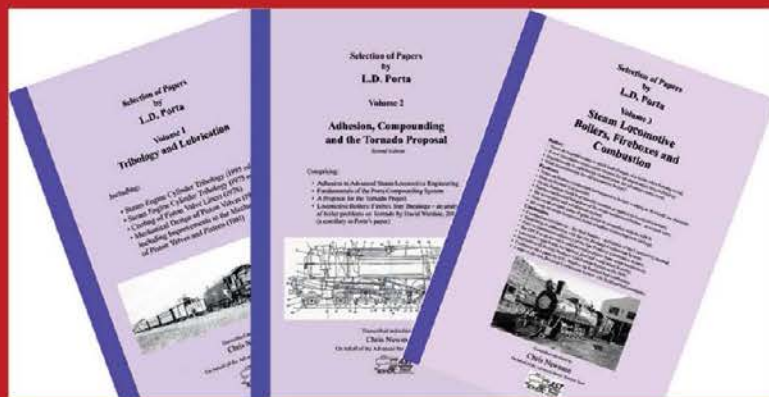




The Advanced Steam Traction Trust

2025 Prospectus

Engineering, Publishing, Community



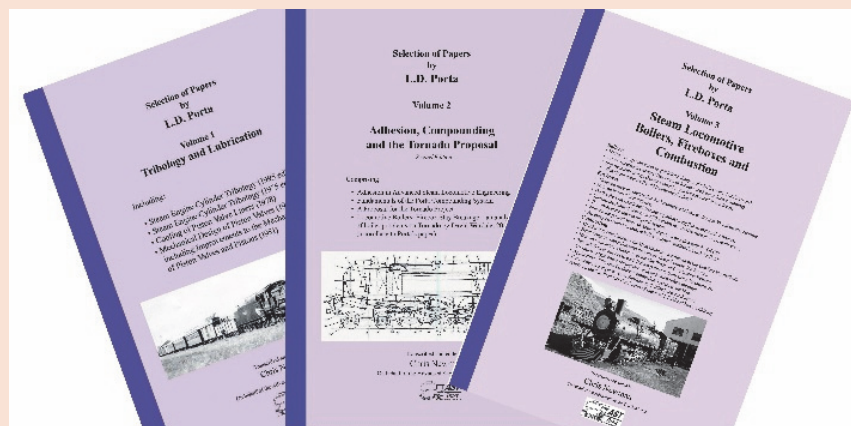


The Advanced Steam Traction Trust 2025 Prospectus

Locomotive Design and Manufacture



Specialist Book Publishing



Like-minded Community



And Much More

First published in 2025

Chris Newman, Edinburgh, Scotland,
on behalf of the Advanced Steam Traction Trust
www.advanced-steam.org.



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The Advanced Steam Traction Trust, Company No 09086052, Registered Charity No EW37304
Registered Address: 9 Warburton Close, Lymm. Cheshire WA13 9QE

Printed in Great Britain

The Advanced Steam Traction Trust, 2025

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ASTT in Brief

The Advanced Steam Traction Trust (ASTT) was founded in 2012 to carry the torch of “modern steam” engineering by continuing the work of Chapelon’s successor, Livio Dante Porta and of his disciple David Wardale, aimed at improving rather than simply preserving steam traction, and thereby prolonging its interest and appeal for the enjoyment of future generations.

ASTT has over 100 members from all over the world, a majority from the UK. A significant proportion are professional engineers. Following the practice of the old Institution of Locomotive Engineers (disbanded in 1969), ASTT holds an annual conference at various railway centres, both past and present.

ASTT is registered as a not-for-profit company, however it has a subsidiary company called Advanced Steam Traction Services Ltd (ASTS) through which its commercial activities are run. It is planned to register ASTT with the Charities Commission.

Through ASTS, the trust publishes and markets books specialising in modern steam and occasionally takes on consulting work as and when manpower resources permit.

ASTT undertakes non-commercial projects such as the design and construction of its 1/5th scale 10¼” gauge demonstrator locomotive “Revolution”.

Aims

Steam locomotives attracted huge amounts of interest and affection in their heyday, and despite being out of the public eye for nearly 60 years, they continue to bring pleasure and interest, including to today's youngsters. ASTT seeks to preserve this ongoing enthusiasm for future generations by introducing to the custodians of today's heritage steam fleet technical improvements that could reduce operating and maintenance costs, increase reliability, and bring down carbon emissions through improved efficiency, all without significantly affecting the external appearance of their locomotives. Many of these improvements derive from the recommendations put forward in the late 20th century by the great Argentinian engineer Livio Dante Porta (see Appendix 1), but several have been developed in more recent times by ASTT's own engineering team.

Background

The Trust was formed in 2012 on the foundations of the 5AT Project. This project (see Appendix 3) aimed to design and build a high-performance 100+ mph 4-6-0 2-cylinder simple locomotive based on the footprint of the BR Standard Class 5. (The 5AT still features on our logo.)

The 5AT was conceived by British engineer, David Wardale, who famously rebuilt two locomotives in South Africa in the late 1970s and early 1980s, the first being a Class 19D 4-8-2 that was lightly modified with a Lempor exhaust and a GPCS combustion system, both inventions of **Livio Dante Porta** (mentioned above).

Wardale's second and more advanced rebuild was of a 25NC 4-8-4 which he unveiled in 1981 painted bright red, after which it quickly became known as "The Red Devil". It was the remarkable performance of this locomotive – giving a 43% increase in drawbar power output and up to 150% increase in drawbar thermal efficiency – that confirmed the validity of Porta's advanced steam theories, and which inspired the launch of the 5AT Project in 2002.

The Advanced Steam Traction Trust (ASTT) continues to pursue Porta's ideas through the publication of his technical papers and through the development of a 1/5th scale demonstrator loco, "*Revolution*", that features many of his principles.

ASTT carries many of the hallmarks of the old Institution of Locomotive Engineers in that it holds annual conferences at which members and others involved in steam locomotive design, construction, modification, testing and preserving, get together to give and listen to presentations on a wide range of technical subjects within a like-minded community.

Like many charitable organisations, ASTT has a commercial subsidiary called Advanced Steam Traction Services Ltd (ASTS) which undertakes commercial activities on behalf of ASTT, including sales of books, and conference admissions.

ASTT Management Committee



Chairman: John Hind, BSc, C.Eng. M.I.Mech.E.

John has been chairman of ASTT since its formation. John is a retired mechanical engineer with experience in project management and project planning, with over 20 years of experience in the Power Generation and Automobile industries.

