

# The Worshipful Company of Engineers

(Incorporated by Royal Charter 2004)

## The Swordsman Newsletter



Issue 19



January 2008

**CONTENTS**

Editorial	1
Clerk's Corner	1
The Annual Golf Day	2
Visit to Portsmouth 13th to 16th September	3
Visit to Vosper Thorneycroft	4
Portsmouth Docks, Royal Naval Museum and Block Mills	5
Tour of HMS Victory	6
Visit and Dinner at the Royal Marines Museum	7
Weald and Downland Museum	9
Dinner on HMS Warrior	10
Choral Eucharistic, Portsmouth Cathedral	11
Visit to Portsmouth Grammar School	12
Visit to the Royal College of Defence Studies	13
Ladies' Luncheon	14
Mansion House Banquet	15
Annual Carol Service and Dinner	16
Personalalia - New Liverymen	18
The Development of Novel Treatment Wetlands for Land Remediation	19

**COVER PHOTOGRAPHS**

Top Row Left to Right	The Editor's feet and the view through the Glass Floor of the Spinnaker Tower, The Spinnaker Tower and HMS Victory
Middle Row Left to Right	Bay Leaf Farmstead at the Weald and Downland Museum, A Ceramic Roundel in Portsmouth Cathedral and Blocks on board HMS Victory.
Bottom Left	The Gadsden Fireplace in Wax Chandlers' Hall
Bottom Right	Tower Bridge from Tower Pier before Embarking

**FUTURE EVENTS**

6 February 2008	11th Bridge Lecture	City University
26 February 2008	Election Court and Service	Wax Chandlers' Hall, St Vedast-alias-Foster
7 March 2008	United Guilds Service	St Paul's Cathedral, Wax Chandlers' Hall
22 April 2008	AGM (Common Hall) and Installation Dinner	Butchers' Hall
13 May 2008	Spring Outing	St Pancras Station
13 May 2008	Corporation of the Sons of the Clergy	St Paul's Cathedral
24 June 2008	Election of Sheriffs	Guildhall
8 July 2008	Awards Dinner	Merchant Taylors' Hall
25 July 2008	Livery Golf Day	Clandon Regis GC
11- 14 September 2008	Out Of Town Meeting and 25th Anniversary Dinner	Shropshire and Ironbridge Guildhall
29 September 2008	Election of Lord Mayor	Wax Chandlers' Hall
1 October 2008	Ladies Luncheon	Mansion House
31 October 2008	25th Anniversary Banquet	

## **EDITORIAL**

A Happy New Year to all members of the Company. As we look forward to the Company's 25th Anniversary this year the current edition of the Swordsman looks back over the exciting programme of the last four months of 2007. Also included is a resume of the winning submission for the first Fiona and Nicholas Hawley Award.

Once again my thanks to all the reporters of the events who make my job rather easier than it would otherwise be. We are hoping to publish a special 25th Anniversary Edition of The Swordsman 'The Silver Swordsman' towards the end of the year.

I would welcome any recollections of special events or of a personal nature which Liverymen might like to contribute.

*Raymond Cousins*

## **THE CLERK'S CORNER**

At last sweetness and light has returned to Wax Chandlers' Hall with the completion of their refurbishment in late September and since then we have had a number of successful events here as well as Court and Standing Committee meetings. I must say that this finish has been a considerable relief to Stephen and me as our working environment was becoming extremely tiresome. Most items are complete in the Hall now although the Clerk to the Wax Chandlers' tells me there was a small snag-list still to finish off. However, by any stretch of the imagination it's a massive improvement on what it was before. This is good news because The Court authorised the renewal of our 5 year lease on the Engineers' Office and this was also completed satisfactorily in the summer. In the newly decorated Court Room on the ground floor we have our Royal Charter and Grant newly framed (courtesy of The Master) to match the Wax Chandlers' Grants and Sion College memorabilia there. Also in the Court Room there is a wooden glass fronted display cabinet and we have been given permission to display a portion of our silver and other precious Company items, which we would not normally have been able to show, in there. In the Livery Hall an electronic hearing loop system has been installed and a significant portion of the costs of this were given through a generous donation from one of our own senior Court members. Overall, although the hire of the Hall costs have risen (after a

year here rent-free during the refurbishment) the improvements have been worth waiting for.

You will all be aware that 2008 is our 25<sup>th</sup> Anniversary Year and you will know that these days we have to think and plan ahead almost a year or more in advance with the pressure on dates from so many new Livery Companies in the City but the same number of Livery Halls for hire. The arrangements are now well-advanced for the coming celebrations when there are 3 dates associated with our inauguration to remember: Petitions Submitted – 5 July 1883; Grant of Livery – 13<sup>th</sup> September 1883; Letters Patent received – 1<sup>st</sup> November 1883. When you look in the calendar opposite you will see that the various major events in 2008 are coincident or extremely close to these 1883 dates, and I hope that you will all put them in your diary. We will be making the Annual Banquet a very special event, with invitations to our 'Founders' being particularly attractive and the Ironbridge Gorge dinner on the Saturday of our Shropshire Out-of-Town weekend should also be memorable. To help mark these events in the 25<sup>th</sup> year there have been some special artefacts commissioned and these will be available to all those attending the commemorative activities.

In the coming year we are also looking to further improve on the Engineers' Company web-site and we have commissioned Ms Antoinette Kriel, Stephen's partner, to develop this with new software and capabilities. In particular there should be useful facilities in an individually password-protected 'members' area as well as expanded public access areas especially in the Charitable Trust's Grants, Awards and Prizes sections. In due course, events booking forms will be available in the Members area as well as other items of internal Company management matters. Feed back is always welcome on these developments and the Web-Master, Court Assistant Mr Clive Walker, or the Clerk's Office are ready to hear from you. On the subject of electronic business you may note from the latest events calling notice that we are trialling BACs transfer arrangements to pay for events – if this proves satisfactorily my intention is to continue the practice.

In the meantime, there is still a human interface here in the Company, please do not hesitate to call either Stephen Grundy, The Assistant Clerk and Beadle, or me for details on any aspects of the Company's business or activities – we are always delighted to hear from you.

*Graham Skinner*

## THE 2007 ANNUAL GOLF DAY, DINNER AND MORE!



*Clandon Regis Golf Club*

The 2007 Annual Golf Day, Dinner and More! was held for the second successive year at Clandon Regis Golf Club, near Guildford.

A total of 18 golfers played in the afternoon 18 hole Stableford competition for the Worshipful Company of Engineers' Trophy, which although slightly down on 2006 included more Liverymen than the previous year. The temperature was also down on last year – by 12 deg C – at a mere 23°C, which with sunshine all day constituted near perfect golfing conditions.

The Dinner was attended by 25 Liverymen and guests after which the prizes were awarded by the Senior Warden, Mr Tony Roche.



*David Scahill – Organiser and Champion*

It was very much the day for Liveryman Sir Robert Walmsley who was nearest the pin on Hole 3, nearest the pin in 3 on Hole 15 (the two prize holes) and was also runner-up in the Trophy Competition

with 30 points. As it is a long established rule that competitors are only awarded one prize, his two other “prizes” were awarded to: Dan O’Malley the Senior Warden’s son-in-law, also with 30 points who was just shaded into 3<sup>rd</sup> place on count back over the last three holes; and Gwen Fairer-Smith, guest of Liveryman Peter Cullimore, who was runner-up in the Ladies’ competition. The winning lady was Doreen Robinson, wife of the Junior Warden, and the winner of the men’s competition with 36 points was Assistant David Scahill who also received the Worshipful Company of Engineers’ Trophy.



*Doreen Robinson – the Ladies Winner*

Rob Walmsley was again amongst the prizes as a member of the winning team in the morning’s Texas Scramble together with Raymond Cousins, Tony Roche and Dan O’Malley.

