The 762 Club

***Building No 762 Baldwin locomotive* Lyn**
for the Lynton & Barnstaple Railway

Newsletter No 6 - Winter 2013

Introduction

Welcome to the Winter 2013 762 Club newsletter giving an update of the design and build status of new-build 'Lyn' for the Lynton & Barnstaple Railway.

Many L&B members will see the current exciting progress of L&B trackbed purchases and development of the historic L&B coach re-builds taking place. The addition of No 762 'Lyn' to the L&B is a key part in the re-creation of the iconic Lynton and Barnstaple Railway.

Thank-you to all our valued members for your continued support through your membership, sponsorship and/or ongoing donations. Additional funding is always required so if you are able to take out another membership, sponsor additional components or encourage future members to join it would be especially welcome. **Additional funds will shortly be required to continue the manufacturing and build progress!**

Longstanding 762 Club members will know the 762 Club is VAT registered and therefore claims back the VAT on the locomotive build. The end of 2012 saw the appropriate VAT reclaim submitted alongside a claim to HMRC for Gift Aid on applicable donations made during the calendar year 2012.

Current membership stands at 190 members.

The 2012 year end financial accounts are now being prepared by James Hellyer at Accountancy Edge and these will be distributed to members in the next newsletter later this year.

The 762 Club at Lynton & Barnstaple World

L&B Members will have seen the photo in Issue 99 of the L&B Magazine of Jon Pain manning the 762 Club stand at the L&B Autumn Gala with Martin Swainson. The 762 Club was also present at the Warley Model Railway Club's annual exhibition at the NEC in October 2012 held over a weekend and this year a sizeable section was set aside as 'Lynton & Barnstaple World' which had a dedicated theme of the L&B with 'Lyd' as the centrepiece and a large number of L&B model layouts, static models, sales stands and the L&BR Trust display stand.

As part of this the 762 Club was invited to display the project which we did with banners, large display boards, photographs, drawings and components. The 762 stand was located next to the Heritage Coach Project display and adjacent to Exmoor Enterprise which deals with the reconstruction of the Railway.

The amount of interest generated was excellent with a constant flow of interested visitors – and members – on both days. The way in which the 762 project is directly relevant to the rebuilt coaches and the longer line wasn't lost on anyone.

The L&BR stands were placed directly behind 'Lyd' which was in a beautiful condition and sparkled under the lights. It was good to be able to point to Lyd in its SR livery which is almost identical to Lyn's appearance in a short time! Having Lyd there also made our stands unmissable.

There were two items on display which had not been seen before and which generated much interest. Cast superheater return bends which had been made by Investacast in Ilfracombe. These were a very tactile thing to hold and appreciate the technical excellence in their production. We were able to produce drawings of the superheater and point out what and where they fit into the assembly. As they had only been produced a few days before the show, we were most fortunate in the timing. Directly afterwards they were off to Bennett Boilers for approval and incorporation into the real thing. The second casting was slightly larger and this was for a GWR King superheater.

The way in which the 762 project has been structured and the design & production arranged was praised by several representatives of other steam locomotive teams. Especially from the Tornado project. It was said – and we must agree – that the building of Lyn is the most technically advanced new-build steam locomotive project to date in the UK and probably the world. The design appraisals, computer design and 3D modelling all being highly regarded.

Above: Lyd at the Warley Show. Perhaps the next time it will be Lyn?

Above: 762 Club Director Peter Miles discusses the project with L&B and 762 Club member Dave Stockwell and another perspective member!

Change of Directors

Jeremy Martin has been with the 762 Club team since its very beginning. He has held the position of Technical Co-ordinator between the Club, its technical advisors and principal contractors Alan Keef and Bennett Boilers. Jeremy's personal work commitments often take him overseas for extended periods of time to the far reaches of the globe and as his business expands it was becoming harder to devote the time required to support the project. Reluctantly Jeremy decided to step down from being a Director. The Club wishes him well and thanks him for his sterling contribution towards getting the locomotive build underway. Jeremy continues as a lifetime member of the 762 Club and follows the locomotive construction with keen interest.

As a result current 762 Club lifetime member Peter Best joined the Board of the 762 Club at the end of 2012 and has agreed to fill the technical co-ordination role left by Jeremy. Peter is ideally situated to carry out this task being based near Stroud in Gloucestershire as both boiler and locomotive build contractors are in the West of England. Peter will be regularly updating the membership on progress relating to the building of Lyn and enclosed is a biography of his railway involvement.

Recently semi-retired Peter first became interested in steam from a very early age and was fortunate enough to remember steam on the mainline witnessing the last few years of steam culminating on 4th August 1968 on the LCGB end-of-steam special. After a brief respite whilst beer and girls were discovered, he came back to an interest in steam via steam rollers and traction engines, one of each of which he owned. As time and finances became available Peter decided to support the North Yorkshire Moors Railway and offered to buy a locomotive for them. Unfortunately one became two within the space of six weeks and he became the proud owner of a Barry wreck in the shape of ex-Great Western Locomotive 4277. This in addition to a Baldwin S160 which had been located in Poland and was subsequently restored in their railway works, became the first two locomotives in what was to be an expanding fleet under his locomotive company, Steam Powered Services.