John wrote two articles for Steam Railway Magazine titled "Do You Want New Steam?" (Issues 288/9 in 2003).

John was closely involved with the 5AT Project from 2006 until its replacement by ASTT in 2012. While chairing the 5AT Engineering Working Party, he undertook detailed estimates of costs and timescale for designing and building the 5AT. The techniques and methods that he established enables ASTT teams to estimate the costs for new-build steam locos. John lives near Manchester in England.

John is responsible for quality and mainline certification for the new-build Clan Class "Hengist". In addition, he volunteers in the workshops of the East Lancashire Railway.

Secretary: Hendrik Kaptein Professor of Law



Hendrik teaches and publishes on jurisprudence, criminal law, legal ethics and argumentation & logic. He also serves as a board member & treasurer in non-profit organisations, and is active as a Red Cross volunteer. He is also a chief bell ringer of the Old Church in Amsterdam. He has enjoyed a lifetime interest in mechanical engineering, and publishes on steam locomotive engineering, inspired by his experience as an amateur steam loco driver in Poland and Germany. Hendrik lives in Amsterdam.



Lead Engineer: Jamie Keyte BSc Mech. Eng.

Jamie has been with ASTT (and the 5AT Project) since the early 2000s. Highly skilled in CAD, Jamie is also a remarkably innovative engineer who has schemed out a number of novel proposals for the development of steam traction, and has spearheaded the design, manufacture and assembly of the rolling chassis and tender for "Revolution", ASTT's demonstrator loco. Jamie is also a spreadsheet expert and has developed a sophisticated Excel spreadsheet that he uses to predict the performance of steam locomotives.

Jamie is part-owner of Keyte Smith Ltd in Kirkby-in-Ashfield, Nottinghamshire, which specialises in compressed air equipment including for rail usage.

In addition to ASTT's Revolution project, Jamie and his company are heavily involved with the LNWR George the Fifth Steam Locomotive Trust.



Lead Designer: Richard Coleby

Richard served an engineering apprenticeship at Derby Loco Works in the last years of steam from which he gained an in-depth knowledge of the repair and maintenance of steam locos.

After leaving BR in 1969, he set up in partnership to build large scale miniature steam locomotives and was responsible for the design and building of several engines including the famous Stapleford Nickel Plate Berkshire (at the time the most powerful

1/5th scale locomotive in the world) and a 59 class Garrat now residing at the NRM.

Now retired, Richard has been a member of the 5AT Project and ASTT since the early 2000s and has worked on a number of projects including 3D arrangement and detailed drawings for parts of the 5AT. More recently he has been heavily involved in ASTT's *Revolution* project for which he has designed the cylinders, valves, smokebox, superheater and steam circuit, featuring a number of novel ideas. He has also led a number of experiments in the testing coal substitutes.



Treasurer, Bookkeeper, Membership Secretary, Book Publisher and Webmaster: Chris Newman BSc. Eng.

Chris is a retired civil engineer, born and educated in the UK. After emigrating to Australia in 1970, he worked for 20 years in the grain storage, handling and transportation industry in Queensland. Moving to China in 1991, he worked as a consulting engineer on large grain infrastructure projects, subsequently running his own small engineering business in that country. He retired to Edinburgh in 2013.

Chris was one of the original team that initiated the 5AT project in 2001 after reading Wardale's book "The Red Devil and Other Tales from the Age of Steam". Chris was responsible for setting up the original 5AT website and for developing ASTT's website..



Committee Member & Trustee: Alex Powell M Eng.

Alex joined the ASTT as a student member in February 2016.

He graduated with a M.Eng from Newcastle University in 2022 whereafter he became a Full Member of ASTT and was elected to membership of the management committee..

In 2021, he presented a paper titled "Running on the Mainline with Clan Line" at ASTT's Conference in Loughborough.

Alex is leading the boiler design for the *Revolution* project.

ASTT Membership

Membership of ASTT is open to all. Professional engineers and technicians are strongly represented amongst the membership, but so too are those whose interests are more general.

There are three classes of membership:

- Full Membership (costing £20 p.a.*)
- Associate Membership (costing £10 p.a.*)
- Student Membership (free to full-time students and apprentices).

** Membership fees will rise by 25% in 2026.*

Full membership is by invitation and offers voting rights at general meetings.

Privileges of Membership

ASTT offers several privileges to its members:

- Access to members-only pages of the website.
- Access to ASTT archives including conference presentation files and video recordings.
- 20% discount on ASTT publications.
- Discounted fees to ASTT conferences.
- A triennial PDF Newsletter (or technical journal).
- Opportunities to learn about advances in steam traction technology and the science and engineering that underlie the technology.
- Opportunities to contribute to ASTT's efforts to maintain steam as an efficient, economic and reliable form of traction for both main line and heritage traction.
- Opportunities to meet and get to know like-minded people, and to learn from experts in the field.

ASTT is actively seeking younger members who can one day take over the endeavours of its older members.

Membership Numbers

ASTT had a membership of around 125 at the end of 2024, with a growth rate of around 10% per annum. Members come from all over the world, with some 63% from the UK; 15% from Europe; 10% from North America; 9% from Australia & NZ, and 4% spread across Asia, Africa and South America.

Members' ages range from 19 to 94, with an average age of 56.

Currently there are 11 student members.

ASTT Conferences



Attendees at ASTT's 2019 conference in Crewe pose in front of No. 70000 "Britannia"

Following the practice of the old Institution of Locomotive Engineers, ASTT organises an annual conference at various railway centres around the country.

Conferences are usually held over a 2-day weekend in early October, and feature eight or nine presentations, a conference dinner, and a visit to a local workshop or place of railway interest.

Past conferences have been held as follows:

- 2016 – Haworth
- 2017 – Bury
- 2018 – Bury
- 2019 – Crewe
- 2020 – held outdoors due to Covid
- 2021 – Loughborough
- 2022 – Darlington
- 2023 – Swindon
- 2024 – Derby

.Our 2025 conference will be held in the Hopetown Museum in Darlington over the weekend of 4th - 5th October and will form part of the Rail 200 celebration in that city. All are welcome to attend.

Admission to ASTT conferences is charged on an "at-cost" basis which usually amounts to around £50 per day to cover room hire, lunches and refreshments, plus around £30 for a conference dinner. Attendance numbers vary from around 25 to over 50.

Presentations cover a wide range of topics. Speakers are often members of ASTT, but non-member specialists are frequently invited to speak on subjects of their expertise.