As the numbers of the “and More!” tour were reduced to two this year, it was an easier task than last year to decide on where to go, and Ruth Cousins and Gill Scahill spent the morning on the Guildford Historical Trail, which covered amongst others, sites associated with Lewis Carroll who lived with his sisters in Guildford from 1868 to his death in 1898 and where he wrote “Through the Looking Glass.” This could be considered as Part 2 of the “Complete Lewis Carroll Tour”, Part 1 – Carroll’s earlier life, having been organised by Philip and Elizabeth Hawtin in Oxford in 2003!

In the afternoon the ladies visited Watts Gallery and Mausoleum, a fine example of the Arts and Crafts movement and which was runner-up in the 2006 BBC Restoration Village competition.

*Gill and David Scahill*

## VISIT TO PORTSMOUTH 13 to 16 September 2007

Like last year, the Engineers found themselves at a port on the South Coast for their annual out of town visit. This year we were welcomed to the Queen's Hotel in Southsea by the Master, David Bawtree, his wife, Ann and the Clerk, Graham Skinner.



Having been handed our welcome packs of the final schedule of events and leaflets about the many attractions of Southsea, Portsmouth and the surrounding areas we went off to seek our rooms and there were welcomed by an exciting range of cosmetics for men and women from the collection of Liz Earle, the Master's daughter.

The hotel, a big impressive old building stands at the edge of Clarence Parade and looks across a large green to a very impressive Memorial to those who lost their lives at sea during the two world wars and then further out to the main channel into Portsmouth Harbour, with the Isle of Wight beyond.

During the stay we saw many ships including an aircraft carrier passing the war memorial into the harbour. Other events on the green included wind skating and releasing pigeons as well as keep fit activities and kite flying.

For the early arrivals it was then a walk across the green and along the promenade in still, warm, weather. Some of the leaning trees were a reminder of how the wind normally blows but the weather could not have been kinder to us.

The first evening dinner was in the hotel at round tables, named after famous ships, which were hosted by the Officers of the Company and Past Masters. During the evening we were briefed on the programme for the weekend and the many delights of the evening included a chocolate fountain.

The Master persuaded us to part with many £5 notes to see how close the numbers would match one that he had donated to the Charitable Trust earlier. The Master masterminded the results of this competition at the Saturday lunch. Ignoring the prefixed letters it was surprising how quickly the notes contributed were eliminated from the contest. The total raised was £590 with half going to the holder of the closest number. Modesty forbids mentioning who the winner might have been but gift aiding the winnings back to the Charitable Trust and with the proceeds of the auction from the "special box" which keeps being returned and which was won by David Johnson the total proceeds for the Charitable Trust were over £700.



I now leave the rest of the story to those who have kindly 'volunteered' to write about the different sections of the weekend. My thanks to you all, and to the Master and Ann, the Clerk and Margaret for their splendid organisation.

*Raymond Cousins*

**VISIT TO VOSPER  
THORNEYCROFT SHIPBUILDING  
HALL  
14 September 2007**

The first excursion of the Out of Town Meeting saw two coach loads of us enter Portsmouth Naval Base to see VT's new ship building facilities. This is a modern commercial venture that has brought warship (and other ship) building back into the dockyard. As part of its strategic growth plans, VT has been moving much of its shipbuilding and warship repair and support business from Southampton to inside the dockyard wall at Portsmouth.

For good labour relations and efficient working practices VT operate a four day week, Monday to Thursday, starting very early each morning. This makes it easier for their workforce, many of whom still live near Southampton to get into work and reduces their amount of travel. It also allows good periods for maintenance of the plant or bringing in other staff at the weekend.

VT has been operating in direct support of today's Royal Navy warships in Portsmouth for nearly ten years, through a 50/50 partnership with BAeS, Fleet Support Limited, that has successfully modernised and reduced the cost of support of the ships and the Naval base. But, it was VT's relatively new shipbuilding facilities that we visited. In particular, we were escorted round the Steelwork Production Hall, the Unit Construction Hall and Ship Assembly Hall which are at the heart of some 33 acres of the Naval Base. Our party's tour guides were John Richardson, Ian, the welding manager and Stephen Hunt (masts – but not as we might have known them from the past!), who answered all of our questions with patience, and, in turn, set us two challenges

The Steelwork Production Hall employed the latest technology, laser cutting to within 0.3 millimetre accuracy, and lean process techniques, constantly revised to maximise efficiency on the batch production lines. Shift working is based around a 10x13 metre pallet system, linked like a railway to move work down the "line" to the Unit Construction Hall. The juxtaposition of this modern machinery had, as a counterpoint, a 9.5 metre wide steel rolling mill – manufactured in Victorian times (1898) by Smith Brothers in Glasgow, bought from J Samuel White on the Isle of Wight, and brought to Portsmouth from

VT's old yard at Southampton as it is still the most effective machine of that size.

The second hall was equally impressive for its fabrication of shapes like three-dimensional jigsaw puzzles, particularly the complex large mast for the new T45 destroyers where weight control is crucial in view of the potentially heavy top hamper that these structures create for the ship's stability. The Ship Assembly Hall showed how modular construction and concurrent outfitting have matured such that whole sections of ships could be prepared (complete with cabling pipework, equipment and even modular bathrooms and accommodation cabins), moved by heavy-lift transporter and the sections welded together with perfect alignment - millimetre accuracy has replaced the proverbial "to the nearest dockyard inch"!

The Ship Assembly Hall is being extended to provide sufficient space for the huge sections of the Navy's new aircraft carriers to be fabricated. As a real test of engineering precision, these massive sections will be shipped to Scotland for final assembly into complete ships with every confidence that the joining welds between the megablocks will be as straightforward as any those of the elementary modules made in controlled conditions.

And what were the two challenges given to us? First, a consequence of the very precise laser cut metal shapes was very sharp edges, and these could only be radiussed manually, in the old-fashioned way. If anyone has an automated solution, VT would like to know! Secondly, despite sponsoring some 200 apprentices (of all specialisms) and working with schools and university in Portsmouth, it was still proving difficult to recruit skilled welders – although the Polish were happy to meet the need. So, if any Liveryman could help out, again, I expect that VT would like to hear from you!

*Barry and Linda Brooks*

## PORTSMOUTH DOCKS, ROYAL NAVAL MUSEUM AND THE BLOCK MILLS

14 September 2007

Following the visit to Vosper Thornycroft shipbuilding yard we assembled in the Princess Room of the Royal Naval Museum and in marked contrast to the state of the art engineering just experienced, returned to the days of Nelson and the industrial revolution. We were then treated to an illustrated presentation by historian, Jonathan Coad, who took us through the development of Portland Docks in general and the famous Block Mills in particular – (the intended visit to the Block Mills not being possible due to extensive refurbishment works). Jonathan took us back briefly to the Tudors who were the first to establish a permanent Royal Navy with dockyards located in the Thames area to face threats mainly from Denmark and Holland. However, over the 18th Century there came a drift in dockyard location to the South Coast as a result of threats from France and increasing ocean-going naval challenges.



In parallel with these responses there was considerable expansion in Navy capability. As illustration the Navy in 1698 comprised 266 ships, by 1780 the number had become 617 and by 1814 it was not less than 900 vessels. In addition to sheer numbers the sizes of the ships kept increasing; masts became taller, their longer yards needed more standing and running rigging, and there were more and heavier anchors and cannons. These changes in turn led to increased demands for all aspects of servicing in the dockyards – reflected in large brick built storerooms (to reduce fire risk), greater timber handling and seasoning and shaping

facilities, larger and longer roperies, and longer, wider and deeper wet and dry docks.

