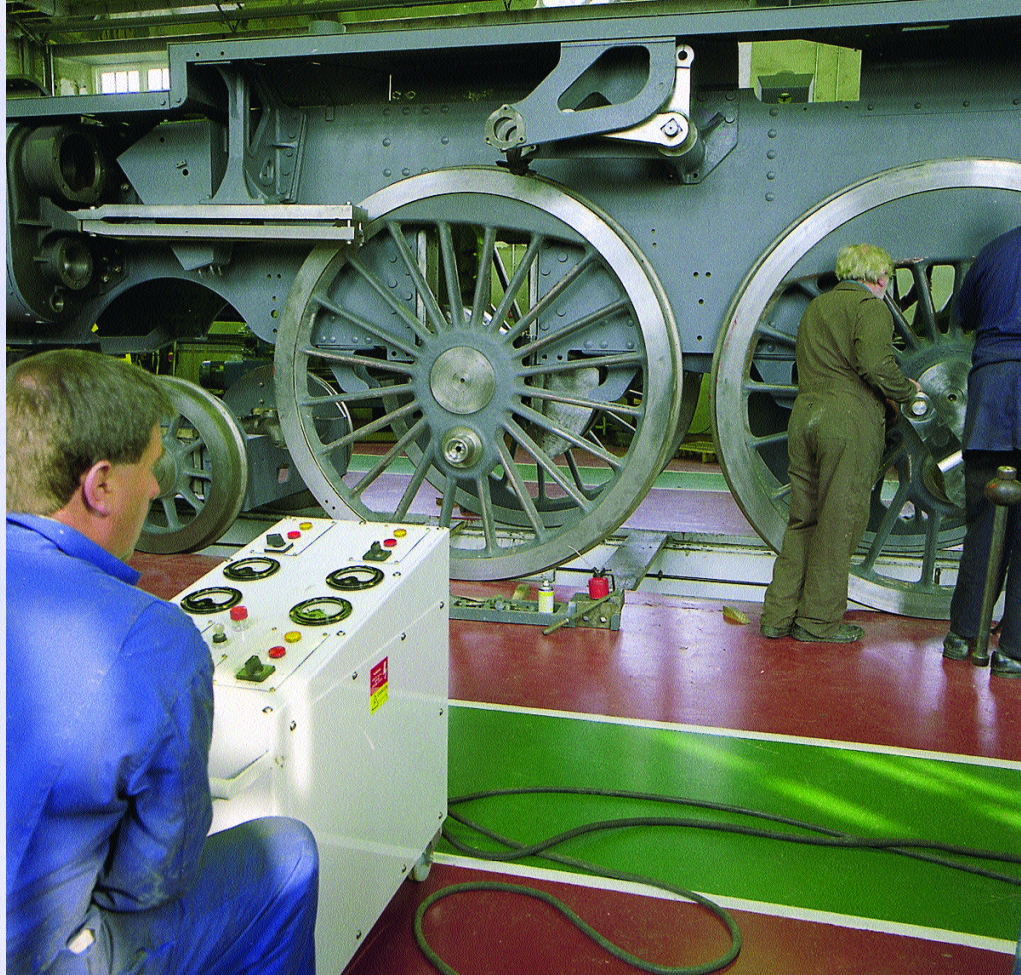




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Top Link

Issue 5
Autumn 2002



60163 on its wheels – and it moves!

Journal of The A1 Steam Locomotive Trust

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Works opening: 2nd Saturday in the month at 11.00, 12.30 and 14.00.
(You need to buy entry to Darlington Railway Museum, next door, first.)

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DEDICATED COVENANTS

drawn to show just the A1 reverser mechanism, to reduce the risk of machinists misinterpreting the original, a typical LNER generic drawing showing several versions for several locomotive classes. Costs in cash/per month are below, left.

The full drawing, plus those for the screw and the handle, may be viewed on the Covenantors' section of the A1 website. The TIF files may be viewed using Microsoft Photodraw, Imageview or other raster-imaging packages. To sponsor any of these items, or others, contact Alan Dodgson at enquiries@a1steam.com or 01325 460163, giving your name and contact details (phone/e-mail/address).

Opposite (left): Excerpt from LNER Drawing K223, showing section through the nut, trunnions and locking mechanism. (© *The A1 Steam Locomotive Trust*)

Below (right): LNER pacifics all used similar parts. This is the nut and trunnion cover from 4498 *Sir Nigel Gresley*, under overhaul at Grosmont. (photo: *David Elliott*)

Your bit of history . . .

Reverser stand parts:

PS490 nut (pattern/cast)

£450/£7.50 pm

PS491 nut (machining)

£750/£12.50 pm

PS492 screw £600/£10 pm

Reversing stand nut trunnion:

PS493 pattern

£450/£7.50 pm

PS494 castings £150

PS495 machining

£450/£7.50 pm

PS496 support plates £150

PS497 Bell crank assembly

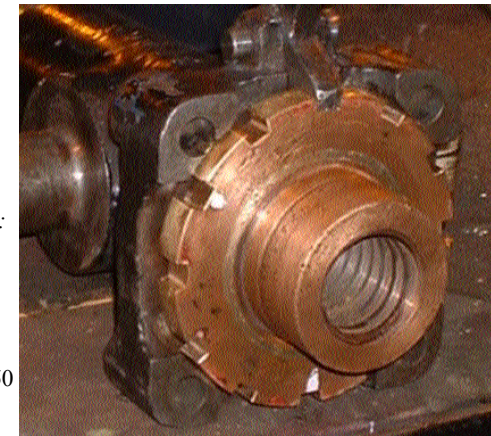
£450/£7.50 pm

PS498 Reverser handle

(complete) £650/£11 pm

PS499 Locking device £150

Avoid disappointment: buy now!



Back cover: K1 62005 and two Peppercorn A1s: 60152 Holyrood and one with red background to its nameplate. (photo: Keith Pirt, reproduced by kind permission of Steam World magazine)

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Editor: Gerard M-F Hill

JOURNAL OF THE A1 STEAM LOCOMOTIVE TRUST

gerard@a1steam.com

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Imagine
grandchild
standing t

Cover: David Elliott operating the jacking system. (photo: Fastline Photographic Ltd



What an excellent Convention we had this time! We saw *Tornado* move on its own wheels and had a look underneath. At the end of the morning presentation, the chairman invited questions. He got only one: "Can we have lunch now?" The Board's reports after lunch sparked off ideas from the audience. Report: p. 6.

