

## A Tale of Two F1 Matras

### Part Two (Matra MS10)

#### Matra MS10

##### Introduction/History

The second Matra in this tidy brace, is the MS10, which Jackie Stewart did race to very good effect in 1968. For that 1968 season, the late and sadly missed Ken Tyrrell bought a suitably modified Matra chassis and bolted on a standard Ford Cosworth DFV with the ever popular and well understood Hewland gearbox. At this time, the earlier DG300 gearbox was in use, being updated by the lighter FG400 in mid season. In the mid 70's, the FGA400 became available which was a modified improved version still, this being a gearbox we are more familiar with, usually incorporated in many F1 cars from the mid 70's. As this British founded team represented Matra in the World Championship, the team became known as *Matra Elf International*. Its effective pit neighbour at the Grands Prix, was the true French Matra team (*Equipe Matra Elf*) powered by its own Matra V12 engine, also using the Hewland DG300 gearbox.

Elf's involvement (*Essence et Lubrificants Francaise*) in Formula One, was pivotal in providing finance and much desirable international marketing exposure for this French oil company. It was in early 1967 that Elf with Matra agreed to co-operate in the

production of an all-French Formula One car, hence the MS11 came into being for the 1968 season; Elf evidently also supported the Matra International entry under Ken Tyrrell, who negotiated vigorously to be able to buy Cosworth DFV's for 1968, having seen them in action at Zandvoort '67 in Colin Chapman's Lotus 49's. He then went to Matra (with Jackie Stewart under contract) and persuaded them to sell him a Matra chassis, sufficiently modified to accept the British engine. This done, such a chassis was provided with a rear diaphragm around the gearbox on which the rear suspension was mounted. This enabled efficient engine changes to be made in the field without disturbing the rear suspension, a requirement forced upon them by the designer. The DFV was almost certainly, only partly stressed (unlike the fully stressed Lotus 49 version), utilising an additional lightweight tube frame extending back from the monocoque rear face, to support this encircling diaphragm. The rear suspension loads were directed into this diaphragm, which was cross braced above, (once or twice, depending on the race in question). The loads were directed through the cross bracing(s) into the gearbox maincase in the usual way and thence through the engine into the monocoque. British Dunlop tyres were available and provided the necessary finance to enable Ken Tyrrell to retain the services of Stewart. The first Matra chassis provided for Kyalami 1968 was the MS9 and provided Ken Tyrrell's team with valuable experience. The definitive MS10 wasn't available until the 'Race of Champions' in March, at Brands Hatch. This left much to be desired and after a Formula Two shunt in which Stewart damaged a wrist, Jackie eventually drove the MS10 in anger for the first time, at Spa Francorchamps where certain victory was denied him following a last minute 'splash and dash' for fuel.

Victories came at last in the Dutch, German and United States Grands Prix. Jackie Stewart was narrowly pipped to the World Championship at the Mexican Grand Prix by Graham Hill (Lotus 49B), after fuel tank sealing polymer came adrift and partially blocked the fuel pump.

### **Materials and Methods**

The MS10 was resurrected from an extraordinary wreck of an MS11 handed over by a friend at some obscure motorway Service Station. The specifics of ‘materials and methods’ are described in the Hesketh 308 article in *Scale Auto Modeller, Volume 3, issue 9*, and also in my previous article describing the 1968 Matra MS11.

Essentially, aluminium tube/brass rod, plasticard, various adhesives, Milliput, model fillers and Halfords acrylic spray paints were the basis of the materials used.

### **Research**

Detailed building, followed studying of available research data from many sources, particularly LAT (London Art Tech, digital photographic archive), History of the Grand Prix Car 1966-1985, Doug Nye 1986 (Hazleton Publishing) and History of the Grand Prix, Alan Henry 1990 (Bison Books for WH Smith). An MS10 was due to be at the

Goodwood Festival of Speed in 1997, but unfortunately didn't arrive due to clutch trouble. However, the most valuable information was derived from photographs of MS10 at Zandvoort 1968, acquired from LAT and also from the aforementioned books by Alan Henry and Doug Nye.