Other Meetings

ASTT holds an AGM on the first Saturday of March each year. Since 2021, these meetings have been held over Zoom. They are usually followed by a talk (or two) if speakers can be found. In recent years these talks have focussed on progress with the Revolution Project.

Zoom is also used for other meeting as and when required, but these are usually confined to subcommittees that have been formed to handle specific tasks or projects.

Titles Published by ASTT

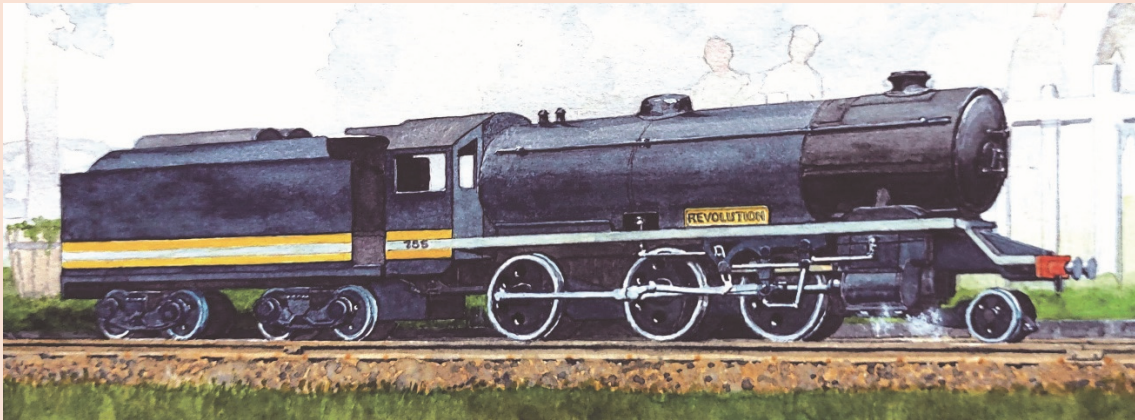
| | Year | Author | Title | Pages | RRP* |
|---|------|---|---|-------------------|-------------------------|
|  | 2015 | David Wardale | The 5AT Fundamental Design Calculations | 556 (b&w) | £49.00 |
|  | 2016 | Alan Fozard and others | The 5AT Feasibility Study edited | 230 (colour) | £35.00 |
|  | 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 by L.D. Porta - Vol 1 - Tribology and Lubrication | 250 (b&w) | £25.00 |
|  | 2019 | L.D. Porta transcribed and edited by Chris Newman | Selection of Papers by L.D. Porta - Vol 2 - Adhesion, Compounding and the Tornado Proposal | 256 (b&w) | £25.00 |
|  | 2021 | L.D. Porta transcribed and edited by Chris Newman | Selection of Papers by L.D. Porta - Vol 3 - Steam Locomotive Boilers, Fireboxes and Combustion | 290 (b&w) | £25.00 |
|  | 2024 | L.D. Porta and others Compiled by Martyn Bane | Selection of Papers by L.D. Porta - Vol 4 - Locomotive Boiler Water – Treatment, Circulation and Preheating | 513 (colour) | £40.00 (£48 hard cover) |
|  | 2025 | L.D. Porta transcribed and edited by Chris Newman | Selection of Papers by L.D. Porta - Vol 5 - Exhaust Systems and Other Aspects of Loco Design, Performance and Operation | 340 (some colour) | £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) | £25.00 |
|  | 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) | £27.00 |
|  | 2023 | David Wardale | Reminiscences of a Trainspotter | 67 (b&w) | £16.00 |

The RRP's (recommended retail prices) shown do not include postage. Paid-up members of ASTT are offered a 20% discount on these prices.

These and other books can be purchased through ASTT's website at <http://advanced-steam.org/books-for-sale/>.

ASTT Studies and Projects

The “Revolution” Project

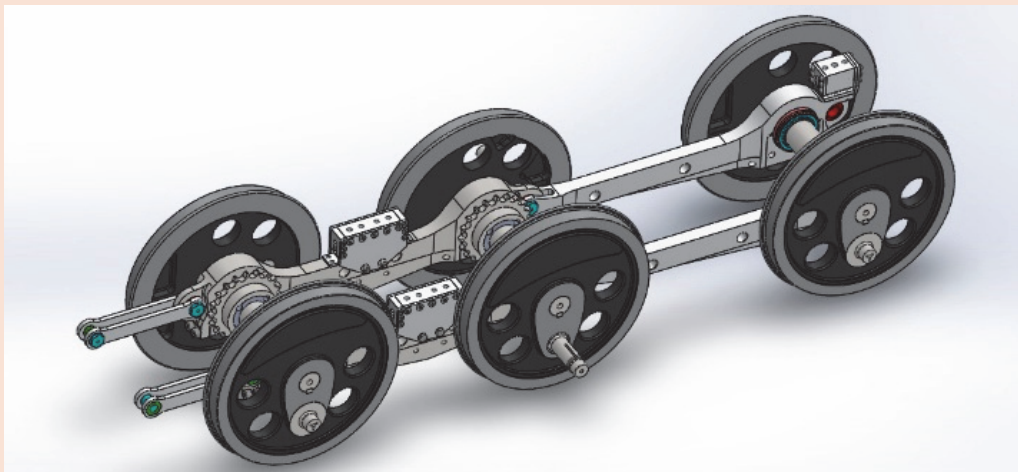


“Revolution” is a 1/5th scale 2-6-0 “demonstrator” locomotive that is currently (2025) under construction. The brainchild of ASTT member, Jamie Keyte, with design contributions by Richard Coleby (cylinders, valve gear and motion) and Alex Powell (boiler), it features several Porta-inspired innovations including:

- Interchangeable exhausts to allow comparisons between Lempor and other types.
- Kylala exhaust splitter.
- Exhaust-steam feed to underside of grate.
- Large steam chests and passages.
- Multiple narrow valve and piston rings.

Some of its other novelties include:

- Steam-jacketed cylinders (no condensation)
- Rocker drive to outside-admission valves (similar to Bulleid’s but outside-driven).
- Roller bearing throughout (axles and motion).
- Precise (and fixed) horizontal spacing of axles (coupling rod stresses controlled)
- Elastomeric springing of frame and axles (no more broken springs).
- Traction forces directly from axles to drawbar (no more frame cracks).
- Pivoted spring beams housing roller bearings.
- Chain drive connection to static dynamometer (for measuring performance).
- Disc brakes



Background to the Revolution Project

As mentioned in an earlier section, ASTT came about following the demise of the 5AT Project and from David Wardale's recommendation that the 5AT Group members would be better to focus their activities on promoting a smaller simpler locomotive that would offer heritage railways good level of performance, low fuel consumption, low maintenance costs and, above all, high reliability.