The editor met lots of interesting people that day, rounding off with half an hour with Tony Roche, our new CME. What a lovely man! And what experience of engineering he brings us: just about every aspect of railway management. The interview – what could be deciphered of the editor's scribble – is on pp. 17–19.

News of the A1 Project keeps spreading, raising the profile of engineering at the same time (see page 12). Rob Ludwig e-mailed us from the USA: "I am truly impressed with your endeavor to build a steam locomotive from scratch. I have had this same idea for a different design, been researching the web for information and was stunned when I saw your site. Keep up the good work."

Recently the editor acquired from R. J. McKay, a Texas railwayman and railfan, a copy of E. B. Phillipson's book *Steam Locomotive Design*. R. J. wrote: "I am tickled to death that the book has gone to a place where it will be used as God and the author intended." Phillipson was a leading member of Gresley's design team. The book is now on loan to our director of engineering, and we hope it will be useful in checking the thinking behind the design, especially where the original drawings do not specify enough detail or contain anomalies.

In the past *The Safety Valve* has featured covenantors from France and New Zealand; this time our correspondents are from sunny Yorkshire. An exchange of letters goes more deeply into rivets, but our first letter puts forward a splendid idea: re-creating the back cover picture, which we owe to the kindness of Keith Pirt, who was there in 1965, and Barry McLoughlin, editor of *Steam World*.

We are once again indebted to Fastline Photographic for pictures from the works. The Big Picture is something a little different this time. British-born over-50s may well recognise the artist, but not many will have seen an A1 in this livery. To do so again, turn to page 27 and choose a dedicated covenant! That's the way to get the locomotive finished. The visible gap now is the boiler and it seems we are moving towards a solution to funding this expensive, one-off item.

Drain Cocks next time will focus on the Cartazzi axle; History will look at a special day at Kings Cross in 1949. For a bit of both features, see page 20. Your letters, e-mails, photos and other contributions are welcome as ever.

Gerard M-F Hill

MORE PARTS ORDERED

On 22 September an order was placed with the well known and highly experienced firm of John Hesketh & Son, Castlecroft Ironworks, Bury, Lancashire, for some £8,000 worth of motion parts, the most expensive items being the two eccentric rods. Also ordered were the six trunnion plates and sets of three of the following: combination levers, union links and radius rods.

Most of these are being made to updated versions of original drawings in the K422 series (the LNER prefixed all motion drawings with 'K'), but those for the eccentric rods have been redrawn. The steel specified is BS 970 080M15 normalised and the foundry will supply certification for material composition, properties and heat treatment. Heskeths previously forged the connecting and coupling rods for us.

Tornado, now wheeled and standing in Darlington Loco Works, is being sized up by some of the trustees on the morning of the 2002 Convention. On the left are Andrew Dow, Mark Allatt and Barry Wilson; but who is holding back the loco single-handed? (photo: Fastline Photographic Ltd)



THE 2002 CONVENTION

On 5 October, there were 139 people in Darlington Locomotive Works for the trust's 2002 Convention. There was a lot of visible progress in the works and on the locomotive.

Mark Allatt welcomed everyone and introduced Tony Roche, who said a few words before handing over to David Elliott. Then, with Ian Howitt on the 'works shunter' (the fork-lift truck, actually), the 35-ton assembly moved on its own wheels in public for the first time – and with not a squeak or sigh.

David pointed out that the wheels and axles had been fitted to ten times' greater accuracy than would have been possible with plain bearings, which need a 20 thou gap to preserve their lubrication film.

Within a few weeks, the axles would be finally bolted together, under the eyes of representatives of Timken and The Engineering Link, our VAB. At the same time the bogie manganese-steel liners would be permanently fitted. The Cartazzi axle had been left open on one side, so people could see the slides, but it had otherwise been assembled and adjusted.

The cab had been re-cut to an accuracy of ± 4 thou; the roof angles were still to fit. A dedicated covenant was paying for the new chimney. Orders worth about £8,000 had been placed for motion parts and steamchest covers.

All this progress was partly the result of Ian Howitt's men being in the works 2–3 days a week, the equivalent of about 1.1 men working full-time. The Bridgeport machine had been a good buy: it was in constant use. The pattern store over the office was in use; access was by a redundant signal ladder from Oxfordshire. The fork-lift truck was in regular use and the heavy lifting beam was pointed out.

Special mention was made of Mike Wood, Barry Wetherell, Barry Wilson, Barry Thompson and other volunteers. (You don't have to be called Barry to volunteer; it just helps.) In 2003 Mike Wood intends to organise manufacture and fitting by volunteers of footplating and drain-cock gear.

Bachmann A1 owners, see page 13.

Not got one? See the same page!