I am especially indebted to Neil Davis, a former Matra International mechanic and subsequent Tyrrell works-manager without whose input, much of the detailed wiring and plumbing of the MS10 would have been beyond knowing. While the MS10 was in a state of half-build, Neil visited me and together we thrashed-out the general arrangement of the various electrical wiring routes, the fuel system, oil lines and miscellaneous aspects which brought a wonderful authenticity and accuracy, lifting the model of this F1 car beyond the ordinary. I remain very grateful for his willing enthusiasm which characterises so many of his contemporaries, further inspiring the younger generation.

### **Building a Matra MS10**

#### MS10 Chassis and Bodywork (using an ex-MS11 chassis)

Using a cutting disc, the rear pontoons were removed from the Matra-style monocoque.

A rearward extension to the central monocoque was built-up using plasticard and

Milliput, providing additional fuel tank space behind the driver's seat-back, typical of the era. Within this location, the fuel collector pot was installed receiving fuel from the side tanks. The shape and length of this chassis extension was carefully determined from the LAT photographs. Having sanded and filled until an acceptable monocoque rear bulkhead area was complete, the radius-rod pickup points were tackled. This involved careful assessment of shape, size and position on the monocoque sides, using the photographs available. Similar attention was paid to the locating-site for the higher of two tube-frame elements for the lightweight frame extending from the rear monocoque to the rear diaphragm encircling the bell-housing area between engine and gearbox. On the outer aspect of the monocoque this upper element was fixed into a faired fitting just below that of the upper radius-rod. The lower element of the rear chassis frame was attached directly into the back of the monocoque just below and inboard of the lower radius-rod attachment point on both sides.

Any blemishes including holes for fixing external water pipes and sidetanks on the original monocoque were filled and sanded before the whole monocoque was primed and sprayed Ford Electric/Monza Blue. Lastly, a double brass rollover bar (1.75mm brass rod) was formed, basing its size and shape on information in the LAT photographs. After spraying this a shiny steel colour (Alclad chrome, next time) the four posts of the roll over bar were fixed into the monocoque via the specific locating points on the fuel tank top using Epoxy resin. A headrest was fashioned from plasticard and sprayed Satin Black.

The MS10 nosecone was dealt with in almost exactly the same way as for the MS11.

Additionally though, extremely thin slots were cut at an angle across each side of the nosecone to accommodate the very narrow aerodynamic prototypical winglets used on this car.

The upper bodywork or cockpit cowling was modified by additional plasticard on either side at driver shoulder level, in order to allow for a shorter windscreen than on the original MS11 kit. Later, an acetate screen was made and fitted having used a card template and fine wire ties to attach the screen almost invisibly to the edge of the cockpit surround.

#### MS10 Inner Chassis

As in the MS11, the battery compartment was removed, enabling a more normal footwell to be constructed from plasticard. Pedals were added with their push-rods into the forward bulkhead to the mastercylinders applied later on the front surface behind the oil tank. The fuel coupling on the inside of the left fuel tank was fitted just to the left of the clutch pedal. Unlike the MS11, in this race the MS10 did not make use of a reserve tank above the driver's knees, therefore this fuel coupling was blanked off by a secure cap. As in the MS11, for races in which the reserve tank was required, the alternative cockpit cowling was secured by Dzus fasteners and then a mechanic would manoeuvre himself head-first down into the monocoque. He would then attach the downpipe from the reserve

tank to this sidetank fuel coupling. Thereafter, the cockpit cowling would not be removed for the duration of the meeting unless absolutely necessary.

The gearshift detail was similar to that for the MS11, but I found the kit dashboard unsuitable and scratch-built my own. Trying to repaint the original plastic dashboard was very difficult, resulting in less sharply defined features that were unsatisfactory. The photographs best illustrate how this was achieved using plasticard, aluminium and plastic tube of varying diameter to produce instrument cases. A spare set of instrument dial decals was very helpful to complete the realistic and crisp appearance. Sections of small brass rod were attached into the dashboard behind switches and into the back of the instruments. These allowed for the connection of wires for the full and accurate-as-possible, wiring of each item.