The S160 entered traffic on the NYMR in the Spring of 1993 whilst 4277 took four years to restore and remake. However the great day came in 1996 when for the first time in 32 years she entered traffic on the Severn Valley Railway.

In 1999 the fleet was added to by ex-British Railways Standard Class 4, number 75029, which was bought from the East Somerset Railway and subsequently renovated by Peter's staff on the North Yorkshire Moors Railway. This famous locomotive which was formerly called Green Knight and owned by the artist David Shepherd became a particular favourite of Peter's partly because it was such an excellent workhorse for the NYMR but also because it was beautifully restored and painted and looked immaculate when it entered traffic on the NYMR in 1999. The final locomotive that Peter has been involved with has been ex-LMS Black 5 45212 which although owned by the Keighley and Worth Valley Railway was leased to Peter's company in order that he could restore and run the locomotive on the NYMR for a ten year period. Again this locomotive was restored by Peter's staff at Grosmont and entered traffic in 2002 at the start of a highly successful period of operation which culminated in October of last year with the locomotive having clocked up over 67,000 miles.

Peter wanted to get involved with another locomotive and it was our good luck that he was inspired by the potential that the Lynton and Barnstaple Railway offers and particularly wanted to involve himself in the locomotive side of providing motive power now and in the years to come. We hope that Peter can use his knowledge and experience in locomotive restoration and operation to help us complete Lyn within the not too distant future.

Peter Miles (the Chairman of the L&B Railway Trust and CIC) has also joined the 762 Club board as at the end of 2012 and Martin Swainson and Jon Pain remain as board Directors.

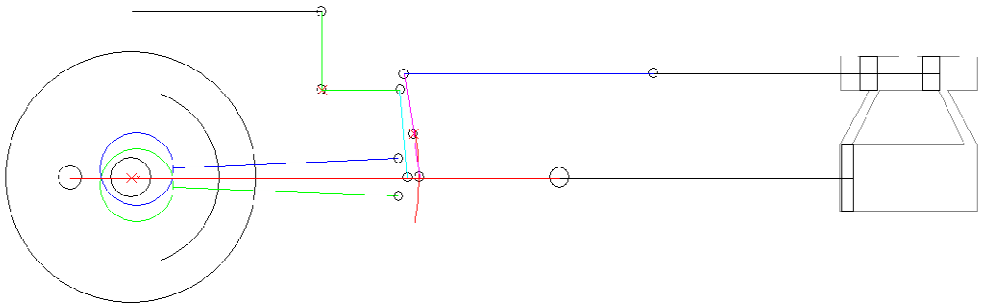
Design Update

Since the last newsletter update the cylinder design has been completed. The major thrust of the design work has been to complete the design and 3D modelling of the motion and valve gear which is now complete apart from the finishing touches to the reverser stand.

Rolling bearings have been incorporated into all of the motion and valve gear without detracting from the external appearance by using higher tensile materials to construct the rods. This has enabled the external envelope and appearance to be maintained while accommodating the increased size of the rolling bearings compared to the original plain design. The benefit of this change is that it will reduce operating friction and more importantly maintenance when the locomotive is in service.

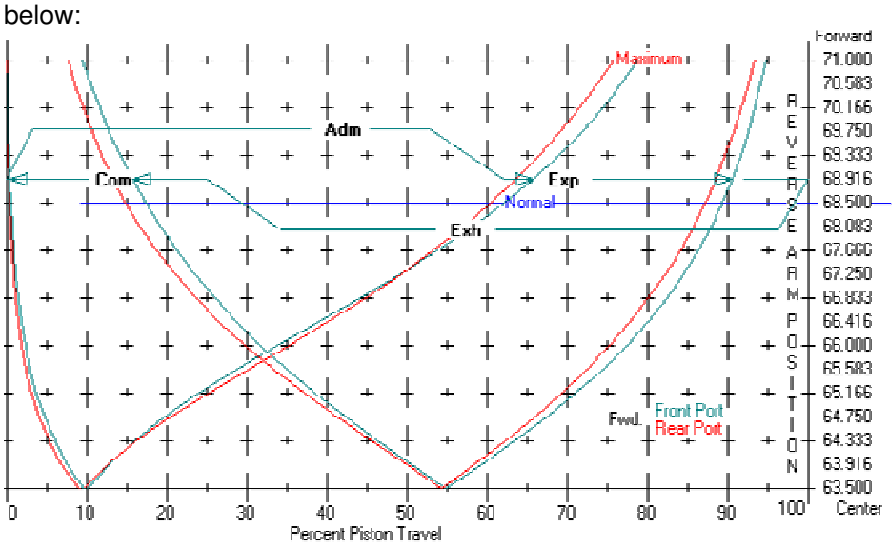
During the course of designing the motion the slidebar design on the original locomotive was found to be too flexible and vertical deflections when under load were excessive which would have led to rapid wear of the piston rod and neck ring. This has been overcome by improving the mounting design which has added considerably to the stiffness without changing the section sizes. After some discussion it has been decided to white metal line the slidebar slippers as it is felt that the improved bearing properties and ease of repair in service will aid our objective to lower the maintenance burden.

