AST Trust
Advancing Steam Traction

NEWSLETTER No. 24 - MAY 2024

Latest progress on Revolution as of 25th April is the outside machining of the four cylinder covers. These are machined from cast iron bar. The central hole in the front covers is for test instrumentation (pressure transducer). On the rear covers this is off centre to allow for the gland, one of which is shown.

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CHAIRMAN'S PIECE
John Hind

We are just past our annual renewals window. If you have not paid, our membership secretary Chris Newman will have chased you for up annual subscriptions. The simplest way to pay is by a direct debit, then it's never forgotten. Our policy is to send out one newsletter once a subscription has lapsed. If you have not renewed, this will be your last newsletter!!!!

At the AGM Hendrik Kapitein was elected as Secretary – welcome Hendrik. Mike Stockbridge has joined the committee as an ex-officio member, welcome Mike. Mike has been involved in conference planning and took part in last November's Bure Valley trials.

Preparations are in hand for the October Conference. Later in the newsletter, Chris Newman writes in more detail. All are welcome and with a move back North to Derby, we hope to see many regular attendees and also new ones and anyone who was not able to come along last year. The formula is as before – some talks, a visit and a conference dinner. We are hoping for a speaker on oil firing, which is a current vogue to guard against fire risk and coal shortages.

Ian Gaylor gives an update on what we have learnt from testing of alternative fuels and we have plateaued in adding to our knowledge of how they perform. Nothing that we have tested performs as coal, despite suppliers pricing it as coal. The mystery is why despite some of them having calorific values similar to coal. We have ideas for trials to understand this, but that will need funding beyond what we can afford.

Funding from National Heritage Lottery Fund, (NHLF) may be available, but we have to meet their criteria. One of them is 'Protecting the environment'. There 3 other investment principles which must feature in an application. They are 'Saving heritage', 'Inclusion, access and participation' and 'Organisational sustainability'. It is on these other three that ASTT may struggle and we might need to partner with another organisation or organisations to meet all the other criteria. I have had a short discussion with Steve Oates of the HRA about this and will be providing a short briefing document for their discussions with the NHLF.

Charities Commission – Appeal for HELP

A key part of the funding for Revolution is reclaiming Gift Aid on UK taxpayers' donations from Her Majesty's Government. To ensure this happens we need to be registered with the Charities Commission, particularly so if donations are greater than £5000/year. The budget includes receiving £18,500 of Gift Aid, so registering is vital.

This involves completion of an application demonstrating that we meet a number of the criteria. We are looking for anyone who is willing to take this on for us. If you are willing to help in any way on this please contact me john.hind@advanced-steam.org

MEMBERSHIP MATTERS
Chris Newman

ASTT's management committee consists of:

John Hind	Chairman & Trustee	Jamie Keyte	Trustee
Hendrik Kaptein	Secretary & Trustee	Alex Powell	Trustee
Chris Newman	Treasurer & Trustee	Grant Soden	Ex-officio
Mike Stockbridge	Ex-officio		

Full Members: The Committee has accepted the nominations of three new Full Members: Joseph Cliffe, Mike Stockbridge and Chris Parmenter.

New Members: We welcome three new members who have joined since our No 23 Newsletter of November 2023:

Orlando Mostert from South Africa: Orlando is our first member from the African continent. He is also a keen student of modern steam and would like to see a return of steam to South Africa as a means of keeping trains running over lines that have been stripped (by thieves) of their electrical power cables and equipment.

Roger Hahn from New York State in the US: Roger is a qualified architect but has also studied mechanical engineering. He got to know Nigel Day when he was doing his work on the Mt. Washington Cog Railway, and with Nigel's help he manufactured what he believes is the smallest Lempor exhaust which he fitted to his 45mm gauge, coal fired, live steam loco – see here.

David Fryer from Canterbury, UK: David is a retired control engineer who is providing valuable assistance to Chris Newman in the interpretation of Porta's 1957 paper on the Kylpor exhaust system.

Bejo Christen from Switzerland. Bejo joins us as a Student Member. He is studying theatre, but is also a keen student of steam. He owns a 3.5" gauge steam loco and has built a steam powered bike. He's one of our few members who have offered assistance with marketing and promotion.

Ton Pruissen from Holland. Ton specialises in film restoration, editing and sound. Since 1991, he has made some 80 films on steam traction, trailers for many of which can be found on YouTube.

Student Membership: We currently have 9 student members.

Non-renewals: It is sad to report that 17 of our 2023 members have so far failed to renew their subscriptions. Five have written to confirm their intention not to renew. Reminders have been sent out to the others including 2 student members who have not responded to requests to confirm their student status.

Membership Numbers

Membership numbers are now:

Full Members:	39	UK members:	71	Age ranges	
Associate Members:	61	EU:	16	Over 60	Approx. 51%
Student Members:	9	USA:	9	30 to 60	Approx. 36%
		Australasia:	10	Under 30	Approx. 12%
Total Membership:	109	Asia & Africa:	3	Av. age	Approx. 57

PUBLICATIONS PAGE
Chris Newman

Book Sales

34 books have been sold in the five months since Newsletter No 23 was circulated. Not included in these are ten books donated to libraries – 8 to the National Library (as required by publishing regulations) and two to the National Railway Museum in York.

The sales numbers are listed as follows:

Publisher	Author	Title	Sales	Total
ASTT	L.D. Porta	Porta's Papers Vol 1	4	143
	L.D. Porta	Porta's Papers Vol 2	5	135
	L.D. Porta	Porta's Papers Vol 3	4	97
	C. Newman (Editor)	Porta's Centenary Compendium Vol 1	4	82
	C. Newman (Editor)	Porta's Centenary Compendium Vol 2	12	35
	Ian Gaylor	Lyn Design Calculations	1	110
	David Wardale	5AT FDCs	3	218
	David Wardale	Reminiscences of a Trainspotter	2	36
	Alan Fozard	5AT Feasibility Study	0	43
Camden	David Wardale	The Red Devil and Other Tales from the Age of Steam	0	260
	Phil Girdlestone	Here be Dragons	0	33
	Jos Koopmans	The Fire Burns Better …	0	11
	L.D. Porta	Advanced Steam Design	0	5
Crimson Lake	Adrian Tester	A Defence of the MR/LMS 4F 0-6-0	0	42
	Adrian Tester	Introduction to Large Lap Valves	0	19
		Total sales	35	1272

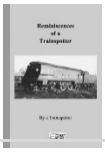
It is planned to add two more titles in the coming months: one on Water Treatment written and edited by Martyn Bane; the other being Volume 4 of the series of papers by Livio Dante Porta - this one covering a variety of topics including:

- Porta's 1969 "Manchester paper" (previously published by Camden)
- Notes on the Design of Mallet Locomotives
- Notes on the Design of Garratt Locomotives
- Cario - an Advanced Axlebox Scheme for 21st Century Steam Locomotives
- Steam Locomotive: Running with Closed Regulator
- On the Performance of the British Standard Class 8 No 71000 Steam Locomotive
- The exhaust of Locomotives
- Lempor Theory

We'd like to expand our book selection, so we welcome any suggestions for additional titles that we might be able to sell, or new texts that we might publish under ASTT's logo.