The steering wheel from the kit was enhanced by using Milliput to form the padded steering wheel boss in the centre, as used on Stewart's cars. Stainless steel rod (2.25mm) was used to give the appearance of a more substantial steering column, than that supplied in the kit.

The seat for the MS10 was clearly a fitted affair, tailored to suit the driver. Using information derived from LAT photographs, a new seat was made from Milliput which slotted neatly over that provided in the kit. The colour was essentially that of untreated fibreglass (I used Vauxhall Parchment). The seat took quite a few weeks to perfect, later

having slots cut to allow for the passing through of seat belts, the lugs of which would have been secured to the chassis beneath the seat. Seatbelt material and hardware was supplied by Marshall Auto. I made some GQ logos to place on the shoulder straps, these having their origin in the aviation industry, helicopters specifically.

The oil de-aeration tube was made as in the MS11 and ran along the left side of the car, inside the cockpit.

Since his 1966 crash at the Spa Francorchamps circuit, Jackie Stewart drove with a pair of spanners attached to the left side of the cockpit next to the dashboard. These were replicated in plastic and painted red for this model. These would have enabled removal of the steering wheel in the event of a crash where the chassis was distorted, trapping the driver. Use of seatbelts and the spanners were unique and personal expressions of Stewart's pioneering leadership by example, in the field of safety in Formula One at that time.

#### Forward Oil Tank and Radiator

Bearing in mind that this was a dual oil/water radiator, plumbed to the oil tank immediately behind it and the engine further back, appropriate connections were researched and applied before a Satin Black colour was applied to the whole radiator. It

was clear from the LAT photos that a few additional strips of metal adorned the front edge of the simple radiator as supplied in the Tamiya kit. This was achieved with thin plasticard before painting. Once the radiator and oil tank were secured onto the chassis-front, several other additional pieces of metal panelling were apparent from the photos bridging the space between them, being easily replicated in thin plasticard. These also incorporated downward directed cooling ducts, perhaps onto the mastercylinders and into the footwell area of the cockpit. In addition, a semicircular upright sheet of metal was placed around the oil tank just behind the radiator, as if directing excess heat away from the oil tank and chassis-front in general. Plasticard was used to replicate this item which was also sprayed Ford Electric/Monza Blue. Tamiya masking tape sprayed matt white was used over the two sides of the radiator-front as at Zandvoort that weekend. This was presumably because of the cool weather conditions, thus optimising engine fluid temperatures.

A steering rack and pinion was made from aluminium tube of varying diameter, such that one would move freely within the other. This was attached to the front bulkhead as in the MS11 allowing original track rods to accommodate front wheel steering, though independent of the steering column in this model. Front brake lines emerged from the area of the mastercylinders behind the main oil tank.

### MS10 Engine and Gearbox

Here, it could be simply stated that the readily available Hewland gearbox was mated to the Ford Cosworth DFV V8 engine, the latter which was now only just becoming available to other Constructors. Lotus having had the Ford Cosworth DFV V8 engine designed and supplied for their 1967 Lotus 49 car, showed what a formidable engine this was, though a little unreliable at first. Immediately, Ken Tyrrell recognised the potential of this engine and had acquired a number of them for the 1968 season. In modelling terms, it could also be said these items were simply fitted together on the rear of the monocoque and little more need be said. However, as alluded to earlier, the MS10 used a system of bracing tubes from the rear of the tub to a reasonably hefty diaphragm around the gearbox bell-housing. This was to allow the engine to be removed and replaced at the track, with the rear suspension still attached to the tub itself. This idea came from Matra's designer and was very soon dispensed with as the British Constructors grew used to removing the entire engine/gearbox and rear suspension as one unit. The latter technique as employed on the next chassis (MS80), ensured greater rigidity to the car as a whole, in using the engine as a *fully stressed* component on which to attach the gearbox and rear suspension. For this model, this diaphragm was scratch-built from plasticard and incorporated some metal rod/tube to act as suspension pick-up points. The engine having been attached firmly to the rear of the chassis, bracing tubes of 1.75mm aluminium tube were fixed into both the monocoque and the encircling diaphragm. This enabled the gearbox to be fitted on the back of the engine in the usual way.