Given the difficulties experienced in raising funds for the 5AT Project, a plan to build a 1/5th scale miniature “demonstrator” loco was formulated by Jamie Keyte, based on the idea that it could be used as a test-bed for new ideas and to measure their effects on performance. Ultimately, it could be used to demonstrate these ideas to the industry with a view to commercialising them. A 2-6-0 was settled upon for its simplicity and because it combined a high level of adhesion pony truck guidance through curves. It was coincidental that Wardale had suggested that a LMS Ivatt 2-6-0 would make a good starting point for developing a commercial modern steam machine.

Budget and costs

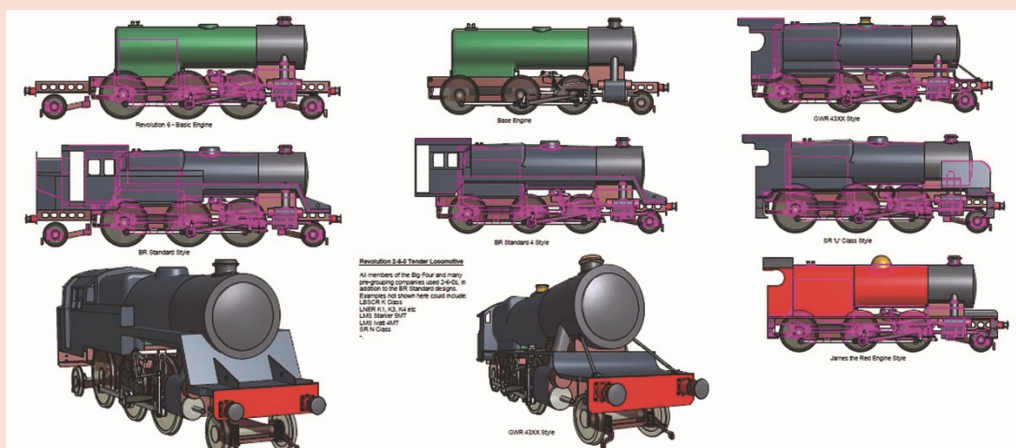
The original 2020 budget for the locomotive came to £99,300 including a 12% contingency. Since then, several line-items have changed in cost but the overall budget remains the same – with the contingency reduced to 9%. As at May 2025, some 40% of the budget had been raised and spent.

Progress to Date

In 2023 the rolling chassis was completed and successfully test-run over several circuits of the 10¼" gauge Stapleford Miniature Railway. Since then, the motion, cylinders, valve-gear and tender have been largely completed, leaving the boiler, firebox, superheater and steam pipework as the main challenges ahead.

Ultimate Aims

The ultimate aim of the project would be to develop a full-scale design based on what is learned from the project and to find an investor to set up a company to manufacture a standardised set of parts that could be purchased and assembled by heritage railways, to build robust simple standardised locomotives, choosing from a range of outlines and colours to suit specific needs, such as illustrated below..



Electronic Performance Testing of Locomotives

The first project undertaken by the AST Group was the design, manufacture and installation of a Lempor exhaust fitted to KVWR's S160 No 5820. The design followed the principles defined in the Fundamental Design Calculations for the 5AT but incorporated a novel annular vacuum ejector exhaust that exits through an outer liner to the chimney rather than directly into the smokebox.



KVWR S160 No 5820 and its ASTT's Lempor exhaust.

Components were manufactured under the supervision of trust members, and installation was undertaken during an overhaul of the locomotive. However, its high utilization before its overhaul rendered it impossible to conduct performance testing before fitting the Lempor which precluded "before and after" comparisons. The locomotive had a reputation as an indifferent steamer which was why the Trust was asked to recommend improvements. In the subjective opinions of crew members, the new exhaust considerably enhanced the locomotive's performance both in steaming capacity and power output – so much so that there was a suspicion that the improvement might have been too great and that some reduction in draught might have had a beneficial effect on firebed stability.

At around the same time (2015), ASTT member and retired RAF electronics engineer, Mike Horne, took on the task of developing and testing of a sophisticated electronic system for assessing locomotive performance through measurement of:

- Piston position
- Steam pipe pressure and temperature
- Cylinder pressure front and rear to create indicator diagrams
- Blast pipe pressure and temperature
- Smokebox vacuum
- Firebox vacuum to measure pressure drop through the tube bank
- Arch vacuum to measure pressure drop over the arch
- Event marker to mark events during a test run

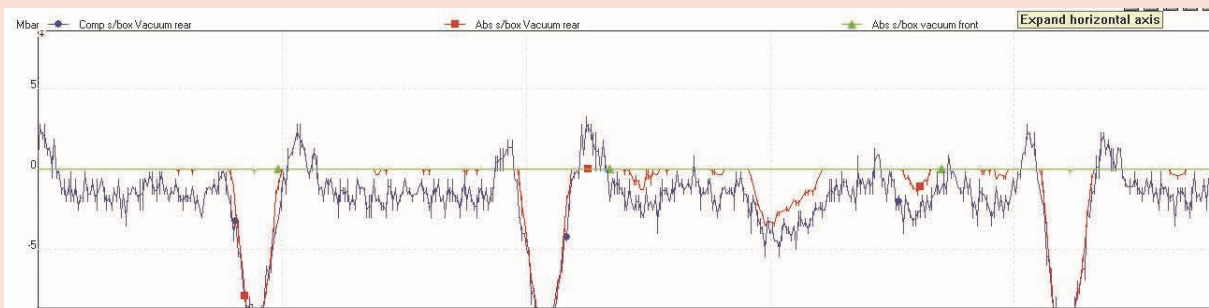
All these were to be sampled at a rate of 1 kHz (1000 measurements per second) – being the fastest practicably available at the time.



ASTT's monitoring equipment festooned over KLR's "Badger"

In 2016, an extensive programme of equipment testing was conducted over several days using the Kirklees Light Railway's 15" gauge 0-4-0ST "Badger" as guinea-pig. Many unexpected problems were experienced, each having to be understood and resolved, the end-result of which was a reliable and accurate measurement system that was superior to most, if not all, others in use.

In 2017, the opportunity arose to carry out comparative testing on the two S160s, Nos 6046 and 5197, operating on the Churnet Valley Railway. Measurements were limited to smokebox vacuum only, however these proved useful to one of the engines when a weak exhaust beat on one end of one cylinder was diagnosed to have been caused by a broken valve ring. The tests also confirmed that there was no measurable pressure difference between smokebox front and rear. They also established that smokebox vacuum can go momentarily positive during the exhaust cycle.



