Science & Engineering Events 2023

23/11/23 : The Pipe Organ – art, science, craft, and technology – A talk by Andrew Moyes, former MD of Nicholson Organs, Malvern.

Andrew Moyes - our speaker – originally qualified in engineering and worked for the railways. Although he played the organ as a hobby from the age of 14 at his local church, he had no idea that it would later form a vital part of his working career. A colleague had suggested that with his engineering knowledge he would be ideal to work at Nicholson's Organ Factory in Malvern. After paying the factory a visit he was soon to become their MD.

A typical small organ possesses about 1,500 pipes. The largest 2 organs in this country can be found in The Albert Hall and Liverpool Cathedral. These venues both claim the most pipes at around 10,000. They regularly add pipes to keep the claim.

He described the 2 main types of pipes, flue pipes and reed pipes. The technical components of the pipes are named after the human body and the entering air is known as wind. He explained how the air vibrates to produce the sound and that the smallest and largest pipes are at the extreme of human hearing. On occasions an organist with many years experience has complained that the high or low notes are not working, only to discover that it is a matter of hearing deterioration.

The relationship between diameter, length and other constituents of the pipe relating to sound were explained in terms of science. Doubling the length of a pipe changes the sound by an octave. Different notes are also achieved by blowing harder and closing the pipe end. Closing the end is known as "stopped", this is where the term opening all the stops comes from. The sounds were all aptly demonstrated using some pipes that Andrew had brought with him. The difference between a flute and a string sound were quite impressive.

Manuals (keyboards) were explained, up to 6 in a cathedral including the foot manual are normal. Although the US can claim 7 manuals. Unlike other instruments the pipe organ keys themselves cannot show feeling, they are more like on/off keys. The feeling is therefore obtained by having different manuals and a variety of "stops". For instance, the bottom manual is "the choir manual" the next up is "the greater organ". These manual keys can be connected via mechanisms at the rear. This makes the keys harder to press and over the years the synchronisation has been progressed to using electro-pneumatics.

Nicholson Organs, one of only 2 major organ manufacturers in existence in the UK originally cast their own metal for making organ pipes. This was cast as flat sheet and hand planed, before forming into pipes. Metal is now imported. The best organs have an alloy of 50% tin and 50% lead to give the best tone, but the percentages can vary to give different effects. Wooden pipes are made of strip wood assembled to form a square section pipe.

Andrew's last big commission before retiring in 2017 was an organ built for Auckland, New Zealand. This was the largest organ built in Britain since 1942. Weighing 40 tonnes and housing 5,432 pipes it took 20 months to build. It was completed 2 months ahead of schedule.

Christchurch in New Zealand lost their organ to the massive earthquake and were looking around the world for a replacement. After seeing and hearing the Auckland organ they didn't need to look any further. Nicholsons gained another large commission. The largest pipes of these organs measure 32 feet, the smallest about the size of a pencil. The longest pipe in the Dursley Methodist Church is about 8 feet. One point of note is that organ pipe lengths are imperial. French and German organ pipes are also measured in feet.

In the Q and A session we learnt that ebony is still obtainable and used for keys. Ivory has a substitute. Nicholsons have many ivory keys from organs they have dismantled which is forbidden to be sold.

Organs need regular tuning, the Methodist one is tuned twice a year. The Auckland one receives a week's attention once a year from Nicholsons.

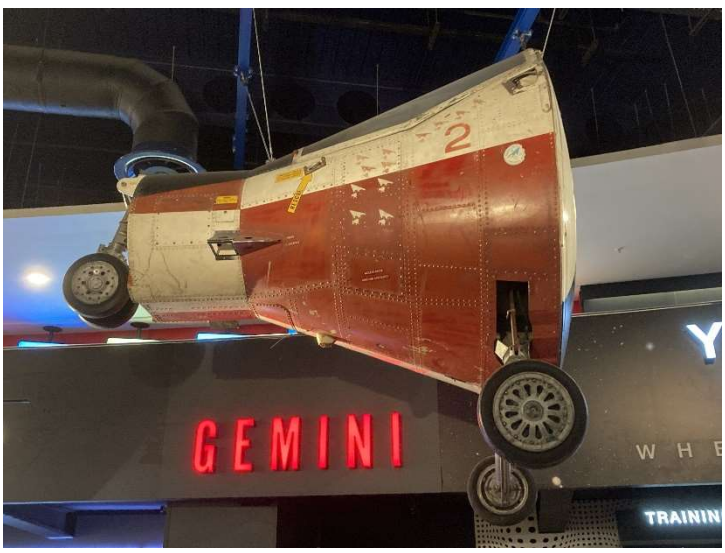
Dusting is less frequent provided the organ is covered during building works. Gloucester Cathedral organ needed a thorough dusting after a drone was used inside the building.

