

Featured Engine No. 46

by Kim Siddorn

Merlin development in Wartime Production

Several people were very kind about my presentation about Roll-Royce piston aero engines at the April club night, so I thought I'd split the text into several parts so that all our members can see it. This is the last section – Ed.

Ironically, in view of its later reputation of extreme reliability, the early development of the engine was plagued with problems, with gear train failures and persistent failures of the water jackets (the cooling mixture eventually became 30% glycol as antifreeze in water at +18psi pressure). Eventually in July 1934 the Merlin passed its type test and was rated at 790bhp at 2,500rpm at 12,000 feet. The Merlin B incorporated a ramp head, which improved fuel mixing and flame propagation & in February 1935 delivered 950hp at 11,000 feet equivalent.

Based on their experiences, Rolls-Royce decided to make the crankcase and cylinder blocks as three separate castings, with bolt-on ramp heads to the cylinders. This engine was the Merlin C. By this time, the promise of a low-profile aero engine of 1,000bhp had persuaded both RJ Mitchell and Sydney Camm to base their designs around this new untried engine. This engine still had problems, but after some modifications as Merlins E and F, a Merlin E passed a civil 50 hour Type Test at 955bhp (maximum 1,045bhp).

As an emergency measure, it was decided to scale up the Kestrel cylinder head to the larger engine to build the Merlin G. This engine easily passed its Type Test a month before the F which was now in production as the Merlin I. The Merlin with the Kestrel style head was then designated Merlin II. This engine weighed 1,335lb and was rated at a maximum power of 1,030bhp at 3,000rpm at 16,250 feet, and ran on 87 octane fuel.

A variant of the Merlin III with a higher supercharger gearing (providing up to 12.5lb boost) & a Coffman cartridge starter was termed the XII and marked the difference between the Spitfire I and II.

In 1935, after problems with supercharger gearing, Rolls-Royce decided to take out a license for the Forman 2-speed drive for the Merlin supercharger, even though it added significantly to the engine's length. Designated the Merlin X, it used little energy at low speed in the denser air at lower altitudes, while being available to pressurise the induction at higher altitude. There are supercharged engines providing zero extra boost at sea level being flown today.

In 1939 a decision was made to focus on 100 octane fuel for aero engines. This fuel allowed higher boost pressure and temperature without detonation, allowing +12lb boost rather than a +6lb limit.

Rolls-Royce attracted Stanley Hooker (later Sir) from a quiet academic life into the hectic world of cutting edge aviation. He couldn't quite believe the poor figures for the supercharger then in production and quickly suggested – with some deference – that

things might be otherwise, markedly improved its efficiency. He also improved the flow characteristics of the air inlet, improving the power output at altitude. Although his modifications made the engine longer, turning the carburettor inlets to point forwards considerably reduced the increase. Hooker's modifications led to the Merlin XX, and allowed power to be maintained at much higher altitudes (1,175bhp at 20,000 feet compared to 1,160bhp at 13,500 feet for the Merlin II). The single-speed supercharger Merlin 45 incorporated many of these modifications, and this engine, fitted to the Spitfire airframe, became the Mark V Spitfire.

Some of these engines were modified for low-altitude power, since most of the air combat was taking place around 6,000 feet. In these, the supercharger impellers were shortened, and the speed of the constant-speed unit increased. This gave a maximum power height of around 6,000 feet, and increased speed by around 22 mph at this height. If coaxed to higher altitudes, however, the engine suffered badly.

At one point in production, the skew gear drive that drove the magnetos gave trouble. Typically, a pilot would pitch the aircraft into a dive and find that he had no power when he opened the throttle to pull out! Nothing had been changed, the same steel was being used in the skew gear shaft, heat treatments remained the same. It must have caused as much consternation at the time as the Trent 900 failures must be causing Roll-Royce at this time. Eventually, it was discovered that the way in which the main reduction gears were driven onto their splines was at the root of the problem.

