



**THE 'CLAN' PROJECT**

[www.theclanproject.org](http://www.theclanproject.org)

# **THE 'CLAN' PROJECT**

## **building 72010 'Hengist'**

# **Welcome**

**21st century manufacturing  
for a 21st century locomotive  
from 20th century design**



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72009 Clan Stewart

The Standard Steam Locomotive Company Limited (parent body of THE 'CLAN' PROJECT) was set up to build the 11th 'Clan', using the original design drawings. The engine is being constructed as a continuation of the original British Railways design sequence, adopting all the improvements outlined in the Lot 242 drawings and taking the name & number of the next locomotive scheduled on the original 1954 Crewe works itinerary, to build a further 15: the first of those, 72010 'HENGIST'.

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### 72000 Clan Buchanan

The first 5 locomotives, 72000 to 72004, were based at Polmadie (Glasgow), the remainder, 72005 to 72009, being shedded at Carlisle Kingmoor for all their working life.

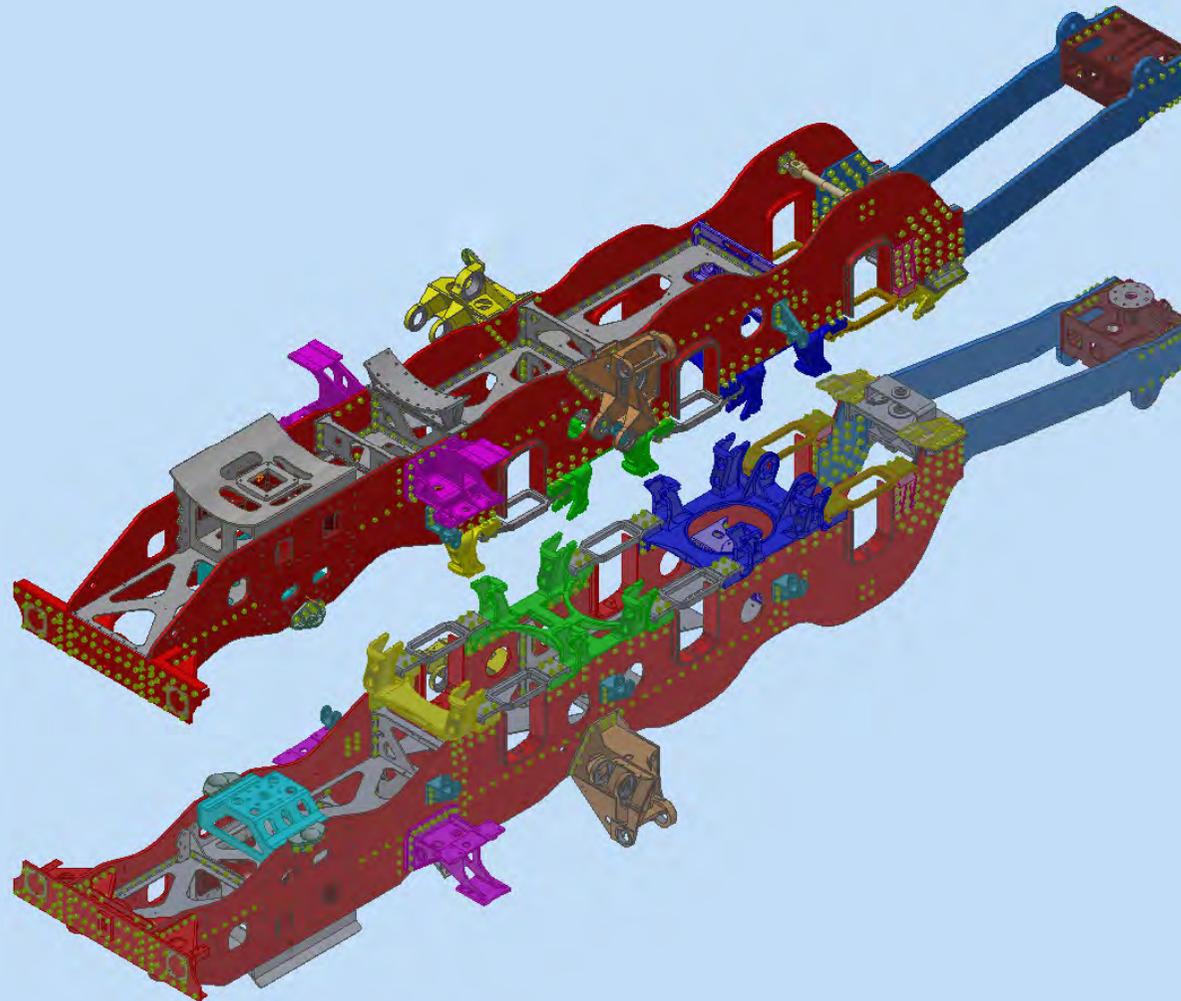
The footplate crews from Kingmoor liked the performance of the 'Clans', unlike the crews from Polmadie, unused to the wide firebox. Polmadie firemen preferred the narrow firebox of the 'Jubilee' class 4-6-0s. One criticism of the class was that crews expected class 7 performance from them, because they looked similar to the 'Britannia' class 7 but, the 'Clans' were a class 6 engine.