Book sales provide a useful income to ASTT which helps to fund our activities, not least our *Revolution* project. **Members are urged to support these endeavours by purchasing books from us.**

Titles published by the Advanced Steam Traction Trust

	Year	Author	Title	Pages	RRP*
	2015	David Wardale	The 5AT Fundamental Design Calculations	556 (b&w)	£49.00
	2016	Alan Fozard and others	The 5AT Feasibility Study edited	230 (colour)	£35.00
	2018	Ian Gaylor	Steam Locomotive Design Specifications and Calculations for New Build Baldwin 2-4-2T 'LYN'	604 (colour)	£52.00
	2018	L.D. Porta transcribed and edited by Chris Newman	Selection of Papers – Volume 1 - Tribology and Lubrication by	556 (b&w)	£27.00
	2019	L.D. Porta transcribed and edited by Chris Newman	Selection of Papers – Volume 2 - Adhesion, Compounding and the Tornado Proposal	556 (b&w)	£27.00
	2021	L.D. Porta transcribed and edited by Chris Newman	Selection of Papers – Volume 3 - Steam Locomotive Boilers, Fireboxes and Combustion	556 (b&w)	£27.00
	2022	Compiled and edited by Chris Newman	A Compendium of Articles and Papers to celebrate the Centenary of the birth of Livio Dante Porta - Volume 1	226 (colour)	£27.00
	2023	Compiled and edited by Chris Newman	A Compendium of Articles and Papers to celebrate the Centenary of the birth of Livio Dante Porta – Volume 2	331 (colour)	TBA
	2023	David Wardale	Reminiscences of a Trainspotter	67 (b&w)	£16.00

As noted above, it is planned to add two more titles in the coming months: one on Water Treatment by Martyn Bane and Volume 4 of the series of papers by Livio Dante Porta.

* The RRPs (recommended retail prices) shown include UK postage. Additional postage costs may apply to some titles. Paid-up members of ASTT are entitled to a 20% discount on these prices.

All these books can be purchased through ASTT's website at http://advanced-steam.org/books-forsale/.

CONFERENCES
Chris Newman

2024 Conference

As advised in a flyer recently circulated to members, ASTT will hold its 2024 conference in the Astor Court Hotel in Derby over the weekend of 5th to 6th October 2024. There will be space for around 40 attendees in the meeting room, so those wishing to attend are urged to secure their place at an early date.

An interesting selection of papers are being arranged, with an emphasis on alternative low carbon fuels. In addition, we can expect an update on our Revolution project from Jamie Keyte, who has also offered to give a short talk on the industrial history of Derby.

The conference programme is expected to include a visit to the Midland Railway Centre in Butterley and perhaps also the Princess Royal Class Locomotive Trust (home of LMS Pacifics 6203 and 6229) if time permits. In addition, the conference will include a conference dinner at the Aston Court Hotel.

2025 Conference

As reported in our last Newsletter, 2025 will be a year of celebration that will mark the bicentenary of the opening of the Stockton and Darlington Railway on September 27th, 1825. Plans to mark the occasion are still being developed, but they are likely to be held all over the country under the auspices of an SDR200 organisation (see https://www.sdr200.co.uk/ and https://railway200.co.uk/. Listen also to Peter Hendy's talk about "Railway 200 & how the railway made the modern world" in Green Signals' podcast No 7.

ASTT would like to participate in these festivities, both through its 2025 conference and through our *Revolution* project which may be complete in time for the bicentenary (though there's no certainty of that). Our current idea is to plan for our conference to be held in the Darlington / Shildon area and for *Revolution* to be put on display at some suitable location – the aim being to publicise ourselves and increase membership.

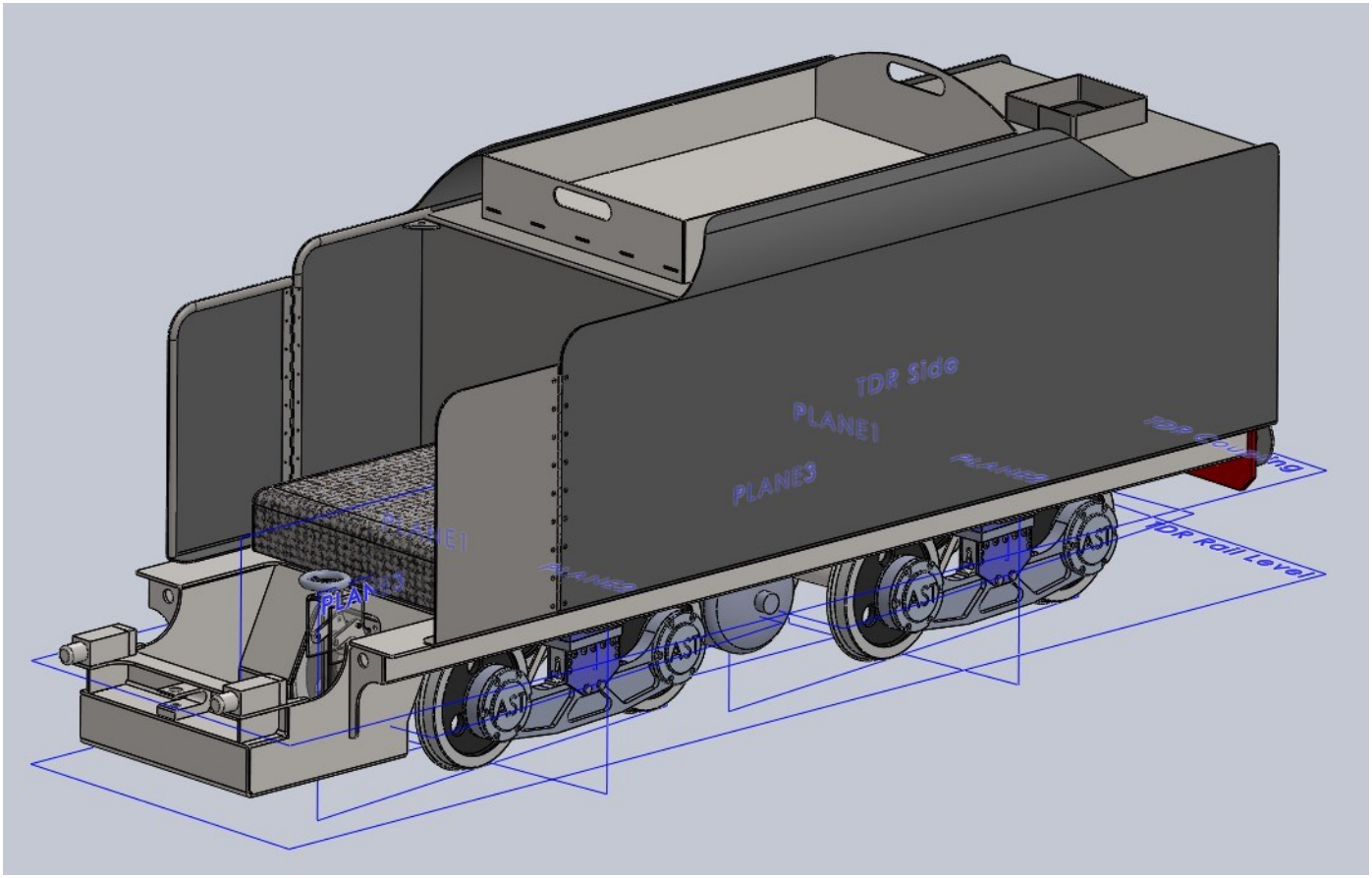
We would very much like to receive suggestions from members about how we might go about promoting ourselves at, and in advance of, the bicentenary. We will be even happier to receive offers of help with organising and promoting our presence at the event, both in terms of the conference and displaying *Revolution*.

