

From the builders of No. 60163 Tornado – the first new main line steam locomotive built in Britain since 1960

# Yes!

## I would like to support the P2 Project and join The Cylinder Club

**Please complete the form below and return to:**

The Cylinder Club, P2 Construction Fund  
 The A1 Steam Locomotive Trust  
 Business reply RTJS-XECR-XARL  
 Darlington Locomotive Works  
 Hopetown Lane  
 Darlington DL3 6RQ

No stamp is required. We will then send you the appropriate Standing Order and Donation Registration Forms so that we can set you up on our systems and reclaim UK income tax paid through Gift Aid where appropriate.

Why not visit us at Darlington and see No 2007 *Prince of Wales* under construction for yourself? We are open 11:00hrs to 16:00hrs on the third Saturday each month.

### THE CYLINDER CLUB APPLICATION FORM

Name .....

Address .....

..... Post Code .....

Email ..... Telephone .....

- I have enclosed a cheque for £1,000 made payable to "A1 SLT – P2 Construction Fund" or
- I would like to make four (4) payments of £250 – please send me a Standing Order form or
- I would like to make eight (8) payments of £125 – please send me a Standing Order form

Are you a UK tax payer?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Are you a member of The Founders Club for P2 No. 2007 <i>Prince of Wales</i> ?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Are you a P2 No. 2007 <i>Prince of Wales</i> covenantor?	Yes <input type="checkbox"/>	No, please send details <input type="checkbox"/>
Are you a member of The Boiler Club for P2 No. 2007 <i>Prince of Wales</i> ?	Yes <input type="checkbox"/>	No, please send details <input type="checkbox"/>
Are you a member of The Mikado Club for P2 No. 2007 <i>Prince of Wales</i> ?	Yes <input type="checkbox"/>	No, please send details <input type="checkbox"/>
Have you sponsored a component (Dedicated Donation) for P2 No. 2007 <i>Prince of Wales</i> ?	Yes <input type="checkbox"/>	No, please send details <input type="checkbox"/>
Are you an A1 No. 60163 <i>Tornado</i> covenantor?	Yes <input type="checkbox"/>	No, please send details <input type="checkbox"/>
Are you a member of The 163 Pacifics Club for A1 No. 60163 <i>Tornado</i> ?	Yes <input type="checkbox"/>	No, please send details <input type="checkbox"/>

To help our marketing efforts, could you please tell us where you picked up this leaflet?  
 .....

## Please join The Cylinder Club and help us to make the cylinder block for No. 2007 *Prince of Wales*:

**The Cylinder Club** – Following the success of The Founders Club (to get the project to the point of cutting the frames), The Boiler Club (to fund the construction of the boiler) and The Mikado Club (to fund the wheeling) we have decided to establish The Cylinder Club to fund the cylinder block for No. 2007 *Prince of Wales*."

We set an initial target for The Founders Club of at least £100,000 from 100 'Founders' but due to the overwhelming generosity of our supporters we actually raised £450,000 from 360 donors. Our aim for The Boiler Club is to raise at least £600,000 from 300 supporters each donating £2,000 in up to 40 payments of

£50 and by June 2017 we were already over half of the way there. The Mikado Club has been so successful that it reached its initial 160 member target three months ahead of schedule and so has been extended to 200 members to also fund the wheeling of the tender.

If we are to remain on schedule to complete No. 2007 *Prince of Wales* in 2021 we need to order the cylinder block in 2017. We have therefore set ourselves the challenge of raising £100,000 through The Cylinder Club from 100 supporters each donating £1,000 (plus Gift Aid) to the project in up to eight payments of £125 by standing order.

