RCEA
(SUSSEX)

An Association for Retired Professional Engineers

NEWSLETTER December 2014

President's Message

In recent times we have seen many technological changes especially in the area of digital data transmission and the corresponding processing of such data. This, of course, has been made possible by the rapid improvement of associated hardware such as the "smart phone" and "tablet" computers which have made access so much more affordable to many more people. Reflecting on where we were at the beginning of my career one notes that today's hand held devices are much more powerful in terms of processing power than that available to the first astronauts that landed on the moon! In many ways this has brought huge improvements to the way we live and do business much of which would fall apart without such equipment. But are we aware of the downsides of how such technology is used? Every day we hear reports of data theft, widespread plagiarism, fraud and personal manipulation not to mention the background brainwashing of the unaware. As engineers we should be proud of our technological achievements but I do wish that we had better control of how our inventions are used.

The object of the Association is to keep our members abreast of recent changes and advances in engineering technology. Recently we had a talk on fracking which attracted a lot of interest in our community due to the many contentious issues surrounding the use of such technology. In January we bring you a talk on "Wind Power at Sea" perhaps not quite so controversial as fracking but nevertheless an issue which is of great interest mostly due to our reservations regarding cost and its ability to provide power when required. After all if there is no wind or only a gentle breeze they produce very little power. Although modern advances have made the use of such technology possible we have very little control over the weather on which they depend.

Another recent engineering achievement has been the landing on a comet of an investigative probe. Named "Philae" it was recently separated from its mother spacecraft "Rosetta" which continues to track the comet and relay data acquired by Philae back to earth. To put some perspective on this achievement consider the fact that it takes almost 30 minutes for any signal to reach the spacecraft. As it takes electromagnetic waves approximately 1 nanosecond to travel 1 foot that makes it an awful long way away. I'll leave you, as engineers, to do the maths! More to the point we can look forward to more detailed information regarding this project later on in 2015 when someone who has been deeply involved will be giving us a talk on the topic. A condensed version of the mission can be found at http://en.wikipedia.org/wiki/Rosetta_%28spacecraft%29

From our own point of view a more modest achievement has been the commissioning of a totally new website for the association. This was undertaken by a close relative of one of our members. It is totally up to date and highlights forthcoming events making it easier for visitors to readily view our programme and the activities of the association both past and present. Most of you will have already visited it as a result of an email announcing its launch. For those of you who have not it can be found at http://www.rceasussex.org.uk

Catering for our members who relish the huge amount of past projects in which many of us will have been involved we have two other talks in this winters collection. One describing the activities in the Solent area of the Saunders Roe company and their Princess flying boat aimed at the commercial airline market and the other detailing the problems encountered when mixing the past with the present in railway transportation.

So you can see that the committee has been working hard on your behalf to ensure that we have a fulfilling programme of events, I'm sure that you will join me in expressing my sincere thanks to them for all that has been achieved over the past year. However, we are always on the lookout for new material and rely on you, our members, for ideas and contacts. Remember, if the schedule of events is devoid of anything that takes your interest then please say so. Any member of the committee would like to hear from you.

So, as we come to the close of another year, it only remains for me to wish all our members a very happy Christmas and good health in New Year. I look forward to welcoming you at our events in 2015.

David Thomas

PROGRAMME OF EVENTS 2015

Tuesday	**13th January**	**Talk, Power from the sea – Creating a successful British Offshore Wind Industry**
Thursday	**15th January**	**Coffee - at Spotted Cow, Angmering**
Thursday	**29th January**	**Coffee - with Partners at Highdown Vineyard**
Tuesday	**10th February**	**Talk, the Princess Flying Boat**
Thursday	**19th February**	**Coffee - at Spotted Cow, Angmering**
Thursday	**26th February**	**Coffee - with Partners at Highdown Vineyard**
Tuesday	**10th March**	**Talk, The challenges of operating preserved steam locomotives on the main line in the 21st century**
Thursday	**19th March**	**Coffee - at Spotted Cow, Angmering**
Thursday	**26th March**	**Coffee - with Partners at Highdown Vineyard**
Wednesday	**15th April**	**Lunch at Northbrook College, 12.00 for 12.30**
Thursday	**16th April**	**Coffee - at Spotted Cow, Angmering**
Thursday	**30th April**	**Coffee - with Partners at Highdown Vineyard**
Thursday	**14th May**	**Outing – Afternoon cruise on the Wey and Arun Canal**
Thursday	**21st May**	**Coffee - at Spotted Cow, Angmering**
Thursday	**28th May**	**Coffee - with Partners at Highdown Vineyard**
Tuesday	**9th June**	**T.B.A.**
Thursday	**18th June**	**Coffee - at Spotted Cow, Angmering**