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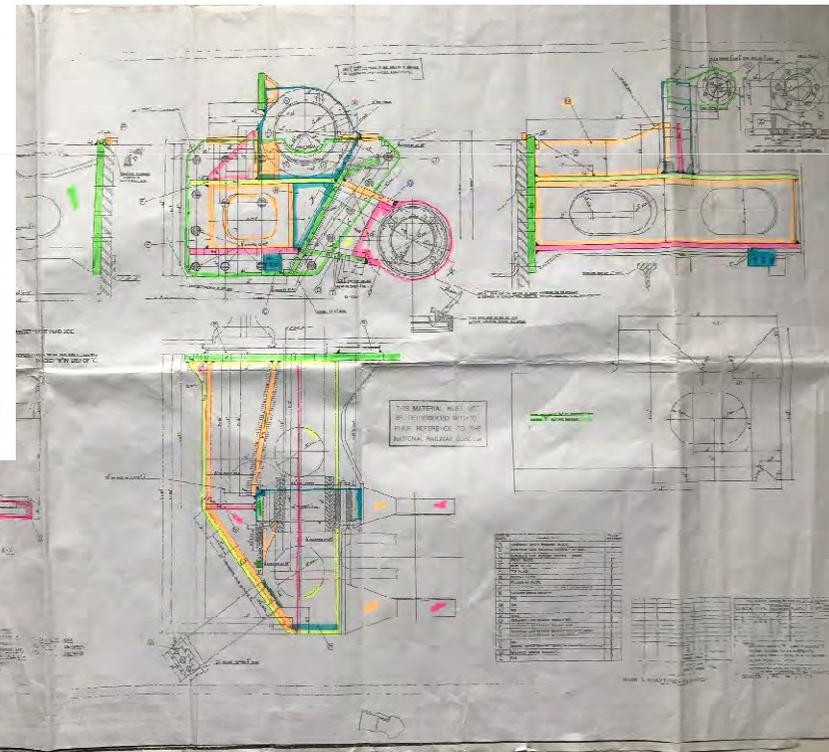
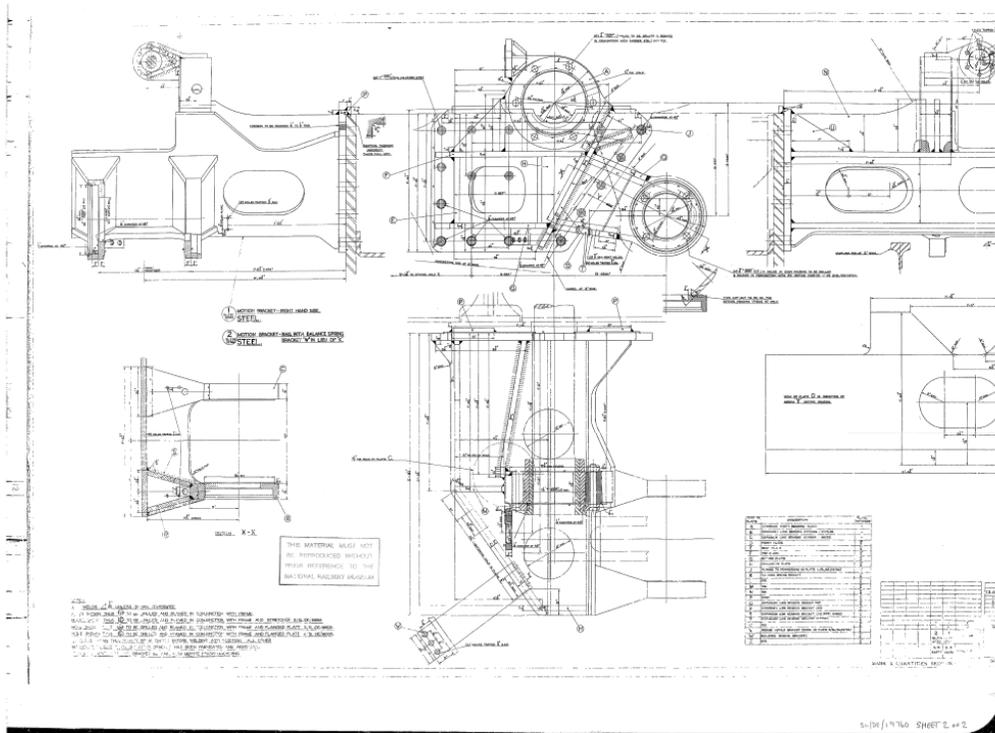
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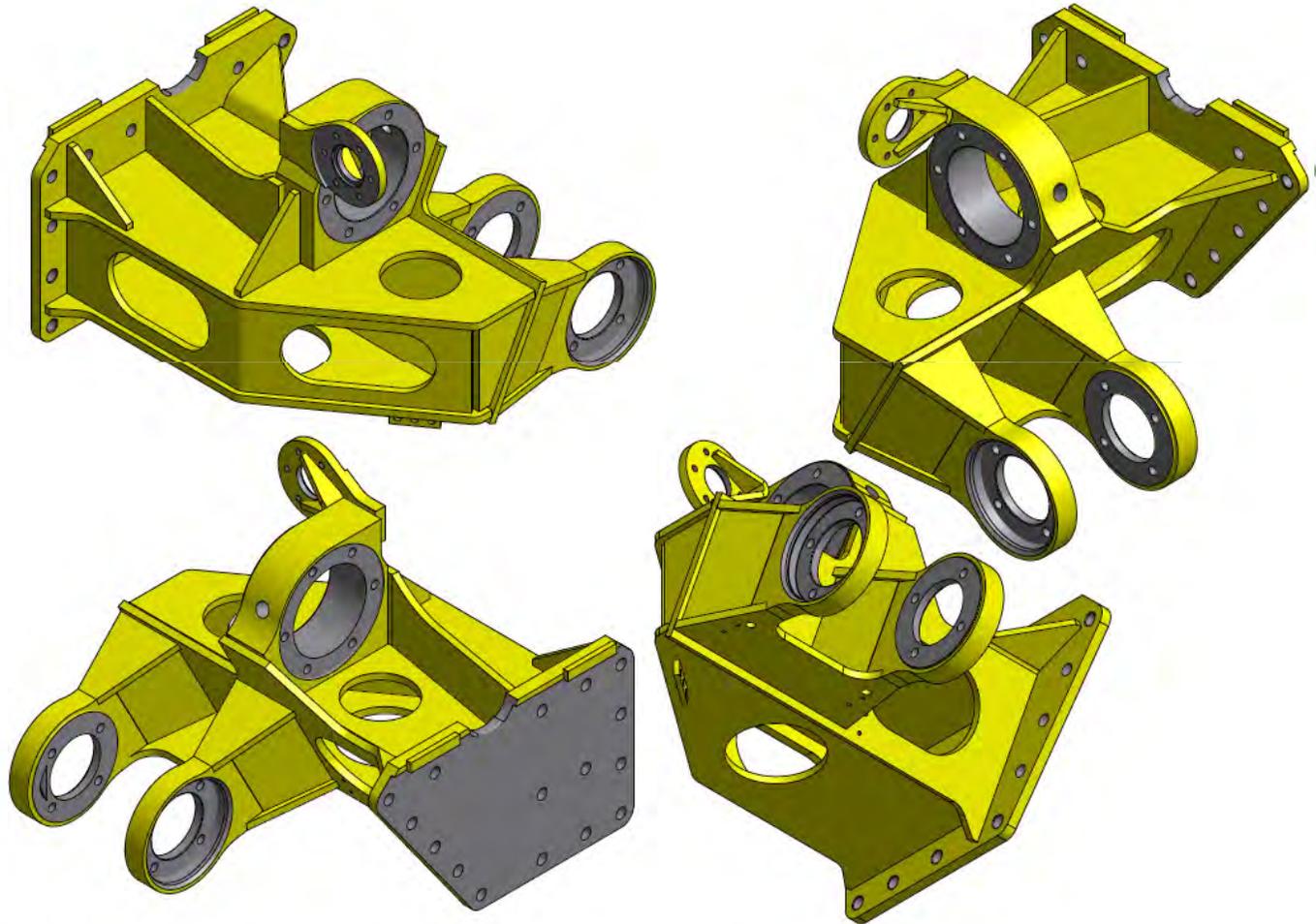
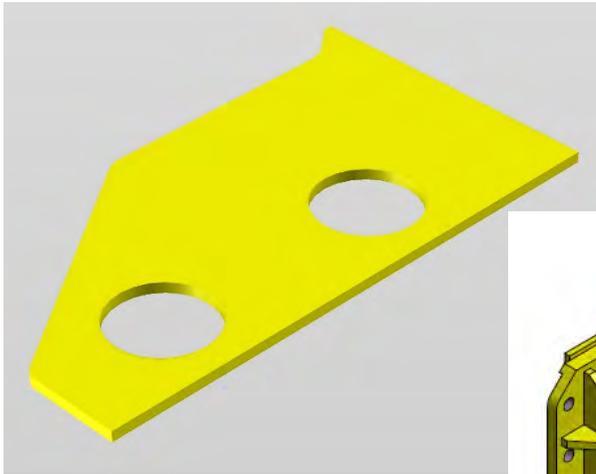
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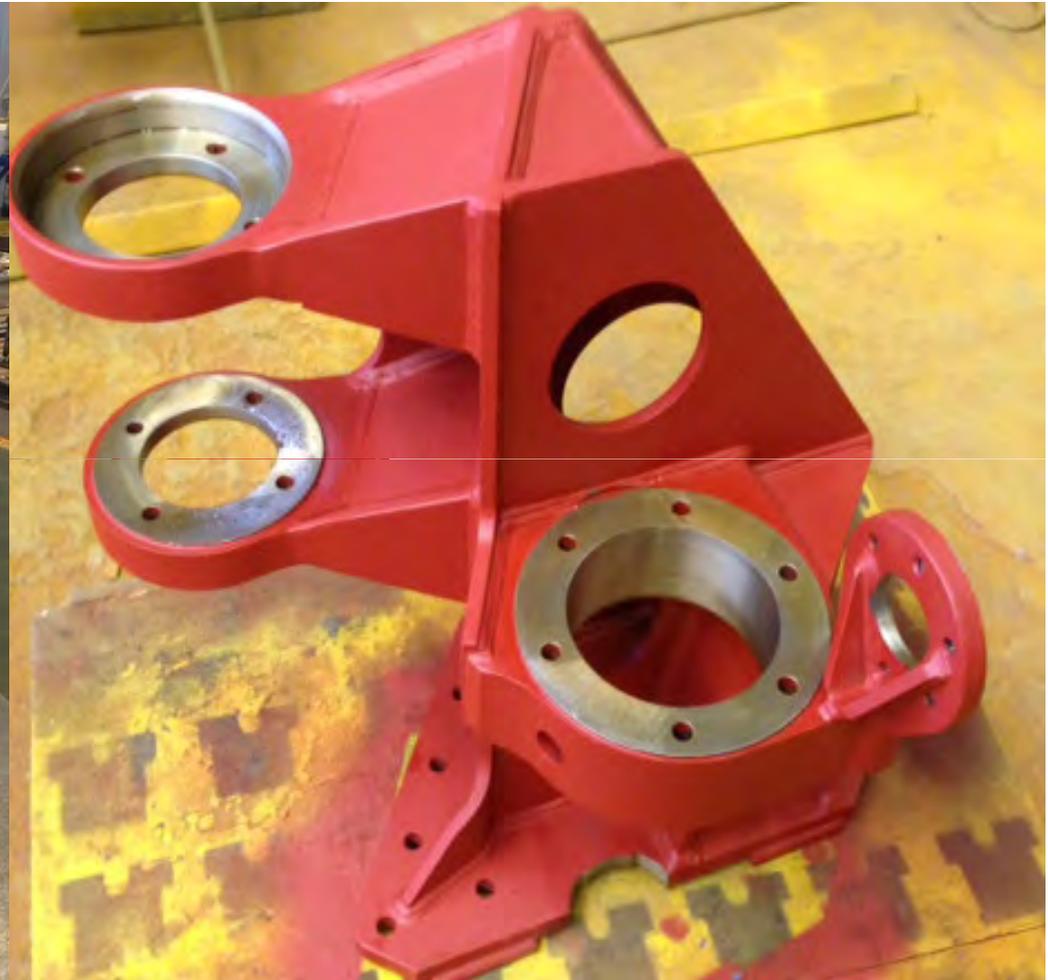