The pit and the pendulum

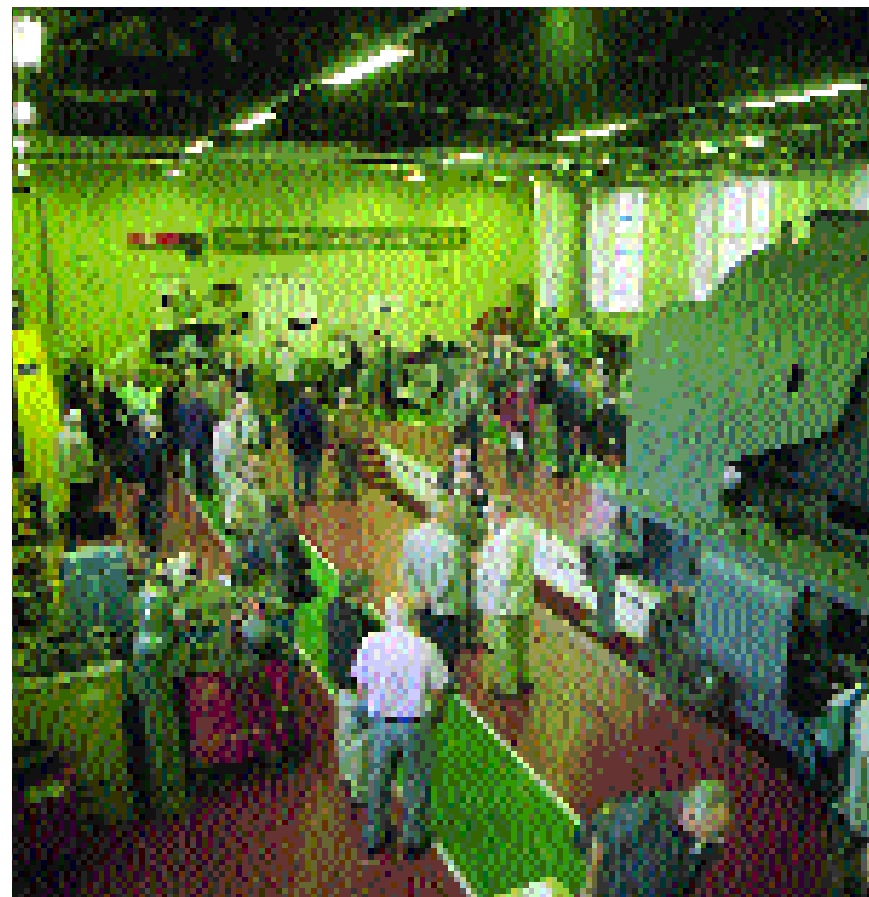
David Elliott was given a round of applause, for what he had achieved as much as for his presentation. When Mark Allatt called for questions, there was only one: "Can we have lunch?" He invited covenantors to put informal questions to the Board over lunch.

Many people took advantage of the chance to don a hard hat and climb down into the pit to view an A1 from below. And the pendulum? Time flew.

AT THE WORKS

Those who were ready for coaling and watering took one of the vintage buses to the Blackwell Grange Hotel, where they could get a drink, help themselves from the buffet and sit to

eat, to a buzz of animated conversation. In the afternoon session, trustees and ordinary covenantors both focused on the next big push: building the boiler and how to finance it.



Inside the works: the start of the 2002 Convention.
(photo: Fastline Photographic Ltd)

THE CONVENTION

Three minutes early, Mark Allatt opened the afternoon session.

Barry Wilson: Finance

Covenant income was 6–7% up, though the total was slightly less (£8,900 p.m.) as we had some large donations last year. Interest was strong. *Top Link* helped, as it was so much better than its predecessor. We had spent £778,000 on the locomotive so far and we were looking to buy a new support coach.

We had net assets valued at £809,000, with £40,000 in the bank; our one long-term debt – £54,000 to William Cook, Burton – is due only when *Tornado* is in profitable service; and new covenantor numbers had increased rapidly in the last three months.

Wreford Voge: Taxation

Last year we spent a lot of time proving we were a charity; previously we had the same problem with Customs and Excise. To maximise our income, it is vital that covenantors fill in a Gift Aid Declaration (GAD). This means a nominal gift of £600 brings us £769.26 at a cost to the donor of £461.54!

Andrew Dow: The boiler

Barry Wilson said “Start with a joke”. Instead, Andrew quoted the motto on an office wall: “Comes a time in the life of any project when you have to shoot the engineers and get on with production”. So far, a steady income

had funded a stream of small- to medium-cost items successfully. The boiler was different: one piece, one builder, one payment. Even with staged payments, it would outstrip our existing income, as lead time was just 7 months.

David Elliott had talked to a number of boiler manufacturers, but they didn’t want to be involved in a one-off item so different from their other work.

When ready, the process of pre-qualification will identify companies that can build and certify a boiler to the EU regulations applicable from 29 May 2002. It will be competitive, but just as we are sizing up manufacturers, they are looking at us. How will we pay?

We can stop work for two years and save: unacceptable. We can look for a benefactor: unpredictable. We can go to the financial markets for a bank loan or bond: but even if we could service the repayments, what security can we offer? Unfortunately, there is at the moment no market in half-built steam locomotives.

We are deep in discussion with our financial advisers. Whatever we do, we must accelerate build, completion and entry into service to realise our dream.

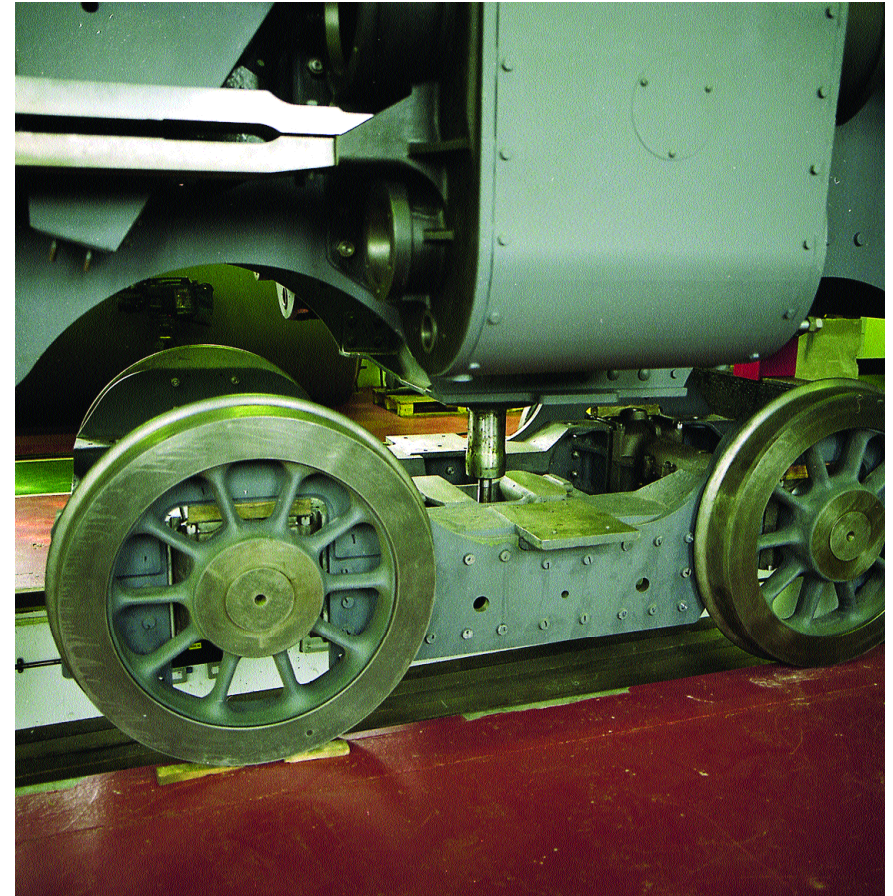
Rob Morland: The project plan

The project plan was set up eight years ago and has changed remarkably little. Rob promised a piece in *Top Link* soon but the changes this year were the