Thursday	**25th June**	**Coffee - with Partners at Highdown Vineyard**
Tuesday	**14th July**	**T.B.A.**
Thursday	**16th July**	**Coffee - at Spotted Cow, Angmering**
Thursday	**30th July**	**Coffee - with Partners at Highdown Vineyard**
Thursday	**20th August**	**Coffee - at Spotted Cow, Angmering**
Thursday	**27th August**	**Coffee - with Partners at Highdown Vineyard**

All Talks and Meetings will commence at 2.30 pm and be held in the Chichester Room, Field Place, Worthing; unless another venue or time is indicated.
Timings for visits and outings will be as printed in the detailed description of the activity.
Coffee mornings commence at 10.30 a.m.
The Coffee with Partners is at Highdown Vineyard, Littlehampton Road, Ferring, BN12 6PG.

New Website for the RCEA

As you will have read in our President's Message our website has new look. Please check it out.

For latest information, log into **www.rceasussex.org.uk**

New Members and Speakers for Talks

The RCEA needs new Members to ensure that we can continue as a thriving organisation. Please think of appropriate people you know and encourage them to join the RCEA.

We need more volunteers to give talks to us on Tuesday afternoons from September to March. Speakers from outside organisations are harder to find and often seek payments for the services. We are aware that many Members have the knowledge from their working careers to provide interesting talks. If you are willing to give a talk please let us know.

New Members and Associates

Brian J. Hill. C.Eng, MIET, FICE

Latest Member's Handbook

Would all members please check their own entry in the Members Handbook which has just been issued to ensure their entry is correct in every detail i.e. address, telephone number, e-mail address, etc. Any errors or omissions should be communicated to **Malcolm Hind, Membership Secretary** so that the appropriate corrections can be made to the master copy ready for printing the next Members Handbook.
Unfortunately an error crept into the handbook and the days and dates for outings do not match. Please check the Newsletter and website for details of outings.

RCEA Insurance.

Members need to be aware that the insurance policy that the Association holds is solely for the protection for the assets and liabilities for the Association as an entity. The policy does not provide cover for personal injury or loss to individual members. Members therefore attend any of the Association's events at their own risk; although under some circumstances there may be some cover from the insurance arrangements of the venue owner.

Newsletter Entries

If you would like to provide an article for inclusion in a future newsletter it would be most welcome. We are always looking for new material. As a guide an article should be prepared as a Microsoft Word document, preferably in font size 10 and font style Times New Roman but this is not essential since all text will be 'standardised and formatted' when composing the newsletter. Pictures can be incorporated into the newsletter and are best supplied as JPEG images as separate files and separately from the text. (Word documents incorporating pictures can sometimes be very large files and are often not easy to manipulate into a suitable format for the newsletter.) derek.webb2@ntlworld.com

SOUTHERN RETIRED CHARTERED ENGINEERS

Events are arranged by the SRCE to which our members have a standing invitation.
We have not received a current list of events in time for this newsletter. We hope to include a list in the next one.

Brief Detail – Talks, Outings and other activities January -April

Talk:

Worthing, Tuesday 13th January
Power from the sea – Creating a successful British Offshore Wind Industry
Matthew Knight BEng, CEng, MIET, Director of Strategy and Government Affairs for Siemens Energy

Offshore wind offers Britain a huge renewable energy resource. It also has the potential to build a new industry, bringing jobs and investment to coastal communities. Delivering this promise means overcoming political and financial challenges as well as developing skills and technology that will work safely in the harsh environment of the sea. At the same time we must rapidly reduce the cost of electricity generated. Matthew's talk will discuss all of these issues and how they interact to make Offshore Wind a fascinating and exciting new industry. It is a topical subject and generates much interest especially since the planned Rampion field off the Sussex coast has been approved. This field will consist of between 100 and 175 turbines generating up to 700MW of power.

Talk:

Worthing, Tuesday 10th February
Saunders Roe and the Princess Flying Boat
Bob Wealthy

The talk presents background to the formation and evolution of the Saunders Roe Company at Columbine Works, East Cowes. The origins of the "large flying boat" concept are traced that resulted in a UK Government contract being placed in 1945 with Saunders Roe for design and construction of the SR45 Princess, with BOAC as a somewhat reluctant "customer". Design, development and construction of the Princess and the facilities employed at East Cowes in the course of the project are described together with the build up to the first flight and flight test programme. The reasons for the eventual demise of the Princess are identified and these eventually led to all three Princess craft being scrapped in the1960s, despite various efforts to find an alternative use. Some relics of Saunders Roe and the Princess project that remain in existence are identified, however, the Saunders Roe Company faded from view when it lost its independence in 1958 following acquisition by the Westland Group (Photo from Bob Wealthy Collection via GKN/Saunders Roe Archive)

Talk:

Worthing, Tuesday 10th March
The challenges of operating preserved steam locomotives on the main line in the 21st century
Cedric Spiller

On August 11th 1968, the last British Rail (BR) steam train ran. By1971, Peter Prior of Bulmer's Cider had persuaded BR to let him run steam loco No 6000, King George V,
This led to the formation of SLOA (Steam Loco Operators Association (SLOA) with dedicated routes for steam operation.
Following privatisation and the introduction of 'Open Access', steam trains are now allowed over the Network Rail system. However with the development of higher speeds, electrification, steam locos limited to 75 mph, the availability of coal, water, drivers, and firemen what is the future?