By 1795 Portsmouth was far and away the Navy's largest refitting yard in which year by good fortune the appointment was made of Sir Samuel Bentham as Inspector General. At that time the drydocks were in some difficulties due to the increased requirements and inefficient expedients became necessary such as use of high spring tides and reducing dead loads on the docks foundations by removal of all stores, equipment and guns. But it was at the entrances to the drydocks that the problems were greatest – the gates proved the weakest part of the structure and did not readily lend themselves to alteration and widening (the traditional design approach for drydocks in the poor subsoil of Portsmouth had been by masonry walling and timber floors under pinned by timber piles. This, however, meant that the gate piers were not linked to each other by direct means).

Bentham adopted the innovative and elegant approach of using inverted masonry arches at the entrances which firmly linked the gate piers and lessened the need for piling. He turned his attention also to the use of steam power to replace horse driven pumps and used the new source of power not only for dock operations but also to drive machinery for woodworking machinery.

Ships pulley blocks were then used in huge quantities. For example, a 74 gun warship had no fewer than 922 blocks in varied sizes for her standing and running rigging and a further 450 for working the guns. Typically, a block comprised three main components – a sheave or pulley of lignum vitae wood, a bearing of gun metal or similar and a pin of iron or – for blocks near to power magazines – of hard wood to reduce the fire risk, all contained within a shell of elm wood which had good resistance to marine conditions.

Bentham persuaded the Admiralty to completely change the system of supply and production and with contributions from his own inventiveness in woodworking machinery and his collaboration with two others created one of the early great mass production factories of the Industrial Revolution. The other two were Marc Isambard Brunel with inventive engineering interests and Henry Maudslay, machine designer, who had workshops capable of supplying newly designed equipment to the highest standards then available. To these three might be added the name of one, Simon Goodrich, the first Engineer to be employed by the Navy who sorted out day to day

## TOUR OF HMS VICTORY 14 September 2007

mechanical problems. As a result of this combination of talents and by use of new machinery and production techniques by 1808 annual output was no less than some 130,000 blocks. For the record the Block Mills continued in use until well into the 20th Century and has a secure place in industrial history.



*Typical Blocks*

These ports of call provided an opportunity to view, at leisure, particular items that suited our individual interests or attracted our curiosity. In the museum we were able to admire the high quality of detailing and craftsmanship in the vessels on display and in the galleries to gaze at the extraordinary collection of Nelson memorabilia reflecting the adulation given to the hero. Indeed, it seemed that almost anything that could be made at that time was made with the name Nelson on it. There was also a life size presentation of Lady Hamilton and if a true likeness it did her image no great harm. There was a similar life size representation of Nelson, presumably just before Trafalgar, his hair greying yet because of his small stature and colouring looking quite youthful and modest; definitely not in the typical cavalry officer pose. Perhaps, too, there was another measure of the man, for on exhibit there were examples of his writing. One of these was written with his right hand before the Tenerife action at which he was wounded and his right arm had to be amputated. For comparison there were two letters written with his left hand. The first of these dated a mere two days after the operation was somewhat spidery yet legible – apparently still on duty! The second, some time later, was significantly more fluent and confident – interestingly both these two were easier to read than the first letter.

*Robert Richie*

There may have been a few sore heads on Saturday morning – some, not from the effects of over-indulgence at Friday evening's Livery Dinner at the Royal Marines' Museum, but from painful collisions with one or more of HMS Victory's deck beams during the company's tour! However, even those with such reminders could not have failed to marvel at the ingenuity of the designers and skills of the shipwrights of this magnificent example of Britain's naval heritage. HMS Victory is the only surviving 18th Century 'ship of the line' in the world and today is still in use as the flagship of the Commander-in-Chief Naval Home Command and a living museum to the Georgian navy.

In this short report of our visit, it would be superfluous to quote all of HMS Victory's vital statistics and we are all familiar with her significance in Britain's naval history as Lord Nelson's flagship at the battle of Trafalgar in 1805. But a brief look at a few of the most salient details gives an idea of what was entailed in her construction which commenced in 1759. HMS Victory took almost seven years to build and was launched at Chatham in 1765 where later she was substantially rebuilt and re-launched in 1803.



Wandering around No. 2 dry dock before boarding, one could not fail to be impressed by the sheer grandeur of the exterior of this amazing vessel which after all, was a ship intended for battle! From stem to stern, HMS Victory is elaborately decorated and any visitor (including engineers) would be impressed by the intricacy of the fixed and running rigging. The complexity is probably equivalent to modern electronic systems, except that in this case all is tangible – in every sense of the word.

We learned that some 6000 trees, mainly oak were used in the ship's construction which was about 2' thick at the waterline. 27 miles of cordage were used. Her full sail area was about 60,000 square feet (nearly



one and a half acres) and when commissioned her displacement was 3500 tons.

Our tour of the ship began on the lower gun deck which doubled as the main mess deck. Here there were thirty 32-pounders. HMS Victory had 104 guns in total, thirty 'long 12-pounders' on the upper gun deck and twenty-eight 'long 24-pounders' on the middle gun deck.



From the lower gun deck, we moved down to the orlop deck to look down into the hold that could store provisions for six months at sea. Stores included 220 tons of water, 50 tons of beer, salted fish, beef and pork and two tons of butter. Flour and dried provisions

such as peas, beans, oatmeal, ships' biscuits were also stored here. Oxen and live chickens were kept on board to provide fresh meat for as long as possible. 50 tons of coal were carried for the cooking stoves and hot water boilers.

35 tons of gunpowder could be stored in the ship's magazine – seven and a half tons of which were used at the battle of Trafalgar. HMS Victory had some 220 tons of iron ballast and extra moveable ballast in the form of shingle that doubled as a bed for the lower barrels.

The Great Cabin was extravagantly spacious with its three compartments, a day cabin, a dining cabin and a sleeping place. It was used by Lord Nelson whilst on board, but this accommodation contrasted starkly with the uncomfortable-looking and claustrophobic accommodation of the ratings. In fact it appeared that hammocks were slung in any available space anywhere in the ship.

Although the sick berth is on the upper gun deck – when in battle, as it was below the waterline, the after cockpit on the orlop deck was used for the surgeon's casualty theatre. The theatre and its array of surgical instruments, many of which looked like ordinary

carpenter's tools, seemed to be of great interest to many of us. It was here that the surgeon and his assistants carried out emergency operations such as extracting bullets and large splinters and limb amputations. Without quoting the rather gory details, according to the notice an amputation could be completed in about one and a half minutes.

At Trafalgar, HMS Victory had a crew of 821, including 142 marines. It is remarkable that the casualty list is so short. The list showed that 57 men were killed and 106 wounded, of which thirty-eight were classified as either dangerously or badly wounded. As the citation says, "This result stands testament to the abilities of the surgeon and surgeon's mates".

..... and the Royal Navy's victory over the combined fleets of Spain and France on the 21st of October 1805 off Cape Trafalgar, stands as a testament to 'the Nelson Touch'.

*Philip and Jane Ramsell*

## VISIT AND DINNER AT ROYAL MARINES MUSEUM

**14 September 2007**



*Arriving for Dinner at the Royal Marines Museum*

The sun was still shining as we arrived at the splendid Victorian building, which is home to the Royal Marines Museum at the eastern end of Southsea's gracious esplanade. As a small child I had often watched the marching skills and listened to the stirring music of the Portsmouth Royal Marines Band, so it was with much nostalgia and a feeling of privilege that

Mike and I walked up the steps into the glorious interior of the Museum. This grand building was once the officers' mess and became a museum only in 1974, after I had moved away but where I should have returned long before this.

