As part of its golden anniversary celebrations in 2006, the Gauge 0 Guild has provided a 7mm scale model of 60103 Flying Scotsman to be part of a ten-year exhibition at the National Railway Museum. The engine was presented to the museum, on the Guild’s behalf, by George Hinchcliffe on the 20 March, which proved to be a tight deadline that had consequences.

The name Flying Scotsman is perhaps rather more apt than I first thought since this job has gone through my workshop in a few short weeks. This has in turn caused problems, rushed jobs are always prone to things going wrong and this one was no exception.

The various parts and work were provided at reduced or no cost. The kit from David Andrews, wheel castings from Alan Harris, motor/gearbox from ABC and plates donated by Guilplates. I built it at no cost and it was professionally painted in BR blue, circa 1949-50 by Dennis Morley for next to nothing.

The kit will produce either an A1 or A3, there being sufficient parts to do both, consequently, there are a lot of bits left over and ticking off each item in the instructions is one way of ensuring none get missed out. So what do we get in David's box? Which is large, robust and would certainly hold the completed engine, were it not that Philip Dredge had made a special hardwood case for it.
As you can see from Figures 1-3, there is a great deal. All the castings appear to be crisp and neat (which proved to be case on most of them) and the quality of the etches is outstanding and include many duplicates for small parts. I particularly liked the 0.7mm thick nickel silver etches for the chassis and motion. There is also a bag containing the nuts and bolts - unusual in that many of them are a beefy 6BA - handrail knobs, ready turned crank pins, plunger pickups and various brass and steel rivets.

The wheels chosen originally for this engine were of castings by Alan Harris and I think it may be worth going through the process I use to turn them up from the raw castings. Simply put, I use a version of the method advocated by W Castellan, which was published in MRJ No: 44 in 1991, modified using Alan Harris's advice to avoid overloading the spokes when turning up the flange and tread.

The first thing to do (Fig 5) is mount the casting, using a set of soft jaws, by its tread, having first filed off any casting pimples, and true up both the spigot and the back of the wheel. The soft jaws are turned down to be a slightly larger diameter than the wheel itself. This provides more grip and a very positive location. Mark each wheel to indicate jaw 3 (or whichever is convenient for you). Figure 6 shews the back marked at jaw 3 with the spigot and back trued up. Get all the wheels to this stage before proceeding further.

Now change the jaws for a conventional set and mount the wheel in the chuck by the spigot but ensure that the mark is now opposite jaw 3. Check that the inside of the wheel flange is concentric to the spigot with a pointer mounted in the tool post. Each wheel then has the face skimmed and the tread and flange turned down to within 0.01mm of its finished size as here in Figure 7.

The flange and tread are then turned down to exact size using a form tool as in Figure 8. I use a form tool from the Scale 7 Society, which I carefully sharpen before dealing with each wheel.
The axle hole was started using a centre drill, 3 sizes of drill and then reamed using 4.74mm reamer from Alan Harris as in Figure 9. All these operations – from skimming the face to drilling the axle hole and polishing - are carried out on each wheel in turn before it is released from the chuck.

The spigot is then sawn off while the wheel is held, by the spigot, mounted in a vice and then remounted in the chuck by the tread using the soft jaws again, ensuring that the mark is again lined up on jaw 3 (Figure 10).

Once the spigot stub has been turned off, the back is turned down until the spokes shew through and the wheel is 3.5mm thick (Figure 11). Polish them using 1200 grit wet and dry wrapped around a file. Do use a handle and take care!

The vice on the vertical drill press is then set up with a simple jig to drill the crank-pin holes, all exactly alike and in line, to fit the supplied crank pins as shewn in Figure 12.

An important element of this project is research since, not being an adherent of the "London and Nearly Everywhere" I have little, if any, information about it. Mike Marritt kindly loaned some books and the KRM found a picture of Flying Scotsman at about the right time and members of the 7mm e-group have provided others. I am most grateful for their unstinting help.