Spring Lunch:

Wednesday 15th April. Lunch at Northbrook College, Worthing, 12.00 for 12.30

There will be a bar for pre-lunch drinks, the cost to be settled individually by Members and guests. The cost is £14.00 per head including a tip, for a three course meal which in the past has proved to be very good value.
The occasion is not only an opportunity for new and existing members to meet socially but will also help to give 'work experience' to chefs and waiters.
Because of college lead times, applications MUST be made by 14th March.
Should the numbers exceed the maximum seating allowed there will be a waiting list made, as in previous years.
So please book early to avoid disappointment. The committee look forward to seeing you there.

Booking form is at the end of this newsletter.

Contact Ms Brenda Whitmell, 01903 905922 e-mail bcwhitmell@uwclub.net

Outing:

Thursday 14th May. An afternoon cruise (2hr 30 min) on the Wey and Arun canal. Optional lunch at the Onslow Arms at Loxwood (not prearranged). Approx cost is £10 and will include a cup of tea if we get enough support.
Please make a note of the date; we need a good turnout as the boat seats 50 people, although 42 is more comfortable. The boat has a toilet and a mobility lift.
A booking form will be included in the March Newsletter.

Reports

Outing:

Monday June 9th 2014
Worthing Wurlitzer Organ

This report was held over from the August Newsletter. There were 39 members and guests present.

Summary of the presentation by Jim Buckland: Chairman of the Sussex Theatre Organ Trust.

The talk started with a series of slides showing the Wurlitzer plant in North Tonawanda, near Niagara Falls in the USA and an explanation of the evolution of Wurlitzer musical instruments. We saw the inside and outside of the factory and parts of the manufacturing process. When production of Wurlitzer Theatre Organs was at its height in the 1920's, the factory was producing one complete pipe organ every day.

The theatre pipe organ provided sound for silent films before the first talkie appeared in 1929 and substituted for the large orchestras that were used in the massive cinemas. The inventor of the Wurlitzer Organ was an Englishman called Robert Hope Jones who was an organist and choirmaster in Birkenhead and a telephone engineer with The Lancashire and Cheshire Telephone Company. At that time pipe organs were controlled by pneumatic systems or direct mechanical actions and he pioneered the use of an electrical system to control the air flow into the pipes which enabled the console to be positioned away from the organ itself.

Hope Jones believed that the organ should be able to imitate the instruments of an orchestra and that the console should be detachable from the organ. The traditional pipe organ industry was hostile to his evolutionary ideas and he experienced considerable difficulty in the acceptance of his innovations. For a while he worked with some of the established organ builders but he was dissatisfied and Hope Jones emigrated to the USA. He was not successful in his business ventures and joined the Wurlitzer Company where he made many significant innovations which set the cinema organ apart from its church counterpart. Because of the excellent tonal quality of the Wurlitzers it was extremely popular and was a great success. By his nature Hope Jones was always seeking to improve the various aspects of the organ construction and was consistently interfering with production until the Wurlitzer management barred him from the factory. This had a profound effect on him and on 13th September 1914 he committed suicide.

The sound of the Wurlitzer organ is produced by air flowing through pipes. There are two basic types of pipe, flue and reed. Flue pipes contain no moving parts, whereas reed pipes include a piece of metal (the reed) which vibrates when air flows over it, much like a clarinet. Reeds generally make a sharper, louder sound. The exact tone of both flues and reeds is a function of the shape and size of the pipe and the structure of the reed. In the theatre organ the air to each pipe is controlled by a two-stage electro-pneumatic valve which was described in detail. To this day the design has remained the same because of its excellent action and speed of operation.