The engine came from an early seventies car via the spares box and the gearbox (DG300) was that which was supplied with the original MS11. These items were stripped down, tidied up, rewired and super-detailed as much as possible. This included the building of some electric fuel pumps of the Bendix type which were fitted on the back of the monocoque, one each side taking fuel from the tanks and supplying this to the collector pot (behind the seat back) and thence via the main electric and mechanical fuel pumps to the fuel metering unit in the 'vee'. These pumps needed a representative electrical wiring, made possible by the use of some very fine wire.

In the MS10, the alternator was incorporated in the Lucas *fuel injection system* within the 'vee' for the later races in 1968. An alternator was an essential item in all racing engines, the electric drain on the battery from the electronic fuel injection system being quite considerable.

The various tachometer cables, electric wires, oil blow-off pipe and the fuel pressure line etc, were taken from the dashboard, each item being secured to the tank top and tidily routed towards final destinations in the engine bay. The hydraulic line for the clutch exited the rear monocoque on the left side. This was then routed and attached to the clutch assembly on the right side of the gearbox. The rear brake line emerged on the right side of the car, passed through the cockpit and was split into two in the region of the right upper radius rod attachment point behind the driver's right shoulder. Thence, the two

brake lines found their way to the rear brakes via the upper radius rods, to which they were secured with fine wire ties.

The exhaust pipes were adapted from those supplied in a Lotus 49/49B kit. After reworking, 4.75mm aluminium tube was used to replicate the original steel tail pipes.

These were painted in such a way as to represent the effects of heat changes.

Rotaflex couplings were made as in the MS11, both cars using a similar system, along with standard Hardy-Spicer UJ's.

#### MS10 Plumbing and Wiring

Brass rod, 1mm in diameter and softened by annealing in a flame was used to fashion various support hoops and a battery cradle enabling tidy arrangement of the battery, electrics tray and oil catch-tank around the gearbox. The rearward projecting gearbox 'nerf' bar and attached exhaust supports were made of brass and completed the appearance typical of the era. The catch-tank was made from plasticard and fixed on the support cradle to the right of the gearbox. This received pipes conveying excess fluids from the forward oil tank, the gearbox and probably the fuel tank breather. A new battery and battery cover was fashioned from plasticard and sprayed with grey primer before being placed in the battery cradle and secured by Bungee cord. Electric cable connections were fitted to the battery etc and then the familiar Lucas ignition box was placed in the

‘vee’, as was typical from mid ’68. In earlier races that year, the ignition electrics had been in component form, placed on a tray over the gearbox.

A small battery master-switch arrangement was fashioned above the left gearbox maincase, with a cable running forwards to a point near the driver’s head. This as far as I can see, was another safety element, ahead of regulatory requirement. By 1969, such items were mandatory, along with an overall minimum weight, a fire-extinguisher system for both engine and driver, as well as a more substantial roll-over bar and seat belts; but for now, these were voluntary, though increasingly recommended in the light of a frighteningly fatal accident rate at the time.

Brass rod was used in a similar way (as in the MS11) to plumb oil/water between the engine and forward radiator and oil tank. Scratch-built water header tank and water return pipes from the cylinder heads, were made from aluminium tube and annealed brass rod respectively. These were a particular challenge and pleasure to achieve, especially the latter. Great attention to detail was paid to the routing of electrics and other cables and pipes through the cockpit and across the fuel tank top. These then arrived in the engine bay to achieve as much realism as possible including a scratch-built throttle cable system with return-spring etc. In variance to the MS11, a fuel filter was made and affixed to the left tank top before being plumbed in via the mechanical fuel pump and the fuel metering unit in the ‘vee’. This was in marked contrast to the usual much smaller ‘pancake’ filter used in F1 cars in the early 70’s onwards, usually mounted on the forward aspect of the

left throttle plate. A copy of the MS10's fuel filler was made and placed in a convincing recess, atop the fuel tank next to the fuel filter and riveted round, as in the real car.