S160 smokebox pressure measurements show momentary positive pressures

In recent years, the equipment has been routinely used to measure locomotive performance during fuel trials on the Bure Valley Railway and elsewhere (see overleaf). ASTT offers its services to locomotive owners to conduct performance monitoring tests on their machines.

Seeking Alternatives to Coal - Trials on the Bure Valley and Other Railways

For several years, ASTT has been conducting research into alternative fuels, seeking a solid fuel alternative to coal that could be used by heritage railway without having to modify their locomotive fleet.

Initial trials were conducted in 2012 on the 10¼" gauge Stapleford Miniature Railway using small samples of various types, however none could be kept on the firebed for more than a few milliseconds. At the time, the Coalition for Sustainable Rail (based in Illinois, USA), was claiming success with torrefied wood samples made bespoke in small quantities at the local university, but samples of torrefied wood obtained from UK and European suppliers proved ineffective. Trials were also conducted using wood pellets with slightly greater success, but none proved successful.

Better prospects were offered by a Dutch product called "Subcoal" derived from "non-recyclable end-of-life waste streams, predominately a mix of paper and plastics, which typically end up in landfill", which was to be used in a power station in South Wales. On the positive side, this fuel was very low-cost and offered a significant reduction in CO₂ release. On the negative side, it had a low calorific value of 19 to 25 MJ/kg (average 22 MJ/kg) and had a content of up to 0.4% chlorine and 0.2% sulphur.

Tested on its own, it performed poorly (as anticipated), but when ground-up and mixed with melted vegetable wax and compressed into "cakes", it produced an impressively responsive fuel. However significant funding would be needed to conduct a feasibility study to assess its suitability as a reliable locomotive fuel.

ASTT has been working closely with the Heritage Railway Association, and several suppliers of manufactured solid fuels. In so doing, it has taken a leading role in conducting qualitative and quantitative tests on several railways including the 10¼" gauge Stapleford Miniature Railway in Leicestershire, the 15" gauge Bure Valley Railway in Norfolk and the standard gauge KWVR in West Yorkshire.

To date the tests have shown that none of the alternative fuels are a true substitute for coal because of their lower calorific values and energy densities.



Low-carbon fuel being tested by ASTT on Stapleford Miniature Railway.

Other Studies by ASTT



The Clan Project: In 2014, the Clan Project invited ASTT to undertake a study to assess what improvements might be made to the original Clan design, with particular emphasis on improving its power and therefore its haulage (and thus money-earning) capacity.

In response, ASTT produced a detailed feasibility proposal filling 94 pages with 29 specific recommendations aimed at boosting performance to “Britannia” levels and improving reliability. The principal recommendations were as follows:

- increase boiler pressure to 250 psi.
- a single chimney Lempor exhaust system (so as not to change loco’s outline).
- remove stress-raisers from the frames.
- fit multiple narrow lightweight rings to pistons and valves, including bronze ones.
- adopt direct oil injection rather than atomisation for piston and valve lubrication.
- steam-injection into primary air supply to eliminate clinking and improve grate life

In carrying out the study, ASTT used 21st century problem solving techniques and CAD technology to suggest causes of known issues, one such being poor piston ring wear (common to several BR Standard classes) being caused by the single sidebar arrangement, resulting in piston rings being renewed on average at 10,000 to 12,000 mile intervals, and exceptionally at 5,000 to 6,000 miles, as compared to other BR Standards that achieve 25,000 to 36,000 miles. An improved sidebar support arrangement has been recommended - a solution that could also be applied to the Duke of Gloucester, Britannias and BR5s.

George V Project: ASTT has had a loose association with the George V Project through its former Treasurer Paul Hibberd who was closely involved with it, and through Keyte Smith Ltd which has been involved in the manufacture of components for the project – Keyte Smith Ltd being part-owned by ASTT’s lead engineer, Jamie Keyte.

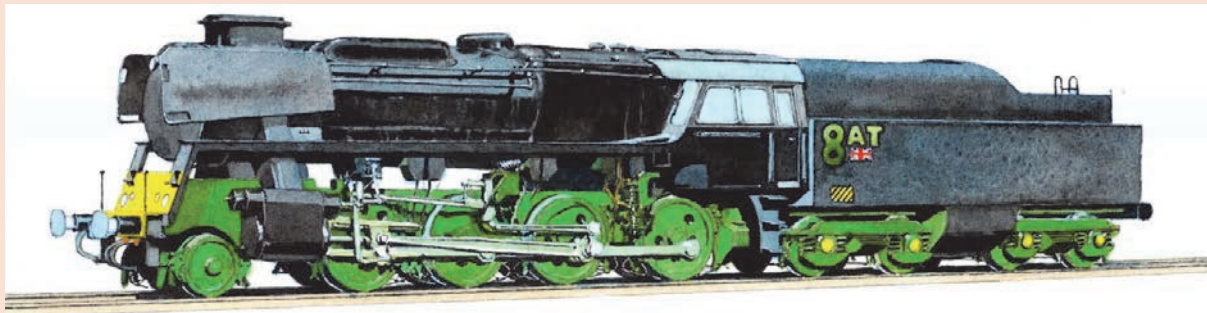


Splasher manufactured by Keyte Smith Ltd for LNWR 4-4-0 No 2013 “Prince George”

Indonesian Coal Railway Project Study: This study was undertaken between 2004 and 2008, long before ASTT was established. It is mentioned only because of its extraordinary nature and because it was carried out on behalf of the 5AT Project by ASTT's current treasurer.

The basic story was that in 2004, Chris Newman (who was then working in China) was approached by a senior engineer/planner working for a consortium that wanted to build a 100-mile railway to haul coal from a Sumatran coal mine to a planned export terminal on the coast of the island. Due to recent rises in local oil prices, the planners were interested in possibility of using steam traction to burn waste coal from the mining operation, and wondered if the 5AT could be adapted for the job.

The enquiry led to an investigation of the prospect of producing a small-wheeled 2-8-0 freight version of the 5AT (dubbed the 8AT), and since Chris was working at the time on the 5AT Feasibility Study, some of his deductions found their way into that study – in particular that it would be much simpler, quicker and cheaper to design a “modernised” version of the Stanier 8F than to start from scratch with a new design.



Artist Robin Barnes's impression of the 8AT as first envisaged.