The original Worthing Wurlitzer came from the Troxy Cinema in Stepney where it was opened in 1934 by a famous organist Bobby Pagan. It had ten ranks of pipes (distinct tone colours) as well as tuned percussion instruments such as a xylophone and "traps", which were extra effects such as cymbals, car hooter and sirens which were for use with silent movies. The organ was removed from the Troxy in the 1950's when it was no longer required and installed in Buckingham Town Hall. It was the first attempt to transplant a theatre organ in the UK and was a very poor result. As an aside, the Troxy Cinema is still in existence and has been restored to a magnificent state as a multi entertainments centre. It is in the process of being refitted with another Wurlitzer organ from the sister theatre of the Troxy the Trocadero at the Elephant and Castle by the Cinema Organ Society. In 1976 Jim Buckland purchased the organ from Buckingham Town Hall because the building had been condemned. It was by then in very poor condition and the Sussex Theatre Organ Trust team spent six years restoring every part of the organ to a very high standard before installing it in the Assembly Hall, where it was opened in 1982, once again by Bobby Pagan who now lived near Worthing. An important part of the job was the installation of a console lift which was obtained from the Granada Cinema, Woolwich. The lift had to be considerably modified to enable the concert Steinway piano together with the orchestra music stands and chairs to be stored under the stage when not in use. The lift enables the console to rise whilst being played in the authentic cinema fashion. It is lowered and stored away in an under-stage enclosed area between concerts.
The Troxy Wurlitzer sounded excellent in the Worthing Assembly Hall because of its superb acoustics but Jim was not content and wanted to emulate the big Wurlitzer sound that one could only hear in the large American cinemas. He took the Wurlitzer in the Paramount Theatre, Oakland, California as his model because of its excellent quality and decided to enlarge the Worthing Wurlitzer and try to get as close as possible to the sound of the Paramount Organ. At about this time the BBC decided to dispose of BBC Theatre Organ number 4 which was a Wurlitzer organ which had originally played in the Empress Ballroom Blackpool and had subsequently been moved to the Playhouse Theatre, Manchester as the BBC theatre organ which was where most of the prestige BBC musical shows were performed and broadcast. The organ was purchased from the BBC and a second chamber was built on the left side of the stage in the Assembly Hall to house the additional ranks of pipes from for the new enlarged organ. The pipe work was completed with the addition of some very historic and beautiful sounding pipe work purchased from the USA from the estate of George Wright, perhaps the greatest and most influential theatre organist that ever lived. The final part of the enhancement was to bring three American theatre organ consultants over to England who spent considerable time regulating all of the pipe work so that the organ speaks into the magnificent acoustics of the Assembly Hall in a balanced and musical manner. This process, called tonal finishing, is essential for the organ to sound like an authentic Wurlitzer such as installed in the Paramount Theatre, Oakland. The newly enlarged Worthing organ, by now the largest Wurlitzer Organ in Europe was opened by four famous organists in February 1997.

As well as building a second chamber to accommodate the extra ranks of pipes, the organ console, from where the organ is played, needed considerable enlargement to make room for the additional stop tabs, or switches, which control the selection of the pipes to be played. The construction of the new top to the organ console was a very involved job and we were shown slides of the complicated jigs required to build the new console as well as pictures of the various assembly stages.

To end the presentation Jim Buckland showed some slides of memorable moments in the life of the Worthing Wurlitzer installed in the Assembly Hall. These included the presentation of the Worthing Award to Jim and his team in 1981 for their significant contribution to the cultural life of the town and the presentation to Jim of a further award by the Council in 2001. In 1987 Bobby Pagan played his last ever public performance, whilst in 1992 a young Richard Hills played his first ever Wurlitzer concert. He of course has gone on to greater things. He was the Organ Scholar at many of the famous installations and his popularity capped last year with his own Promenade Concert playing the great Willis organ in the Royal Albert Hall.

The afternoon concluded with Richard Hills demonstrating the organ as only he can play it. Richard was awarded the Organ Scholarship at King's School Rochester in 1994 and studied at the Cathedral. He then became the Organ Scholar at Exeter College Oxford after which he became Organ Scholar at Portsmouth Cathedral following which he became Organ Scholar at Westminster Abbey from where he was appointed a Fellow of the Royal College of Organists. He is now Director of Music at St. Mary's Bourne Street London which is a very prestigious appointment at one of London's prominent Anglo-Catholic churches. He does many international tours and is very well known for his concert performances in the USA. He has to his credit many CD recordings of famous international instruments. He has earned outstanding acclaim for his ability to excel at classical, liturgical and light popular music.

Talk:

Tuesday 16th September 2014: Meccano to e mail – my career in engineering.
Mike Wooldridge RCEA

Mike started his talk with a reference to Meccano – something which old school engineers are traditionally supposed to have cut their teeth as youngsters. From here he traced his entry into engineering via an apprenticeship with Allen West, an engineering degree, and a first job back at Allen West. He was soon moved into the Industrial Electronics Division where he was given the job of developing a constant horsepower drive for a crane. This is a control system that translates into: the lighter the load, the faster the hoist speed, and, more challenging, the lower speed. (See photo over page)

After several weeks of frustration and despair, he finally had a Eureka moment, followed by another one as the drive was re-engineered onto Thyristor bridges – a new technology at the time. He subsequently spent many challenging and rewarding weeks on site, commissioning dockside and Freightliner cranes. In summary, a constantly variable 5:1 speed range in both directions was achieved on a 400HP motor.