These engines had a complex history with many different variations. The Scotsman started life as an A1 and changed much over the years, some of which are open to question. For instance, there are two schools of thought on the number of spokes in the trailing wheels. Some say ten, others twelve.

Flying Scotsman today actually has trailing wheels with nine spokes! The important things from the point of building the model are those differences that are visible. Did it have a Banjo dome? Was it right or left hand drive in 1949-50?
So, now to start building, beginning with the tender as is my normal practice. I always try to build as much as possible "in the flat" before commencing assembly. All the material used is quite thick, especially the nickel silver, so cleaning up the cusps is essential, particularly where parts are seen edge-on.

Securing nuts and bolts are a nice, hefty, 6BA and where they need to be fitted there are etched hollows that exactly match the shape of the nut. A great idea that makes the job easy, accurate and quick. (Other manufacturers please note!) The basic components laid out in Figure 13 with most of the work done “in the flat” prior to construction. Construction is fairly self-explanatory. However, much care is needed to get the curves right. Attention to the cusps also ensures that the parts fit as they should. Figure 14 shews how the inner supports and ends are fitted first ensuring that they are all square and perpendicular to the base. The sides are then relatively easy to fit and ensure squareness (Figure 15). Getting the tank top and coal space in is somewhat of a challenge but the parts do all fit, they just need some care and patience (Figure 16). The body is now close to completion so work was started on the chassis.
Figure 17 shews all the parts for the chassis, cleaned up with nuts fitted and bearings in. I originally lightly sprung the two centre wheels as you can see.

The etches allow for this by providing half etched extensions for the bearing holes. A simple matter to file them to shape, checking carefully for fit as one goes along, and some steel guitar wire soldered to the bearing and the side of the frame. However, I later scrapped them as too fussy and used the designed method of a screw above each axle to control vertical movement. The nuts for them are clear in the picture at Figure 18 of the assembled chassis.

More pictures of the tender at various stages of construction. I added some brass angle when fitting the rear buffer plank to give more strength and this is just visible in Figure 19. This beam must take the whole of the train’s weight. The brass castings for the tank vents were missing so rather than wait for a replacement set to arrive I made some up from brass rod instead, which can be seen in Figure 16.

The detail on the front and rear (Figures 20 & 21) that cannot be fixed when the parts are in the flat were added next.

Figure 22 illustrates the step, rivet and outrigger details, which were all added later in construction.
The brake gear, if assembled as per instructions, would make removal of the wheels quite difficult so they were modified to be removable (See Figures 23 & 24). A length of small bore tube 4mm long was soldered on the upper brake rigging fixing point and the shoes simply sprung on to them. It was necessary to alter the fitting of the cross bar and leave it as part of the fixed gear. The doors were later removed when I realised that on the A3, the doors (separately provided) were on the cab sides (refer back to Figure 20).

THE ENGINE.

The first thing to do, after making up the laminated connecting rods, was to set up the master chassis jig using the rods to get the spacing right for the mock axles (Figure 25). For simplicity and speed I opted for a solid chassis but some provision is built into the kit for springing or compensation.

In Figure 26 you can see how the bushes are slid onto the mock axles and the first side-frame offered up and soldered to them. The same procedure follows for the other side frame but in reverse.

Finally, in Figure 27, the two halves are soldered together using the spacers. The result should be a dead accurate chassis. This was the first time I had used this tool but it produced an accurate, but tight, chassis. However, once it was run-in it performed excellently. The remaining work on the chassis continued after the body had been completed and delivered to Dennis Morley for painting because of the tight deadline on this job.

The footplate has some complex curves and so the built-in jig that comes with it proved to be a great boon (see Figure 28). Care is needed to get the curves right but the jig keeps it all square. It stayed in place until the cab and firebox/boiler/smokebox were fitted. Due to time constraints it was not possible to make them removable. At the front
of the engine there are two, thick, nickel silver parts that represent where the frames come through the footplate. There is a small error here. The slots in the footplate need to be lengthened by about 4.5mm to allow the parts to fit correctly. David has altered his instructions to reflect this.