As an interim measure, Chris suggested that the Indonesians consider importing a fleet of reconditioned Chinese QJ 2-10-2s to meet their planned timescale, QJs being readily available and quite cheap at the time.

Sadly, it took the project planners so long to raise capital that it was 2008 by the time they were ready to seek funding, by when QJs were no longer available from China and the Great Financial Crash was about to wash away any prospect of funding being made available.

It was, almost certainly the last realistic opportunity for the use of steam on a commercial (non-tourist) railway.

Mexican Study: A few years later (2011), the 5AT Project was approached to look into the prospects for steam traction on a new tourist rail system that was being planned in Mexico.

The proposed railway was to carry tourist from Cancún airport on the east coast to historic sites around Chechen-itza in the centre of the country via the coastal resort of Playa del Carmen. Freight lines were also proposed to connect the port at Progreso on the northern coast to the State capital, Merida, and on to Valladolid, to connect with the tourist line to provide a through route between the capital and Cancun.

The railway planners' interest in using steam traction was in the expectation that it would boost tourist numbers. Their interest in the 5AT was because they wanted to operate trains at relatively high speed.

Some months were spent preparing an outline route map from which track and infrastructure costs were estimated, while rolling stock quantities were estimated on predicted passenger numbers and freight tonnage. Schedules for both freight and passenger trains were estimated based on calculated locomotive performance and assumed track conditions (for both single and double track operations). From these, track mileage were calculated (420km), along with rolling stock requirements were calculated (20 locomotives; 176 carriages; 158 grain wagons and 91 container wagons) and project costs estimated.

After many man-months of effort by the 5AT group, the railway planners lost interest in the steam option after being wooed by electric train suppliers. Contact was lost with them in 2011 when their website began presenting images of ultra-modern high-speed electric trains. Notwithstanding, planning a project of this type and magnitude was of great value as a learning exercise for the group.

ASTT Website



The “Technical” section of ASTT’s website contains a large amount of information about steam technology in general, and “modern steam” in particular.

The website holds two sites in one in that the main site (<https://advanced-steam.org>) carries information specific to ASTT, while <https://advanced-steam.org/5at/> contains archived information about the 5AT Project from which ASTT evolved. Links to switch from one to the other can be found in the black menu bar below the logo.

Appendices

AP1 - Livio Dante Porta and his Legacy

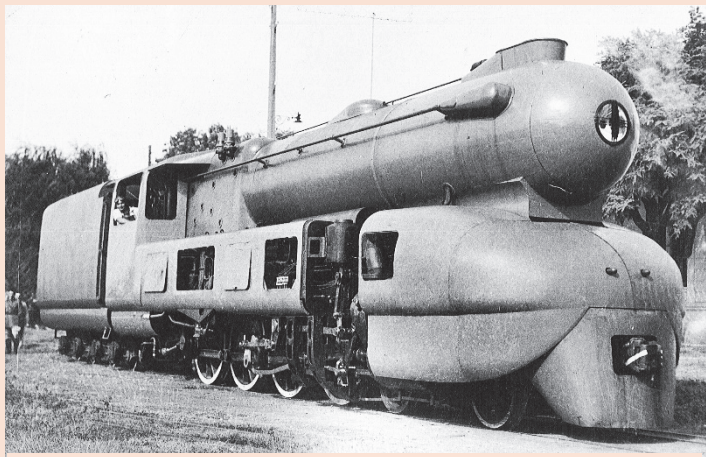


L.D. Porta c.1980

Livio Dante Porta, who died in 2003 at the age of 81, was an Argentinean engineer of immense ability and an evangelical belief in the future of steam traction. His motto was “never give up”, which he followed to his dying day.

Porta began his career in dramatic style by winning a contract to produce a “modernised” locomotive to be exploited by the Peron government to symbolise the advanced state of the country. Thus in 1947, just a year after graduating, Porta began work on the rebuilding of a nondescript metre-gauge Pacific which emerged in 1949 as a streamlined 4-cylinder 4-8-0 compound named “Argentina” that featured several novel features including Porta’s “gas producer combustion system” or GPCS which he used through his working life. On trial, it hauled a 1200-ton train at 65 mph and 2000 tons at 50 mph producing 1581 kW (2100 dbhp) at the drawbar, giving a power-to-weight ratio of 23.2 kW/tonne (31 dbhp/ton), equalling the best in the world - Chapelon’s SNCF 240P class (also of the 4-8-0 wheel-arrangement, but of much larger size).

Porta was a great admirer of Chapelon, but not to the extent of being uncritical of his work. Indeed, Porta could claim to have taken Chapelon’s advances to a new level. Like Chapelon, he produced a large number of new and innovative designs of which none was ever built, so, like Chapelon, his fame has to rest on the success of the locomotives that he rebuilt.

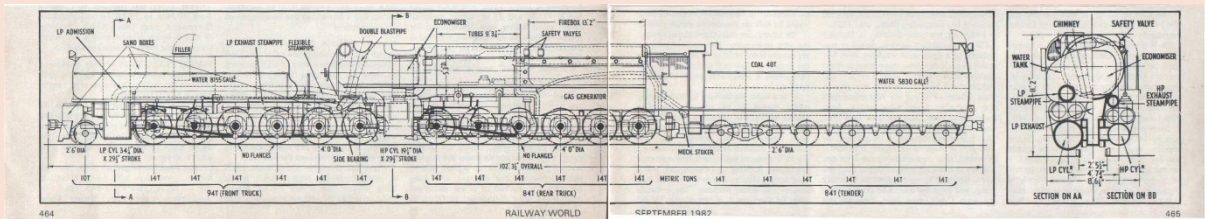


Porta’s 4-cyl Compound 4-8-0 “Argentina” c.1950

From 1957 to 1960, Porta was employed as General Manager of the 750mm gauge Río Turbio Railway that was built in the 1950s to haul coal from Río Turbio on the western border of Patagonia 160 miles over unballasted light-rail track to the port of Río Gallegos on the eastern coast. The railway was famous for its fleet of 20 diminutive Japanese-built 2-10-2s weighing no more than 48 tons, of which 38 tons was available for adhesion. Porta specified several improvements to the second batch of these locomotives which included increased boiler pressure, GPCS fireboxes, fitting of multiple narrow rings on valve heads and pistons, changes to the tubes and superheaters, and fitting of Kylpor exhausts. These changes not only boosted their drawbar power output by 25% but significantly improved their steam tightness and

reduced down-time and maintenance. The haulage capacity of these little engines was prodigious, with 1700 tonne trains being routine, reaching 2000 tonnes on test.