Andrew's 20 years as MD at the factory gave the audience a thorough and interesting knowledge of organs. The talk concluded with a video of the inside arrangement of pipes of the Auckland organ, and it being played during final testing.

Paul Sheppard

12/10/23 : Space Centre, Leicester

It is home to the UK's largest planetarium, six interactive galleries, 42m high iconic Rocket Tower and over 150 hands-on elements. We watched a short film in the planetarium, and then we were free to explore. There were a lot of school children attacking the hands-on displays, which contained several interesting parts. My



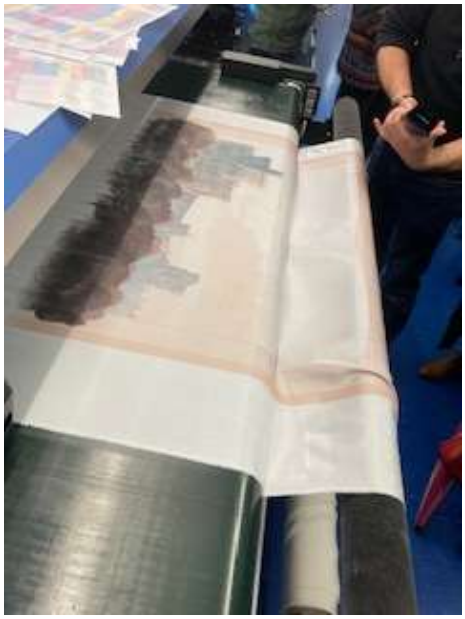
favourite was the Rocket Tower, giving good views of 2 rockets, and featuring lots of historical space related photos, stories and artifacts.

28/9/23 : Beckford Silk Mill

Founded in 1975 by the Gardner family and run today by their children. Started off supplying to the heritage market and today have customers all over the world.

After watching a video of the different processes, Anne took us around the factory and we soon felt how passionate she was in explaining in great details how the different stages in silk printing came about. Indeed, her brother Robbie who looks after the production side was equal to his sister in keeping their father's passion alive.

Through the design studio where everything is hand drawn before being scanned into a computer, once proofed it is then printed or screened onto the silk. The two machines that were in operation are in fact modified paper printers, and one that printed scarves for an Irish Golf Club is the only machine in the world that can print using acid dyes which makes the colours more vibrant.



After that we were privileged to see a painting of Windsor Castle by the King himself being printed.
Once the drying and cleaning has taken place the silk roll finishes up being stretched and dried on a 100-year-old clip stenter machine where creases are taken out. The roll Is then cut to individual pieces rolled and sewn before packing for sale.

We marvelled at the dedication to detail in producing these wonderful silk products with the ability to use old and new technologies while keeping family traditions alive. You will always tell a Beckford silk product because the design is seen on the reverse side as well.

Donald Gibson

27/7/23 : Coventry Transport Museum.

The focus of the trip was a visit to the Coventry Transport Museum but as the museum is in the city centre, the nearby Cathedral, gallery, and other attractions were also a draw.

The museum itself is very large, with many exhibits ranging from the earliest bicycles (including one that originally had 14 seats!), to cars, motorcycles, trucks, buses and military vehicles. There is also a special exhibition of land speed record-breaking vehicles, including the world's two fastest cars, either of which would rapidly lead to the loss of your driving licence!

The museum provided us with a large room where we were served tea, coffee and biscuits, and we were then free to wander at leisure. The large number of exhibits are very well and imaginatively presented and labelled and there is a lot of social and war history alongside the vehicles. The common factor of the exhibits is that they have some connection with the city of Coventry, so the makes on display included Jaguar, Daimler, Triumph, Hillman, Sunbeam, etc, and there were several royal vehicles including two large Daimlers used by George Vl and Queen Mary, and Lady Diana

Spencer's Mini Metro. We were also able to see inside a hall containing cars which are not normally on display – this room contained what was perhaps my favourite exhibit, a 1912 Crouch Carette. This was a very jolly looking little car which looked like it belonged in a cartoon, but unfortunately it was both difficult to control and to stop, so it must have been quite an exciting drive!