The development of high-altitude bombers required the development of an engine with a higher full-throttle height. Rather than move to turbochargers, Hooker suggested adding two superchargers in series. The four Peregrine block X24 Vulture engine already had a supercharger of the required size and this was simply attached to the rear of a Merlin 46. The engine now required an intercooler to cool the inlet charge. The new engine, the Merlin 60, had a full-throttle height of nearly 30,000 feet. A redesign changed the supercharger gearing and the introduction of separate block & heads produced the Merlin 61. This engine produced spectacular improvement when fitted to a Spitfire although extra cooling required an enlarged radiator under the left wing. Although intended for the Mark VIII, it was possible to fit it to the Mark V airframe, & this became the Spitfire Mark IX/XVI series. Now the end was in sight, modifications came more slowly

The Merlin continued in production when the war ended and probably reached its zenith with the Civil Series 612 which gave 1,650 bhp at altitude & was an engine of great complexity, having triple stage supercharging & twin intercoolers. Production ceased in 1950 when some 150,000 engines had been built. As a matter of interest, at the end of the war, a Merlin ex factory cost about £3,000

Calendar of Events

Key. Event – E. Club night - CN

Info, sort outs & crank ups, phone 01749 342671

Dec 5th E. **Crank up** at Nunney Catch 01749 342671

Dec 27th E. **Mince Pie Crankup**:- Court Hotel

Dates and venues may change. Check before driving!

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We are quite happy to run adverts for other club members if they offer services to club members – Ed.

Chairman's report (printed as received)

By Brian Baker

The club night at the Court Hotel on Monday October 25th had as guest speaker Roger Flower from Burnham on Sea give a talk and slide show on the Burnham on Sea Rescue Hovercraft Service. This was a very slick presentation by Roger, giving the members present an insight how this valuable service, run by volunteers on a very dangerous stretch of West Country coastline works, saving lives from the treacherous mud, and from boats, and from the extremely dangerous inflatables sold by gift shops in the coastal towns of the County, and often putting to sea by very young children. This service relies entirely on public donations, and as Roger declined any payment for himself the club gave him a donation for the Hovercraft Service. This was a very interesting and entertaining talk and it shows the dedication of people like Roger who give up their time to save lives of people from all walks of life putting themselves at considerable risk of losing their own lives often in terrible weather and conditions. The club would like to thank Roger and his colleagues for carrying out such important duties for the safeguard of others. I would like to remind members that as this year draws to a close the subscriptions for 2011 will be due on January 1st. The good news is the committee has decided that the subs will remain at this years prices. A double membership is still £13, a single £11 and junior members pay only £1. You can renew at the Nunney

Catch crank up and at the crank up at the Court Hotel on the 27th Dec. Over the years the Sortouts at Cranmore railway have grown in size, the Autumn Sortout on October 16th was probably the best yet. We had stall holders from Southampton, Basingstoke, Barnstable and Gloucester etc. On a very cold but dry morning the space for stalls quickly filled up, with a steady stream of buyers coming through the gate during the morning. This was a very successful event run with the minimum of effort and no capital out lay. I would like to thank the members who helped out manning the gate etc and helped to run it.

"Tis where the Wurzul Bush Grows" – GDSF

by Eric Gay

Well, it was approaching that time of year again & we were getting worried when on Wednesday August 25th the rain came and it rained for twenty four hours non stop up yer in wild Wiltshire. Now why may you ask why were us worried – well, we was off the next week to Dorset, to this gert big do they do 'av up on the 'ill near Tarrant Hinton. Us didn't want to sit thur all week in the pouring rain.

Come Monday 30th of August our worries had reduced somewhat, for the sun was shinning as the convoy left Trowbridge, Pete with Friend Toad, towing the caravan, us two in the middle with corn mill and Banford. Sue brought up the rear the with trailer carrying Amanco and pump. Next stop The Great Dorset Steam Fair - would it be mud or dust ?

We had good weather right up to Sunday and then we only add a bit of rain, that wern't enough to fill a thimble. It migfht not be everyon's cup of tea, but I for one think it is a right good week – long may it continue! I for one wish Martin and all the team every success in the future

This year show had its sad side as most of you must know Michael Oliver MBE founder of the Great Dorset Steam Fair (Great working of Steam Engines at Stourpain Bushes) left the green arce's of Dorset for Higher Pastures on the 29th November 2009. He was a very hard act to follow and I am sure that he will be long remembered by all of us that exhibit and attend this wonderful show.