As we imbibed excellent champagne we were able to wander through the rooms displaying RM history from their founding in 1664 (it's amazing how much we owe in this country to the reign of Charles II) right through to their current service in Iraq and Afghanistan. Memorabilia of Lord Louis Mountbatten, Life Colonel Commandant of the Royal Marines is proudly displayed, as is the most amazing collection of medals anywhere in the world. Perhaps the most remarkable section for us contained the paintings of Victoria Cross recipients, with citations to their inspiring courage. There were no less than ten VCs awarded to Royal Marines. We were particularly moved by one Major Frederick William Lumsden with his VC and DSO with three bars! What a debt we owe to heroes like him! No wonder that we felt we should draw ourselves up a little taller, smooth down our evening dress and revel in our British history.

Every item in the museum is immaculately presented, detailed and explained and all the rooms are pristine in their presentation. As we gathered and enjoyed gentle conversation we were entertained by the harpist Audrey Cameron Finmore, whose music floated around us, providing a memorable sense of occasion.

Then all too soon we were summoned for the Formal Livery Dinner in the Mountbatten Room, superbly decorated with much gold leaf, great marble fireplaces and huge, lovely chandeliers. Our notes told us that a humble clerk mistakenly added an extra nought to the budget, allowing the original RM officers and ourselves to enjoy such opulence. Having clapped in our top table with the Master's guests Dr Tim Hands, headmaster of the independent Portsmouth Grammar School, and his wife Jane, grace was said by the Chaplain, Reverend Michael West. We were then able to admire a really super portrait of Queen Victoria as we ate dinner. Unusually she was not facing us but standing in a more relaxed pose as if she felt at home here. This painting by Hubert Herkomer is a copy of the one by H.von Angeli held by HM The Queen but is felt by many art critics to be superior.

Entertainment was beautifully provided by StopGap, six young men, all Choral Scholars of Portsmouth Grammar School and Portsmouth Cathedral singing



*Choral Scholars from Portsmouth Grammar School singing before Dinner*

four songs, with one repeated as an encore, unaccompanied in close harmony. These were 'If ye love me' Thomas Tallis, 'Steal away' trad., 'Slow motion time' Henry Bennett, and 'My Evaline' trad. They had also sung 'The Queen' and provided the Benedictus.

The Master David Bawtree gave a speech relating highlights of Portsmouth's rise to fame as the greatest naval dock. He spoke of Portsmouth's history going back to the reign of Richard the Lionheart, who created the first dry dock, through the founding of the first naval college, the importance of Lord Nelson, to the building of the first Dreadnought battleship in just one year and one day. Although as he said, he hoped the contract had not been for one year exactly! And Portsmouth remains the foremost naval dockyard through its role in the building of two new aircraft carriers and the new Type 45 destroyers by Vosper Thornycroft. He then introduced Tim Hands who based his humorous speech on education, with some amusing anecdotes about PGS sports trips, and the importance of engineers. He reminded us that both Dickens and Brunel had been baptised in the same font. Tim Hands believes that Brunel was the last of the Renaissance men, an inspiration to Portsmouth and engineering. He concluded that today's engineers are not sufficiently appreciated.

A really wonderful evening, we emerged into the clear night air to see the lights of myriad vessels in the Solent against the background of the Isle of Wight overspread by the stars with a sense of pride in the men and the place that is the Royal Marines Museum, Portsmouth.

*Mike and Valerie Howse*

## WEALD & DOWNLAND MUSEUM 15 September 2007

On a perfect morning with a clear blue sky, two coach loads of the Out-of-Town Visit attendees set off promptly from the Queen's Hotel for Singleton and the Museum. En-route one coach party was entertained by the Master and the other by his wife, Ann, with very clear and informative commentaries about the locales through which we travelled. This made the journey time slip by and the countryside of the South Downs area was a pleasure to see.



*Restored Town Hall Building*

Following a welcome coffee and comfort break, the first event was an introductory presentation by the Weald and Downland Museum's Director, Mr Richard Harris. Among such a large body of Engineers he was brave enough to admit to being an Architect. For many years, however, he has specialised in the preservation and restoration of historically interesting timber buildings. The museum opened on 5<sup>th</sup> September 1970.



*Mr Richard Harris describing the museum*

By the time he took up post in 1975 some 150,000 visitors per annum were being recorded. This is similar to the current level though over the years numbers have fluctuated between about 125 and 190 thousand.

He explained how the museum is run by trustees as a charity. There are 45 historic buildings from the 14<sup>th</sup> to the 19<sup>th</sup> century re-erected on the site, ranging from a privy to a long barn. Unlike many other historic building museums, primarily in other European countries where the display of artefacts is the driving objective, the Singleton project aims to save buildings that record heritage and are in danger of being lost through either redevelopment or decay. A typical example of the way in which the staff of the museum work was in the saving of the Walderton house which dates from mediaeval times.

This task began with extensive archaeological investigation which in turn helped decide in which period of its life the building should be displayed. Also in this process expertise was developed in regard to traditional techniques to ensure authentic restoration. Richard said that much debate was generated prior to the eventual decision to put replica furnishings in the various buildings to enhance the social understanding for the visiting public of the periods represented by the reconstructions.



*The Gridshell Building*

Apart from being an attraction the museum has an important role as an Adult Learning Centre besides offering schools displays of rural history. To date some 25,000 children have taken part in organised visits. For the adults there have been 2,000 days of training since 1992 at a cost of some £80-90 per day. Eight students at a time learn timber framing

conservation which can eventually follow through to MSc level qualification at particular Universities.

Before we set off to see the exhibits Richard explained the reason for, plus the design and construction of the unusual Gridshell building in which the presentation was taking place. Concealed amongst the trees, its very modernity appears as a stark contrast to the other old structures in the museum's grounds. This structure represents the very latest in techniques for creating large clear span timber buildings and its form, design and construction owes much to the use of computers. It provides the necessary well lit working floor for the restoration of full sized building components besides having a large basement area underneath, cut into the hillside as part of its foundations, where the collection of some 10,000 artefacts donated to the museum are housed. Though the initial aim was to create a large workshop it is now primarily used as a teaching space. When completed, this building, which had been financially supported by the Heritage Lottery Fund, won many awards. A fuller description of both this building and the museum in general can be found on the excellent museum's web site.



*The Romany Festival in Progress*

Our party was then split into a number of manageable groups and given a quick introductory tour by the Director and members of his staff. On the day of the visit a lively Romany festival was in progress and apart from likes of the fried chip wagon it created much colour and life to the museum scene! Examples of the differences between a carpenter's repairs and that of a timber conservationist's approach were demonstrated by the Director.

As the coaches departed for lunch in Portsmouth many expressed the view that they would return for a longer visit another time to better appreciate what there is to see. All would surely agree with the Director's mission

statement that the museum is there to inspire. Once again the Master, with the help of Ann and the Clerk, had planned an excellent Out-of-Town event.

*Henri and Joan Pageot*

## **DINNER ON HMS WARRIOR**

**15 September 2007**

One of the highlights of this year's Out-of-Town meeting at Portsmouth was dinner on HMS Warrior.

When launched in 1860 HMS Warrior was the largest, fastest and most powerful warship in the world. The central armoured section is clad with 4½" wrought iron backed by 18" of solid teak. In tests, the most powerful guns of the day could not penetrate this armour, even at point blank range. She had a company of 706 individuals and was capable of 17.5 knots under sail and steam. Her original main armament consisted of 26 6 lb muzzle loaders, and 10 110 lb and 4 40 lb Armstrong rifled beechloaders. The ship is currently riding to anchor. Her four heaviest anchors each weigh 5.6 tons. These were the heaviest in maritime history to be raised manually. It took four to five hours to bring them up and involved 176 men on the capstan.