AFTER LUNCH

boiler and motion expanding to 23 and 45 tasks respectively, and inclusion of the second tender at £155,000. Of the

310 tasks, 110 were completed and 34 were in progress. From current monthly income, £11,000 including tax



On 2 October 2002, the frames are lowered, bit by bit, on to the wheels and the bogie pintle (centre) is about to engage. The bogie wheelbase of 6' 3" leaves no wasted space: the outside cylinders are a nice fit inside the wheels. (photo: Fastline Photographic Ltd)

THE 2002 CONVENTION

rebates, 60163 could roll out in seven years; if we had £1.25 million by early 2003, we could finish it in two years.

Tony Roche: How do we get there?

Where are we now? The frames are 98% complete, coupled wheels/axles 99%, bogie and Cartazzi 95%, cylinders/valves 75%, motion 48%, platework 55%, but boiler/smokebox only 11% complete, running gear 5%, tender 1%, and test/trials 0%.

A year from now should see the first four finished, motion/platework at 85% and significant progress on the running gear, a support vehicle bought and the boiler ordered.

Ordering the boiler is critical and all that we do in 2004 and beyond depends on money: receive and fit boiler, order and receive tenders, complete running gear, motion and platework, fit support vehicle with crew quarters and generator, run tests and trials, do final finishing/painting, get approval of railway safety case and licence to operate. In 27 months it could be in steam.

On the screen flashed the 1935 W. Heath Robinson cartoon, 'Building the first locomotive' – it can't be done like this. Essential is a quality management system that documents construction to ISO 9001: 2000; Alan Lusby had made a good start. It covers document control, design work, record keeping, storage and quarantine, purchase control, inspection and measurement.

Safety certification requires us to 'Prove your train is safe'. Where design is unchanged, 'grandfather's rights' exempt it; where it differs (one-piece frames, welded boiler) the full process applies. The engineering team need your support, but we *can* do it.

Mark Allatt: Conclusion

Our aim remains the same, to build and operate a Peppercorn A1. With 20% growth we can do it by 2008 but, with a lump sum in 2003, *Tornado* could be in service in 2005 and repay the loan by 2009. Our target now is completion in 27 months. Are there any questions?

Will you consider a long-term bond or selling equity in the operating company?

To be successful, bonds need underwriting; these are whole new areas.

Equity release on homes could raise cash.

Yes, and the trust would get tax relief.

What security has the trust for a loan?

We are discussing acceptable security.

What of the Lottery? Should we all write?

We'll try again. Letters don't help.

I am considering an interest-free loan.

We would not get tax relief though.

What of 60532? It will need a new boiler.

We've seen no interest in building two.

Could covenantors act as guarantors?

Administration would be a nightmare.

How about asking covenantors if they will guarantee funds or offer other ideas?

We'll look at this. Ideas are welcome.

Have the events of 2001 been completely resolved? Yes!

INSIDE THE DARLINGTON WORKS



The great day – the greatest so far, at any rate – has come at last and the locomotive is being finally wheeled. The double doors at the east end of the works – through which *Tornado* will roll out on completion – are open, to let more light on the job. In the foreground is the bogie; behind that, positioning of the crank axle is being checked before the next stage. Beyond and above, the frames are already lowered part-way down. The yellow upright is one of the jack pillars.

(photo: Fastline Photographic Ltd)

The A1 Project is glad to be a standard-bearer for British engineering; in return an article in *Professional Engineering* recently waved the flag for us. It got us more attention than expected. The caption writer set off quite a fuss with a picture of Ian Howitt reaming boltholes in the frames, describing him as “an engineer” – as he is. Lots of engineers wrote to complain this was misleading.

A typical reaction was “Carrying out work on bolt holes is clearly that of a fitter and should be referred to as such”. But there were other views too.

“Surely it is imperative that the word ‘engineer’ is applied at all levels of the engineering spectrum, from concept through development, design, prototyping, manufacture, installation, commissioning, running, maintenance and decommissioning. The hands-on brigade are no more but certainly no less important to the life and performance of an engineering design than the engineer in any of the other arenas.”

Some saw a little more: “There is of course the possibility that this is a trick, and the chap shown in the photograph is actually the company’s senior engineer taking a welcome break from the office, but if so, your caption should have been more specific.”

So what do engineers do?

Another writer, who also realised that this might be an engineer doing fitting work as a volunteer, asked “who said

real Engineers don’t get their hands dirty? Seriously, my feeling is we’re too precious about the E-word.”

Others took up this theme: “Some people are fortunate and have been able to attend universities. They have gained qualifications and know all the theories, but how many can really fit a key, scrape bearings and tip gear teeth. In fact, would they be willing to dirty their hands and spend the many hours required to perfect such skills? The great engineers of history have been practical men with sound logical minds.”

In the same vein: “I am a chartered engineer fortunate enough to work for a small company where I still get the occasional opportunity to don my overalls and get my hands dirty as a ‘fitter’. Do you think there may be a hint of jealousy amongst the complainants?”

Boiler to build: heating engineers needed?

It is a problem though: “News reports contribute by describing crooks sent to jail for botched plumbing jobs carried out from the back of a tatty van as ‘heating and ventilating engineers’.”

Where did reporters get the idea? “Visiting my old school, I described myself to my former class teacher as a mechanical engineer. He immediately assumed I was a car mechanic or something, and seemed baffled when I explained I had an honours degree in mechanical engineering. This is where the real problem lies – in education.”