Please let us know if you can offer any suggestions and/or help.

REVOLUTION PROGRESS
John Hind

Recent work at the Huntingdon facility has been centred on the ashpan design. This has proved to be a bit trickier than normal due to the different design from normal practice of the trailing wheelset suspension and the traction rods that pass the traction forces to the tender.

However all issues have been satisfactorily resolved and the resultant sub-assembly can be viewed in the accompanying illustrations. The main difficulty was in finding a path for the front damper actuating levers and clearance for the bellcrank above the mainframe deck plate.



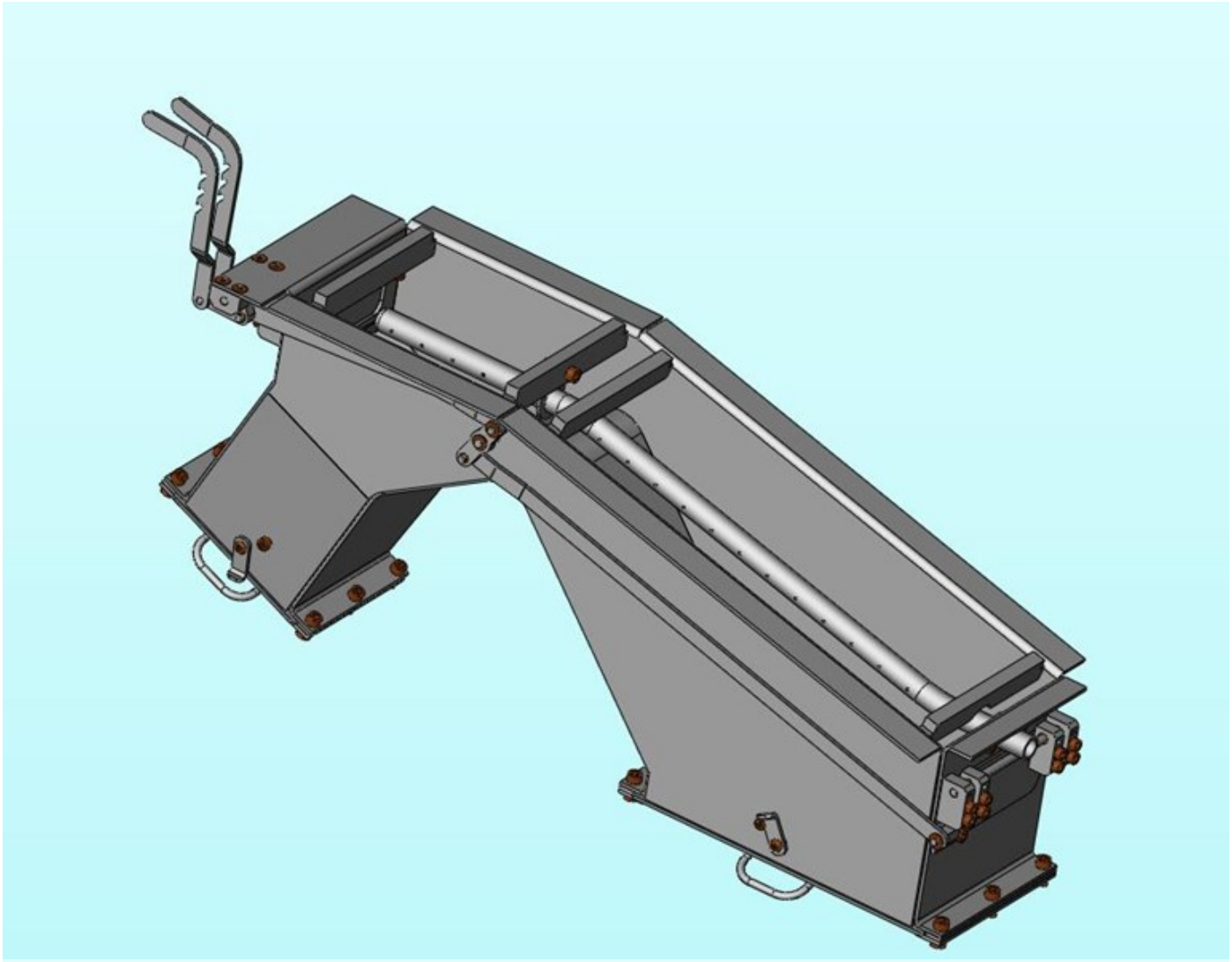
The damper levers are restrained by a bracket fixed to the backhead of the boiler (not shown) so the complete boiler/ashpan assembly can be lifted out of the frames complete.