### Special benefits for members of The Cylinder Club

- Opportunity to buy ticket (seat already reserved) on one of the first trains hauled by No. 2007 *Prince of Wales*
- Reasonable access to No. 2007 at all times
- Opportunity to buy exclusive Cylinder Club badge
- Opportunity to join one of the teams building No. 2007
- First choice of other components to sponsor
- Special Cylinder Club day with *Tornado*
- Special signed print of John Wigston's new painting of No. 2007 *Prince of Wales* alongside No. 2001 *Cock o' the North* and No. 2002 *Earl Marischal*.



For further information on any aspect of the new Gresley class P2 please visit [www.p2steam.com](http://www.p2steam.com), email us on [enquiries@p2steam.com](mailto:enquiries@p2steam.com) or call our hotline on **01325 460163**.

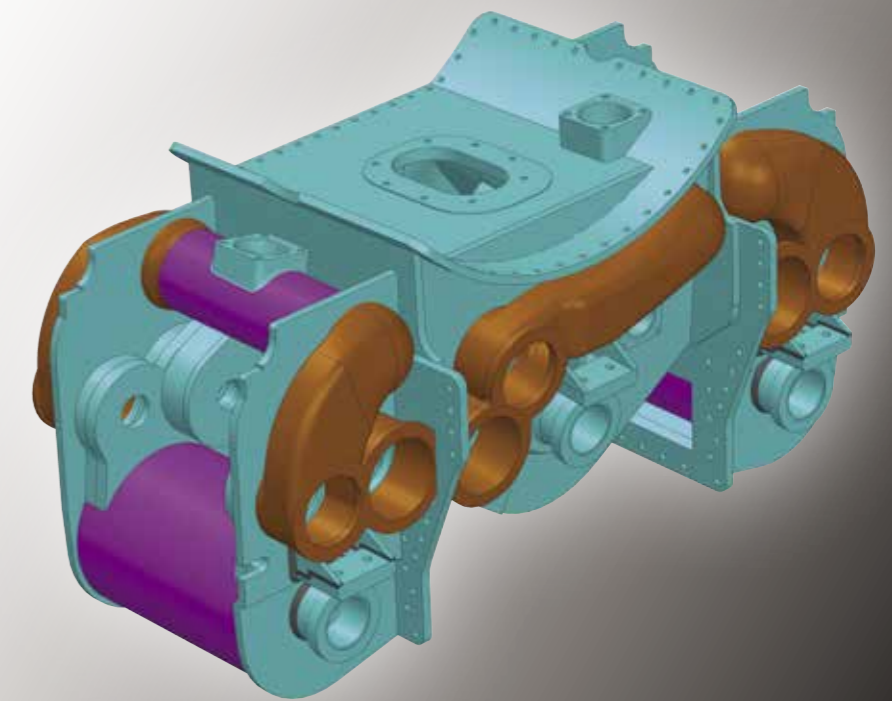
**Together we can build this remarkable locomotive!**



## “Putting the horsepower into Britain’s most powerful steam locomotive”

Over £2.5m pledged, frames erected, all wheels cast, cab and smokebox completed

### Help us to make the cylinder block for new Gresley class P2 2-8-2 No. 2007 *Prince of Wales*



Follow us on:

**Join The Cylinder Club today!**





How No. 2007 *Prince of Wales* will look on completion. Altered from an official portrait of No. 2001 *Cock o' the North*.

The Gresley Society Trust

The Gresley class P2 2-8-2 'Mikados' were the most powerful express passenger locomotives to operate in the UK. They were designed by Sir Nigel Gresley to haul 600 ton trains on the arduous Edinburgh to Aberdeen route. Sadly the design was never fully developed and they were rebuilt by his successor Edward Thompson into ungainly class A2/2 4-6-2 'Pacifics' in 1943/4, and scrapped by 1961. As the builders of No. 60163 *Tornado*, we have set ourselves a new challenge: to develop, build and operate an improved Gresley class P2 'Mikado' steam locomotive for main line and preserved railway use. The project to build the 7<sup>th</sup> Gresley class P2 'Mikado' is using the latest computer design and modelling techniques to enable it to deliver its true potential.