*The Master and Ann receiving the guests*

The evening began with drinks on the broad upper deck on a warm and sunny evening. The contrast with Nelson's Victory, built one hundred years earlier was striking. Over head in the rigging the flag signal "discover Warrior 1860" fluttered majestically in the evening breeze while below people stood around in small groups chatting. During drinks there was sufficient time to visit the hold and inspect the 1250

horsepower, steam engine, which (for the steam buffs amongst us) was a two cylinder reciprocating trunk engine built by J. Penn of Greenwich in 1887. We were told that this was not the original engine; that was removed in 1920 when the ship became HMS Vernon, a torpedo training school.

Drinks were followed by dinner on the main gun deck. Trestle tables seating 10 were located between the 110 pound guns. Remarkably, the tables were suspended from the ceiling to ensure that they always remained level when the ship was at sea. The dinner was breast of guinea fowl, preceded by bubble and squeak crab cake followed by chocolate and Baileys molten pots. Owing to the poor acoustics and the fact that the podium was not visible from all points on the deck, The Master gave just one short speech. Furthermore, in true naval tradition the Loyal toast was drunk seated. In view of the low decks, Clive considers this a very prudent tradition. Entertainment was provided by Shep Woolley and the ‘Ansome Cabin buoys’ and a magician, Robie, who did some very impressive card tricks at our table.

The repertoire of Ansome Cabin Buoys included numbers from the Dubliners, the Beatles and the Rolling Stones. It was a wonderful atmosphere and soon lots of people were dancing on the well preserved deck.



Happy memories of the dinner on HMS Warrior will remain with us for many years to come. These will be strengthened by the commemorative glass that we all received from The Master at the end of the evening. The glass is engraved with the Company’s Coat of Arms and carries the inscription “Worshipful Company of Engineers, HMS Warrior (1860), Portsmouth 15 September 2007” in three lines. On the bus back to the hotel several people were seen carrying

an empty Warrior wine bottle – an extra personal souvenir of an unforgettable evening and a marvelous ship.

*Clive and Janet Walker*

## **CHORAL EUCHARIST PORTSMOUTH CATHEDRAL 16 September 2007**

We walked in the beautiful sunshine towards Old Portsmouth, guided by the tower and cupola of the Cathedral standing above the houses. As we rounded the corner, the bright clean building immediately



revealed itself as a mixture of styles constructed over the ages. Inside, looking from the West door, installed in the 1990s, we could see over 800 years of development; first the 1930s Nave, then on through the door piercing the massive 17<sup>th</sup> Century tower, to the Baptistry and Quire and, finally, to the 12<sup>th</sup> Century Chapel of St Thomas à Becket, to whom the Cathedral is dedicated.

The Reverend Canon Nicholas Ash welcomed around 60 Liverymen and guests to the Service. This opened with Introit by Orlando Gibbons, ‘Almighty and everlasting God’. The Sung Eucharist setting was the Mass No.2 (Missa Brevis) in G major by Franz Schubert—one of his early sacred compositions (1815)—the best known, but too rarely heard these days. And what a pleasure it was to hear the Cathedral Choir, made up mainly of boys and lay clerks from Portsmouth Grammar School, who not only showed their outstanding professionalism under the Master of

Music, Dr David Price, but also their pleasure in performing. Included in the Choir were the six choral scholars who sang for us at the dinner on Friday at the Royal Marines Museum. However, the Choir did not have it all their own way—there was some lusty singing of the hymns by WCE and other members of the congregation! The service ended with the sub-organist, Marcus Wibberley playing the voluntary, *Apparition de l’Eglise éternelle* (1932), by Olivier Messaien.



In the sermon, Canon Ash explained how he squared his faith with his original studies in physics. He referred to the “fundamentalist”

Richard Dawkins views that there is only fact and reason, and nothing else. Canon Ash accepted the variety of

knowledge constantly being revealed to us, and our ability to reason, but considered that Dawkins has failed to take into consideration the spiritual and emotional experiences which we have all had. He concluded that Dawkins had not shaken his faith in God and that we, also, should not allow ours to be shaken by such extreme arguments.

After the service, sherry was served (with the remains of a baptismal cake for the fleet of foot), followed by a tour of the Cathedral. We heard that its location has ensured close associations with the Royal Navy and seafarers generally and, as a result, it is known today as ‘The Cathedral of the Sea’.

The Cathedral, above all, is a living symbol of the faith of generations which built and cared for it—and this continues with the development fund appeal ‘Continuing the Voyage’. The objective is to raise £2 million to build a community building (for development and extension of music and education in the community), create a visitors centre and conserve and restore the fabric of the mediaeval church. WCE is pleased to have made a contribution to the fund which has now reached over £1.5 million.

*Don and Beryl Prichard*

## VISIT TO THE PORTSMOUTH GRAMMAR SCHOOL

16 September 2007



*The Master, Senior Warden, Clerk and former pupil, Peter Wason at the entrance to the Brunel Staircase*

The final event of the visit was lunch at the Portsmouth Grammar School, of which our Master David Bawtree is Chairman of Governors and has his name engraved on the gate posts. The School is just a short walk up Portsmouth’s historic High Street from the Cathedral, almost in Nelson’s footsteps on his way to sail in HMS Victory for the Battle of Trafalgar.

This independent school was founded in 1732 by Dr William Smith, a former Mayor of Portsmouth and Physician to its garrison. The school essentially refounded in 1878 on a site created by the demolition of the City Ramparts in Cambridge Road and these buildings now house years 5 and 6. The school was originally an all boys establishment but has been co-educational for some years and has an outstanding record of success for boys and girls equally, not just academically but also in a very wide range of sporting and cultural pursuits. It also proudly turns out more future professional engineers than any other school in the country.

Following lunch – school dinners were never like that! – we visited the School’s very interesting Brunel collection honouring one of Britain’s most well known engineers who, along with Charles Dickens was a famous son of Portsmouth. The exhibition was housed on one of the staircases and included many pictures of Brunel’s work and portraits of the time.

*Peter Wason Old Boy of PGS*

**Visit to the Royal College of Defence Studies, Seaford House, and Lecture by Assist. Com, Tarique Ghaffur CBE QPM MA  
12 October 2007**

Following experience in the First World War, a Cabinet Committee in 1922 under the seeing eye of Winston Churchill recommended the establishment of a defence college to train senior staff for the defence of the Empire. Thus in 1927 the Imperial Defence College was founded, with a student group of 25 from the UK, Australia, Canada and New Zealand. The merits of the College were ably demonstrated during the Second World War, after which the Imperial Defence College was expanded to attract students from the United States, and later, from countries throughout the world. Renamed the Royal College of Defence Studies (RCDS) in 1970, the College provides a year-long course for around 80 students (known as members), about three quarters of whom are military, the remainder being government officials and industrialists.



*Seaford House*

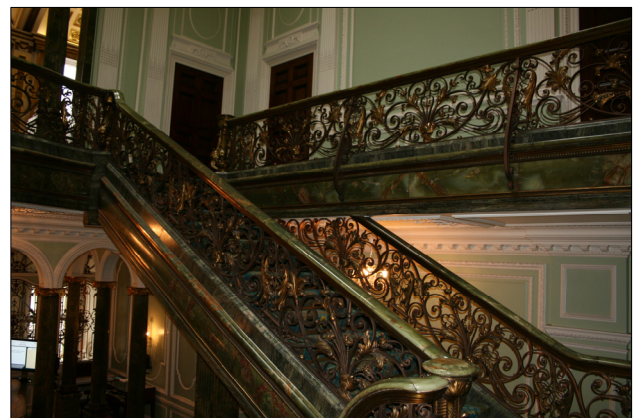
Seaford House, Belgrave Square, was built in 1842 during the development of Belgravia and leased to the Earls of Sefton until the end of the 19<sup>th</sup> century. It was then refurbished to its present standard with fine wood panelling, ornate ceilings and a grand staircase of South American onyx marble. The House was requisitioned by the Government in 1940, and has been the home of the RCDS since 1946.