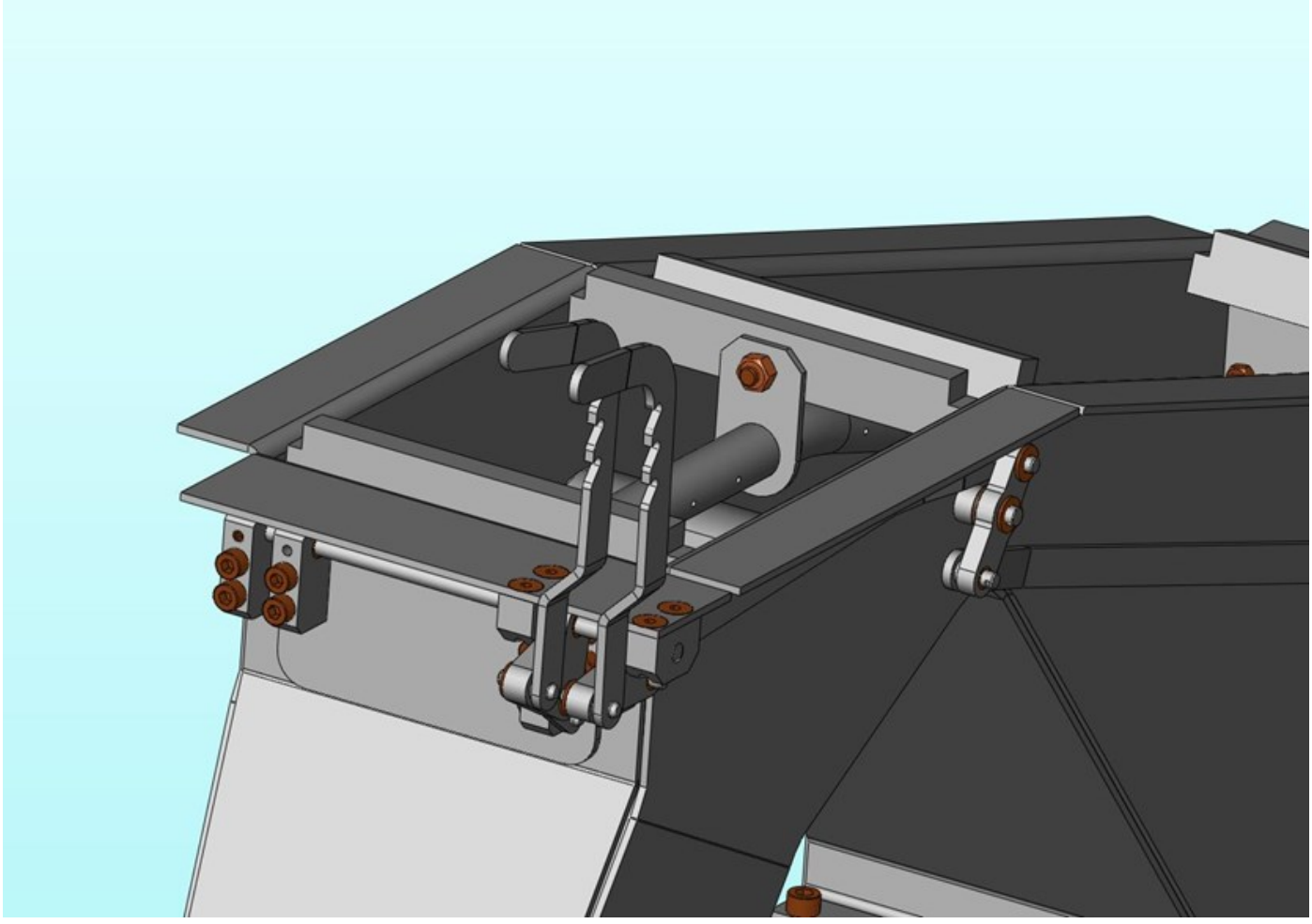
Ash dumping is considerably eased by using sliding plates and the undergate steam, which prolongs the life of the grate, is provided through a pipe running centrally below the grate bars, both features used successfully on the Curwen Atlantic at Stapleford.

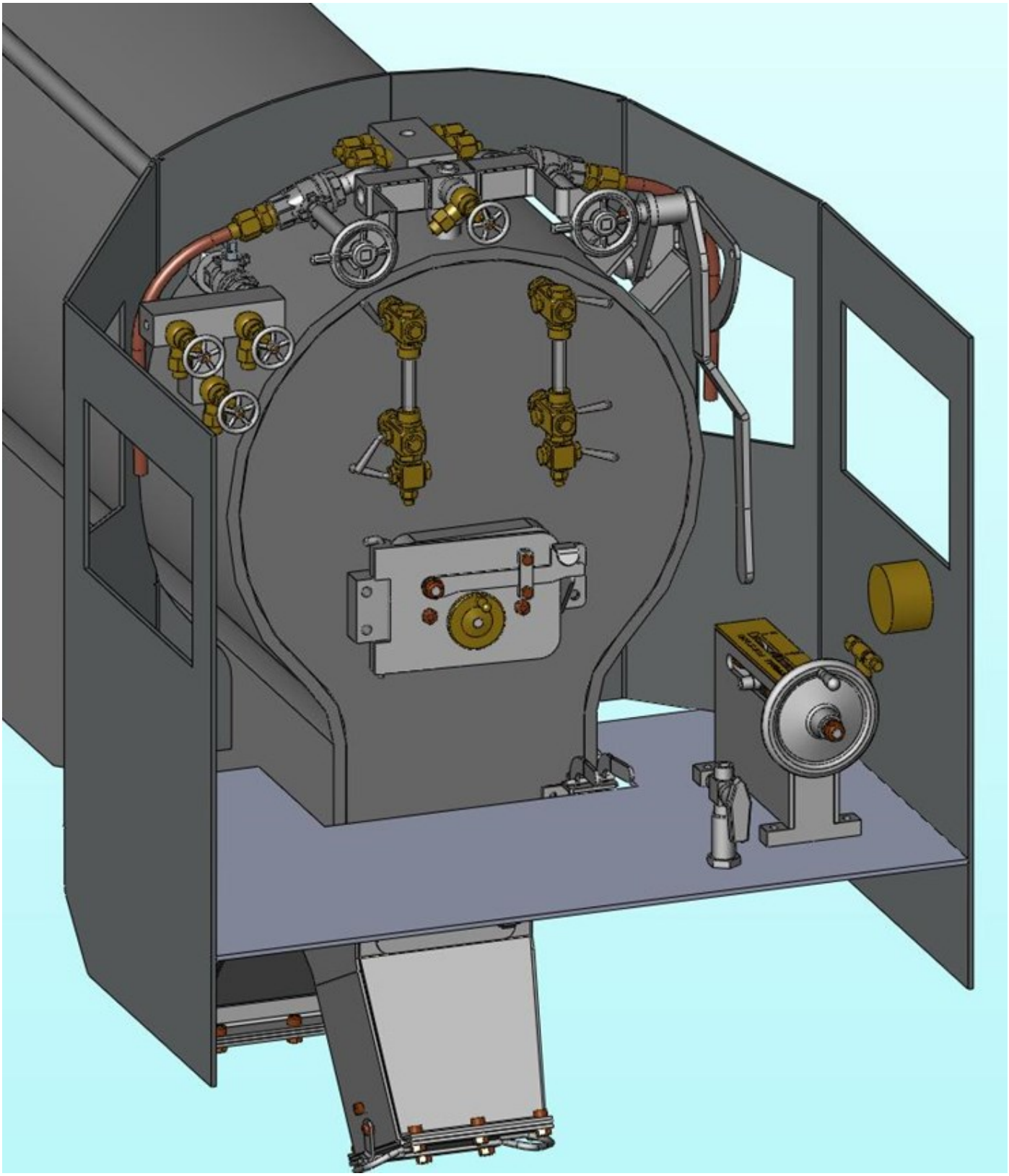
On other fronts the material for the cylinder & valve liners has been obtained and the order for machining these also placed together with the valve stems. The cylinder cladding has been drawn up and an order placed for this as well.