Since the release of the Bachmann A1 models, there have been some problems of poor running, with motors overheating and even ceasing to run.

Those models affected need to be recalled so that reworking can be carried out. This will be undertaken at the Bachmann manufacturing facility in China and models will be returned to customers as soon as possible.

Many customers are delighted with their model and say it has performed perfectly in everyday service. Satisfied owners should not feel obliged to return their A1, but they can if they wish.

If you live in the UK

If you wish to return a Bachmann A1 for checking and any rectification, and you live in the UK, pack your model (locomotive only, no tenders please) in the correct box if possible. It may be wise to use a spare box rather than the presentation wooden box.

It should be suitably wrapped and labelled, and sent to: Bachmann Europe plc, A1 return, Freepost, Moat Way, Barwell, Leicestershire, LE9 8EY. Please secure an adhesive label on the outside of the package, with your name, address and postcode clearly written IN BLOCK CAPITALS, plus

your telephone details, to enable Bachmann to keep track of your individual model.

Only A1 models can be sent by the ‘Freepost’ service. Any other models sent in this way will be returned with an invoice for the cost of postage

On arrival at Barwell, each model will be booked in and allocated a number. The box and model will be clearly marked with this dedicated number and shipped to Hong Kong for rework. Once the necessary remedial work is done, the model will be returned to Barwell, where it will be checked and then despatched to its owner.

Bachmann ask that models be returned to them by 30 October 2002, to qualify for the freepost service and repair. Any models received after that date will be subject to normal postage.

Overseas readers

If you live outside the UK, return your model (loco.), packaged and labelled as above, to your country’s distributor. They will collate the models and then despatch them to Bachmann in England or directly to Bachmann Asia. A full list of distributors is on the Bachmann website – www.bachmann.co.uk.

For your superb, limited-edition model of Tornado, send a cheque to The Locomotive Construction Company for £165 with your name and delivery address to The LCC, 24 Welling Close, Redesdale Park, Wallsend, Tyne & Wear, NE28 8TE, England. UK delivery is included; if overseas, please enquire. Each one sold helps the trust.



CHAIRMAN'S COLUMN



Well, what a sight it was! I arrived at Darlington Locomotive Works, the Friday before the Convention, walked along the corridor, turned the corner and almost had to be picked off the floor. For a fleeting second, I thought I saw a completed *Tornado* – my first A1 cop! Then I noticed the gap behind the smokebox!

As predicted in my last column, our engineering team burnt the midnight oil over the summer months to ensure we reached all our targets for the Annual Convention: *Tornado* on her wheels, cab and smokebox in place, and moving for the first time. Alongside were many other components, including all the major motion parts, waiting to be fitted once the crowds had gone.

I'd like to take this opportunity to highlight some key points that came out of the afternoon's presentations and the question-and-answer session:

- If all the funds needed to complete *Tornado* were in place by early 2003, she could be in steam within 27 months.
- The way we build *Tornado* is now changing – much of the work from now on is a few large units (boiler, two tenders) costing hundreds of thousands of pounds, rather than many smaller components costing a few hundred pounds.
- We need to move from serial construction to parallel construction, working on frames, boiler and tenders simultaneously to bring forward the completion date.
- We must pay for the boiler at the pace it can be built – not the other way round.
- Since we must continue to involve more people in the project, to keep income growth on track, I set the trust recruitment targets – 100 new covenantors by Easter, 200 by August Bank Holiday and 300 by the 2003 Convention.

To put *Tornado* into main-line service without delay means a cash injection early next year of about £1,250,000, and Andrew Dow is leading our efforts to find the best way of raising this sum (see page 8); we will keep you abreast of progress. The Board was delighted with the response of the audience at the Convention, and we are now following up the many ideas that were put forward.

As you will gather from this issue of *Top Link*, our 2002 Convention was a great success. I'd like to offer my thanks to all those (you know who you are!) whose hard work, beforehand or on the day, made it possible. I'd also like to thank all of you who made the often-long trip to Darlington. I hope you enjoyed the day as much as I did. And if you couldn't make it . . . look at the photographs, read the report, look at our website – and I hope to see you next year,

Mark Allatt Chairman

MEET THE CME



At the end of the Convention, Tony Roche made time to talk to the editor.

We've never had a Chief Mechanical Engineer before, so what is your role?

First it's about getting the right people to do the various engineering jobs that need doing. Then it's up to me to make sure that what is delivered is safe, will work and will give value for money, to enable the operating licence to be issued.

Isn't that what David Elliott does?

We operate very much as a team and we work on the principle that two heads are better than one. David is a really good all-round engineer: he knows engineering thoroughly. His role involves all three aspects of professional engineering: desk, drawing-board and workbench. Mine is principally focused on ensuring that the approved systems and processes are in place, so that quality and safety requirements are fully met and we can obtain a licence to operate *Tornado*.

Does your job overlap with David's?

To some extent it does, but we work well together as a team. With his knowledge, David identifies the parts we need next and the drawings for them; he locates and negotiates with suppliers, trying to find a 'one-stop-shop' where he can; and then monitors progress and conformance.

How are you finding the job so far?

A lot more demanding than I envisaged: there were a lot of things that needed a bit of reorganisation and push, but much of that is now complete. For the future I can do a lot of my work from home and come to Darlington about once a month.

You're best known for your work on the diesel-engine High-Speed Train, not for steam. What made you join the A1 Project?

I grew up with steam: it's in my blood, if you like. But it's the majesty and power of steam that makes it so fascinating – on top of that it's as close as you can get to fundamental mechanical engineering.

The Big Picture (pp. 14–15)

Alan Anderson's painting of 60117 Bois Roussel is from a postcard c.1950. The livery is that applied from May 1949 to August 1951 to BR express passenger locomotives and seldom seen since outside Wilbert Awdry's 'Thomas' books. The caption reads in part: BRITISH RAILWAYS. NORTH EASTERN REGION. An A1 class locomotive hauling a Pullman train across the Royal Border bridge, Berwick-on-Tweed. (courtesy of Peter Costello)

MEET THE CME

TONY ROCHE



"I grew up with steam". Does that mean you worked with steam? You don't look old enough.