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**The largest single components are the mainframe plates, one of which is seen here after completion of machining. This was produced on a 4 axis NC machining centre**

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The frame plates are held together by various pressed and cast stretchers, two of the three main cast stretchers being illustrated here. The larger of these weighs over half a tonne. All three will need to be finally machined before they can be fitted.

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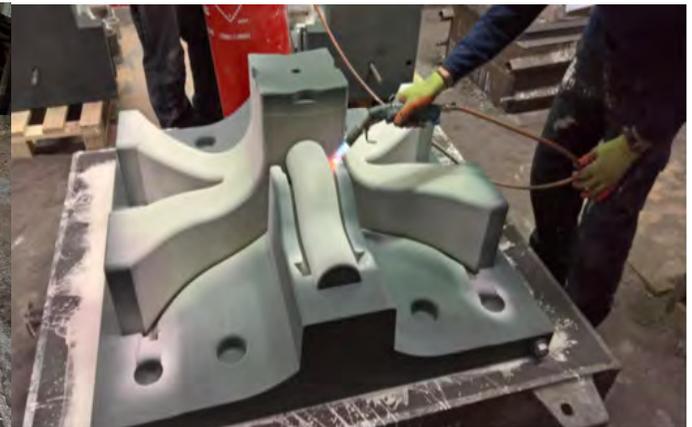
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### Casting of the Exhaust Steam Manifold (Spider)

The steam spider transports the used steam from the cylinders to the base of the smoke box.

This was the first component on this project to be sand printed.

Vendor Number	Type	Pattern Price	Casting
1	Sand	£8,000	£5,950
2	Traditional	£12,310	£2,353
3	Traditional + Fabrication	£5,400	
4	Traditional	£9,400	£1,195
5	Casting only		£4,500
6	Sand	£6,900 + £1,500 cad	£2,036



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Completed Smoke Saddle with  
Exhaust Steam Manifold

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## **Future Progress**

**Apart from the obvious engineering achievements, which have been illustrated in this presentation, other operations and procedures have been progressing steadily in the background.**

**The first of these has been a collaboration, between SSLC and the Advanced Steam Traction Trust (ASTT), to improve the performance of the locomotive, otherwise known as the 'Clan Locomotive Improvement Program', or CLIP for simplicity. The results of this study have been presented and amount to almost 100 pages of information, technical data, drawings and recommendations. We have accepted the report, in its entirety, and it has been passed on to our Engineering Committee, who will look into the best methods for its implementation. Some of the drawings and recommendations, proposed by ASTT, are reproduced in the following pages.**

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...as it did at the start. In fact, the only change required is to the chimney, which is of a slightly larger diameter. The chimney would need to be modified, in any case, to meet the modern loading gauge.

The principle, by which this study was to be guided, was that the locomotive must look the same at the end of the process...