Having gained experience on analogue operational amplifier circuits, he then moved over to digital engineering and went to work for the newly formed Ministry of Technology Technical Support Unit. This unit advised government departments on these new fangled things called digital computers. In those days mainframe computers required a very tightly controlled environment and Mike spent his first 4 years advising, and carrying out trials, on these – more interesting than it sounds, especially as only one out of more than 8 that he trialled passed at its first attempt. He was also responsible for specifying and trialling an 860kVA no-break power supply for the newly set up Police National Computer.

Then he moved over to advising on the computers themselves and carried out many appraisals and trials on computers ranging from large mainframes (generally single tender ICL if the required power was greater than '1 Atlas' power) to minis such as a DEC PDP11, or a CTL Modular One.

During this time, data communications steadily grew in importance. Modems gave way to Kilostream and Megastream links, and these gave way to the Internet. Mike was assigned to an ISO committee that developed standards for office documents and email. Although these were subsequently overtaken by what we see today - typically Microsoft Office running over an SMTP-based offering from someone such as Google or Yahoo, Mike feels he played a tiny part in specifying User Requirements for email – something which we all take for granted today.

Birkenhead DD2s

Visit:

Tuesday 30th September 2014: Tangmere Military Aviation Museum - Behind the Scenes.

Following a kind offer by Mr Dudley Hooley the Museum Director to view areas not generally seen by the public, sixteen members and three wives attended the visit to the Museum. We were split into two groups. Group 1 was shown round by Mr Phil Stokes the Museum General Manager. Group 2 were shown round some of the major museum exhibits by Dudley. After lunch in the NAAFI, the Groups swapped places.

Much of the behind the scenes work is conducted by the Special Projects Group. They are a group of volunteers all with engineering or craft skills. We were shown round their various workshops and some of their recent/current projects:

Royal Aircraft Factory SE (**S**cout **E**xperimental) **5a Scout:** The Royal Aircraft Factory SE 5a Scout was one of the most successful British fighter aircraft of the First World War. It had a 200Hp Hispano-Suiza engine and a Vickers synchronised gun which fired through the propeller and a wing mounted Lewis machine gun.

To commemorate the start of WW1, the Special Projects Group have built a SE5a open cockpit, complete with the sound effects of the aircraft's Hispano-Suiza engine starting and running and the sounds of its guns firing. One of our group became aWW1 pilot for a time. His comment was that the seat was comfortable, but space was rather tight. That was without all of the clothing that pilots wore to protect to themselves from the cold!!

Spitfire Cockpit: Work was in hand to replicate a Spitfire cockpit. When we arrived in the workshop, the team was cutting a sheet of aluminium to make one of the main cockpit ribs. They showed us the completed cockpit aft rib that they had made and described the production process.

Link Trainer: Link Trainers were originally developed by an American, Edwin Link, in the late 1920s to teach pilots how to fly their aircraft in blind flying conditions such as cloud, fog and darkness, an essential skill known as Instrument Flying.

The Museum has two Link Trainers. The "red and white" Link Trainer is now going through a refurbishment programme to return this trainer to good 'flying' condition, hopefully by the end of this year. Once the red and white trainer is up and running, the plan is for the other Link to be reconditioned for children to 'fly'.

Ferret Scout Car: The Ferret was developed in 1949 as a result of the British Army's need to obtain a replacement model for its Second World War light armoured vehicle. It is fast and small enough to be used in an urban environment but strong enough to negotiate rugged terrain off road. The museum's Ferret belonged to the RAF Regiment and has been totally restored and is now roadworthy.

Corrosion Prevention: We were given an overview of the corrosion prevention process that was currently being undertaken on the following aircraft:

> **De Havilland Vampire:** These have a mixed wood and metal laminated structure in some areas. The main problem being addressed is rot in the wood owing to water ingress.
> **De Havilland Sea Vixen:** General corrosion prevention.
>
> **McDonnell Douglas Phantom:** General corrosion prevention included replacing corroded magnesium panels. These are extremely expensive so they are being replaced by cheaper aluminium panels.

English Electric Lightning: One of the current projects is to develop a computer simulation of the Lightning cockpit. The interior of the cockpit has been photographed, both horizontally and vertically. These will be fed in to a clever piece of software which will produce a 'cockpit view'. You will be able to 'hover a pointer' over any instrument or control and a description of its function/operation will appear on the screen.