Well, I'm 59 but I began my apprenticeship with BR on Western Region steam locomotives at Stafford Road, Wolverhampton. I always saw myself as an engineer. My father was an electrical fitter, but engineering of every kind, and especially heavy engineering, was all around you in those days. Engineering was the big thing. I just saw it as a really worthwhile job.

How did you train? And what was your first job?

I went to technical college when I was 13. My first job was as a fitter's boy, but after about a year I was taken on as an apprentice by British Railways. I worked on GW types for the first couple of years – valve-and-piston examinations stick in the memory if you've done them – and then the first 0-6-0 diesel-mechanical shunters. I was moved onto the graduate course and did an external degree. At the same time I was working on the diesel-hydraulics and the Blue Pullman with a fine man called Ray Shiletto: just the two of us. Sometimes he'd have to go off and I'd be left on my own to service the Blue Pullman; I was still only 17 or 18.

Tony Roche went on to a very successful career in railways . . .

He qualified as a Chartered Engineer and went on to lead the team that in the 1970s produced the HST power cars. He has been works manager at Wolverton, chief executive of British Rail Maintenance, the Director of Mechanical and Electrical Engineering for British Rail and then Deputy Managing Director of Network South-East. He helped create the rolling-stock leasing companies, became a director of Eversholt Leasing and in 1994 was appointed to the BR Board to oversee the sale of its subsidiary companies while at the same time he improved safety.

He has been President of the Institution of Mechanical Engineers (2001/2) and is a Fellow of the Royal Academy of Engineering – a position reached only by invitation and which Tony described as "the ultimate accolade anyone can receive in engineering" – as well as a member of the court of the Worshipful Company of Engineers, a governor of Imperial College and chairman of its health and safety audit committee.

He is a partner in First Class Partnerships Ltd, a specialist company providing "constructive challenge and support" to senior policy- and decision-makers in the rail industry. He is a non-executive director of National Railway Supplies Holdings and a director of The A1 Locomotive Trust.

Do you have other interests outside work?

Well, I have a family, but as for spare-time activities, the fact is I really don't have any spare time. My trouble is I'm a willing horse. To me engineering is about improving the quality of life, and I'm quite passionate about that.

You've been a works manager. Is Darlington Locomotive Works part of your remit?

Only in an overall way. I'm responsible to the Board for seeing that the works is fit for purpose and well run. There have been significant improvements recently, especially in dedicated storage areas and in labelling.

This week you've seen the locomotive finally wheeled. Are you happy with the work done so far?

Indeed I am: the engineering is of excellent quality. It took time to get on top of the non-conformances, but none of them was a desperate problem. Now we are dealing with them as they arise.

Do you foresee problems in the future?

You never can tell. Part of my job is to try to foresee potential problems and then determine solutions that will avoid them happening. Human error may mean we don't catch them all, but we hope that in most cases we will spot them before anyone else does.

We endeavour to minimise the likelihood of anything putting a stopper on things by continually talking to all the parties involved, especially our VAB [Vehicle Acceptance Body] and Railway Safety.

The Board have been working hard to find someone to build the boiler and working out how to pay for it, but will acceptance be straightforward? Will certification require us to calculate its strength and behaviour as a structural member?

Possibly – in fact, probably it will, if only because it is likely to be an all-welded structure. In addition, the types of steel used today are different; in fact they are far superior to those available to Arthur Peppercorn in 1948.

With the boiler, as with the vehicle as a whole, we have to demonstrate its fitness for purpose. I don't see that as a major difficulty.

We're on track, in fact?

Very much so.

Thank you for giving us so much of your time.

WHY A PACIFIC?

In any enterprise, it never hurts to ask the most basic questions. The pictures here show pacifics designed by Oliver Bulleid and his former colleague on the LNER, Arthur Peppercorn. All four 'group' railways – the GWR, LNER, LMSR and SR – at some time used pacifics for express passenger work. Why?

We start with the atlantic, a wheel arrangement first used in 1888. In 1895, it appeared on the Atlantic Coast Rail Road and the Pennsy's mile-a-minute run between Camden (for Philadelphia) and the racy resort of Atlantic City. The atlantics' very success soon led to heavier trains, and the atlantics could not cope. The answer was a (typical) 50 per cent increase in adhesion weight: 4-4-2s grew into 4-6-2s. Bigger than atlantics, they were naturally called pacifics.

The name caught on, and so did the design: in 1908 the GWR was the first British railway to build a pacific. They never built another and in 1924 *The Great Bear* was 'rebuilt as a 4-6-0' (scrapped). How did the Great Western run its fastest and heaviest trains with nothing bigger than a 4-6-0? The answer is that they used Welsh steam coal of high calorific value and so less bulk. A 'narrow' firebox – with a grate of 30 sq. ft or less fitting the 4 ft gap between the frames – was found to suffice. Pacifics typically had a 'wide' firebox.

In 1877 John E. Wooten of the Philadelphia & Reading Rail Road designed a wide firebox to burn a mixture of low-grade anthracite and bituminous coal. Its larger area – 36 to 50 sq. ft in British pacifics – could burn more coal on a grate of reasonable length. To fit in the larger ashpan, the rearmost axle had to be kept low. The answer? Hence an atlantic or pacific, with trailing truck under



Wooten's wide firebox and a leading bogie for stability at speed.

Before about 1900, locomotive engineers were aware of the dual problem of draught and combustion but, apart from William Adams, they failed to approach it systematically. Putting more coal on a small grate does not necessarily produce more

Bulleid pacific 34081 92 Squadron on the Nene Valley Railway in 2000.

(photo: David Benson)

Peppercorn A1 pacific 60125 Scottish Union with no smoke visible, as usual. It's early 1950s on the ECML, but where? Does anyone recognise those trees? (photo: Geoff Chandler)



heat, as witness the Great Central 4-6-0s nicknamed the Miner's Friends. Over-firing can result in a firebed so deep and lacking in air gaps that it throttles the airflow: the combustion rate goes down, coal is only partly burnt, the fire cools, the exhaust gets ever smokier and in the end the fire will go out.