Pete, Maureen, Toad, & myself shut down our engines to attended the memorial service on Friday with a great many more exhibitors, friends and visitors. "Quo Vadis" led a last salute to that great man of steam and preservation with a long blast from her steam whistle. (*Very appropriate as "Quo Vadis" renders from the Latin as "Wither goest thou?" – Ed*)

On to other engines on show in the stationary engine line. I am not going to list them all, just a few that stood out in my opinion, I was with Pete all week and a certain 2 hp 1914 Amanco that was driving an Amanco pump ran like a dream all week, This was next to a 1920 Banford and Banford Mill and that ran all week grinding wheat without missing a beat, I am too modest to say who owned that but 'tis me pride and joy.

Another Amanco, (not in the programme) displayed by the Carter family from Poole, Dorset, this engine was fitted in a box, the box being part of a horizontal root cutter, I ain't seen the like of that afore, and the restoration was first class - a real cracking restoration. A 1942 John Deere 11hp driving a corn kibler was another engine that ran all week without a stutter,

Two new lorry mounted exhibits this year, one being a 20hp Crossley which runs "backwards", most open crank engines run clockwise and the other a 18hp Ruston Hornsby/ With a 120 engines on show, the engine enthusiast had plenty to see and admire. If you have never exhibited at Dorset why not give it a try you never know you might just like it.

We get to the show on the Monday as this give us plenty of time to set up engines, pump and mill without have to rush, us do even find time for a cup of tea and a chat with a few old friends we have made over the years. Tuesday is spent looking round the auto jumble, and a few of the

trade stalls. There was a 1hp Wolseley for sale, freshly painted and on a bit of a trolley, but at the asking price of £310 I reckon he'll have it there next year! Another that gave me a laugh was a small dynamo – the sort of thing you'd drive from a "small power" engine. He only wanted £850 for it!

Now it was getting on towards lunch time and Art's Cider Shack was our next port of call, good cider and food at a sensible price. The afternoon was spent having a look at the line up of the special Mc Laren Engines, This was the world's greatest ever gathering of Mc Laren Engines with six coming all the way from New Zealand.

One McLaren that I think most of you will have seen is always working hard in the play pen all week is "Boadicea", a 10nhp road locomotive, built in 1919 and is one of 55 the company made for the War office to haul 49mm guns. "Boadicea" was lucky as she never got sent abroad & for some years she worked on heavy haulage. Then sold to Showman Edwin Corigan and returned to the works for conversion to a showman's engine, in full showman's specification her name was changed to "Gigantic", it was soon found that she was far too heavy for showground work and was again sold for haulage work, Shall & Gaskell of Hull used her for hauling large boilers, later her job was dredging in the fens till being laid aside in 1958.

The engine was then sold for £80 00 (I wish I could have been near at hand then I would have gone to ninety quid for her). Now owned by Les Searle of Horsham a new boiler was fitted in 2000/2001.

Possibly the McLaren everybody that knows anything about traction engines wanted to see was the McLaren 10hp tandem cylinder Road Locomotive No.897, built in 1905. I know her tandem engine is on the rally circuit, so if any of you know of one, please let me know. Now a tandem compound has its cylinders one behind the other and not side by side, "Colossus" was delivered as a straw burner to Argentina and no doubt was used for threshing on the pampas.

She ended up with Preston Steam Services, as a bare boiler with only one cylinder and trunk guide in place. Fascinated by having the only surviving McLaren tandem, the new owners have rebuilt this great engine in just 28 months. This included replacing the boiler, making patterns for new castings, a new firebox, building all the steam system and motion work, machining castings and fitting everything, along with countless other works. She is now owned by John Atkinson, Launceston in Cornwall. You can read the story in Old Glory.

Tuesday wore on and it came time for my once a year treat a run into Blanford for fish and chips. The chippy in the middle of town is well worth a visit when you are in that neck of the woods.

Wednesday and no prizes for guessing what we did all day. Pete the pump played with Amanco and Amanco Pump. Me, I played with Banford and Banford mill, with a good few public to talk to, some wanting to know the mysteries of hit and miss governing & some wanting to know what the mill was doing. Sad when grown ups don't know that flour is ground from grain - I can understand young 'uns not knowing, but people of around 30?