Of course, Coventry is also famous for its Cathedral, or should I say Cathedrals plural, since there are two. The 14th Century one was destroyed in a bombing raid in 1940. It is now a preserved shell, although the spire still stands and is the third tallest in England. A modern Cathedral was built next to it and was consecrated in 1962. I'm not a great fan of modern Cathedrals but this one is quite impressive, with beautiful stained and engraved glass, and a tapestry of Christ in Glory that is reputedly the largest made in one single piece.

All in all, a very enjoyable and interesting day and if you have never been there, I would recommend a visit to Coventry and especially to the Cathedral and the Transport Museum.

David Tweats

8/6/23 : Gloucester Cathedral Tower Architecture

Following the successful architectural tour of Gloucester cathedral and crypt on 23 March this year, we arranged a follow-on visit to the tower. This group tour concentrated on how it was built, and the modifications required to maintain the stability of the structure. The tour was led by our very knowledgeable guide, Chris Roberts, who adapted the normal tour of the tower to focus on how it was built and how fortunate we are that it remains standing. We started by looking at the tower from outside on Cathedral Green, before climbing the 265 steps to the top, and were rewarded by magnificent views over Gloucester and its surroundings.

The original Norman Romanesque tower was completed around 1130 and probably looked similar to the current tower at Tewkesbury Abbey. Many Norman towers collapsed due to poor foundations, crushing of stonework, fire damage or storms, and the tower at Gloucester was dismantled around 1340 because of settlement in the South-East pier and cracking in the adjoining arches. For about 100 years there was no central tower until the present one was built between 1450-1460 in a magnificent Perpendicular style. However, the intrepid architect and masons decided to use the four original Norman piers which were already about 350 years old at that time. Much of the stonework from the original Norman tower was also reused, such as the chevron arches visible from outside.

Since the thickness of the walls is progressively reduced in each of the three tiers and the upper tier is only about a meter thick, the spiral stairs become increasingly narrow towards the top – at a height of 69 metres. The castellation and pinnacles look so delicate from below, but the bell tower houses large stone arches which support the fourth corner of each pinnacle, since these are too large to rest on the thin walls. Apart from reducing the weight of the tower by reducing the wall thickness, there are also many flying buttresses supporting it, some of which are visible from inside and others from outside the cathedral.

Part way up the tower, we stopped to see Great Peter, the great medieval bell which weighs 3 metric tonnes and strikes every hour. I was quite glad not to be near when it struck 11.00am! Cast in 1420, this is the oldest Bourdon bell (the largest in a carillion of bells) still in use in England. The bell is too large to fit through the access hatch in the tower vault, so it must have been in place before the vault was completed.
The more I learn about Gloucester Cathedral the more I am impressed by it. It is a real-life history lesson with all four phases of English architecture on

display, yet frozen in time by the Reformation. As our guide pointed out, we are very fortunate that it is all still standing, bearing in mind the dubious foundations and all the neglect it suffered at certain times, especially under Oliver Cromwell – but it does help to have a king buried there!

Tony Wooldridge. Photos by Brian Wetton.

16/5/23 : Incinerator visit no 9

See report from 2021.

13/4/23 : Aircraft Salvage International

The visit started with a very thorough briefing from Mark Gregory, the founder and Managing Director of the company. His talk, given in one of the hangars that the company operate from, not only contained a detailed history of the company's history and what it does, but also a lot of facts and figures about the airline industry with regard to such things as numbers of passengers and environmental issues. Mark is quite a flamboyant person and his talk was interesting and informative, funny in places and controversial in others. It is clear that he is proud of his business and likes to show people round.

We moved to the outside to see a couple of airliners in the first stages of disassembly. The first thing to come off are the engines, which are overhauled and returned to service. A new engine costs in the region of £35 million. A second hand one is worth about £3 to £5 million, a great

incentive to bring them back to service.

The next most valuable part is the Auxiliary Power Unit. After that, some 400 parts are removed from the old aircraft. Things like instruments, avionics and communications equipment. Cabin seating as well if it is modern and in good condition. We were shown some specific operations
that were being done at the time.

By now the only real value left is in the landing gear. The old aeroplane is wheeled over to a large outdoor site. We travelled to this in a couple of vehicles. Here the aircraft is mounted on concrete blocks, wooden sleepers and large metal stands, then the undercarriage is removed. There is now nothing left of any great value and the once majestic aeroplane is unceremoniously broken up with a large machine with a kind of set of jaws on the end of a boom. The scrap material is loaded into skips and taken off site for processing and recycling.