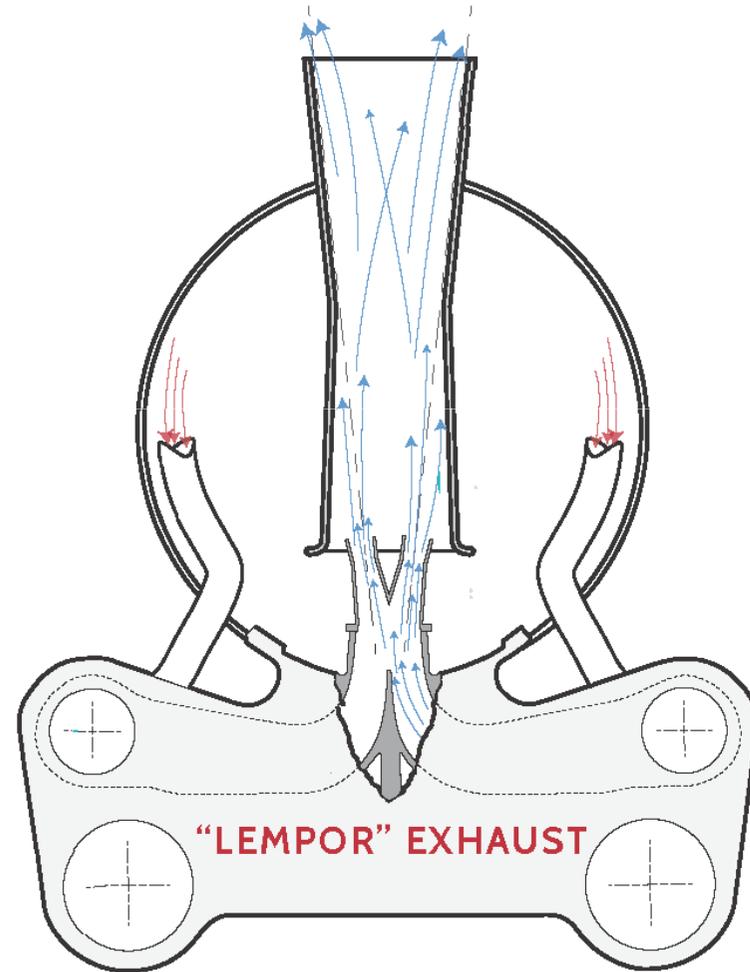
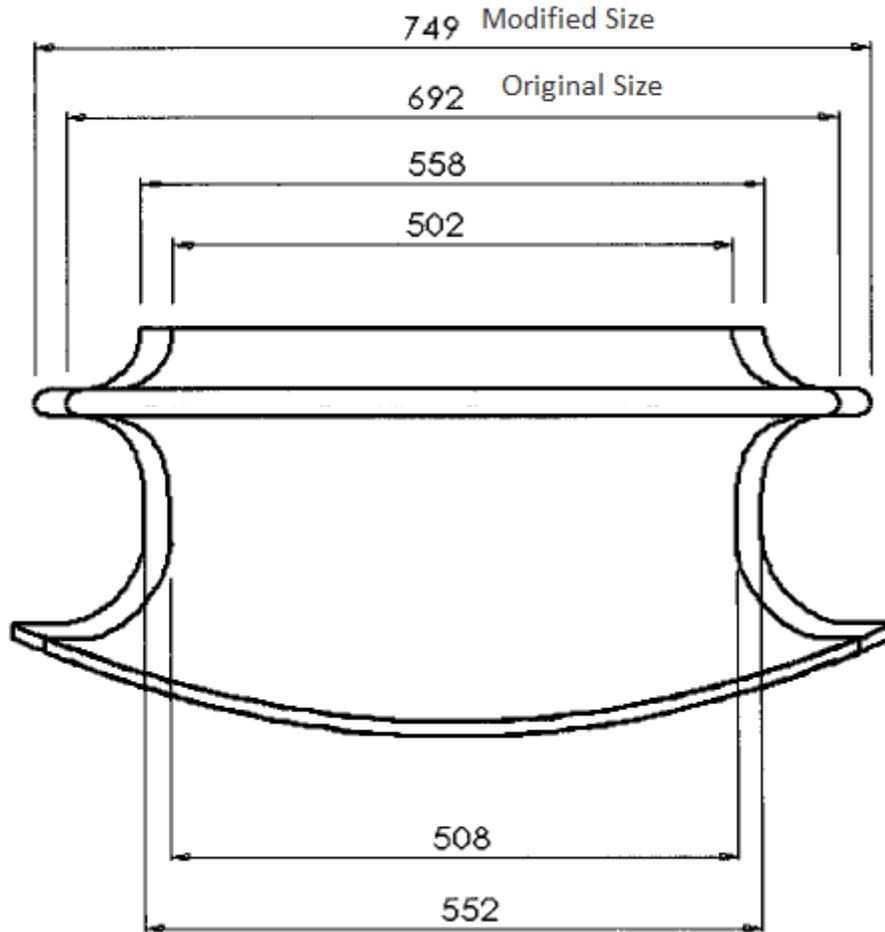


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# Adding a Lempor Exhaust



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**Also recommended, was that the boiler pressure be increased, from 225 psi to 250 psi.**

**This modification, if we decide that it should be implemented, will require the approval of the boiler inspector and insurance company before work can start. We are consulting with them on this issue.**

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Another area looked at, has been the design of both the pistons and the piston valves, along with cylinder lubrication and the way in which the slidebars are attached. These proposed modifications allow for greater efficiency and prolonged piston ring life, in comparison to both the preserved 'Britannias' and 'Duke of Gloucester'.

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REGISTERED IN SCOTLAND  
AS THE CLAN STEAM LOCOMOTIVE COMPANY LIMITED  
SC0451026 (2011) LTD