The valve gear has been computer modelled to optimise the geometry as shown below:



Valve gear geometry

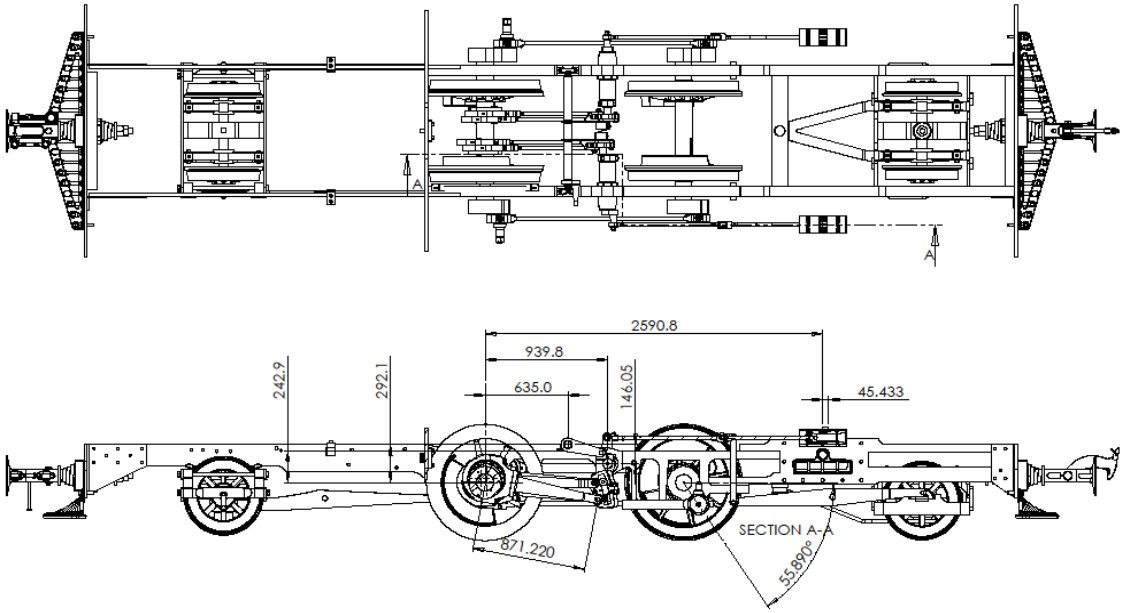
Having optimised the geometry and we are pleased to have achieved a maximum total variation in cut off between each end of the cylinder of 1.6% over the 10-50% cut-off working range of the valve gear and 2.6% in 70% full gear as shown by the valve event diagram below:



Above: Diagram showing port open/closed positions for piston travel and reverser position

Using the information from the valve gear computer simulation the actual movement of the 3D model has been checked and found to be within a few microns so we are now confident that the real components will perform as anticipated. Said quickly this sounds a straight forward task but in reality designer Mike Nelson has had to work very hard to achieve this as it has proved to be a difficult modelling task pushing the functionality of the SolidWorks 3D model and the computer running it significantly.

One of the drawings used to check the modelling is shown below:

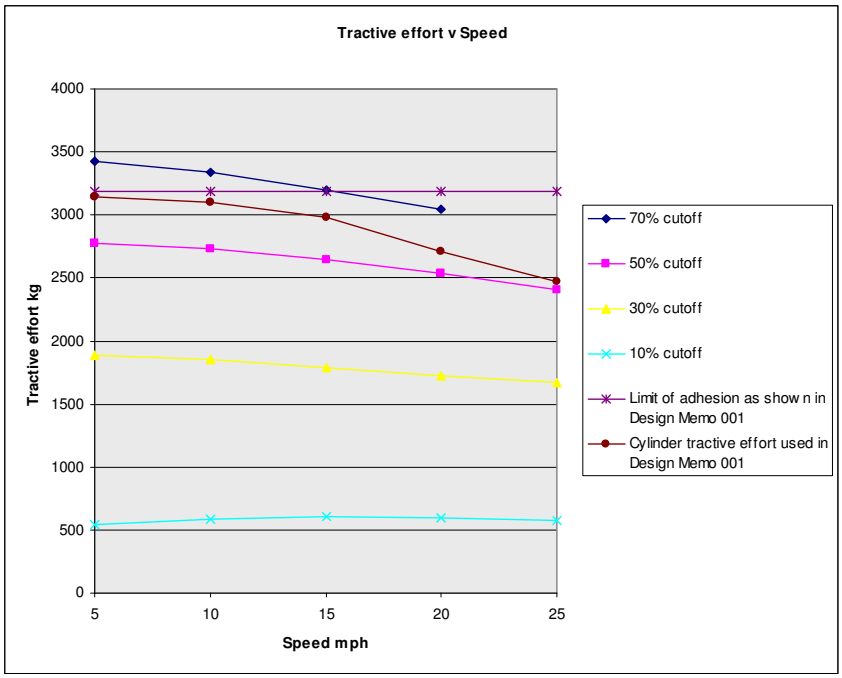


engine shown with 70% fwd cutoff.
crankpin at 55.89°

Checking the valve gear geometry

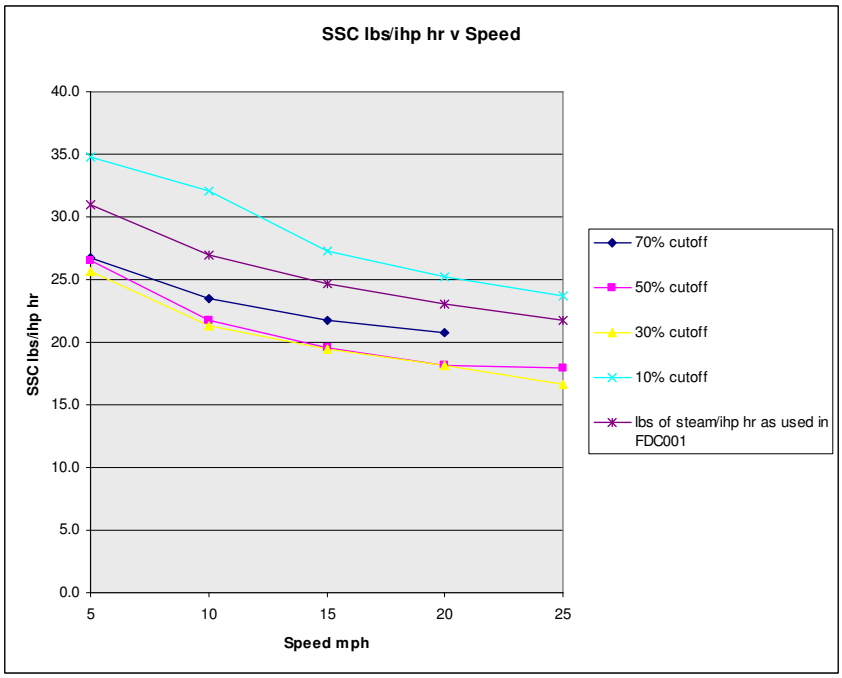
Using the newly established valve gear geometry and the final cylinder and boiler designs the predicted locomotive performance was checked against the original estimates used to establish the feasibility of the design to handle the haulage of the proposed increased loads over the whole Lynton to Barnstaple railway line. This established that the original estimates were validated and exceeded by a comfortable margin and that we can look forward to Lyn meeting our expectations when she is put to work.

Firstly for a range of cut-offs and speeds the tractive effort was calculated and as can be seen in the diagram below at around 60+% cut-off the locomotive can achieve a tractive effort which matches or exceeds the cylinder tractive effort used in our original performance estimates over the whole working speed range with the margin improving at the higher speeds.



Above: Tractive effort v Speed analysis

Secondly the specific steam consumption per indicated horse power hour was also computed and showed excellent results with all but the shortest cut-offs showing lower consumption than the original estimate. The 10% cut-off consumption is above the original estimate because at the low level of steam consumption required at this cut-off the superheat temperature is low, however at 30-50% cut-off which is a more reasonable in service value the consumption is significantly lower than the estimate and therefore we can predict that in service economy of fuel and water will be better than originally anticipated.



Above: Specific steam consumption lbs per indicated horsepower hour v Speed

Currently Mike Nelson has detailed all of the motion components for manufacture and the valve gear is partially complete and a design review is planned shortly before the component parts are released for quotation and manufacture.

For those who would like to view the design progress on a regular basis and see 3D images of the SolidWorks models of the motion and valve gear being created as part of the design for manufacture process by Mike Nelson these can be viewed on the web page which he maintains at http://www.machineconcepts.co.uk/baldwin242/baldwin.htm