**The new locomotive will:**

- Be aesthetically similar to class P2 No. 2001 *Cock o' the North* - it is a construction and development project not an opportunity for major redesign
- Make maximum use of systems, fittings and processes in use on No. 60163 *Tornado* - any changes to the original design will be either for operational, manufacturing or certification reasons
- Take into account the needs of the operator – all decisions will be judged for their value for money

- Meet current and foreseeable regulatory standards to allow the locomotive to operate as intended
- We estimate that No. 2007 *Prince of Wales* will cost around £5m to build over a 7-10 year period. As with *Tornado*, funds will be raised through regular donations 'a P2 for the price of a pint of beer a week', donations dedicated to specific components and commercial sponsorship.

**We have the expertise, the track record and a plan... But this can't happen without you.**



The original one piece cast iron cylinder block for *Cock o' the North*.

**Progress to-date**

- Frame plates for engine and tender rolled, profiled and machined; engine's frames erected at Darlington Locomotive Works; all major engine frame stays, brackets, hornblocks, axleboxes and buffers cast (44 in total); over 1,000 fitted and driven bolts ordered and delivered, approximately 800 now fitted to the frames
- All 20 wheels for engine and tender cast and proof machined; roller bearings for all engine and tender wheelsets delivered; engine axles (including crank axle), tyres and crank pins delivered; tender axles and tyres ordered. First wheelset ordered
- Preliminary discussions held with boiler manufacturers and forged foundation ring corners manufactured and machined; start made on boiler fittings with castings for combined injector steam and delivery valves
- Study into ride and suspension using rail industry standard Vampire® software completed; Finite Element Analysis of improved crank axle design completed to demonstrate compliance with modern standards; assessment and Notified Body appointed to oversee certification - first site visit made
- Cab erected and cab side window frames fitted; engine footplating and splasher kits delivered and permanently fitted to frames
- Smokebox door pressed details made and door completed, door frame manufactured, smokebox delivered and erected; chimney cast and fitted
- Crosshead castings ordered
- Boiler cladding assembly jig built, cladding crinolines and hoops rolled and fitted to jig, cladding sheets procured, rolled and being fitted to jig
- Tender frame construction under way, axlebox and other tender castings ordered from William Cook Cast Products
- Nameplates and chime whistle delivered
- Over £1.3m spent, £1.7m raised and £2.5m pledged of the required £5m.