Aiming to double the railway's coal handling capacity, Porta produced designs for large articulated (Garratt and Mallet type) locomotives, including the 2-12-12-0 Mallet illustrated below. This was one of several designs by Porta that were never built.



From 1961 to 1982, Porta was employed as Head of Thermodynamics at Argentina's National Institute of Technology and Engineering in Buenos Aires.



Dante Porta (r) and David Wardale (l) beside Porta's modernised oil-fired Minaz 2-8-0 in Cuba c. 1990.

On retiring in 1982, Porta took up consulting work which took him to the USA, UK, Paraguay, Brazil and Cuba. At the same time, he was mentoring David Wardale in his endeavours in South Africa, resulting in another iconic rebuild of a Class 25NC that gained the unofficial name "The Red Devil" on account of its buffer-beam red colour scheme and its astonishing improvement in performance compared to the original design which had been hitherto regarded as the most modern and advanced design in South Africa

Despite the remarkable achievements over his long career, Porta remains an unsung hero in the history of steam locomotive development. ASTT aims to promote his legacy through its various activities, including the publication of some of the technical papers that he wrote on a variety of ways of improving steam locomotive performance.

Porta wrote some 240 papers, most still in manuscript form and most of them illustrated with Porta's remarkably artistic sketches. Of these papers, ASTT has published 54 in five volumes that can be purchased through its website (see page 8). In addition, a 550 page "Compendium of Articles and Papers" to celebrate the Centenary of Porta's birth, was published by ASTT in two volumes in 2022/23.

In 1969, Porta travelled to the UK to deliver the very last paper at the very last meeting of the Institution of Locomotive Engineers (see overleaf).

AP2 - Institution of Locomotive Engineers

The Institution of Locomotive Engineers (I.Loco.E.) was an independent professional association and learned society headquartered in London, that represented locomotive engineers from around the UK and overseas. It was founded in 1911 as an offshoot of the Stephenson Locomotive Society to provide a forum for professional railway engineers to meet and learn from one another.



Sir Nigel Gresley
1876 – 1941
CME of the GNR & LNER

The Institution flourished over the following decades as the railways evolved, especially during the 1930s “Golden Age of Steam”, when its presidents included such iconic names as Sir Nigel Gresley of the LNER and Sir William Stanier of the LMS. During the war years it was presided over by Oliver Bulleid of the Southern Railway.

In the post-war period, following the nationalisation of the railways in Britain, the Institution was headed by the then leading railway engineers including R.A. Riddles (1950), Roland Bond (1953) and E.S. Cox (1957).

The eradication of steam from British Railways in 1968 presaged the end of the Institution. Locomotive design departments and manufacturing facilities largely disappeared from the nationalised railway, their work being taken over by specialist private companies. As a consequence, in 1969 the Institution of Locomotive

Engineers was integrated into the Institution of Mechanical Engineers as its Railway Division.

It was fitting that the very last presentation at the very last meeting of the Institution, held in Manchester in March 1969, was given by Livio Dante Porta who pursued the ongoing development of steam traction until the end of his life in 2003. Porta’s paper, titled “Steam Locomotive development in Argentina”, was a poignant epitaph to “what had passed” and an elegy to “what might have been”

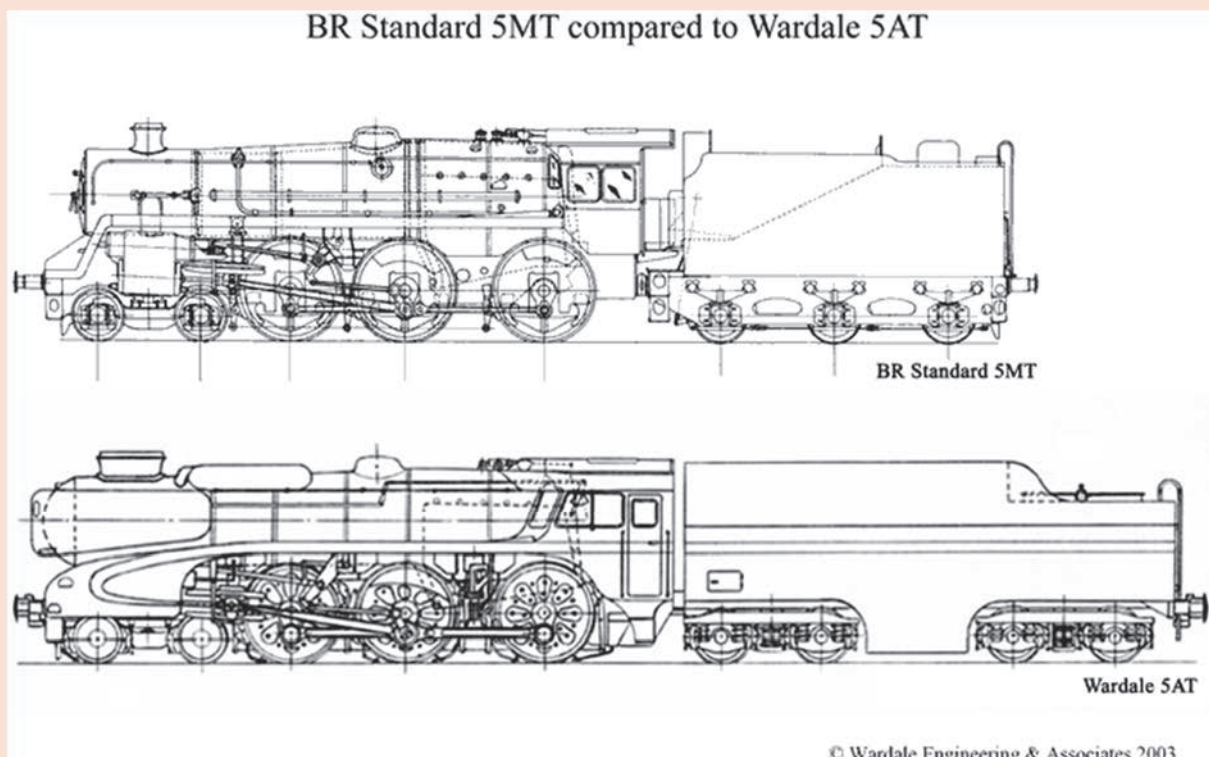
ASTT does not compare itself with the eminent organisation that represented railway engineers during the development of steam traction, but it is proud to pursue the aims of the old Institution by promoting the ongoing development and improvement of steam locomotives with a view to reducing their ownership costs and thereby keeping them operating into the future for the interest and pleasure of future generations.