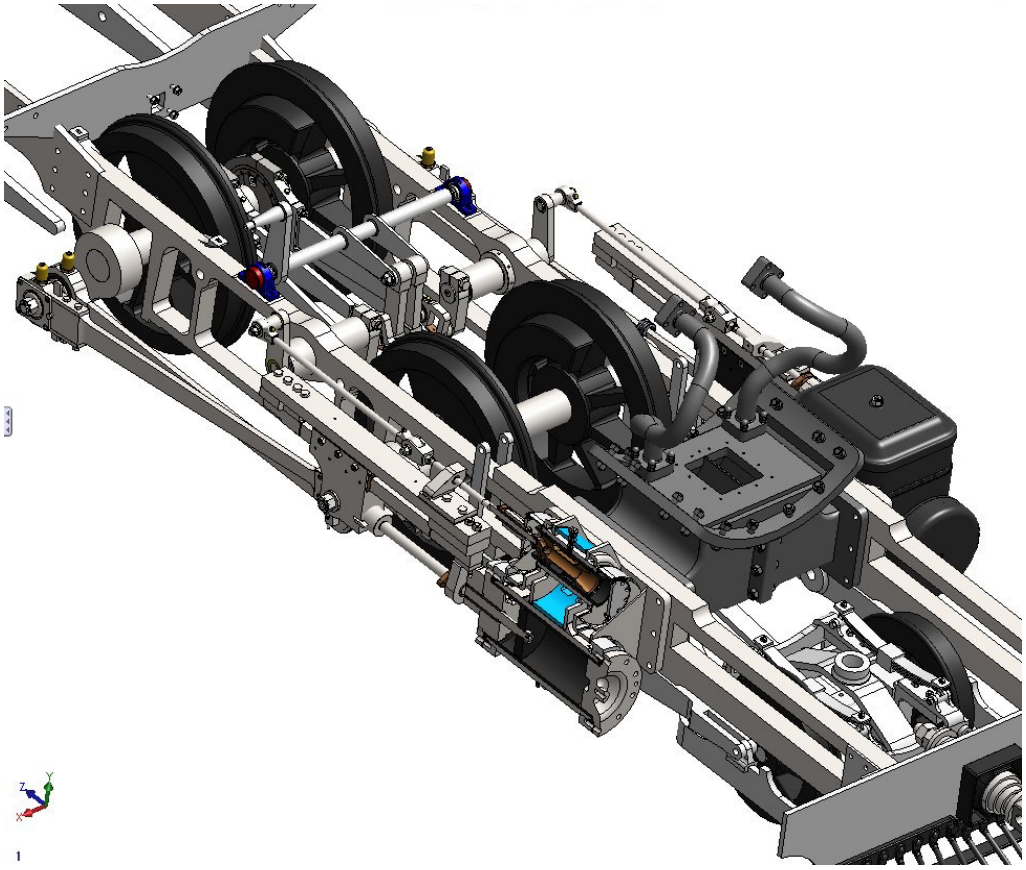
Mike uses a Computer Aided Design (CAD) process for the detail design. His intention is to produce a perfect 3 dimensional model of every component and then assemble the resulting components by constraining them in exactly the same way as will be done with the real components. In this way it is possible to test the fit of every component so that we can be very sure that the hardware will assemble without the usual problems that the old fashioned pencil and paper draughting process always seemed to create. Producing the models follows a very similar process to the actual machining of the part and, because Mike has spent a large part of his life using machine tools, he should have a good chance of finding any elements of the machining that could prove difficult in practice. The actual drawings that are used to make most of the parts are produced directly from the 3D models and all the views on the drawings are driven directly by the models. The dimensions on the drawings are driven only by the geometry and so are always correct providing that the models are accurate. Any changes that are made to the 3D model as the design proceeds are carried into the drawings automatically so the drawings always show the latest state of the design.

Apart from the error reduction, another benefit of the CAD modelling process is that accurate 2D profiles can be provided for any laser, plasma or water jet machining of flat profiles. For some of the parts with more complex geometry, where we will be producing the parts using Computer Aided Machining (CAM), which uses Numerically Controlled (NC) machine tools, 3D data files using either STEP or IGES (two methods of transferring the 3D geometry from the CAD software to the CAM software) will be made available thus ensuring that the machined part will be identical to the computer model. This is the way we can recreate the parts that were castings on the original engine without the significant cost of the casting process.

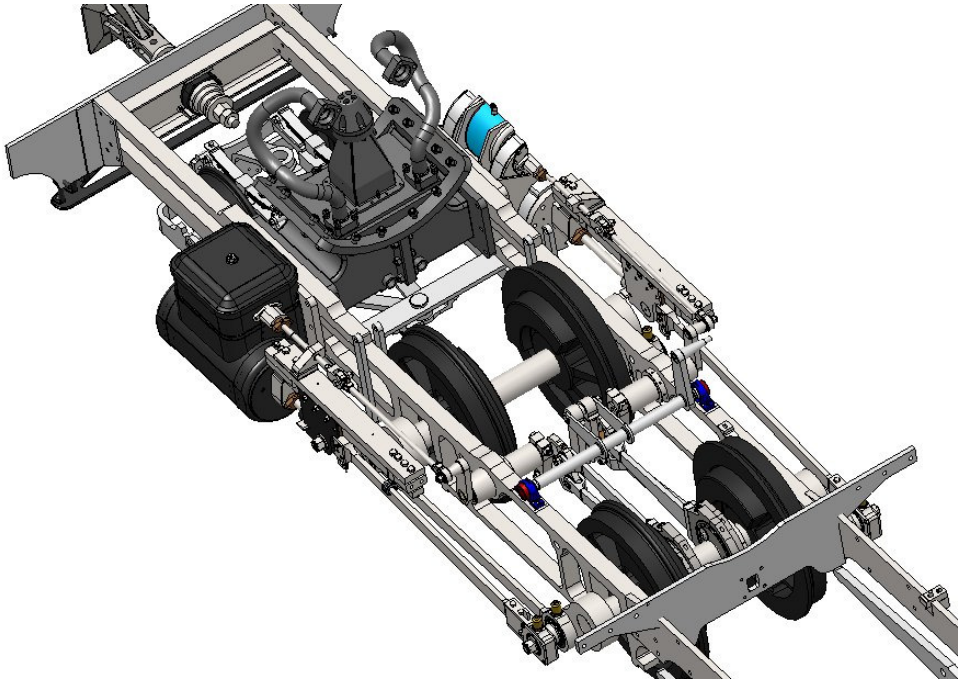
Mike has also assigned a material to all of the parts so that the computer gives a predicted weight, volume and centre of gravity (CG) for every part, sub assembly and for the final assembly enabling Ian Gaylor to calculate the balance and inertia of the moving parts and the actual weight and CG of the complete engine so the springing can be optimised with great accuracy.