Tarique Ghaffur joined the Metropolitan Police Service in 1999 following a successful career in the Manchester and Leicestershire Police Forces. He has been responsible for a number of initiatives including Operation Payback on the proceeds of crime, as well as operations under Trident, against black community

gun crime. He has also overseen a number of large public enquiries including the Damilola Taylor and Victoria Climbié enquiries. Assistant Commissioner Ghaffur has received many awards and honours in recognition of his outstanding community policing achievements.

In his lecture “The Nexus between Terrorism, Organised Crime and Communities”, Mr Ghaffur gave an insight into the scale of policing in London, with some 32,000 officers fielding 4 million calls and Investigating a million crimes per year, in addition to policing thousands of major events. The very diversity of London, whilst being one of the city’s major strengths, is also an attraction to terrorists. Terrorism requires huge financial resources, which are found largely through criminal activities. Terrorists tend to operate in small, often loosely organised groups, and through infiltration of communities and indoctrination of young, largely male Muslim, people. Key points in the plan to combat terrorism include involving the community in its own security, understanding the causes and dynamics of disaffection, and the establishment of role models in major institutions.

The security of the 2012 Olympic Games (another of Mr Ghaffur’s responsibilities) begins in the construction stage to protect the infrastructure, and encompasses all participants as well as the expected 9 million ticket holders. Tracking the identities of the vast number of people coming to London for the event is a major technical and logistic challenge.



*Magnificent Staircase inside Seaford House*

Following the lecture, the Company and guests enjoyed a superb buffet lunch in the opulent and comfortable surroundings of Seaford House. It remains only to thank the Master, the management of RCDS Seaford House, and Assistant Commissioner Ghaffur for a most interesting and thought-provoking visit and lecture.

E J Morgan-Warren

## LADIES LUNCHEON 3 October 2007

The Ladies Luncheon this year was a particularly enjoyable event, not least because we were privileged to be amongst the first to enjoy the newly refurbished Wax Chandler's Hall. The transformation is truly amazing, and the Hall looks magnificent from the moment you walk through the door. The décor is a mix of modern and traditional, which works extremely well. The completion of the works is obviously a great relief to the Clerk and his team, who have had to press on regardless during the refurbishments. Our congratulations to them!



*Sylvia Price, the middle Warden's Lady  
Krysia Butwilowska, the Principal Guest  
Ann Bawtree, the Master's Lady*

Around 40 Ladies attended the lunch this year, which was hosted by the Master's Lady, Mrs Ann Bawtree. We enjoyed pre-lunch drinks in the ground floor reception room, before moving to the Livery Dining Hall for lunch. The Master's Lady said grace and lunch commenced. The menu this year was innovative and particularly delicious. The first course consisted of a salad of glazed beetroot with manchego cheese and artichokes, accompanied by Manzanilla Sherry. The main course was roasted corn fed chicken with poached leeks, pearl barley and winter mushrooms, accompanied by a luscious red Brouilly Domain de Combilly. The dessert was a very naughty brown sugar meringue with Muscat poached winter fruits and vanilla mascarpone. A delicious feast, despite the damage to waist lines!

After lunch we raised our glasses to The Queen, and to The Lord Mayor and the City of London Corporation. Following the toasts the Master's Lady introduced our Principal Speaker, Mrs Krysia Butwilowska. Krysia is currently Head Teacher at St Luke's Church of England Voluntary Aided Comprehensive School in Southsea.

Krysia began by saying that her talk would be a very personal account of her career to date, and what led her to take up the challenging post at St Luke's. Krysia is the daughter of a Polish immigrant, and was brought up to appreciate a sense of family loyalty and a strong work ethic. These qualities are evident in her approach to her work.

Before joining St Luke's, she began her career teaching English and Drama and soon became Head of Department at St Edmund's Roman Catholic Secondary School, where she stayed for 11 years. She went on to become a Deputy Head and was in charge of three other equally successful Christian secondary schools before being asked to take up the role as Head Teacher at St Luke's.

This was a particularly challenging role, not least because the school was classed as a failing school and was on the verge of closure. The school served a very close knit community in the Portsmouth area, where children were not traditionally encouraged to strive to achieve their full potential. There were acute problems with pupil attendance, behaviour and achievement and it was a job that some thought would prove to be impossible. However, after much heart-searching Krysia decided to accept the role and set about introducing her own brand of leadership, which demanded high standards whilst recognising that everyone needed to have self-esteem. She began to weave her magic and St Luke's was transformed.

Krysia outlined some of the changes and challenges she had faced, and her task was certainly daunting. However, her sheer determination and commitment to helping all her pupils to achieve to the best of their ability, be it in developing academic or practical skills, has borne fruit. St Luke's is now one of the highest achieving schools in the country and is recognised as such. Krysia is justly proud of her achievement, and continues to work tirelessly to keep St Luke's at the top of the ladder.

I think it is fair to say that everyone was truly moved by her story and by her obvious commitment to her



work. A number of the ladies attending were, or still are, School Governors and we could readily identify with the challenges she faced. We were all filled with admiration for her achievement and the enthusiastic applause at the end of her talk reflected that sentiment.



*Krysia Butwilovska and Ann Bawtree*

The Vote of Thanks was proposed by the Middle Warden's Lady, Mrs Sylvia Price. Sylvia thanked Krysia for her inspirational talk, and reflected all our views when she said that the children at St Luke's were very lucky to have such a committed and talented Head Teacher. They are indeed!

The Master's Lady echoed Sylvia's comments, and closed the proceedings by presenting Krysia with a token of our thanks. We all departed, having enjoyed a very special and thoroughly enjoyable occasion.

*Margaret Baxter*

## **MANSION HOUSE BANQUET 26 October 2007**

The Annual Banquet at the Mansion House is undoubtedly one of the highlights of the year for Members. The Mansion House, home of the Lord Mayor of the City of London, is one of the grandest surviving Georgian town palaces in London, with magnificent interiors containing elaborate plasterwork and carved timber ornaments. This year 60 Members were joined by 130 guests, including the Masters of 10 other Livery Companies, for a splendid evening of fine wines and good food.

We were received at the start of the evening by the Master and his Lady, together with the Senior Warden, Middle Warden and Junior Warden with their wives. After an excellent dinner, with musical accompaniment by the Connecting Arts Symphonic Brass Quintet, the Master welcomed all present, including Alderman and Sheriff Mr Michael Bear, representing the Lord Mayor. The Master presented Alderman Bear with a contribution to the Mansion House Scholarship Fund and to VSO, one of the recipients of this year's Lord Mayor's Appeal.

This year, the dinner was the occasion of the inaugural presentation of the Fiona and Nicholas Hawley Award for Environmental Engineering. Established in 2006, this award is to be made annually to recognise excellence in environmental engineering to a resident of the UK, under 30 years of age at the date of submission, who holds a graduate or post graduate degree in engineering or science from a recognised UK



*Dr William Mayes, Alderman and Sheriff Michael Bear and Rear Admiral David Bawtree, the Master*

University, or who is studying for a post graduate degree at such a university. The winner for 2007 was Dr William Mayes of Newcastle University, for his work on the development of novel treatment methods for the passive remediation of highly alkaline leachates. These leachates often result from weathering of by-products from globally important industries such as steel and cement manufacture, and electricity generation. These industrial residues have traditionally been landfilled, historically with little or no control of leachate migration. Established remediation options for alkaline leachates, such as acid dosing or active aeration are very expensive. Further, untreated leachates from former industrial operations can present a legacy of persistent environmental degradation for communities already facing unemployment and other social problems associated

with deindustrialisation. Dr Mayes' research has led to the development of engineered treatment wetlands to buffer alkaline leachates as a low-cost passive approach to remediation. These passive treatment systems are also highly suitable for integration into wider ecological restoration of post-industrial landscapes.