The plan is that once the cylinders have been machined they will return to KeyteSmith for fitting the covers and then progress to MetalWorld for the manufacture and fitting of the cladding – this will ensure a close fitting and neat result. When this stage has been completed the cylinders will travel to CFE Engineering for the liners to be fitted and hopefully the valves before returning to KeyteSmith for final assembly.

A start has also been made on a provisional cab layout.







ALTERNATIVE FUELS
John Hind

Rapemeal Cake – Update

After the trials we carried out the BVR in November 2023 of Rapemeal Cake, Phoenix Oils carried out a further trial of the large blocks of Green Dragon fuel at the Bo'ness and Kinneil Railway. This was carried out by the Bo'ness and Kinneil and Phoenix Oils and ASTT did not take part. Phil Thompson of Phoenix Oils, sent in an update and quoting directly from that:-

'This was more of a qualitative trial than a quantitative trial. From our point of view, the aim was to see if the fuel performed in the larger grate area of a standard gauge locomotive, in a similar way when compared with previous trials at the Bure Valley. Three return trips were made with their *No.1* of 1902, hauling a 6-coach service train plus a loco at the rear (just in case of problems).

In summary, we observed the following:

- Generally free-steaming, minimal char, minimal clinker, minimal ash.
- No significant smoke or unpleasant smoke odour, whether under load or standing/coasting.
- HCN measured from the platform was zero – assumed to be burnt off.
- Climbing the approx. 1 in 70 bank from Bo'ness to Birkhill (c.1.5 miles), pressure fell from 180psi to 150psi (and then held at 150psi) on 2 runs and to 125psi on the 3rd run as the fireman tried different techniques. It is assumed that this sub-optimal outcome was due to the lower calorific value of the fuel coupled with high steam demand.
- A pause was required at Birkhill to regain pressure (albeit a few minutes only).
- Water absorption into the fuel was a problem when the fuel was delivered and unloaded in a rainstorm.
- Fuel consumption was not measured, but the consensus of the team at the railway was that consumption was around double compared with coal. Fuel remaining in the bunker was not assessed, so perhaps consumption was not quite as high as double.

The tests on the Bure Valley and with most other small locomotives have shown some degree of acrid smoke (varying from test to test). Exceptions have been *Owl* on the Kirklees (when fitted with a slightly smaller blast pipe), *Lytham St Annes* on the Stainmore (undemanding operating conditions), the *VIC32* and a Lancashire boiler (radically different boiler and chimney arrangements) – and now *No.1* on the Bo'ness.'

The crew's perception that fuel consumption had doubled is consistent with what we found at the BVR in our 2023 tests, though there were clearly more favourable combustion conditions on the larger grate of a standard gauge locomotive.

Phoenix Oils are carrying on with development to improve combustion conditions by varying the size of the blocks. While rapemeal cake has found a use in marine and stationary boiler applications the challenge remains to optimise it for use in locomotive boilers with their rapidly changing loads and combustion conditions, which is not something not generally found in marine and stationary boilers.

Stapleford Miniature Railway Trials

We have no alternative fuel trials planned at the BVR this year, though we are planning some trials at the Stapleford Miniature Railway in June. This is of a fuel that Richard Coleby is developing that is a blend of two agricultural waste products. Trials last year on a 7 ¼ gauge engine were encouraging and the next step up is trials at the SMR. It is just about possible to produce sufficient fuel for a trial at the SMR, in the 'home laboratory'.

MANUFACTURED SOLID FUELS - A PROGRESS REPORT

Ian Gaylor

Summary of current situation

Since the start of the coal crisis the heritage railway industry has been seeking a replacement for natural coal which provides equivalent combustion performance, a high renewable content to meet environmental concerns, similar energy density, acceptable emissions and good storage/handling properties. Good progress has been made over the last 3 years but we are still some considerable distance from achieving our goal.

The reasons our modest progress include the continued short-term availability of coal which has reduced the immediate imperative to solve the problem, a reluctance to address non-renewable CO_2 emissions and a lack of funding to enable scientific examination of the outstanding key technical issues relating to Manufactured Solid Fuels, (MSF), in order to identify better solutions and manufacturing processes.

However, it seems likely that we have a relatively short time window of maybe 5 years in which to move to a sustainable solution. This will be driven by the continuity of coal supply which is likely to become more problematic as demand in the UK reduces whilst public perception will gradually make the burning of natural coal socially unacceptable regardless of the UK government exemption and our relatively small annual consumption. In addition, we should not loose sight of the fact that many of the current MSF's use coal, in the form of anthracite, as a key or even main ingredient which means that they are far from future proofed.

Test programme

Many thanks to all who assisted with the trials and in particular the Bure Valley Railway and their staff, the Fuel Suppliers and the members of the ASTT.

The results of the recent sets of trials in April and November last year at the Bure Valley Railway used the same standardised test methods, locomotive, load and driver and are summarised below whilst the full report can found at (insert ASTT website address): -

Fuels tested

The suppliers and trade names of the fuels which were tested are as follows:-

Eire based, Arigna Fuels *Harvest Flame* is a 100% renewable fuel, made from torrified olive stones which are agricultural residues from the production of olive oil and is imported from Mediterranean countries. 'Harvest Flame' is commercially available in Eire.

Phoenix Oils *Green Dragon* is a 100% renewable fuel made from rapemeal cake which is the waste product from the production of rapeseed oil using domestically grown rapeseed. This fuel is still under development and is only available for trials.

CPL's *Wildfire* contains up to 30% renewables in the form of crushed olive stones.

CPL's *Heritage Smokeless Steam Coal* uses anthracite as the base ingredient which is a fossil fuel.

Oxbow's *Newheat* is fossil fuel based and uses between 60% and 65% petroleum coke as its main ingredient with the balance predominately anthracite.

Oxbow's *Newheat Low Sulphur* is a low sulphur variant produced as a trial batch following concerns about the high sulphur content of *Newheat*.

Test Measures

The tests used quantative and qualitative measures to assess the fuels under 'Demanding Work' conditions with maximum combustion rates exceeding 80lbs/sq ft grate/hr**:-**

Quantative measures were of the weight of fuel used and volume of water used, and the weight of char in the smokebox at the end of the run. To compare runs on a similar basis all the weights are expressed as grm per litre of water evaporated.

The qualitative measures use a standard questionnaire that covers number of attributes such as steaming, impression of fuel used, smoke, etc and the driver is asked to rate them on a 1 to 5 basis with 5 being good and 1 as poor.

In November 2021 Ffos-y-fran bituminous coal was tested under the same conditions as the current trials, quantative and qualitative data was collected and is used as the baseline for comparing the performance of all fuels.