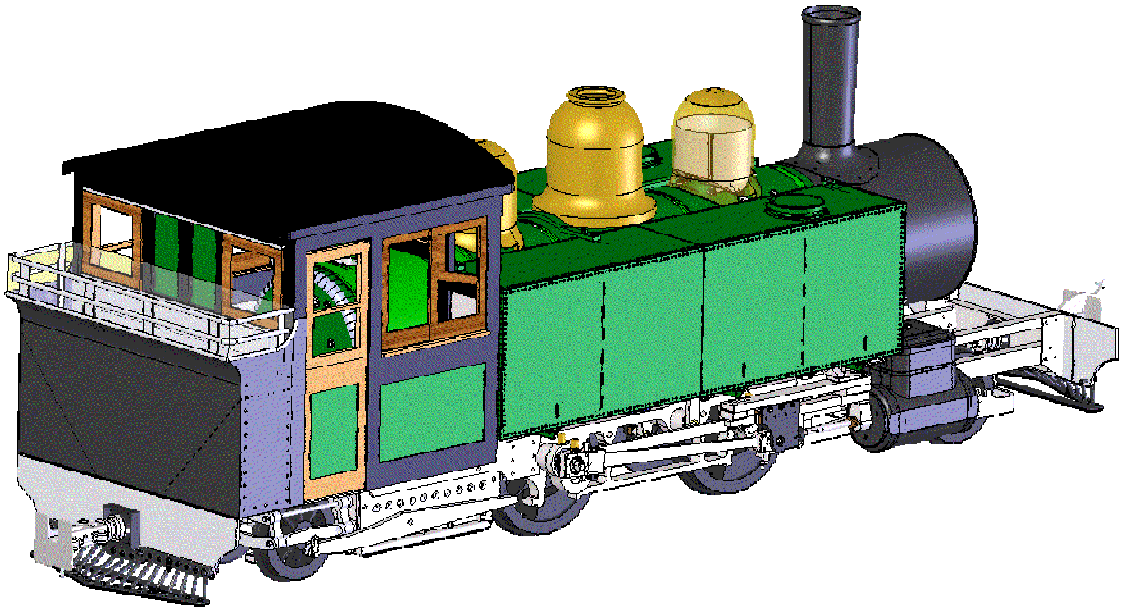
Mike has also animated some of the moving parts of the loco so that we can check that every thing moves as predicted. Animating a model of this complexity in SolidWorks is quite demanding as there are hundreds of parts that the software has to work out the position of for every fraction of the rotation. Mike has put a couple of examples of the motion and the valve gear in motion on his web log.

The accurate 3D model of the boiler has proved invaluable in helping Andy Bennett at Bennett boilers during the boiler manufacture. Mike has often been called on to provide dimensions to help him and it is quite easy to open up the boiler model, ask the software for the actual distance that Andy needs, and tell him while he is still on the phone.



Above & Below : 3D model of the motion assembly with cross section of a cylinder block shown and saddle assembly between the two cylinder blocks.





Above: The completed modelled full locomotive assembly.

Sand boxes
The sandbox parts are all modelled, detailed and awaiting checking.

Firearch
The firearch parts are all modelled, detailed and awaiting checking.

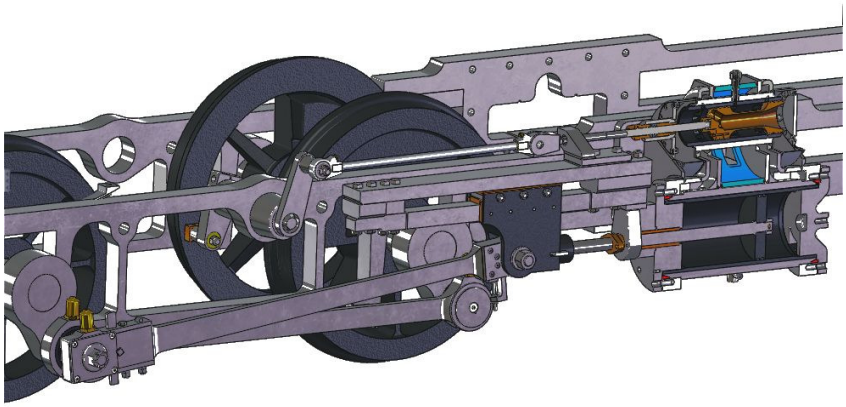
Firebox Door
The firebox door is Modelled and detailed.