The other strategy for getting more work out of a relatively small grate – a sharper draught giving a very hot fire – brings higher combustion rates but also the risk that fuel particles are swept up to emerge from the chimney as sparks, cinders, char and ash. LNWR 4-4-0s were notorious for this, achieving prodigies of haulage at the cost of a mobile firework display. They were fitted with (and needed) char ejectors, resulting in a stream of particles whose pitter-patter on the carriage roof might be mistaken for rain by the uninformed passenger.

On test, Bulleid's pacifics used more coal than similar types. His combative response was "That's because they're doing more work". It was perhaps also because they are very tolerant of over-firing. The resulting exhaust makes a fine picture, as 34081 demonstrates (*opposite*), but it isn't a good advertisement for steam traction. Many pictures like that of 60125 (*above*) show the efficiency of East Coast pacific boilers and their firemen; 'clag' was by arrangement only.

Pacifics originated in the need to burn poor-quality coal. The larger grate allowed lower combustion rates, which reduced tube scouring and unburnt fuel losses, but gave potential for increased power when using better coal. In 1948 this was the reason why BR's Class 6, the Clan, was a pacific and not a 4-6-0; but the theoretical benefit was often outweighed by the practice of the fireman.

THE SAFETY VALVE

The Editor welcomes letters or e-mails, if succinct and polite, but they may be edited for length and content.

Northallerton, North Yorkshire

Dear Gerard,

When I saw Keith Pirt's 1965 shot of a K1 and two A1s in *Steam World*, I felt inspired. The reason? It shows the last remaining K1 and the last A1 built at Darlington, with another Peppercorn Pacific in the background.

Wouldn't it be wonderful to recreate the scene using 62005, 60163 and 60532 – sole extant examples of their class – at York, though the North York Moors Rly might be easier, I think!

I have sounded out Dave Martin of NELPG (responsible for the K1 and A2) and he is in favour. Let me know what you think.

Barry Wetherell

This is a splendid idea! Keith Pirt and Barry McLoughlin of Steam World have kindly given us permission to use the picture: see this issue's back cover.

Corfe Mullen, Dorset

Dear Mr Hill,

I was very pleased to see the photo of 60129 *Guy Mannering* at Haymarket shed, if only because it was the sole A1 I managed to photograph myself! The diesel in the background is almost certainly one of the Sulzer Type 2s that were so numerous at Haymarket.

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Thank you for an excellent magazine. We are all looking forward to the day *Tornado* steams for the first time.

Peter Cooper

The following letters appear here with the kind permission of the writers:

Wheatley, Doncaster

Dear Mr Elliott,

You may not know the background to snap-headed rivets at Doncaster. They came about when the plant built some LMS 8Fs, which were of course plastered with the things. The appearance of these pimples was much disliked; they were caused by someone deciding that the cost of countersinking was higher. What was forgotten was that the filling and rubbing-down process in the paint shop, if they were done properly, became much more difficult each time the tender was repainted.

As a locomotive engineer trained at Doncaster, I would be very disappointed if real or cosmetic snap rivets were used on *Tornado*. I suspect the only reason a welded tank was not produced at Doncaster or Darlington post-war was a shortage of skilled welders.

Doncaster got its own back when a wartime order for tender tanks of Midland design, with flat beaded sides, had the beading snap-riveted in place. That Yorkshireman and ex-GNR man S. W. Johnson would have turned in his grave

THE SAFETY VALVE

if he had known. Apart from the welded tank for the P2, a good many Standard 4200-gallon tanks for K3s built by contractors were welded.

With regard to the cab, Doncaster practice with Pacifics and V2s was to remove the cab by taking out the rivets securing it to the platform. I seem to recollect that a couple of rivets in the beading were also burned out and a strap put across from side to side to support the structure, preventing the roof folding as the sides moved in when the cab was lifted. This is much simpler than taking off the roof or roof plus half the sides. I hope this will help you in your decision-making.

Malcolm Crawley

Darlington

Dear Malcolm,

Thanks for your letter on the use of snap rivets: it was most informative. As for dismantling the cab for repairs, what I have in mind is the possibility of cutting away part of the cab sides to give access to the back corners of the firebox and foundation ring without removing the whole cab.

We are proposing a 5- and 10-year cycle for the boiler, to retain its main-line certificate as long as possible. The 5-year boiler repair requires removal of boiler clothing and lagging, and small tubes. This is feasible (and has been done on *Blue Peter*) without

removing boiler or cab: a wide firebox permits full inspection and access to outside ends of stays. *Blue Peter* now has the front lower part of each cab side bolted on as a separate component.

With the likely complexity of the brake and electrical systems, much of them attached to the cab, the less often we have to remove the cab, the better.

David Elliott

Wheatley, Doncaster

Dear David,

I totally understand what you say about removable pieces in the cab structure. I hope it will be a long time before *Tornado* needs foundation ring repairs. Indeed, I suspect it may not have one, at least of conventional type. Welded fireboxes on Bulleid Pacifics – and, I believe, the Austerity 2-10-0s – had no conventional foundation ring.

A major repair job with 50 sq. ft fireboxes was stays in the bottom part of the backplate and adjacent sides. I don't know, but I suspect this was caused by the almost universal practice of making a thick fire under the door.

One of the worst jobs of my apprenticeship was on an A1, refitting the regulator J-pipe, lying on my back in the tubes while four boiler-smiths riveted stays in the firebox. My ears were whistling for hours after. Small wonder that boiler-smiths were all deaf!

Malcolm Crawley

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Matters arising

On my caption to Bill Bratton's 1961 photo of *Guy Mannering* in *Top Link 4*, David Leyland writes from Duffield, Derbyshire. Knowing I like to get my facts right – so I hope readers will forgive this non-vaporate intrusion – he says:

The diesel locomotive lurking in the background of the photograph is indubitably not a Brush Type 2 – all of which were initially allocated to Eastern Region depots – but a Birmingham/Sulzer Type 2 of the D53xx type. The first twenty of these went to Finsbury Park, Hornsey or Hitchin for GN suburban services, and subsequent batches to Scotland, although some of the Scottish ones worked on the GN section first.

I remember the excitement at Hitchin on the first sight of a Scottish example when the nose of the locomotive, the only part visible, bore no number but had a *tablet-catcher recess*! The GN examples may have moved to Scotland by October 1961.