The boiler comes in two parts, a parallel section and a ready rolled taper section and each is wrapped around circular formers that fit in etched grooves.

The simplest way once the boiler was rolled was to stick it together with some heat resistant tape at the ends prior to soldering up. As you can see in Figure 29, I used Sellotape for the middle since there was little heat generated there. Do take care that the straight section is rolled the correct way with the etched grooves at the ends. I didn't and rolled it the wrong way! Fortunately, David found me a spare so scratch building a replacement was avoided.

I fitted the firebox and two parts of the boiler together using some 3mm brass rod as pegs in the etched holes (see Figure 30). It is important that the formers are lined up on the witness marks at the centre of the etched grooves so that these holes line up properly. The three parts are shewn in Figure 30 with the pegs, which go the full length of the barrel and firebox, soldered in.

The boiler/firebox nearing completion with the cab front temporarily fitted (Figure 31) so that it can be test fitted to the footplate unit. There are tabs at the base of the cab front that fit into slots in the footplate. A few parts still remain to be fitted but now is the time to decide how best to fit the boiler to the footplate. The instructions assume solder but I always prefer to make them as removable components if at all possible. In the end the boiler/firebox was bolted to the cab front and the smokebox saddle but they will still not come apart due to the cab fittings now being in the way. Given more time I could have devised a better method.
The parts of the cab seen in Figure 32 have had as much work as possible done on them before assembly. They are ready for fitting along with the smokebox door. The lamp iron is a lost wax item left over from a DJH kit, exactly like the one in the KRM picture.

Figures 33 & 34 give views of the finished body temporarily mounted on its chassis. Once I was certain that the bodies would fit on the relevant chassis, the bodies were taken to Dennis Morley for painting whilst I concentrated on completing the running chassis.

Figure 35 illustrates the chassis after having been further worked on together with several components that will later be fitted. There is nothing here beyond the abilities of an average modeller with some experience of complex etched kits. From left to right they are: the radial truck for the rear wheels, the base of the firebox, the frames for the bogie, the motion bracket, the cylinders and the front step unit. The chassis, where it bends outward to support the cab, is both narrow and half etched on the bend. I was a little concerned about its strength in the long term and so soldered some scrap etch, suitably bent to shape, to the inside to strengthen it. The real thing, I discovered when at the NRM, has more supporting structure inside the frames.

The motion bracket and the cylinders bolt on so that it can be taken down for painting and maintenance. The radial truck is a particularly neat piece of design. The whole unit bolts in place and the wheels can move from side to side in an arc and turn about their front to rear vertical axes. There is however, a choice of using a simple pony truck instead.

On top of the chassis, between the front and middle driving wheels, are fitted two arms with circular holes in them. These are from part "LL" and are designed to hold the white metal parts of the sand pipe assembly. The part is supposed to fit across the frames but,
once bent to shape, is in fact too short. I simply cut off the centre portion and soldered each arm separately in the locating slots.

The cylinders, seen partly constructed in Figure 36, and slide bars make up into strong, square, units once the parts have been cleaned up. The slide bars need careful work since the parts are relatively delicate in spite of being lost wax cast in nickel silver. It is critical that the cross head and piston runs smoothly and easily in the slide bars and cylinder. I found that by clamping the parts with magnets on the steel RSU plate, I could use a steel set square to ensure that the slide bars were at right angles to the front face of the cylinders.

The conjugated valve gear seen in Figure 37 was next. All the parts actually move, done that way simply because it could be. I doubt much of will be visible once the footplate is in place.

The motion (Figure 38) cleaned, polished and largely made up ready for fitting. Most of the linkage is by nickel silver wire soldered into the back of each joint. Except, that is, for the jointed coupling rod which uses a steel rivet provided in the kit. There are brass rivets provided too but I wanted to avoid brass in the motion as much as possible.