Harrier GR (Ground Reconnisance) 3: The history of Tangmere's GR3 Harrier was explained. It was built as a GR1 and took part in the Daily Mail Transatlantic Air Race in May 1969 to commemorate the 50th Anniversary of the first trans-Atlantic crossing by Alcock and Brown.

Although named an air race it was actually a race of individuals between the Empire State Building in New York and the Post Office Tower in London. Each of the individuals or "Runners" had to use some form of air transport. A number of point-to-point world records for aircraft were broken.

The shortest overall time between London and New York was by Squadron Leader Tom Lecky-Thompson flying "Tangmere's" Harrier in 6 hours 11 minutes. The shortest time between New York and London was by Lieutenant Commander Peter Goddard a passenger in a Royal Navy McDonnell Douglas Phantom in 5 hours 11 minutes.

It later served with No 1 Squadron and No 233 Harrier Operational Conversion Unit at RAF Wittering where it was rebuilt to GR3 standard.

Sea Harrier FRS 2 (Fighter/Reconnaissance/Strike, Version 2): The differences between the GR3 Harrier and the Sea Harrier were outlined. The Sea Harrier started life as an FRS1 and first flew on September 9th 1982. It saw service life with 899 Squadron in 1984 and 1985.

Operational experience highlighted the need for important updates; it therefore became the development airframe turning it into the FRS2 prototype. These modifications included a 35″ extension to fuselage length behind the cockpit to accommodate an all-new avionics fit, a redesigned wing, a new cockpit with HUD, the installation of Blue Vixen radar, new weapons systems and a new Pegasus engine with increased thrust. In its new guise it took to the air in September 1988 for a programme of intensive test flying to demonstrate suitability for service use.

Following the conducted tours we were free to peruse the remainder of the exhibits. Members of museum staff were on hand to answer questions and expand on the information on show. The museum is working hard at making the museum a 'hand-on' experience.

R Keir

Hawker Hunter prototype - **(**took Air Speed Record off Rustington)

Replica Spitfire prototype

Hawker Hurricane

Gloster Meteor

Talk:

Tuesday 14th October 2014
The History of London Bridge and the Demolition and Reconstruction of the present Bridge
Mr Frank Duggan RCEA

Frank was employed on London Bridge from 1968 – 1970 and his illustrated talk encompassed his experience of working on site on the demolition and reconstruction of the present bridge. He also covered the history of nearly 2000 years of river crossings on the site and the demolition of the old bridge and its reconstruction 4300 miles away in Lake Havasu City, Arizona.

History: The first bridge was probably a Roman military pontoon type, giving a rapid overland shortcut to Camulodunum from the southern and Kentish ports, along the Roman roads of Stane Street and Watling Street (the A2). Around AD 55, this temporary bridge was replaced by a permanent timber piled bridge, maintained and guarded by a small garrison. The bridge was probably destroyed along with the town in the Boudican revolt (60 AD). Both were rebuilt and Londinium became the administrative and mercantile capital of Roman Britain.

With the end of Roman rule in Britain in the early 5th century, Londinium was gradually abandoned and the bridge fell into disrepair. The history is then a bit hazy until the earliest contemporary written reference to a Saxon bridge in c.1016 when chroniclers mention how Cnut's ships bypassed the crossing, during his war to regain the throne from Edmund Ironside. Following the Norman conquest of England in 1066 the bridge was repaired then rebuilt and in 1163 the bridge was rebuilt using timber for the last time.

After the murder of Thomas Becket, Archbishop of Canterbury, the penitent King Henry II commissioned a new stone bridge in place of the old, with a chapel at its centre dedicated to Becket as a martyr. It was grander than some town parish churches, and had an additional river-level entrance for fishermen and ferrymen. Building work began in 1176 and it was finished by 1209 during the reign of King John. John licensed out building plots on the bridge to help recoup the costs. The buildings (138 shops by 1358) were a major fire hazard resulting in many fires also they increased the load on its arches, several of which had to be rebuilt over the centuries

By the Tudor era there were some 200 buildings on the bridge. Some stood up to seven stories high, some overhung the river by seven feet, and some overhung the road, to form a dark tunnel through which all traffic must pass, including (from 1577) the palatial Nonsuch House. The roadway was just 12 feet (4 m) wide, divided into two lanes, so that in each direction, carts, wagons, coaches and pedestrians shared a passageway six feet wide.

The narrow arches and wide pier bases restricted the river's tidal ebb and flow, so that in hard winters, the water upstream of the bridge became more susceptible to freezing and impassable by boat. The flow was further obstructed in the 16th century by waterwheels installed under the two north arches to drive water pumps, and under the two south arches to power grain mills; the difference in water levels on the two side of the bridge could be as much as six feet (two metres), producing ferocious rapids between the piers.