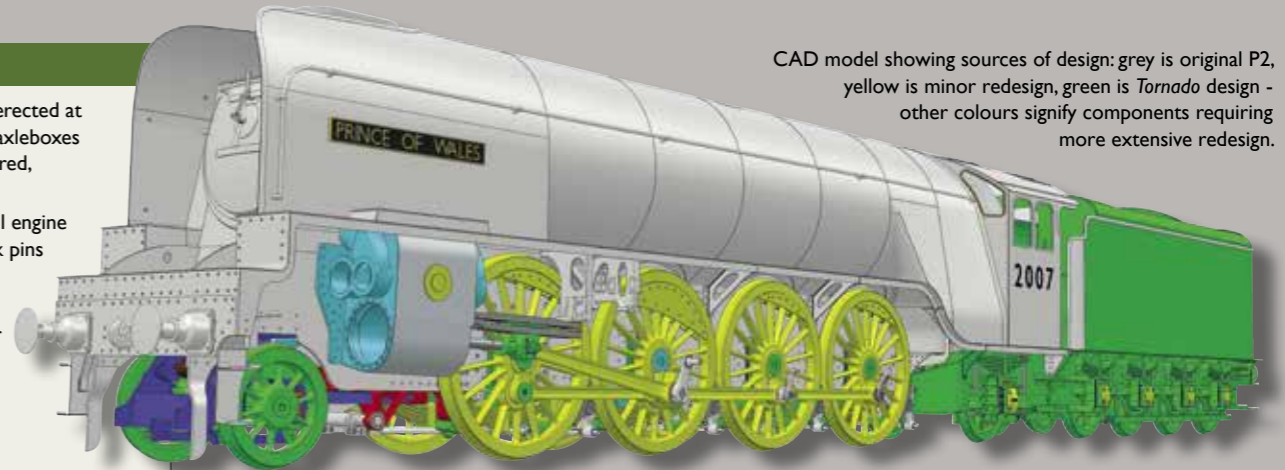
**Why Lentz valve gear?**

The first class P2 No. 2001 *Cock o' the North* was fitted with Lentz rotary cam poppet valves. Most modern steam locomotives used piston valves, where the entry of live steam to and the exit of exhaust steam from the cylinders was controlled by pistons which were driven backwards and forwards by the valve gear. Poppet valves are the type used in internal combustion engines and are activated by cams. Poppet valves can result in higher power, greater efficiency and reduced maintenance.

Dr Hugo Lenz developed a form of poppet valves where the cams of the oscillating type were driven by conventional valve gear. The original Lentz design was developed to be driven by rotary cams, which in turn take their drive through gear boxes and cardan shafts from the locomotive's wheels. This design was successfully applied to several hundred locomotives worldwide.

However, when proposed for No. 2001, Gresley requested that the Associated Locomotive Equipment Company provided continuously variable cams which provided an infinite number of settings between 10% and 75% cut-off. This fine adjustment was required with powerful locomotives to enable economical operation. However, on No. 2001 the continuous cams wore rapidly and required replacement after only 10,000 miles, so stepped cams were fitted adversely affecting its economy. Fortunately for No. 2007 *Prince of Wales*, the Lentz valve gear was further developed by the Franklin company of the USA during the 1940s which overcame the wear problems with the cams and other maintenance issues.

We have been fortunate to obtain details of the Franklin developments and will be incorporating these into the valves and valve gear for No. 2007.



CAD model showing sources of design: grey is original P2, yellow is minor redesign, green is *Tornado* design - other colours signify components requiring more extensive redesign.

**Maintaining momentum**

Since its launch in September 2013, the project to build new Gresley class P2 'Mikado' No. 2007 *Prince of Wales* has made remarkable progress. Over £1.3m has been spent on construction to-date, with over £1.7m raised and more than £2.5m of the required £5m pledged. However, to maintain this rate of progress - and complete the locomotive by 2021 - we need to continue to raise in excess of £700,000 per year. This becomes more challenging as each year passes due to the nature of our 'P2 for the price of a pint of beer a week' covenant (regular donation) scheme.

**Creating No. 2007's cylinder block**

From an engineering perspective, the next critical task is to design and build the new cylinder block. The work involved includes:

- Convert the original P2 class one piece casting into a welded fabrication including Finite Element Analysis (FEA) to check for structural integrity
- Improve the layout of the valves to reduce the clearance volume (which affects cylinder efficiency)
- Re-route the steam and exhaust passages to physically separate them to prevent

incoming steam from heating the outgoing exhaust

- Increase the size and improve internal streamlining of steam passages along Chapelon lines to increase maximum power and improve economy
- Reduce the overall width of the cylinder block to provide *Prince of Wales* with the widest possible route availability on the main line. Manufacture the cylinder block including:
  - Producing the welded fabrication
  - Stress relieving
  - Grit blasting and painting with high temperature paint
  - Machining
  - Fitting cylinder liners and valve seats
  - Manufacturing and fitting cylinder and valve covers
  - Hydraulic testing the assembly.

We have therefore established The Cylinder Club to raise an estimated £100,000 required to design and manufacture No. 2007's new cylinder block.

**Help us to design and manufacture No. 2007's cylinder block by joining The Cylinder Club today.**

To become a member of The Cylinder Club, please complete the form overleaf or email enquiries@p2steam.com, call 01325 460163 or visit www.p2steam.com for more information.