Trial results

The key trial results were as follows: -

Steaming performance

With *Ffos-y-fran, Newheat, Harvest Flame* and *Green Dragon - Small* the locomotive steamed freely.

With *Newheat Low Sulphur, Green Dragon Large* and *Heritage Smokeless Steam Coal - Small* the locomotive steamed satisfactorily.

But with *Wildfire and Heritage Smokeless Steam Coal - Large* steaming was only adequate.

Fuel consumption

All the fuels tested showed an increase in consumption compared to Ffos-y-fran: -

Arigna Fuels – Harvest Flame – 113.8% increase. Based on a one-way journey of 9 miles rather than a return journey of 18 miles.

Phoenix Oils – Green Dragon

Small blocks - 107.5% increase

Large blocks - 96.8% increase. Based on a one-way journey of 9 miles rather than a return journey of 18 miles.

CPL - Wildfire – 39.9% increase.

CPL – New Heritage Smokeless Steam Coal

Small briquettes - 18.4% increase

Large briquettes - 29.9% increase.

Oxbow - Newheat - 18.4% increase

Oxbow - Newheat Low Sulphur - 34.7% increase.

Unburnt Fuel Losses

Except for Green Dragon, the sample fuels have greater unburnt fuel losses which can be observed from the increased quantity of smokebox char.

Clinker, Ash and Char

The sample fuels have a lower quantity of ash and char in the ashpan than the comparative *Ffos-y-fran* coal baseline test.

Newheat, Heritage Smokeless Steam Coal - Large and *Green Dragon - Small* produced around the same amount of clinker as *Ffos-y-fran coal.*

Newheat - Low Sulphur, Harvest Flame and *Wildfire* produced slightly more clinker than *Ffos-y-fran coal.*

Ignition Time

Most sample fuels had a comparative ignition time to *Ffos-y-fran* coal.

Newheat Low Sulphur, Wildfire and Heritage Smokeless Steam Coal - Small were slightly slower

Heritage Smokeless Steam Coal - Large was the slowest of the fuels tested

Smoke colour

Newheat, Newheat Low Sulphur and *Wildfire* had a comparative smoke colour to that of *Ffos-y-fran* coal.

Heritage Smokeless Steam Coal Small and Harvest Flame produced slightly more smoke although this was controllable. Note: When *Heritage Steam Coal Small* was tested over a single journey in April there was less smoke than during the November trials. The reason for this is not known but might be possibly due to variations in raw ingredients.

Heritage Smokeless Steam Coal Large produced more smoke

Green Dragon Small and Large smoke proved difficult to control when coasting or in station environments.

Smoke odour and emissions

Wildfire was similar to Ffos-y-fran

Heritage Smokeless Steam Coal Small and Large, Newheat and *Green Dragon Small* had a noticeable smell when coasting with low draught. Note: When *Heritage Steam Coal Small* was tested over a single journey in April there was less odour than during the November trials. The reason for this is not known but might be possibly due to variations in raw ingredients.

Newheat Low Sulphur, Harvest Flame and Green Dragon Large had distinct odours which were not very pleasant especially when coasting with low draught.

Green Dragon Small and Large had problems with combustion by-products and in a locomotive with a small firebox, Hydrogen Cyanide (HCN) can be emitted in some operating conditions, at levels that could exceed Health and Safety Executive Time-weighted Average limits. Evidence from subsequent tests by Phoenix Oil on a standard gauge engine leads them to believe that this issue may not apply for locomotives with a larger firebox.

Fuel storage

The long-term effects of fuel storage including water absorption, leaching etc. did not form part of the trials however *Green Dragon* is prone to water absorption even with short term exposure to rain on the locomotive resulting in a loss of structural integrity or spoilage. In addition, it is potentially attractive to vermin as a food. Thus, in the present form it cannot be stored unprotected and further development is required for commercial use.

Fuel pricing

Fuel prices as of April 2023 ex-works were all typically £400-£500/tonne but will vary depending on: -

Fluctuating costs of the raw materials, manufacturing costs, capital costs, etc.

The state of the market, competitive conditions and environmental credentials.

The quantity ordered, the supply form i.e. whether loose or bagged and transport cost from the production plant or stockist.

Fire temperature

Typical maximum fire temperatures were around 1200 deg.C based on photographic evidence of fire colour.

Chlorine and Sulphur content

Sulphur and chlorine in fuels can cause boiler corrosion by forming acids that deposit on the boiler parts. The acids are sulphuric and hydrochloric, and they affect the firebox, firetubes, superheater, smokebox and chimney surfaces. The corrosion happens when the boiler parts are cooler than the flue gas dew point. Boilers that are not used continuously are more likely to have this problem.

Chlorine

Trials in 2022 with Manufactured Solid Fuels that contained between 0.18% and 0.28% chlorine rapidly led to harmful deposits

in fireboxes. The coals used in the Heritage sector vary between 0.02% and 0.08% chlorine and when MSF with low chlorine contents of .02% and .03% were trialled no further harmful effects were observed.

Sulphur

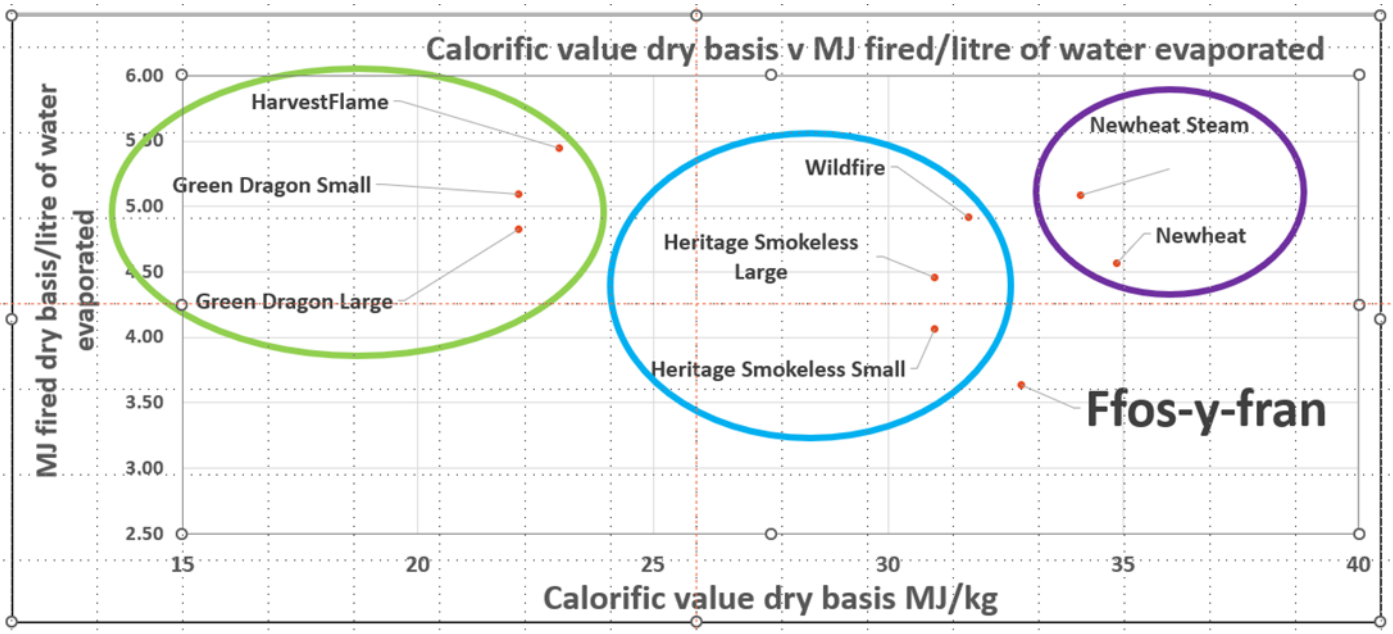
Typical coals used in the Heritage sector during 2022 varied between 0.23 % and 0.92% sulphur.