Ashpan
As with the firebox door the ashpan is modelled and detailed but needs a design review and some tweaking before the drawings are released for checking.

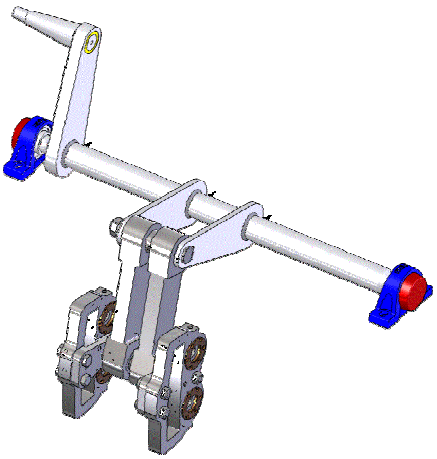
Cladding
The cladding is modelled and detailed but, before it is released for checking, we will need to make sure it will fit on the boiler as made. There are bound to be a number of small dimensional changes to the boiler caused by the inevitable shrinkage during the welding process.

Cowcatcher
The Cowcatcher is modelled and detailed for manufacture and only requires final checking before it can be released for manufacture

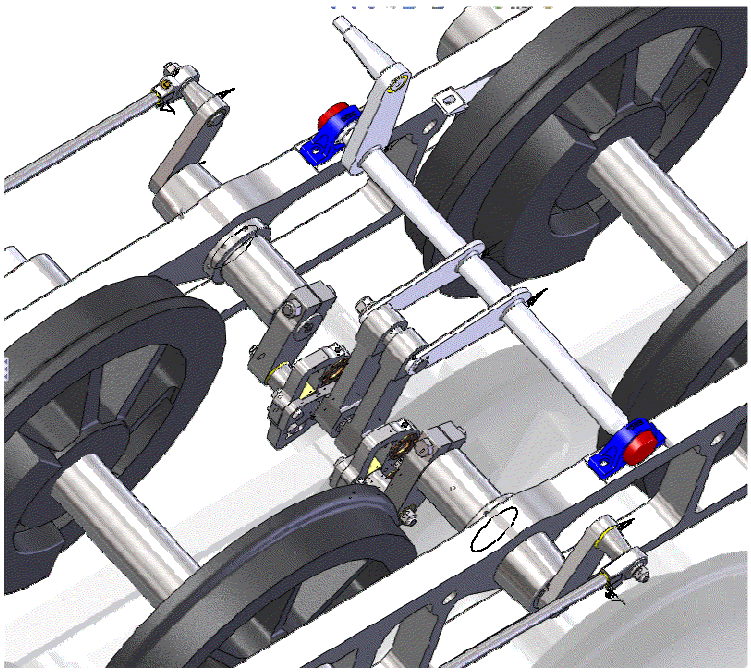
Water tanks
The water tanks are modelled and detailed. There are a few changes that are needed before the detailing can be completed and the drawings issued for checking. This was one of the early assemblies to be modelled and does require modification to accommodate some of the assemblies designed later. It will need a tweak to the mountings to solve a clash with the valve rod and we have to add a recess to accommodate the "reach" rod that runs between the tank and the boiler.



Above: The valve conrod and rocking shaft assembly.



Above: The valve mechanism expansion link and weighshaft assembly



Above: The valve mechanism expansion link and weighshaft assembly on the chassis.