Wednesday evening a trip to the play pen to have a look at the engines still hard at it hauling loads & having fun. We may not have much left in this old country, but we still have the greatest show on earth & I just hope that I can keep attending. We walked on through the fair ground until it was time for a pasty stop with a pint of cider. The cider became a half when I saw the price being asked for Stowford press – "£3. 40? Not on your life!" But they pasties were alright,,, Yes, a big pasty from The Cornish Pasty Co. is over four quid, but I can vouch for they being damn' good. Trouble is, her indoors said I eat too much - ruddy cheek.

Now The Great Dorset Steam fair would not be the same without the line up of showman's engines - this is a sight to see at night if you have never seen sixty odd showman's engines in a line all working with lights shinning out in the darkness, make sure you see this great sight.

It was twenty years ago that I spent an evening on the Showman's engine "General Buller", built in Devizes by Brown & May to the order of J. Cooke of Warrington and travelled with a set of Gallopers. It was the last one built by Brown & May, and is the last survivor of its kind.

Brought by the present owner in 1936 and still with the same family. I was again invited onto this fine engine and the memories of that evening twenty years ago came flooding back & this made my Great Dorset this year.

Now it was time for Maureen to do her good deed and of we went looking for Garrett 4nph showman's tractor Reg. No. AD 8787 Why ? well, she had an old photograph of this engine taken when working for showman John Coles of Bristol, The engine "Queen of Great Britain" was working in Trowbridge Park generating for a set of chair-o-planes. The owner Mr. Turner of

Thormaby Yorkshire was over the moon when Maureen presented him with this early photo of his engine at work.

With sixty three showman's engines on the fair ground you can see why this is the greatest show on earth and it is here with us in the west country - long may it carry on!

One bit now for all you technical types the following was taken from a write up placed alongside McLaren 6nph single cylinder General purpose Engine No. 547 "The Mac". Believed new in 1896, and supplied to relatives of McLaren's in Northamptonshire. Bought in 1950 by Charles Gregory and steamed from Oxfordshire to Cornwall, then sold to an owner in Devon, purchased by its now owner in 1996.

We now get to the technical bit, repairs to the boiler were due and an analysis of the section of boiler barrel extension which had to be replaced were made. Unfortunately, there was not enough material for a tensile test, but chemical analysis indicated some interesting information. Sulphur and phosphorus (which are both undesirable in terms of ductility) were approximately 2 or 3 times that you might expect. No aluminium was found, now this is key addition in modern steels and is added to ensure the steel is fully oxidised. This is one possible explanation why modern aluminium killed steel plates welded into original barrels waste away much quicker than the original plate. I will now get to the point I was taught this over fifty years ago when I was just a youngun starting out in my trade. It was well known that two dissimilar metals would set up a reaction between each other, I would have thought that with modern technology this problem would have been solved.

Well, that's the technical bit done with, it was Thursday evening and we walked to the play pen again, this time for a ride around in a trailer pulled by a traction engine. This was being done to raise funds for CLIC, just throw your donation in the milk churn we were ushered on board by none other than Mr. Robert Coles a good friend to the WSEC in the early days of The Semington Rally, - seems like a life time ago. Then it was Pasty time!

Time just flies by and Saturday was upon us, our real last full day with the engine and mill, more wheat more flour (anyone want some good wholemeal flour you only have to ask its FREE) I am sure that not so many people visited the show this year or perhaps they just did not come around the engine lines. It was a lot of money to get in at £16 a head, or was it? just think what a first class ticket to a concert will cost (I am the greatest fan of Joan Baez, and I have been to two of her concerts in this country £100 for two tickets for around two and a half hours (worth every penny) so you see the Great Dorset is not over priced for what you get. Now If you visit The Great Dorset Steam fair, it is a must to see that line up of showman's engines on Saturday night, you will not see the like anywhere else it is truly MAGNIFICENT with 127 listed in the program and most of them in the fair ground on Saturday night.

I WOULD NOT MISS IT! Every year I look forward to this great sight. I now look forward to being on the Tarrant Hinton downs in 2011.