The National Railway Museum has historical records of the 'proximate analyses' of coals used by British Railways from 1948 to 1961. Over a range of 25 coals reviewed, the average sulphur content was .94%. Nineteen of the 25 coals had less than 1% sulphur. Of the six coals above 1% sulphur, five coals had sulphur between 1% and 1.29% and the sixth, as an outlier had a sulphur content of 1.72%.

The sulphur content of **Oxbow - Newheat** is higher than the sulphur contents of fuels traditionally used by British Railways and users should recognise a risk of accelerated boiler corrosion.

As a result of these concerns, Oxbow produced a small batch of **Newheat – Low Sulphur** fuel with a reduced sulphur content of between 1% and 1.2%, for test in the November trials.

Although we have learned a lot in how the fuels behave, the trials process has now plateaued as we have tested three families of fuel – 100% renewables – HarvestFlame and Green Dragon made from agricultural residues , anthracite-based fuels in the form of ovoids from CPL – Wildfire and Heritage Smokeless, and anthracite and petcoke based fuels in the form of ovoids from Oxbow - Newheat. Any further testing of fuels that are currently available are expected to fall into the groupings shown on the chart. Although we have not tested wood pellets, based on their physical properties of calorific value and density we would reasonably expect them to perform worse than Green Dragon or HarvestFlame.



This shows that even with a fuel that exceeds the calorific value of coal, the fuel economy is worse than lump coal by proportions greater than the differences in calorific values, suggesting that losses are occurring greater than those with coal.

This may be down to unburnt fuel losses, but we are constrained by the lack of funds needed to provide facilities and instrumentation to test this theory, increase our knowledge and enable creation of second-generation MSF which more closely resembles natural coal whilst increasing environmental sustainability.

Future work

The need for a future technical development programme as outlined at the start of the article is key to success. We believe solutions are possible but if we try to move forward without data to guide us, we will be indulging in alchemy rather than science and our chances of success will be accordingly low.

SUPER REPLICA ADVOCACY

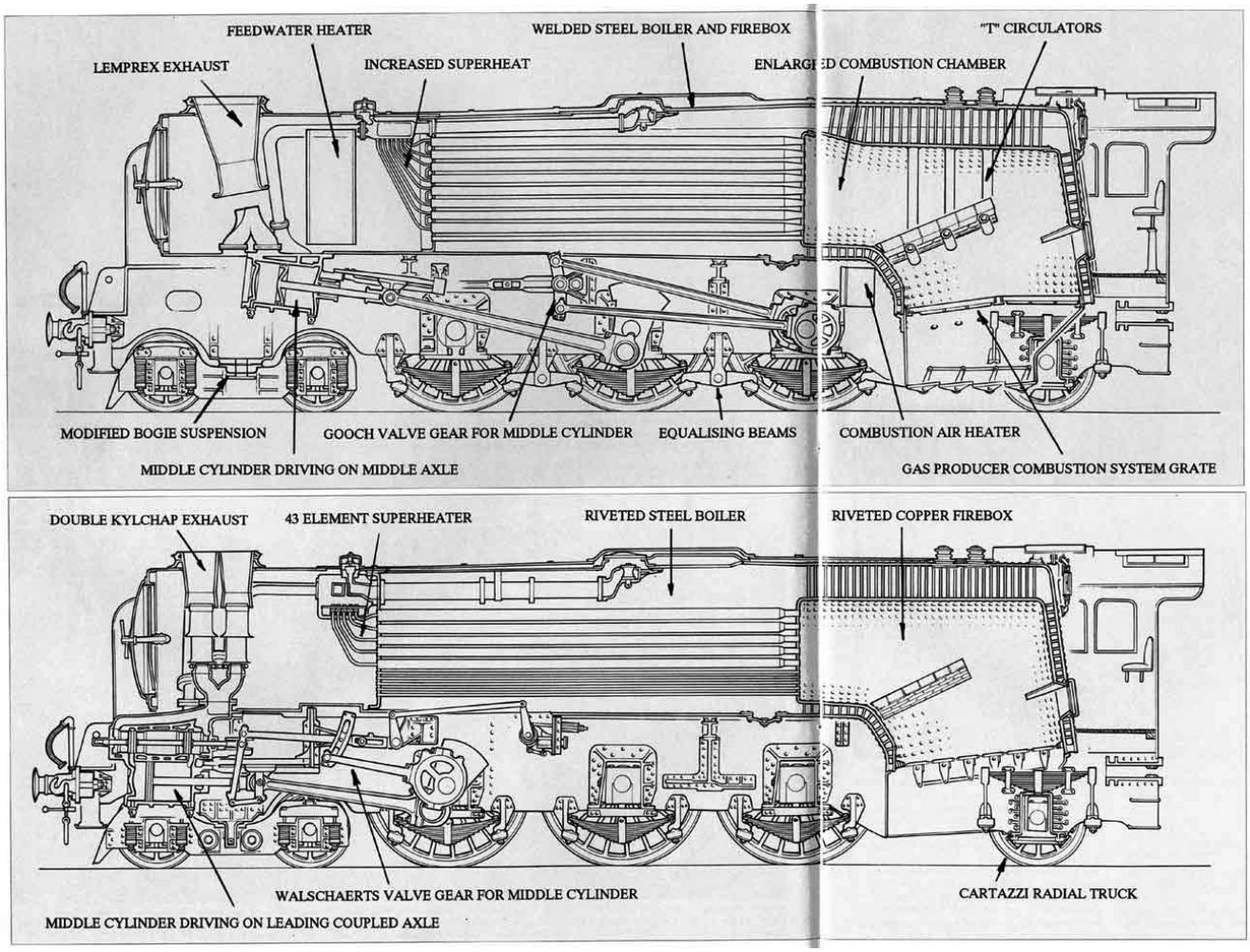
Austin Unruh

(https://steampunksavant.com)

The vast majority in the steam enthusiast space have little to no interest in actually advancing steam. They seem to want to remain in the 1950s. Over the past year I've spoken with plenty of enthusiasts young and old. Barely any of them understand or truly appreciate the work undertaken by Porta and his students. The ASTT is one of the few organizations in the world that is advancing steam traction, and yet we have few members and are not acquiring much funding for a new miniature design. Meanwhile, the T1 Trust and all of the others across the UK are raking in funds at a much faster pace for much more expensive full sized first generation designs.