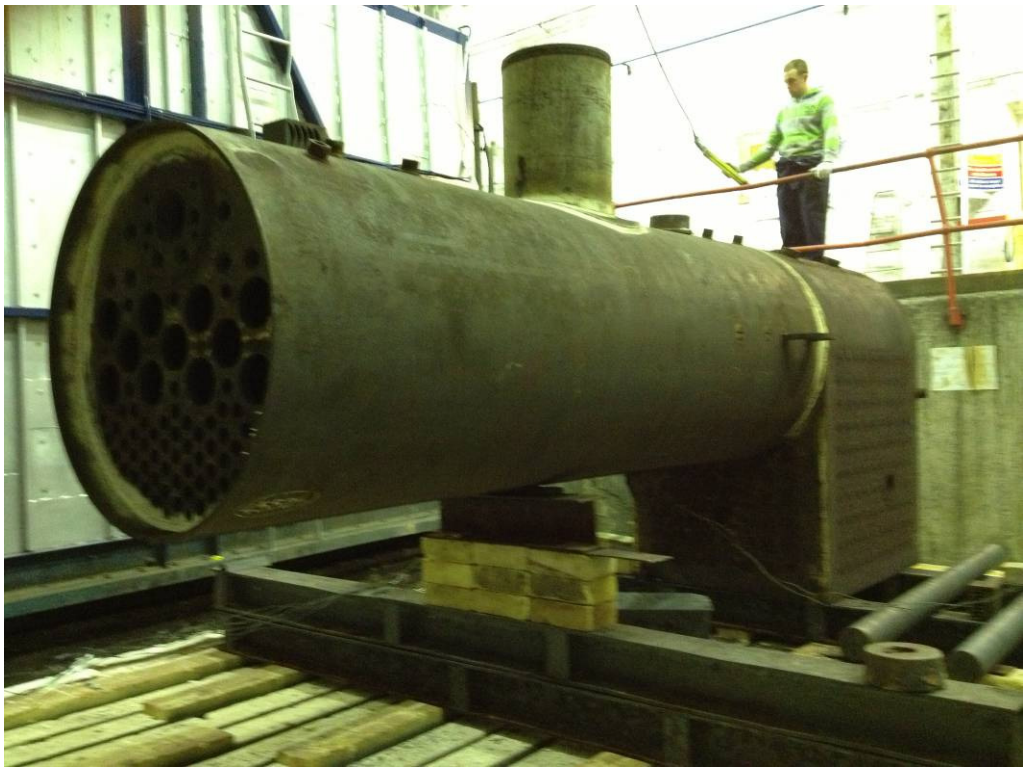
Build and Manufacture

Locomotive Boiler

The locomotive boiler is substantially complete and in January 2013 was shipped from Bennett Boilers to JJ Castings in Mid Glamorgan, South Wales for stress relieving in their oven. This was required as the boiler acquires stresses from the welding, bending and machining applied to it. If these stresses are not released then the boiler components can crack or move during its working life.

Currently the flue tubes are being swaged at a specialist contractor and these will be fitted along with the fire tubes in the immediate future. The superheater return bends have been manufactured by Investacast in Ilfracombe and the next major area of work will be the manufacture of the superheater header and elements.

The boiler itself is now back at Bennett Boilers and the next stage is to have the completed regulator fitted prior to the boiler tubes being inserted. The boiler is now expected to be finished by April 2013 and will be painted in a matt graphite colour whilst the remainder of the locomotive is manufactured. The main part of the smokebox is already made as part of the boiler manufacture. All of the drawings have been completed but the cut-outs and bolt holes for the fitting of the chimney and the mounting to the saddle can't be done until later in the assembly process when the assemblies are brought together.



Lyn's Boiler being located into JJ Castings oven – Photo courtesy of JJ Castings Ltd

Main Locomotive Build

Longstanding members will know the principal locomotive construction is taking place at Alan Keef Ltd, Ross-on-Wye.

Above: Managing Director Patrick Keef of Alan Keef Ltd stood alongside a metre gauge Krauss loco No.5742 of 1908 which is having a ground-up restoration, including a new boiler. It is owned by a Dutch collector but due to run on the Selfkantbahn near Aachen in Western Germany

Saddle Assembly

The drawings, CAD files and models for the saddle are complete and have been previously issued for manufacture. Most of the components for the saddle assembly have been made and the welding of the main assembly is progressing which has been delayed due to flood damage at a sub-contractor to Keefs. The saddle is due to be stress relieved in early February and then final machining to take place.

Cylinder Assembly

The drawings, CAD files and models for the cylinders are complete and issued for manufacture. Construction of the parts are in-progress and the completed assembly is expected to be ready by June 2013.

Above: Cut metal for the Cylinder and Piston assemblies at Alan Keef Ltd in Dec 2012.

The Chimney, Blast Stand and Smokebox door all the CAD models and the detail drawings are complete, checked and issued for manufacture.

Important Footnote/Sponsorship

Progress on building Lyn has been growing steadily. The only limit is money! With your support we will be able to complete the build and see our loco in steam in just about 2 years! There are many ways that you can assist; buy another membership or more, sponsor some parts, donate and perhaps at least as valuable, spread the word and encourage your friends and contacts to join and support this exciting project.

There are currently 47 Crown Stays and 306 Firebox side stays all at a very affordable £14 each which we have recently fitted to the boiler. If we could find sponsors for these we would raise almost £5,000. Additionally there are a number of motion components available for sponsorship that are just about to be manufactured. You help in sponsoring or finding sponsors would be really appreciated.

Every penny donated goes straight to the build of the locomotive.

Making a donation is easy you can either;

a) Internet bank transfer funds to the 762 Club account 30-90-78 account 20636268
b) Write a cheque payable to **The 762 Club** and post to Jon Pain, 26 Oaklands, Bideford, North Devon, EX39 3HW
c) Paypal to jonpain@waitrose.com (remember to send as a gift so as to reduce paypal fees)

A summary of individual donations made can be provided on request (especially useful for higher rate tax payers wishing to reclaim tax on donations paid when doing their year end accounts)