At stages in the visit, Mark gathered us round to explain what was going on. Otherwise, we were free to wander around, looking at the aircraft and talking to the staff. It was all very relaxed. Mark was always on hand to answer any questions we may have. We then returned to the reception area for a bit of a debrief and said our good byes.

Myron Burak.

23/3/23 : Architectural and engineering aspects of Gloucester Cathedral

Our group tour of the main cathedral and the crypt concentrated on how the architecture of the building developed over time, and some of the engineering challenges which had to be overcome. We soon realised just how fortunate we are that the medieval masterpiece of Gloucester Cathedral has survived to the present day! Our visit started in the Norman crypt – built between 1089 and about 1100 – where we learnt that subsidence at this time had required most of the arches to be reinforced, and additional arches added. The cathedral is built on river deposits of sand and clay and subsidence was a serious headache for the medieval masons. We were later shown where additional buttressing had been required both internally and externally when the central tower began to move.

1The nave looking east toward the choir, with pink staining on the pillars from the fire of ???

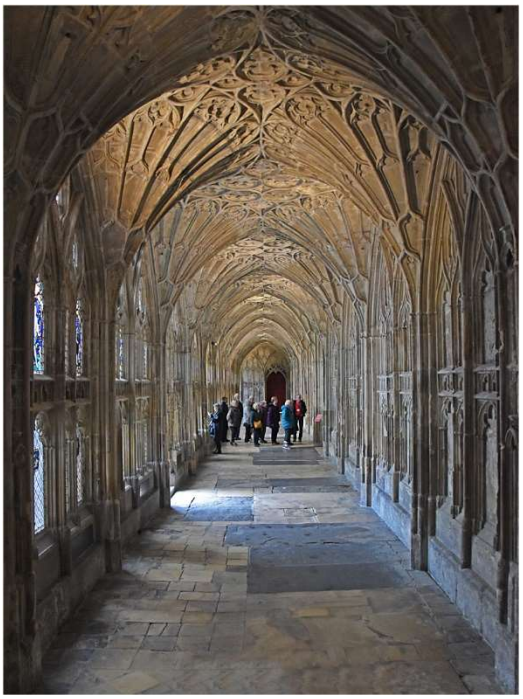
Another constant worry was fire, and the nave roof collapsed when a fire destroyed much of Gloucester in 1122. The pillars in the nave are stained pink where the burning timbers scorched the limestone. And if engineering challenges were not enough, there was a serious risk that the abbey church could have been destroyed during the dissolution of the monasteries under Henry VIII.

2 The group meeting for tea in the Parliament Room

Fortunately, the murdered King Edward II is buried here, and Henry felt obliged to honour his ancestor. Another serious challenge occurred during the Civil War when Oliver Cromwell's troops occupied the building and destroyed many of the artworks including the window of the Lady Chapel.

Finally, there was extensive restoration during the Victorian period, but some of the modern building materials used were completely unsuitable. The need to maintain the breathable nature of the building was not properly understood. The introduction of a concrete floor in the crypt led to flooding; so the concrete was removed in the 1930s and replaced with sand. Cement mortar was used for repairs to the fan vaulting in the crypt and this is now being replaced with the original lime mortar.

We benefited from having a very knowledgeable guide, who persuaded us that a return visit to climb the tower and visit the Tribune Gallery would be very worthwhile. Watch this space!



3 Visiting the fan vaulting in the cloisters and the Chapter House.

Architectural notes:

The original structure of what is now Gloucester cathedral was built over a period of about 30 years, between 1089 and 1121, on the site of an Anglo-Saxon minster. Much of that Norman structure remains today and is most obvious in the massive circular pillars and semi-circular arches of the nave as well as in the crypt. However, over several centuries, some very ambitious architectural changes were made with additions in every style of Gothic architecture. The original Norman structure was ingeniously modified as new architectural styles developed. The Treasury screen is a beautiful example of Early English Gothic architecture with pointed arches, lancet windows, and 'pastry cutter' tracery. The south aisle is Decorated English Gothic with elaborate decoration (eg ball flowers) both inside and outside the building. The south transept is regarded as the birthplace of Perpendicular Gothic with its large traceried windows and upright straight lines. In the choir, the walls and arches of the Normans are draped in delicate lacelike Gothic stonework. The intricate fan vaulted ceilings in the cloisters are a style which was first designed here, and they remain the earliest surviving example of such architecture.