*Mr Nicolas Hawley, Dr Robert Hawley, Dr William Mayes, Mrs Fiona Cameron and Professor Trevor Page, Pro Vice Chancellor of Newcastle University*

Alderman Bear presented the prize of £5000 to Dr Mayes. He then replied to the Civic Toast proposed by the Master. He thanked the Master for his gift to the Lord Mayor's Appeal and went on to emphasise the importance of engineers to the life of the City. He himself is a civil engineer, responsible for a number of high-rise buildings in the city. He noted that London is in the world top ten of cities at risk due to the potential risk were the Thames Barrier to fail. In this context, he hoped that more engineers would bring their special skills to the running of the City.

The Junior Warden next proposed the toast to our guests, noting that many of the visiting Masters from the other Livery Companies were indeed engineers, in keeping with the comments from Alderman Bear.

Finally, our Guest of Honour, General Sir Garry Johnson, Chair of the Governors of Christ's Hospital School, replied on behalf of the guests. He noted the key role of engineering across the whole of society, including our armed services. He particularly mentioned the role of combat engineers in the British Army, on current operations overseas. He also continued a theme from the Master's speech, echoing his concern for the critical shortage of young people in the UK opting to study engineering at university. Supported by the City Livery Companies, Christ's

Hospital School is trying to buck this trend, sending more children into science-based degree courses than any other independent school.

This was a highly enjoyable evening for Members and their guests and was once again an excellent showcase for the Company.

*Simon Watts*

## **ANNUAL CAROL SERVICE AND DINNER**

**11 December 2007**

On a crisp cold winter's evening, over 210 members and their guests strode across the cobbles towards the Chapel Royal of St Peter ad Vincula in H. M. Tower of London.

On crossing the drawbridge, we were greeted by the first female Yeomen Warder, also known as a beefeater, who took up her post recently after 22 years in the army.



*The White Tower*

Before beginning the carol service, we were warmly welcomed by the newly appointed Chaplin to the Chapel Royal, The Revd. Roger Hall.

The choir, a group of 10 who have established a reputation for excellence, lead the carol singing with the first carol "Once in Royal David's City".

We continued with 7 readings by our Wardens, the Master, the Master's Lady, the Clerk and the Company

Chaplin, the Reverend Michael West, before finishing with our last carol, "Hark! The Herald angels sing".

A speedy departure to our dinner was encouraged as the Chaplin was about to welcome visitors for his next service, the last of three services that evening.



*Tower bridge Opening for the Dixie Queen*

So it was back across the cobbles and, thankfully, we left by the West Gate and not by the Traitor's gate, to Tower pier.

We boarded the PS Dixie Queen which has had a stunning £10 million conversion into a luxurious replica of a 19th century Mississippi Paddleboat. She is Britain's largest conference, party and event boat, based right by Tower Bridge! Until recently, she was Stockholm's favourite cruising Night Club, and the haunt of the younger members of the Royal Family.

*Dining on board the Dixie Queen*



*Dixie Bayly aboard the Dixie Queen*

We were all encouraged to be out on deck as we watched Tower Bridge being raised for our passage on our way to Greenwich and Canary Wharf. All went smoothly and the Captain did not need to utilise the additional extensive ex-naval and engineering talent on board to ensure clear passage.

My quick survey of those on board, suggests that, for the majority, this was their first time to dine on board a vessel on the River Thames in London and it was a great success.

We arrived back at Tower Pier at 2200 having enjoyed a memorable evening afloat in good company and an excellent dinner.

*Isobel Pollock*

## PERSONALIA

### New Liveryman

We welcome one new Liveryman, Keith Edward CLARKE, FREng, BEng, DIC, MPhil, FCMI, FRSA, FIET, FBCS invested at the Court Meeting on 9th October 2007



We are very sad to report the deaths of Professor Peter Wolf, a founder member of the Company on 6th October 2007 and Don Lennard, a new Liveryman, on 19th August 2007.



The Ladies Luncheon on 3rd October and the Court Meeting on 9th October were the first two occasions on which the Company was able to use the refurbished Wax Chandlers' Hall. Apart from the pure convenience of being able to return to our home for the last five years it is a great delight to see the lovely work that has been done. Prominent in the improvements are the new lift and surrounding staircase, the new reception room on the ground floor and the Dining Hall itself, elegantly lined with blue silk wallpaper. One of the features in the Hall is the new chimney piece with a strong architectural form carved in Carrara marble typifying the designs of Inigo Jones (1573-1652). This chimney piece was given by Dick Blaxland, a member of the Wax Chandlers' Company, in memory of Sir Peter Gadsden. Dick was a long-

time friend of Sir Peter and has now married into the family. The chimney piece is to be called the Gadsden Fireplace.

It is with pleasure that I report that Sir Peter very kindly left a legacy of £5000 to the Company's Charitable Trust in his will. There was also a collection at the Service to celebrate Peter's life and Belinda has very kindly directed that £1,666, a share of the collection at the service, should be given to the Charitable Trust. The Trustees are extremely grateful for this support.



## THE FIONA AND NICHOLAS HAWLEY AWARD FOR ENVIRONMENTAL ENGINEERING

### The Development of Novel Treatment Wetlands for the Passive Remediation of Highly Alkaline Leachates

Dr. William Mayes

Hydrogeochemical Engineering Research and Outreach (HERO) Group,  
Institute for Research on Environment and Sustainability (IRES), Newcastle  
University, Newcastle upon Tyne, NE1 7RU.

#### Introduction

Highly alkaline (pH 9-13) leachates often result from weathering of by-products from globally important industries such as steel and cement manufacture, electricity generation and other processing industries (e.g. Solvay Process). The extreme alkalinities of these leachates reflect the highly basic nature of industrial residues, such as lime and calcium alumino-silicates (from cement manufacture) and lime-rich steel slags. These residues have traditionally been landfilled, historically with little or no control of leachate migration. Leachates leaving such disposal sites are of such high pH that they absorb CO<sub>2</sub> from the atmosphere and precipitate calcite (CaCO<sub>3</sub>) so prolifically that aquatic habitats are smothered, reducing light penetration to benthic primary producers. In addition, elevated concentrations of metals/metalloids (especially arsenic, chromium, selenium and vanadium) and high sulphate loadings can be of significant environmental concern, and a barrier to compliance with water quality standards such as the EU Water Framework Directive (WFD: 2000/60/EC).



*Alkaline Wetlands*

Established remediation options for alkaline leachates, such as acid dosing, active aeration and/or recirculation of leachates over stockpiled residues, are very expensive. Given that generation of high pH leachates is now known to continue for many years after the operational life of the associated industrial operations (Figure 1), sustained treatment by traditional methods is rare, and untreated leachates can represent a legacy of persistent environmental degradation for communities already facing unemployment and other social problems associated with deindustrialisation.

This paper highlights recent research into developing engineered treatment wetlands to buffer alkaline leachates as a low-cost passive approach to remediation. Passive treatment systems are characterised by an initial capital outlay but low running costs for infrequent (albeit regular) maintenance. They are also highly suitable for integration with wider ecological restoration of post-industrial landscapes.

### **Background to current research**

The background to this current research was informed by PhD studies on the impact of limestone quarrying on natural wetlands. Detailed monitoring of a natural wetland receiving pumped groundwater from a dewatered quarry and adjacent calcination works highlighted the buffering of influent alkaline waters (pH up to 12.8) by a reedbed, and the robust nature of some wetland macrophytes exposed to extremely high pH and low nutrient conditions. This buffering appears to be a feature of microbial respiration in the wetland substrate and water column which increased recarbonation rates and consumes alkalinity. These data were used to secure further funding (from the Corus Group through the Mineral Industry Research Organisation) to assess the feasibility of using engineered treatment wetlands to remediate alkaline leachates.