Note: Thanks to the efforts of Richard Coleby, ASTT retains a close link with the Institute of Mechanical Engineers through its involvement with the I.Mech.E. Railway Division’s “Railway Challenge” - a very successful programme introducing young engineers to the delights of locomotive design and operation. In this small way ASTT provides an ongoing connection from steam to modern traction!

AP3 - The 5AT Project (and the birth of ASTT)

In 1998, David Wardale published his ground-breaking 500-page book, "The Red Devil and Other Tales from the Age of Steam", which described in great detail the work that he undertook in south Africa from 1977 to 1983, where he rebuilt two locomotives by exploiting the ideas and principles put forward to him by Porta. Wardale estimates that the correspondence and technical advice that he received from Porta during this period would have filled at least twice the pages of his book.

At the end of his book, Wardale speculated that by applying Porta's principles to a new design based on the footprint of the BR Standard Class 5 4-6-0, it would deliver the power and speed of the English Electric "Deltics" that were at the time the ultimate expression of locomotive haulage in the UK.



Several readers of the book, including Dr. Alan Fozard and Chris Newman, were captivated by the idea of a modest-sized steam locomotive being able to haul heavy trains at a continuous 100+ mph, and approached Wardale to discuss the possibility of designing and building such a machine. Disappointingly, Wardale expressed grave reservations about the practicality of such a scheme, but he agreed to produce a set of "Fundamental Design Calculations" for such a locomotive that would demonstrate its technical feasibility and verify its performance. Thus, in 2005, he completed the task, producing over 500 pages of calculations which were subsequently published under the auspices of the 5AT Project, and are now published by ASTT.

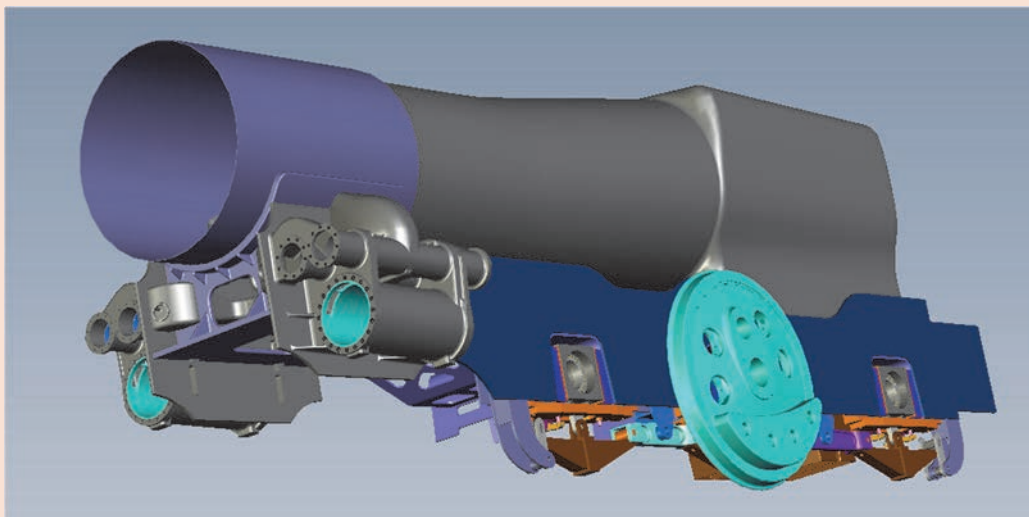
At around the same time, Alan Fozard led a team of volunteers which investigated the financial and economic feasibility of designing and building a prototype 5AT and subsequent "production" machines, leading to the publication of a 25-page "Feasibility Study regarding the formation of a Steam Locomotive Development Company to produce advanced technology "Second Generation" Steam (SGS) Locomotives", to

which were appended 16 Appendices (filling 200 pages) that formed the meat of the study. Of these, perhaps the most important was one titled “Estimated costs of development of the Demonstrator 5AT Locomotive”, which estimated the cost of developing a prototype at £10.4 million at 2007 prices, made up of £4.7 million for design and management (over a 48-month timescale), £3.2 million for the locomotive, £0.8 million for testing and acceptance, and £1.7 million contingency.

A troubling aspect of the study was the uncertainty about a market for a 100+ mph locomotive to operate “cruise trains”. At the same time, an enquiry was lodged about the possibility of building a freight version of the 5AT (see page 15). This prompted speculation that a slower machine, perhaps with 4 driving axles and higher tractive effort, might be a more viable option for hauling heavy cruise trains, however this brought into question the need for the sophisticated “advanced steam” requirements that underlay the high-speed 5AT concept. As a consequence, additional appendices were added to the study that looked into lower-speed lower-tech and lower-cost options.

Such doubts were reflected in the lack of interest from several large companies that were approached for funding. They were also amplified by David Wardale who had never endorsed the idea of building a 5AT. He suggested that the three things most needed by the heritage steam sector were “reliability, reliability and reliability”, and that the group would be far better to focus their attention on promoting a simple low-speed “modern steam” design that placed reliability above performance. He suggested that a modernised low-maintenance development of the Ivatt (ex-LMS) 2-6-0 would be a far more useful machine than the 5AT.

It was this injunction from Wardale that finally drew a curtain over the 5AT Project and saw the launch of ASTT in its place, and which ultimately led to ASTT’s “Revolution” project.



Detailed arrangement drawing of 5AT component parts, prepared by Richard Coleby



The Advanced Steam Traction Trust (ASTT) was founded in 2012 to carry the torch of “modern steam” engineering by continuing the work of Chapelon’s successor, Livio Dante Porta and of his disciple David Wardale, with the aim of improving, rather than simply preserving, steam traction. By so doing it hopes to promote an interest in steam locomotive engineering for future generations.

ASTT has over 100 members from all over the world, a majority from the UK. A significant proportion are professional engineers. Following the practice of the old Institution of Locomotive Engineers (disbanded in 1969), ASTT holds an annual conference at various railway centres, both past and present.

ASTT is registered as a not-for-profit company, however it has a subsidiary company called Advanced Steam Traction Services Ltd (ASTS) through which its commercial activities are run. It is planned to register ASTT with the Charities Commission.

Through ASTS, the trust publishes and markets books specialising in modern steam and occasionally takes on consulting work as and when manpower resources permit.

ASTT also undertakes non-commercial projects, some of which are described in this prospectus. Its most ambitious project to date is the design and construction of a 1/5th scale 10¼” gauge demonstrator locomotive to be called “Revolution”.