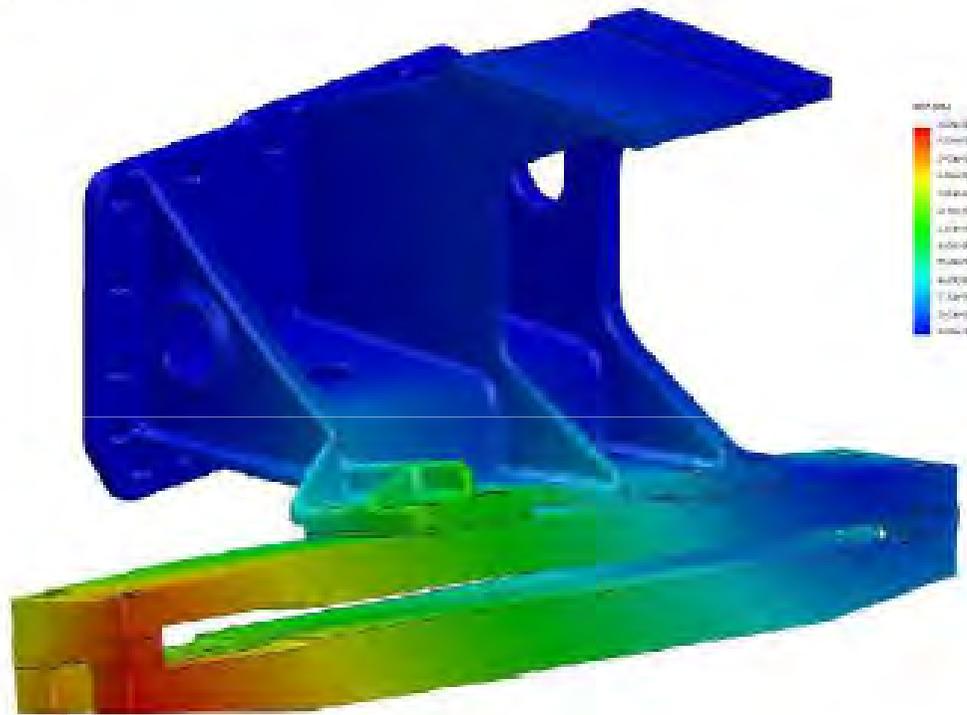


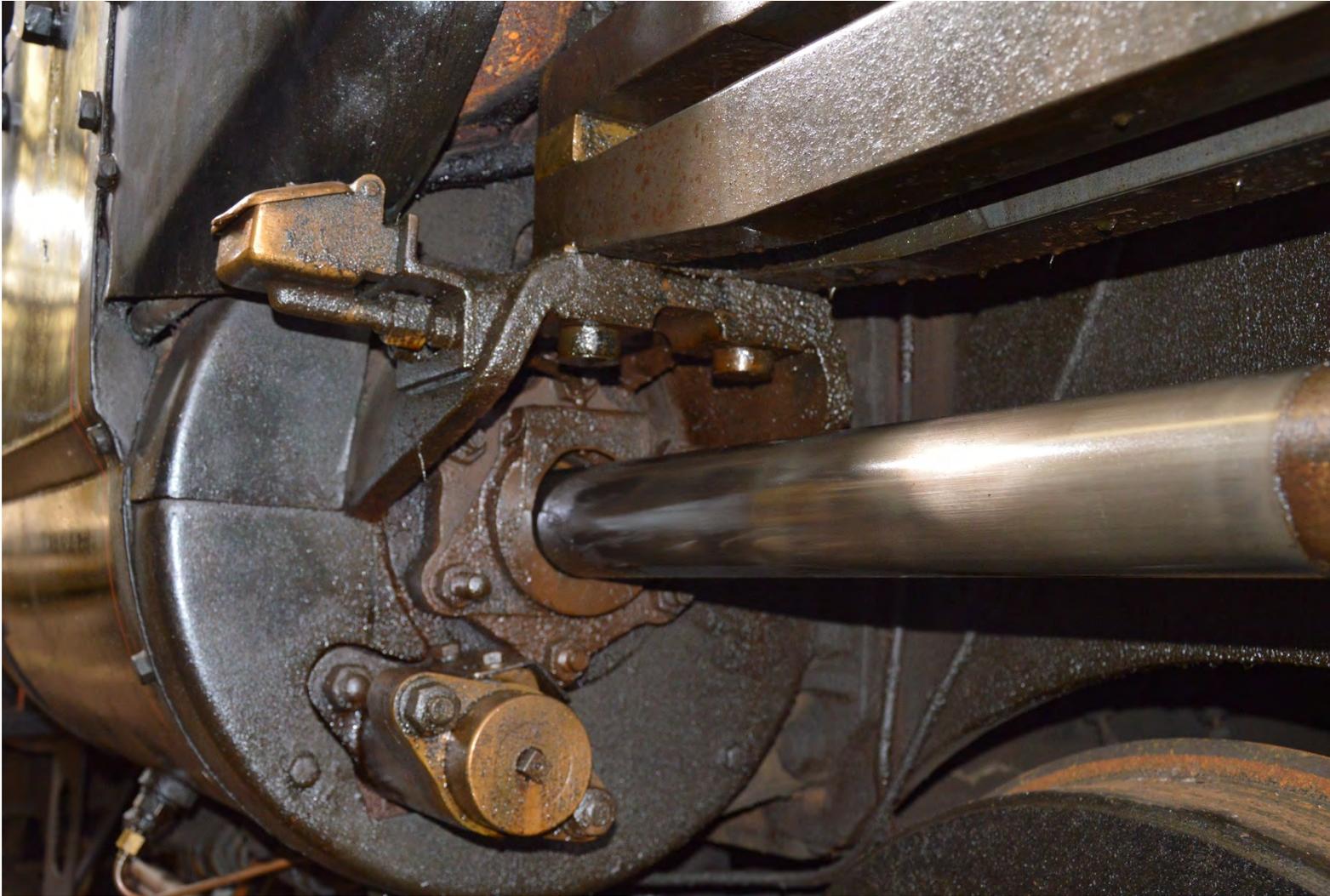
Fig 22 Deflection of Slide Bar bracket SL-DE-19580 under load  
Deflections exaggerated to show effect

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## **Advanced Manufacturing Research Centre**

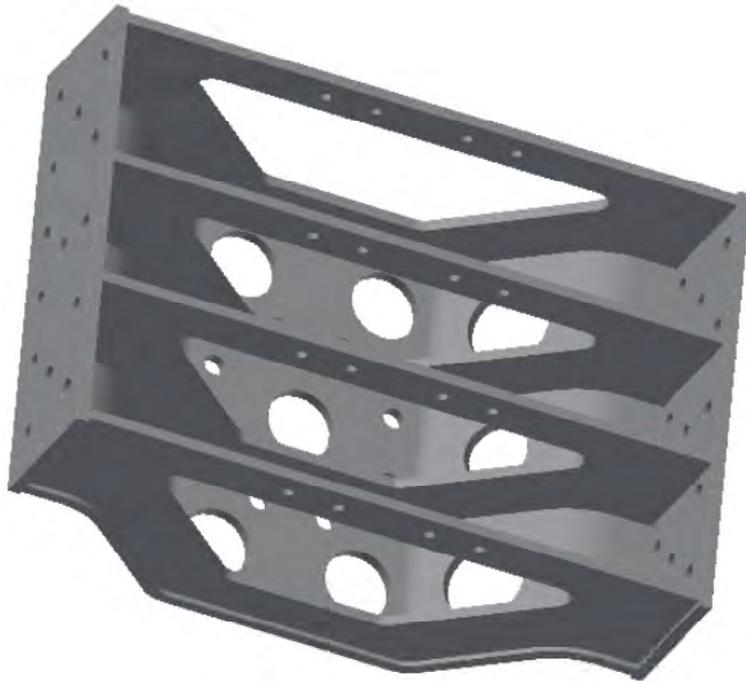
**AMRC is another organisation that we are now working with, helping to train the engineers of the future. Their apprentices are turning our locomotive drawings into 3D computer models, that show both how the completed part will look, when finished and, can be used on modern machine tools, to program the tool to produce the finished part. In helping AMRC with this, we both gain valuable knowledge and, as the computer models produced are interactive, the apprentices can see how the completed parts fit together to produce larger components. This is a practical exercise for them, with tangible results. At some point, they will be able to see ‘Hengist’ and proudly say “I helped to produce that part”. Long may this partnership prosper.**

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The work with **AMRC** is ongoing and producing quality results, as can be seen here. We can pass these along to our engineering partners and expect to get back excellently fitting parts.