In 1758–62, all houses and shops on the bridge were demolished through an Act of Parliament and the two centre arches were replaced by a single wider span to improve navigation on the river.

'Rennie's Bridge': By the end of the 18th century the old London Bridge - by then over 600 years old - needed to be replaced. It was narrow and decrepit, and blocked river traffic. In 1799, a competition for designs to replace the old bridge was held. Entrants included Thomas Telford, whose proposal of a single iron arch spanning 600 feet (180 m) was rejected as unfeasible and impractical. John Rennie won the competition with a more conventional design of five stone arches. It was built 100 feet (30 m) west (upstream) of the original site under the supervision of Rennie's son.

Work began in 1824 and the foundation stone was laid, in the southern coffer dam, on 15 June 1825 with the official opening on 1st August 1831. Rennie's bridge was 928 feet (283 m) long and 49 feet (15 m) wide, constructed from Haytor granite. New approach roads had to be built, which cost three times as much as the bridge itself. The total costs, around £2.5 million (£198 million in 2014), costs were shared by the British Government and the Corporation of London. The old bridge continued in use while the new bridge was being built, and was demolished after the latter opened in 1831.

In 1896 the bridge was the busiest point in London, and one of its most congested; 8,000 pedestrians and 900 vehicles crossed every hour. It was widened by 13 feet, using granite corbels. Subsequent surveys showed that the bridge was sinking an inch (about 2.5 cm) every eight years, and by 1924 the east side had sunk some three to four inches (about 9 cm) lower than the west side. The decision was taken to remove and replace the bridge.

Modern London Bridge: Frank described the design, planning and the construction of the current bridge which was designed by architect Lord Holford and engineers Mott, Hay and Anderson. It was constructed by contractors John Mowlem and Co from 1967 to 1972 at a cost of £4 million (£49.3 million in 2014). It was officially opened by Queen Elizabeth II on 17th March 1973.

The bridge comprises three spans of pre-stressed concrete box girders, a total of 928 feet (283 m) long and was built in the same location as Rennie's bridge which had to remain in use during the build programme. This resulted in the requirement for a very complicated and detailed build programme.

The construction method used was to install one span upstream and one span downstream while traffic used the original bridge. Traffic was then transferred onto the two new girders, and the previous bridge demolished to allow the final two central girders to be added.

Frank detailed excavating for the piers – some close to London Underground tunnels, and the building of the piers. The pre-stressed box girders were then barged from a nearby support site and lifted into position. Once all the girders were in position the roadway and pedestrian walkway were constructed. Once this was completed all of the lighting and ancillary services were completed.

Sale of Rennie's London Bridge to Robert McCulloch: On 18 April 1968, Rennie's bridge was sold to the Missourian entrepreneur Robert P. McCulloch of McCulloch Oil for US$2,460,000. The claim that McCulloch believed mistakenly that he was buying the more impressive Tower Bridge was denied by both McCulloch and Luckin (who sold the bridge) in a newspaper interview. As the bridge was taken apart, each piece was meticulously numbered. The blocks were then shipped overseas through the Panama Canal to California and trucked from Long Beach to Arizona.

The bridge was reconstructed by Sundt Construction at Lake Havasu City, Arizona and re-dedicated on 10 October 1971. The bridge consists of a concrete frame with facing stones from Rennie's London Bridge used as cladding. Prior to re-cladding15 to 20 cm (5.9 to 7.9 inches were sliced from the stones resulting in cladding 150 to 200mm (6 to 8 inches) thick.

Frank's talk was concluded with a question and answer session. An excellent overview of one of the most - (or maybe even the most!!) important London River Thames crossings.

R Keir

Outing:

Tuesday 6th November

Glyndebourne Opera House.

A party 13 members and 4 guests visited Glyndebourne Opera House for a 'behind the scenes' tour. We met in the Old green Room for tea/coffee followed by an introduction to Glyndebourne and the Christie family.

Glyndebourne Opera House was the brainchild of Mr John Christie, who inherited the Glyndebourne estate in 1920, ably supported by his wife Audrey Mildmay, herself a professional singer. The opera house evolved from amateur opera productions held in the Organ Room at Glyndebourne House. This was followed by a small purpose-built theatre to hold 300 people, a reasonable orchestra pit and a stage furnished with the most modern technical and lighting equipment of the time.

Fritz Busch from Dresden and Carl Ebert from Berlin who had left Germany because they could not work under the Hitler regime accepted the posts of conductor and producer respectively on the condition that in all artistic matters they were to have sole responsibility. Christie's only condition was that they should leave all matters regarding the cost of running the opera festival to him. The first performance of the Opera Festival at Glyndebourne was on 28 May, 1934.

