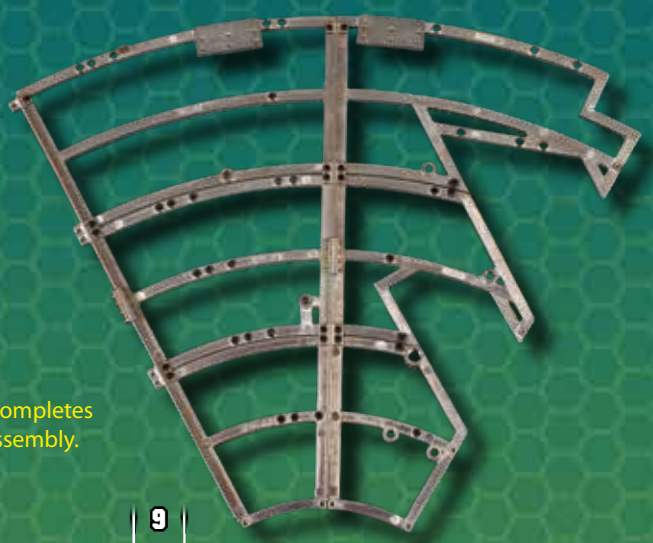


Work along the rib, adding screws through all the holes in the flanges.

19

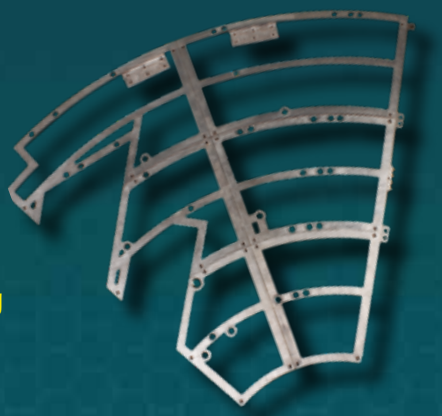


When you have added all the screws, check that they are tight.



This completes the assembly.

HOW THE HULL PLATING FITS



You can turn the completed hull frame over and test-fit the three pieces of hull plating from Issues 9, 10 and 11. You will not fit these permanently until a later stage, so for now, just press the lugs into the holes molded in the frames.

01



Hull panel 10 (from Issue 9) fits into this position.

02



Hull panel 9 (from Issue 10) fits next to it, with the edge slightly overlapping the joint between the panels.

03

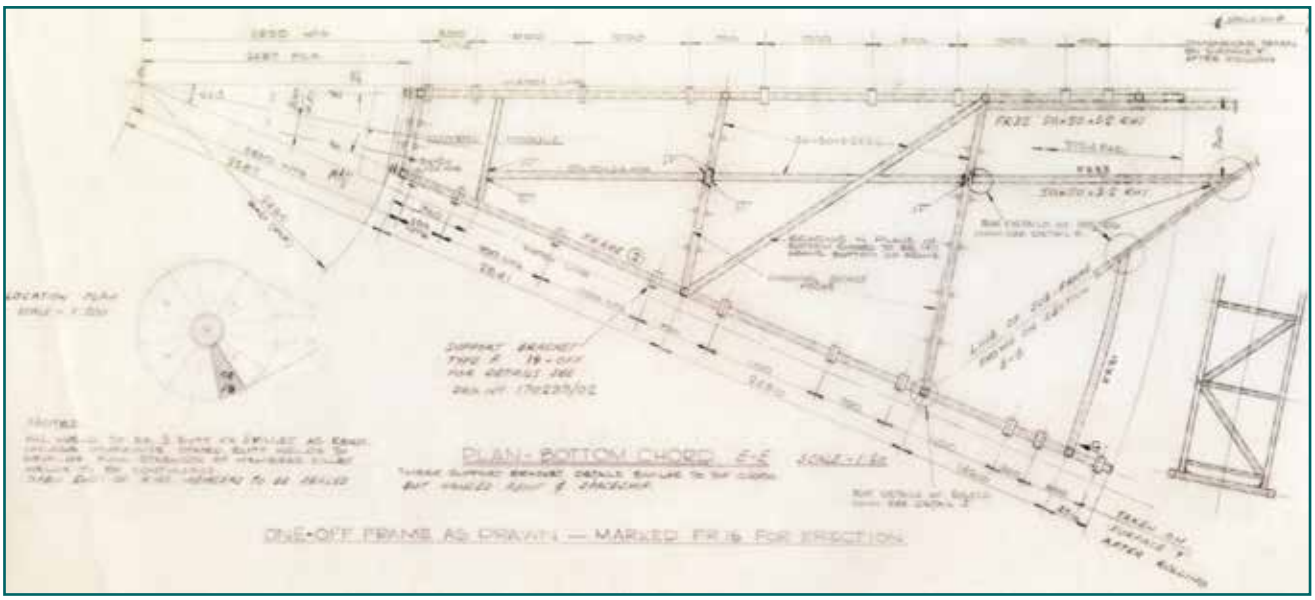


Hull panel 11 (from Issue 11) fits as shown. The rectangular hole is for one of the optional landing legs.

BEHIND THE SCENES

WELDED FRAMEWORK

The huge scale of the full-sized *Falcon* meant that it needed a very substantial metal skeleton to give it stability. Elstree Studios' set-building facilities were extremely capable, but the specialized, 21-tonne welded steel fabrication was commissioned out to Marcon Fabrications, 250 miles away at the south-west tip of Wales. Despite the logistic complications, this made good sense, as the company possessed a large enough hangar to house the huge structure, while Marcon also had movie experience, through being involved in building the giant set for *2001: A Space Odyssey*. In that movie, the main compartment of the *Discovery* spaceship is a huge centrifuge some 12m in diameter and 3m deep, which constantly rotates at 3mph to provide an artificial gravity effect. Built into the structure and revolving with it were the astronauts' desks, computer consoles, bunks and hibernation containers. Not only that, but the movie-makers' lights and cameras, and the projectors used to flash readouts onto the screens, had to be fixed to the centrifuge and keep working while turning through a full circle. Compared to this, building the static *Falcon* was simple, despite its structural complexity.



This blueprint, drawn up in September 1978, was produced by ILM to show Marcon Fabrications how to fabricate the welded frame for the full-size *Falcon*. Sixteen sections like this, each measuring 22.5 degrees, made up a full circle.