The picture at Figure 39 shews the chassis with wheels, coupling rods and motion fitted being run-in. Now of course you are wondering why it has a set of Slater's driving wheels. One of the aims of these articles is hopefully for others to learn by my mistakes. The Harris wheels were turned up with the intention of using Gibson telescopic axles, as I have done in the past. However, when it came time to fit the axles, they proved to be a smaller diameter than the axle holes. I did not have time to make a set of axles to fit. One of the dangers of working to a deadline. I have fitted Slater's wheels for now and hope to get it back some day to change them for the intended AGH.
It did not take too much work to get the chassis and motion completed. They were run-in over several hours on the rolling road until it ran virtually silently, and silkily smooth, at crawling pace.

My intention, as stated earlier, was to rivet the motion together using nickel silver wire and most of it is so done. However, so that the motion can be tested properly and taken down with relative ease in the future, some parts must be bolted. The connecting rod is joined to the crosshead and its associated motion parts with a lost wax nickel silver cast rivet. I tapped this 10BA and fitted it with a nut behind the crosshead where there is plenty of room.

The associated motion parts were then fixed to this part with a 14BA nut and bolt. This enables the motion to be removed but still retain the connecting rods in place. The radius rod is far too loose a fit in the motion bracket so I soldered a small washer on one side and a 12BA nut with the thread drilled out on the other. This ensured that it lined up with the reversing rod and was a close fit in the bracket. The only other modification was to cantilever the return crank that fits to the centre driving wheel boss to clear the rods. Not quite prototype practice. Trapping it between the bush and the retaining screw fits this part.

Once these details were thought out and implemented, assembling the motion was relatively easy, though some parts were only temporarily fitted until after painting. The next job was to take the whole lot apart, clean it all up and paint the chassis before re-assembling, fitting the plunger pick-ups and final testing. By which time the bodies were back from Dennis.

I experimented again (a previous attempt with the 9F was not successful) with chemically blackening the entire chassis by first washing them in very hot soapy water and rinsing carefully to get the oil and grease off. They were then dried with a hair dryer and bathed again in neat Viakal. Copious H₂O and air drying again preceded plunging them into a bath of chemical blacking agent. This worked well and the parts came out well blackened. Yet more copious H₂O and drying was followed by brushing the parts with an old toothbrush to get the residue dust off. The use of latex gloves here was useful to keep
greasy finger marks at bay. The chemically blackened parts were then sprayed with Halford's satin black acrylic paint. No undercoat was used and you can see the result in Figure 40.

A single coat was all that was necessary and this provided an excellent, thin, finish that allowed all the detail to shew through. Should any part get chipped in future, it will still shew black.

Next, the motion was put back together along with the plunger pick-ups. These latter proved to be problematic. The frames are quite wide and it proved necessary to cut the springs for the pick-ups in half because they caused too much friction. I think it would have been better to have used the “American” method of shorted out wheels on opposite sides of the engine and tender for pick-up and I would recommend that for anyone else building this kit.

One odd omission from the kit was a draw bar, though provision is made for bolting one in place. I made one from some copper clad glass fibre, which is bolted behind the tender and engine drag beams so that they are semi permanently connected. It would also make an excellent insulated connector for “American” style pick-up.

The time had come to put the chassis and body together to make sure it all still fitted. It is a close fit but goes together and works. There is a picture of the completed engine parked in my workshop’s private siding (Figure 1) at the beginning of this article.

It has been an interesting project and I have, despite the problems and time constraints, enjoyed it. A well designed kit that could be built by anyone with experience in etched kit construction.
A final look at the finished locomotive (Figure 41), which I think looks very smart in its blue livery that Dennis has made such an excellent job.

David Andrews has read the review and has no further comments to make.

There are more pictures and further information about this project at http://www.raymondwalley.com listed under “Projects”

Raymond Walley.
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