The familiar main electric fuel pump was visible on the lower left flank of the monocoque and kept the fuel flowing from the collector pot behind the seat-back into the engine via the mechanical fuel pump. When the race was underway, the electric pump could be switched off, relying on the mechanical pump to feed the metering unit in the 'vee' with consistent fuel-pressure. However, whilst on the grid awaiting the drop of the National Flag to start the race, the electric fuel-pump was vital to keep the fuel flowing to avoid fuel vaporisation which was the bane of F1 cars of this era, never more so than in races in hot countries where ambient temperatures were high, imposing greater risk of fuel-locks and stalling or misfires.

As in the MS11, an oil blow-off pipe was taken from the oil tank back to the oil catch-tank, without the need to take any extra oil and cylinder head air-pressure back to the oil de-aerator in this well developed engine, where oil scavenge pumps were better able to keep the oil circulating. Initial oil scavenging problems in the Cosworth DFV, necessitating additional oil drain boxes on the right cylinder head (as in the Lotus 49 in mid to late 1967) were solved by mid 1968, such was the pace and drive by Keith Duckworth and his team to optimise engine performance as any deficiency came to light.

### MS10 Suspension

The front rockers were tidied-up and sprayed as in the MS11. Again, Alclad Chrome would have been an ideal medium to replicate the original chromed items. Only slight detail differences were incorporated. The rear suspension was very similar and was fitted with brake lines and the same uprights as in MS11; tyres all round varied only slightly in width compared with the MS11, being narrower at the rear. The photographs show Stewart driving a car with the same central grooves on all four tyres. What is not entirely clear is whether this was in practice only, or in the race itself. The rear anti-roll bar was made from 1mm stainless steel rod and helped enormously in increasing the authenticity of appearance. Small fittings were made to attach this to the rear diaphragm.

### MS10 Concluding details

Ring-style Dzus fasteners were made and these along with wingmirrors and decals made for a distinctive car. Race specific decals were made, namely 'Roadholder' (possibly shock absorbers) and a declaration of Ford power in French on the nosecone ('Propulsee Par Ford'). Other decals were available on the MS11 decal sheet. Unfortunately, the Hewland decal is the wrong colour, authentically this should be black and yellow on an aluminium plate, no red being in the original.

## Final Conclusions, Matras MS11 and MS10

It would be true to say that these two cars are the epitome of late 60's F1 and yet in another way they are not, as there were many variations of the available technology. This variation, also known as freedom of expression in design, would continue long into the 70's and 80's, being increasingly constrained into a uniformity of idealism in the 90's and especially more recently.

The busy, possibly even untidy association of mechanicals in the MS11 is offset by the more focussed engineering seen in the MS10, in large part brought about by the Ford Cosworth DFV, ahead of its time in many ways (designed to be a fully stressed monocoque component, with compact, purposeful tidiness).

In the MS10 we also see the forging ahead of practical safety issues, championed by Sir Jackie Stewart and supported by his far sighted and sympathetic employer. The MS10 provided Matra with their first ever F1 victory, later causing them possible embarrassment (at least in the engine department) as an often disadvantaged Stewart racked up the points to be in with a shout of the 1968 world Drivers' Championship, his bad luck enabling Graham Hill to clinch the crown in Mexico. Emotionally, the MS11 scored over the MS10 especially in its spine-tingling appearance in Monte Carlo, but even then it was an MS10 which led the way at the start of the race, driven by Johnny Servoz-Gavin, taking the place of an injured Stewart.

For me, both cars are a beautiful demonstration of visible engineering, crying-out to be studied, understood and reproduced in celebration of 60's style of romantic Grand Prix racing. As for the 70's, I wish I could be transported back to the paddocks and pit-lanes of the late 60's with my trusty digital camera/camcorder, not to mention an autograph book!

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