These are two of the model drawings so far produced for us. On the left is the frame stretcher for bogie pivot, while that on the right is the frame stretcher with boiler carrier. Both of these are, are waiting to be assembled into the frames

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**One item that has been completed, is the Frame Stretcher with Brake Cylinder Mount. The various stages of manufacture can be seen in this series of photographs: the pattern, the fettled casting as delivered from the foundry and, finally, the finished component, ready for assembly.**

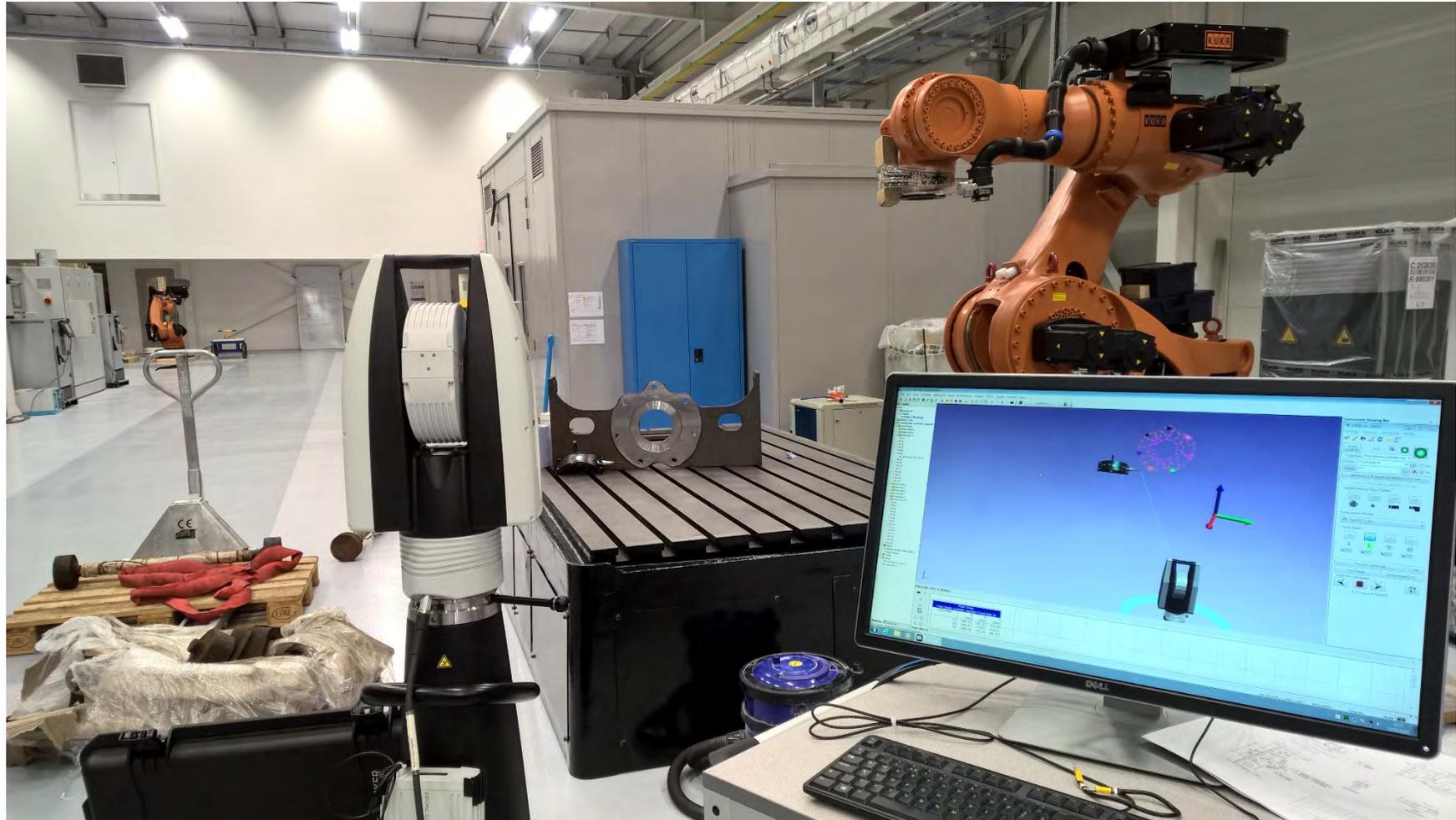
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# Metrology



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The measurement error map for the frame stretcher  
Measuring the frame spreader at the AMRC in Sheffield

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# Metrology



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Measuring the frame extensions at the East Lancashire Railway  
The Leica B-Probe that was used to capture the hole details

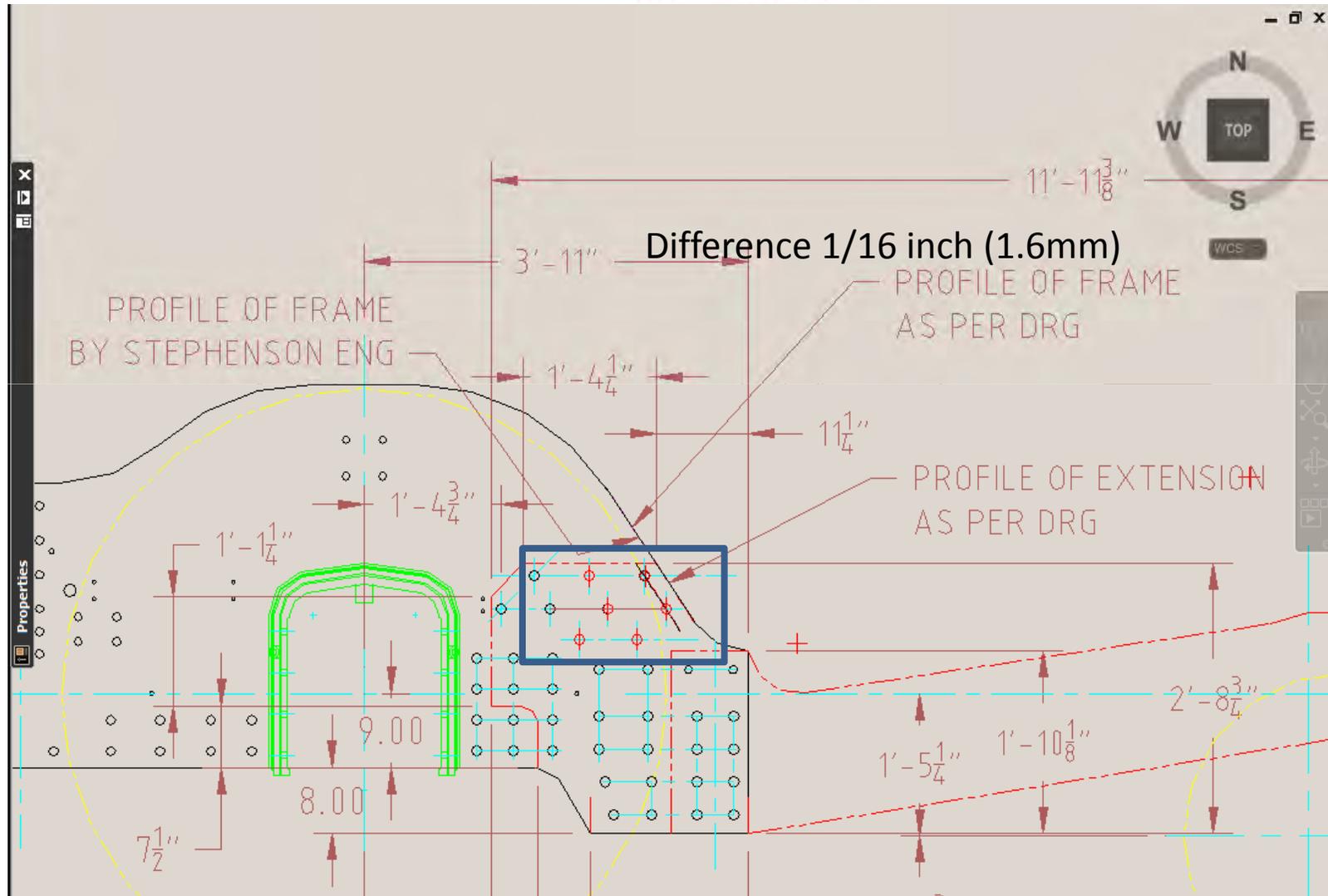
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# Metrology