### **Feasibility of wetland treatment**

To assess the feasibility of using wetlands to treat alkaline leachates, a range of laboratory and field-based approaches were applied to:

1. Characterise the nature of alkaline leachate discharges from a range of industrial sites.
2. Assess the performance of wetland substrates in buffering alkaline waters.
3. Obtain field measurements from ‘volunteer’ wetlands (i.e. those which have developed spontaneously around leachate discharges) at steel slag drainage sites, to allow engineering design criteria to be developed.
4. Determine required treatment system sizes at a range of discharges as an indication of economic feasibility.

A national survey of known alkaline leachate discharges highlighted the consistently high pH (10-12.8) and high  $\text{Ca}^{2+}$  and  $\text{OH}^-$  loading due to dissolution of portlandite ( $\text{Ca}(\text{OH})_2$ ) in residues at a range of sites. Trace metal concentrations in waters and precipitates were typically found to fall below statutory quality standards, suggesting accumulation of ecotoxic metals in the substrate would not be a barrier to system development. Static batch laboratory tests highlighted the relatively short contact time with organic substrates necessary to produce a significant fall in pH relative to control treatments (Figure 2).



### *Volunteer Wetland*

Field measurements at ‘volunteer’ wetlands receiving alkaline drainage provided a natural analogue to field-scale engineered treatment systems, effectively permitting field demonstration and measurement of a process that could be greatly enhanced through engineering intervention. Observations at a wetland receiving leachate from the former Consett Steelworks showed the buffering of influent waters (Figure 3) and allowed the formulation of critical engineering design criteria for treatment wetlands. Foremost amongst these is the area-adjusted removal rate for the key ‘contaminant’ (in this case calcium carbonate, which though not hazardous in itself, is the cause of benthic smothering and habitat loss). Knowledge of this rate allows sizing of systems for other leachate discharges. Treatment system size dominates the feasibility of such systems, given the costs associated with land acquisition. The projected system sizes fell well within the range described for similar treatment wetlands already developed cost-effectively for mine drainage. The findings of this research were published recently in the top-ranked journal *Environmental Science and Technology*.



*Consett*

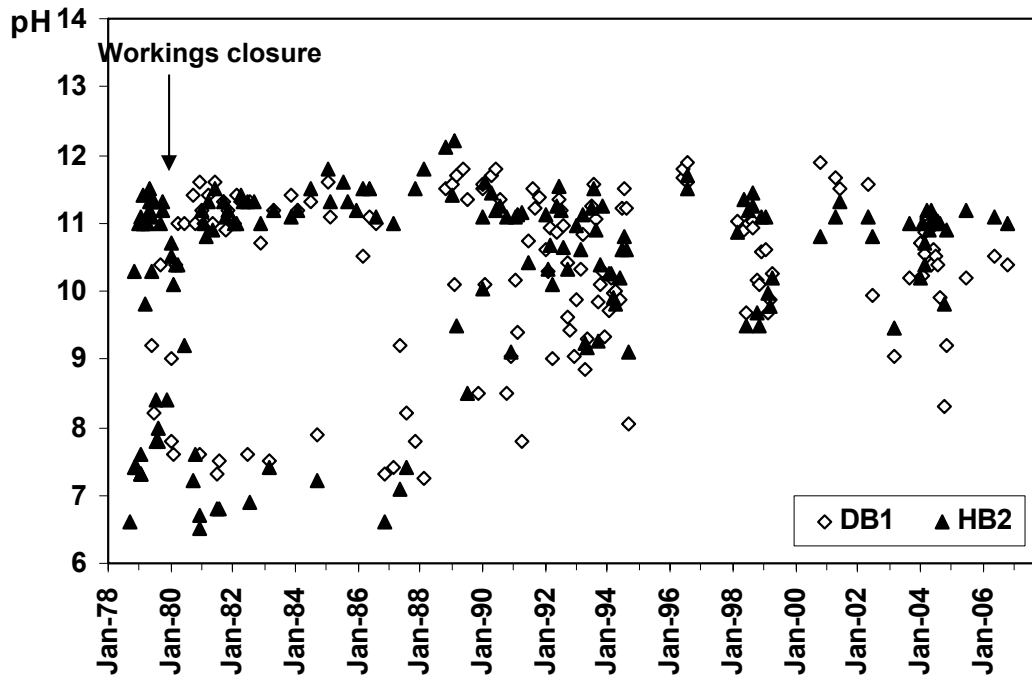


Fig. 1. The longevity of the pollution problem from the former Consett Steelworks is highlighted in the consistently elevated pH in two drainage streams, the Dene Burn (DB1) and Howden Burn (HB2) (Note: the statutory requirement for surface waters is pH<9).



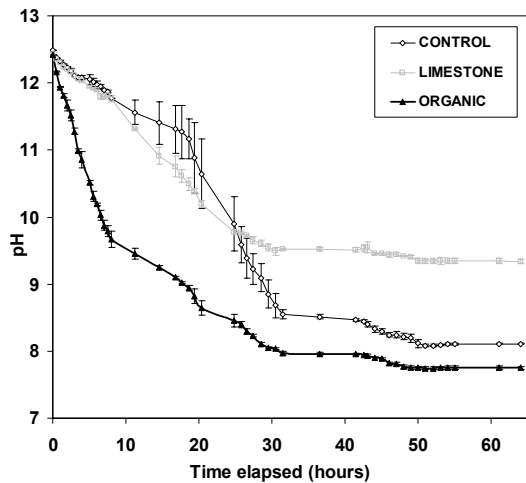


Fig. 2. Batch trials highlighting the lower contact time for significant pH fall with organic media compared to control and limestone treatments (plots show mean (n = 3 for each) and standard deviation (error bars)).

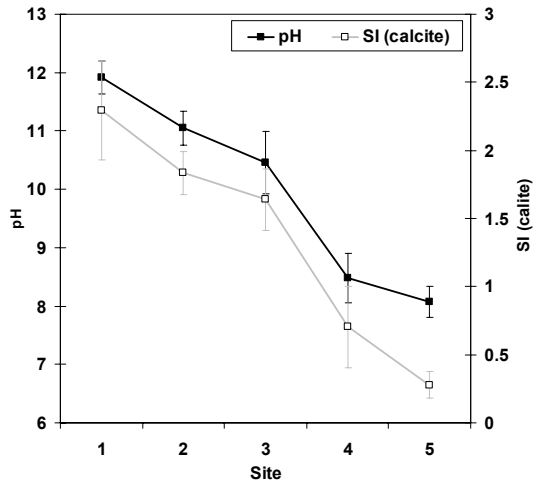


Fig. 3. pH and calcite saturation index changes from leachate source (site 1) across the volunteer wetland (site 2-5) highlighting the buffering and diminished potential for calcite precipitation with progress across the wetland.



*Growth Trials*

### Future developments

Since this research, we have been contracted to advise Corus on the management of leachate problems and are currently seeking funding to apply the design criteria developed here to engineered systems. The support of Corus in this research holds great promise for the commercial application of the technology and indeed they are keen for it to be tested at one of their sites. In addition to industrial stakeholder involvement, future development of these passive treatment systems will best be achieved with

community engagement, since watercourses impacted by alkaline leachates traverse public open spaces of otherwise high amenity value. The espousal by the HERO Group of community involvement in analogous mine water remediation projects was a major contributory factor to the award of the Queens Anniversary Prize for Higher Education to Newcastle University in February 2006. These community engagement approaches are now being transferred to the case of alkaline treatment wetland systems to be developed in the near future. Apart from acting as an interlocutor between local residents and the owners of problem sites, the meetings and site visits used in community engagement represent ideal opportunities for promoting public awareness and understanding of science amongst people of a wide range of age groups and social backgrounds.