This is confirmed by Peter Cooper, whose letter appears under The Safety Valve.

View of a tender behind



Allan Garraway was there on 30 October 1949 when 60123 was retrieved after a collision at Lincoln. With a Voigtlander Bessa 6 6 camera and Ilford HP3 film, he took a series of photos – to which I hope to return – right through the day. This was the scene at 9.50 a.m. It reveals how the rear of the tender was painted. Other things such as streamlining were subject to cost/benefit analysis but not, it seems, tender paint schemes. How often would that careful lining-out be seen? (photo: A. G. W Garraway)

A Dedicated Covenant buys your bit of the locomotive. For each component you buy, you receive a certificate and a copy of the engineering drawing. So far over 180 components or tasks have been financed in this way.

We plan to start work soon on the Driver's Reverser Control, part of the reverser mechanism. As described in *Top Link 4*, Walschaerts valvegear allows variable cut-off of steam admission to the cylinders. The reverser adjusts the timing of steam entering and leaving the cylinders, to suit load and speed requirements, and it also controls the direction of travel.

The A1's reverser control is connected to the valvegear by a reversing rod – the long bar below the footplating on the l.h. side. The rod slides fore and aft: it is fully forward when the valves are in full forward gear, and fully aft when in full back gear. When it is in mid-travel, the engine is said to be in mid-gear.

In the cab, the driver moves the reversing rod by turning a handle, which rotates a nut, which in turn winds a screw thread up and down. The bottom of the screw thread is attached to a bell crank, which translates the motion fore and aft for the reversing rod. The mechanism also serves to lock the reverser in the required position using a handle with a dog, which engages in slots on a ring attached to the nut. We have the casting for the base of the reverser stand. To complete the assembly we need the following (with Dedicated Covenant nos):

Reverser screw PS492

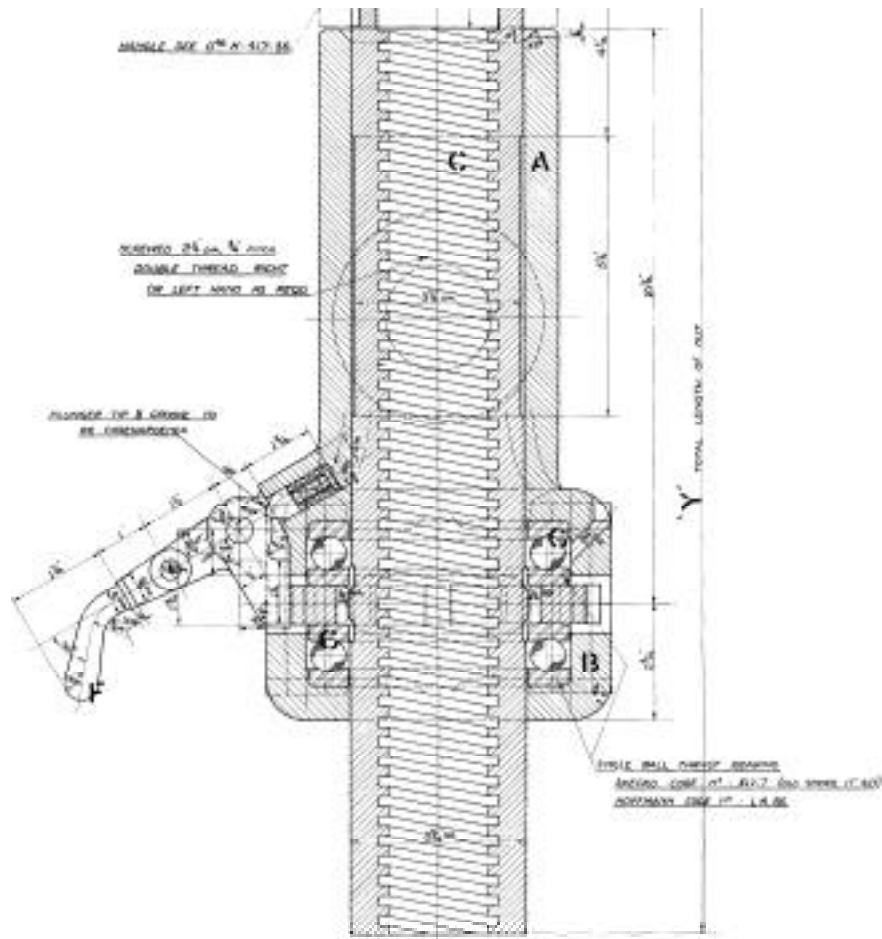
A screwed rod with a forked end to attach it to the bell crank, this was originally made as a forging to minimise machining. We will probably use solid bar turned and milled to the required shape; we can machine away a lot of material quickly.

Reverser nut PS490 and PS491

This will be a gunmetal casting comprising a thick walled tube just over 1' 7" long with an integral disc to form the locking ring about one-third of the way up. The casting will be a challenging machining operation: most of the bore has a 2 1/4"-diameter two-start, square-section thread to fit the reverser screw. We are now seeking quotations from two specialists in long screw threads for this work.

Trunnion and Trunnion cover PS493, PS494 and PS495

These iron castings form a housing for the nut, containing two thrust ball-races on either side of the locking ring on the nut. The larger casting has two spigots which form the trunnions; these support the screw assembly on the reverser stand and allow the assembly to rock slightly as the bell crank moves through its arc. They will require patterns, casting and machining.



Side plates PS496

Made from mild steel plate, these bolt onto the sides of the reverser-stand base to support the trunnion.

Bell crank assembly PS497

This will be machined from steel plate and round bar, and welded together.

Reverser handle PS498

This will be machined in one piece from solid bar to make the boss which fits on the top of the nut, and then blacksmithed to form the final shape of the handle.

Locking device PS499

Originally a drop forging, which is not viable for a one-off, this will be machined from solid steel and the rubbing surfaces case-hardened to resist wear.

Other components needed are studs, pins, bolts and nuts, plus the plunger and spring for the locking handle. The excerpt from LNER drawing K223 shows a section through the nut, trunnions and locking mechanism. This is being re-