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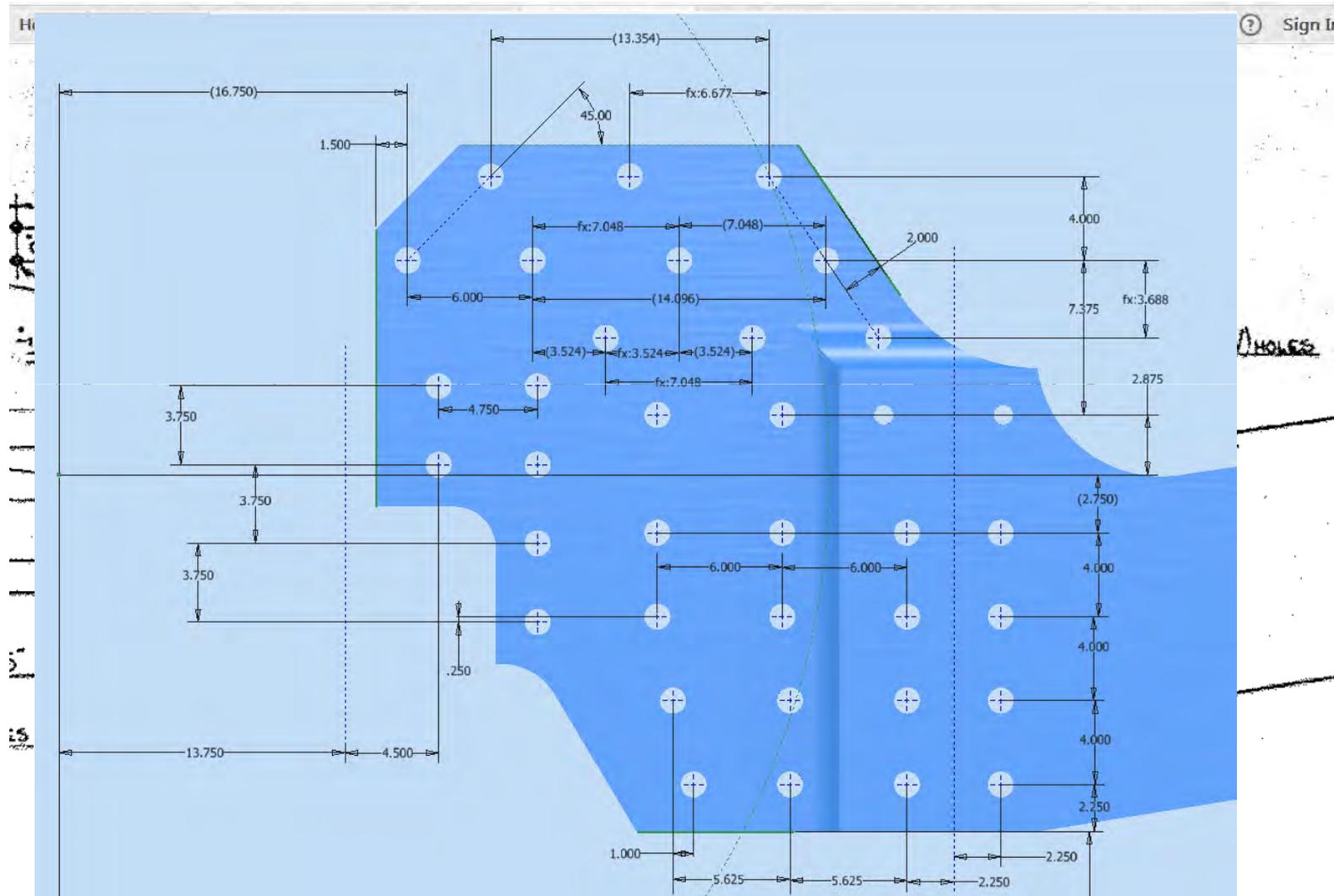
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Why this was so challenging