Citing these reasons, one of my colleagues has insisted that crowd funding advanced steam projects is a recipe for failure, but with all due respect I strongly disagree. There are thousands of steam enthusiasts in the UK and US who are willing to collectively invest millions into new build projects which are replicas of old designs. One of the fatal preventable flaws of the 5AT project was adopting a streamlining style that was contentious. Those who are most knowledgeable about steam don't care about the outside appearance of the 5AT, unfortunately the public does. If only the outside appearance was changed to be more universally appealing it would have netted the project much more financial support. When appealing to the public for support you have to work within the public's aesthetic preferences. Ignoring this truth is a true recipe for failure.

What has potential for more financial support than a wholly new design is a super replica. A new build with the outside appearance of an old design which has been significantly upgraded in every way it can be without effecting its outside appearance a noticeable degree. This is what was proposed by Porta to the A1 trust.



The A1 Trust did not pursue this proposal because from the outset their intention was historical accuracy of technical function. The proposed upgrades were radical, adding additional risks and logistical challenges the trust did not want to take. For Britain the best design for a super replica treatment was a Peppercorn A1, but that ship has sailed. For the US the ideal design for such a super replica treatment is the NYC Dreyfus Hudson.

What is required to garner the highest possible interest in advanced steam is a truly eye catching project that is otherwise as advanced as it can be. In America, a significantly upgraded Dreyfus Hudson is one of the only options that strikes an ideal mix of radical improvement and wide appeal. It shares a streamlining style that is in some ways similar to the 5AT. Unlike the 5AT the look of the Dreyfus Hudson is not contentious at all. It is beloved among American and British enthusiasts alike which will make crowd sourcing feasible. The aesthetic fits the theme of an advanced steam loco. The American enthusiast space is not as concerned about technical replicas as the British enthusiast space. There have already been discussions of a Hudson new build in the American steam fraternity. For these reasons, I believe garnering public support for this Super Hudson will be easier than for any other advanced steam project. Just as the A1 trust was able to crowd source multiple new builds once they acquired the interest of the public so should the T1 trust.

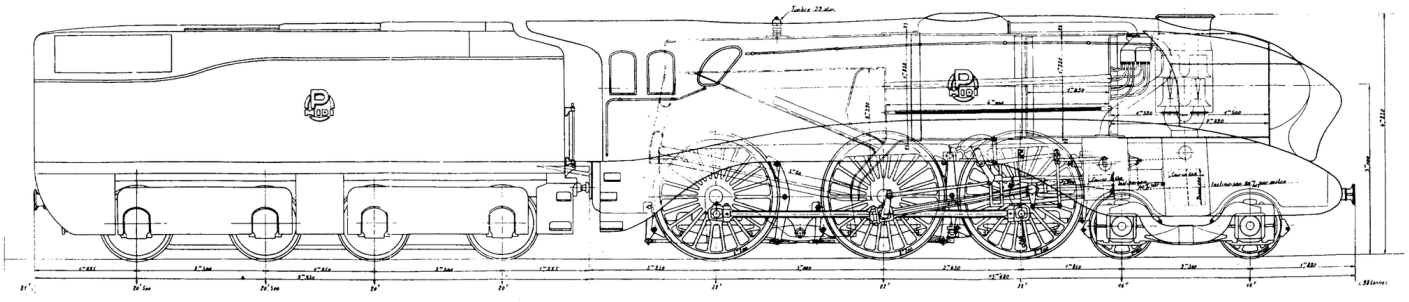
One of the public controversies which will arise is complaints about not adhering to historical accuracy of function. My recommended response to this is, 'We already have plenty of historically accurate operational locos. The next step to securing steam's future is a new design with a perfectly fitting nostalgic appearance that shows off what steam is capable of even in a less than idea form.'

An objection that may be raised by steam engineers is that compromising in any capacity is unacceptable. The wheel configuration of the Dreyfus Hudson constrains how much it can be improved. In engineering you iterate on designs to make gradual and stable improvement. In business you iterate on product design to gradually sway the interest of the public. In either domain, innovating too quickly without concern for letting the market get acclimated to new ideas will alienate the financiers. Introducing advanced steam to the world should be treated no differently. Start with a somewhat compromised design that demonstrates an undeniable improvement to anything that came before, then carefully strip away the compromises of each following design.

I expect concerns about the slippery slope to be brought up. 'If we accept this compromise who's to say we won't eventually end up with the same problems that befell the ACE 3000?' To this I say that the ACE 3000 was a very different project that had

different influences motivating its compromised design. Due to the demands of the commercial market, the designers, excluding Porta, were motivated to make it as operationally close to a diesel as possible. This naturally led to feature creep warping the traditional Stephensonian locomotive into something with little of the aesthetic appeal and generating a combination of too many experimental features that could not possibly have been successful on the first prototype. ACE was subject to the slippery slope, but a radically improved replica will not be. It will be supported by enthusiasts who value the aesthetic features that make the steam locomotive so endearing. This will ensure resistance to the departures the ACE 3000 made from these aesthetics.

No matter how technically uncompromised, aesthetic appeal is still a compromise that must be negotiated. Each successful design will yield more leverage to prioritize function over form. The ultimate goal should be building a design in the same vane as Chapelon's TGV. With the rule being to make tweaks to aesthetic design that only have a very marginal effect on performance and reliability. I'm not optimistic that the public can be swayed to support nearly uncompromised high speed designs, but one day we have to try.



In America there are logistical and bureaucratic hurtles that need to be overcome. The barriers to operating steam on the main line are greater than in the UK. We need to cross that bridge when we get to it and try to gain as much favor as possible with the relevant authorities in the mean time. The T1 will provide ample leverage for this purpose when finished. As the A1 catalyzed many high profile new builds in the UK, so will the T1 in the US.

Asides:

- In Australia the ideal class for a super replica treatment is a Victorian Railways S Class.
- In the States I wish to bring back the British practice of giving locos unique individual name plates. The name of the Super Hudson should be *ATLAS*.
- Sam Mackwell's efforts will help generate leverage for new projects.
- My personal second choice for a British super replica is the Thompson A1/1.

Please contact Chris Newman (info@advanced-steam.org) to request my contact information.