By the 1980s the original theatre complex had evolved in a somewhat piecemeal fashion and included a collection of outbuildings which housed restaurants, dressing rooms and miscellaneous buildings. The `old` theatre also struggling to accommodate the ever more technically demanding productions and to meet the increasing public demand for tickets. In 1987 Sir George Christie announced the idea of building a completely new, larger, opera house.

Michael Hopkins and Partners won the contract and the 'new' 1,200 seat theatre which opened on 28th May 1994 has won many awards for the quality of the architecture and for the craftsmanship of its component parts.

The theatre, a large brick oval building is built from load-bearing, imperial size handmade bricks; the only exception is the fly tower - a steel structure clad in lead. Acid-washed precast concrete is the other prominent material used in the construction, and this has been used for floors and ceilings.

The four level, horseshoe shaped auditorium has been crafted out of century-old pitch pine, fashioned into elegant curves. The stage is semi-circular in shape and over sixty feet in height to allow for the efficient flying and storage of scenery. The acoustics, by Derek Sugden and Rob Harris of Arup Acoustics, have been widely acclaimed.

We started the tour proper outside at the Horsehead sculpture by Nic Fiddian-Green which is situated on the site of the 'old' theatre. We then visited the following areas:

Stage: We were given a detailed explanation of how the stage is set up and operates.
Backstage: Again a detailed explanation of backstage operations and how scenery was moved including the operation of the director's console.

Rehearsal Rooms: There are two main rehearsal rooms adjacent to backstage. These provide full-size rehearsal spaces. This allows singers to experience like-for-like performance conditions.

Outside Scenery Lift: Most of the scenery is made off-site in Wales. It is delivered to an outside lift where the delivery truck is unloaded. The scenery is then taken along a passage under the building to the backstage lift.

New Green Room: This contained a series of photographs showing the stages of construction of the theatre. It also displayed some magnificently detailed props, costumes and wigs from several productions, including Der Rosenkavalier.

Dressing rooms: Some rather small but a rather imposing Conductors dressing room!!

Auditorium: Having already viewed one of the lower levels we concluded the tour by viewing the stage from the Top Tier. This included 'standing' areas

Overall the visit was a fascinating insight into how an internationally famous theatre operates. The logistics, planning and organisation required was extensive and impressive to say the least. We had an exceptional guide whose extensive knowledge and stories/anecdotes made the visit extremely enjoyable.
R Keir

Talk:
Tuesday 11th November 2014
Cooch Memorial Lecture, Development of Flight Simulators

The report on this talk is held over until the next Newsletter.

Talk:
Tuesday 9th December 2014
Surface roughness and Topography measurement
Alistair Sharp
Alastair began by reminding us of his business, discussed last year, in which he presented industrial X-ray systems. He reminded us of the distributor's need to keep distribution life cycles in mind, illustrating this with the end of his distribution of analogue YV tuner test sets with the advent of digital tuners, and told us how he found his third major distribution line – surface measurement.

He then explained why people want to characterise surfaces, moving from there to how it can be done. He mentioned traditional methods, modern optical methods and the latest light scattering system, and talked about what each does best.

He then moved on to describe optical profilometry as instanced by his principal, Nanofocus, and discussed two possible sensors for this as well as illustrating a complete system. Applications illustrated were coating wear measurement and thick film electronics, plus another 8 applications he had found in the UK.

The next discussion was on confocal microscopy, whose operation he showed, including a brief mention of advantages and disadvantages, before discussing applications – a blood sensor requiring extremely accutae measurement including volumes around 1 nanolitre; then engine cylinder bore measurement, with a film showing how this is done; followed by measurement of industrial ink jet printing. He then showed a very versatile mobile version of the system, then concluded this part by a brief illustration of another 12 applications found in the UK.

Finally, Alastair discussed how scattered light can be used to make very high speed surface measurements, enabling complete specimen capture in most cases and showed how the Optosurf system is built. He again discussed advantages and disadvantages. Applications illustrated were piston rod grinding, bar peeling, chatter mark measurement and sheet metal roughness – this with a short film. Alastair concluded with a description of 6 other applications found for this technique.

END OF NEWSLETTER

REPLY SLIP

To: Ms B C Whitmell, 12 Brook Way, Lancing, BN15 8DG 01903 905922

e-mail bcwhitmell@uwclub.net

Please reserve me a place to attend the **Lunch at Northbrook College, Worthing, on Wednesday 15th April 12.00 for 12.30**

Name:……(Block capitals)

Address………

……

……

Telephone Number……..Name of guest/s …….

E mail address……Seating Request …….

I enclose a cheque made payable to RCEA for **£……..…(£14.00) per person**

Applications by 14th March 2014