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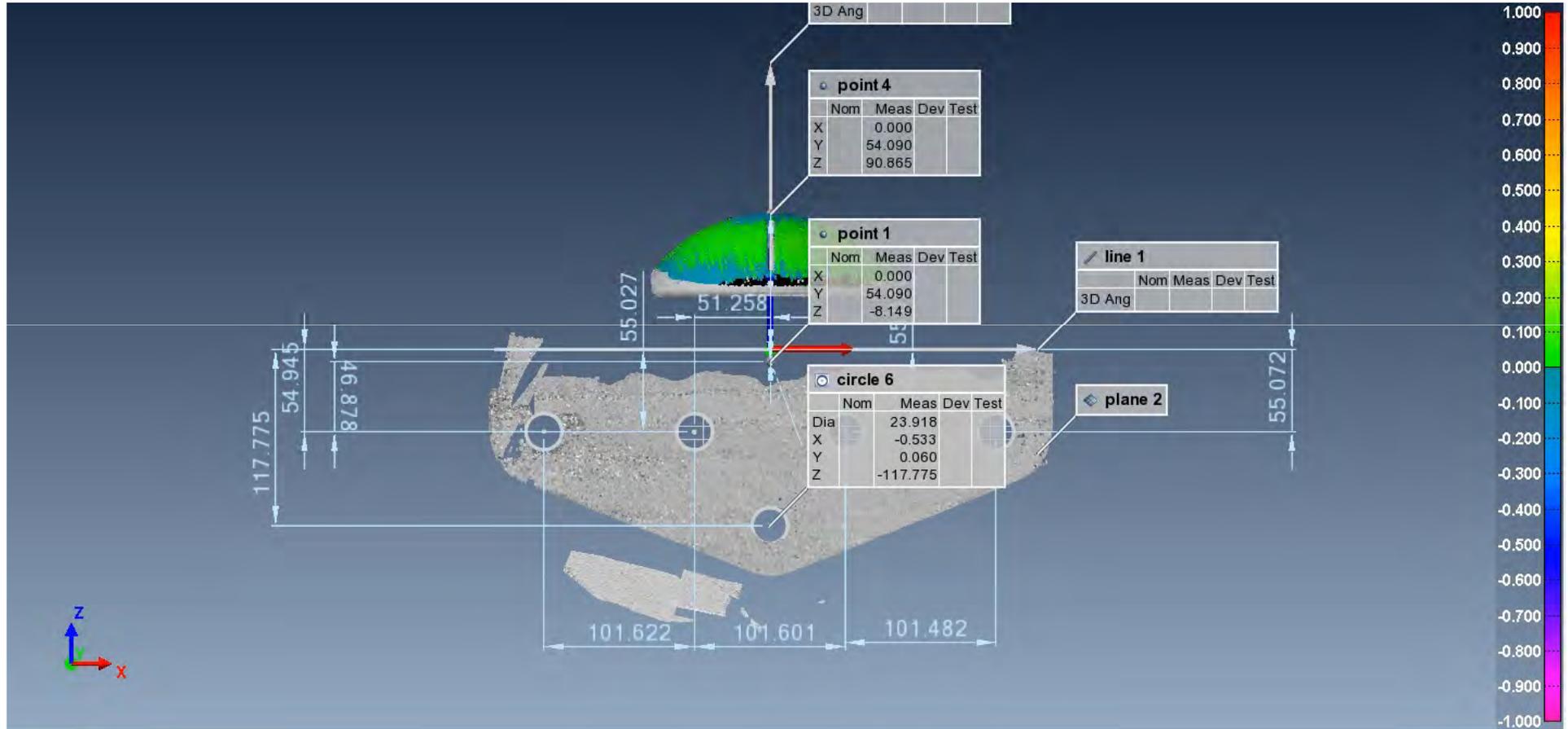


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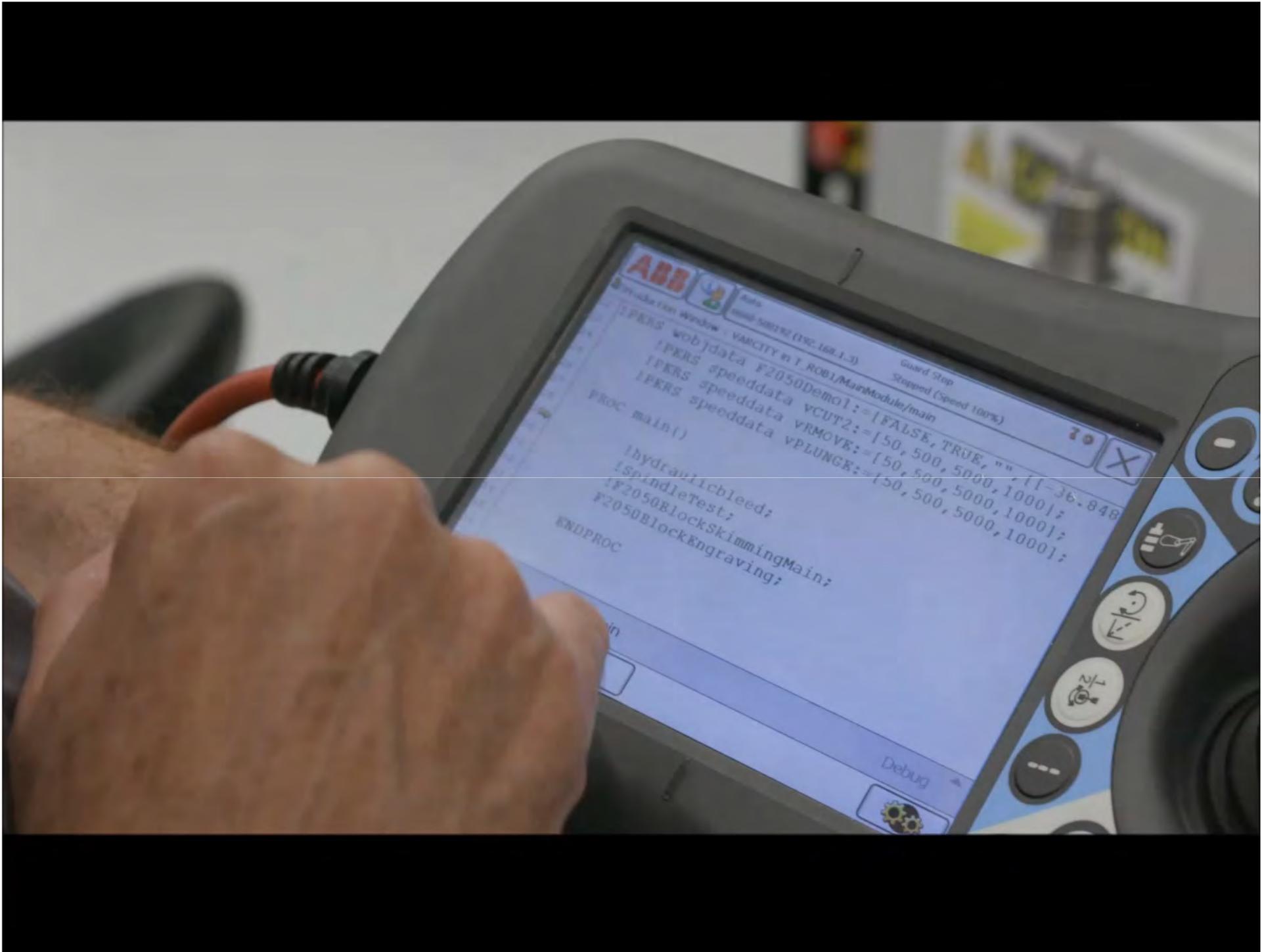


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# Any Questions?

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### Our Vision:

To complete the story of the British Railways design of standard class steam locomotives, by building a BR Standard class 6, 'Clan' type, 4-6-2, express passenger steam locomotive, one of the BR standard classes which missed out on preservation.

### Our Mission:

To administer the re-creation, operation and maintenance of a lost class of British steam locomotive, using original design drawings, but incorporating 21st century design and manufacturing techniques. The locomotive - BR Standard class 6, 'Clan' type, number 72010 and named 'HENGIST', will be the next in line of the original BR production series, which had been cancelled in 1955 due to steel shortages and a national change of motive power policy.

The locomotive will be of a modern, go anywhere, low maintenance, low running cost design, perfect for the 21st century. It will complement, and help to complete, the story of the 12 classes of British Railways' Standard Locomotive designs.

To this effect, we will facilitate its demonstration and provide a display, for historical, educational and recreational purposes, both on the main line and on heritage railways throughout the country.

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