Tony Wooldridge. Photos: Tony Wooldridge and Brian Wetton.

2/3/23 : Visit to the Helicopter Museum, Weston-Super-Mare.

Science and Engineering visited the helicopter museum on 2 March. It was a bright but bitterly cold day, and viewing the collection, housed in a large unheated old hanger, required warm clothing and some tenacity.

Our volunteer guides came from a range of backgrounds, including Martin Barnes, a retired technician from the Westland helicopter factory, Yeovil. Martin, dressed for the occasion in flying suit, opened up on of the cockpits for anyone intrepid and fit enough to clamber inside. Donald Gibson was one member who couldn't resist.

Some of details, particularly about the engines, were quite complex, and it was useful to have retained your anorak. Good job I had mine, as a radiation warning sign on one vintage exhibit led to a discussion on the dangers of radium based luminous paint.

The museum has over 100 helicopters on display. One of the most iconic was a Bell "Iroquois", the 'Huey' used by USAAF in the Vietnam War. There were even a Russian Hind Gun Ship. Another Russian helicopter had been hired out to Pinewood Studios for a Marvel blockbuster movie. You can see it in action (thanks to wires and green screen technology) in the film 'Black Widow'. From the UK, world speed record holder the Westland Lynx was built in Yeovil in 1979. An Augusta was used by the Italian customs. To cap off the collection, and looking pristine and bright was a helicopter formerly of the Royal Flight.

We were thankful for the cafeteria and the hot Shepherd's Pie. Incidentally, the trip coincided with the recent jammed tipper truck and the consequent closure of the M5. We were treated by our competent coach driver to a tour of Avonmouth going and a return journey through Sea Mills and Shirehampton, diversions that kept us reasonably to time and avoided the frustration of long traffic queues.
See also visit report from 2016.

28/2/23 : Incinerator visit no 8

See report from 2021.

21/2/23 : Incinerator visit no 7

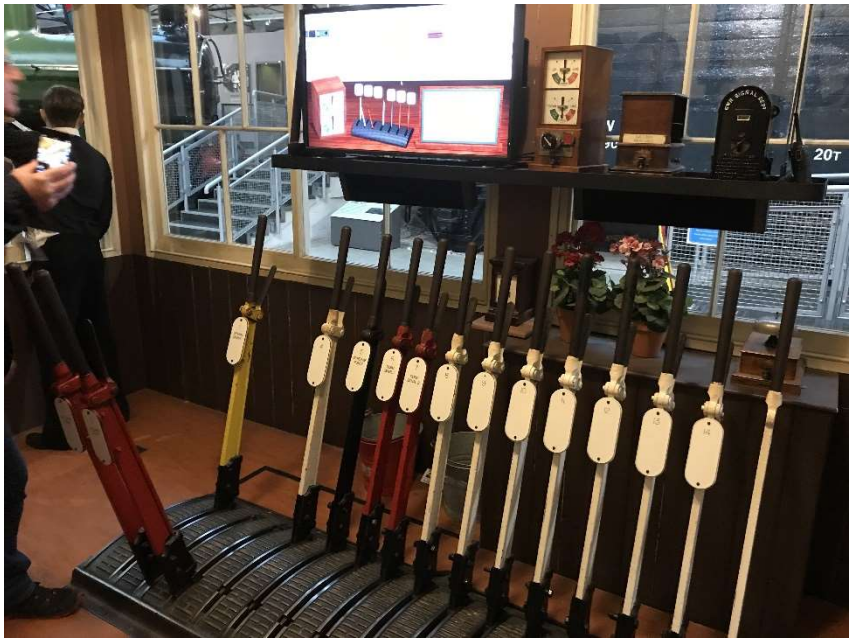
See report from 2021.

26/1/23: STEAM, Swindon

The group enjoyed a guided tour of the Great Western Steam Museum in Swindon. The Swindon Works was built by the junction of the Golden Valley Line and the new GWR line from London to Bristol. Work started on the line in 1841. As the gradient for the line was rather flat from London to Bristol, the early Brunel designed engines such as the 'North Star' used the Broad-Gauge rail width of 7 feet and 1⁄4 inches, enabling the journey from London to Bristol to be completed in a faster

time than previous engine designs. Our guide explained the differing boiler systems and how the cylinder layout went from vertical to horizontal to give a better balance and smoother ride.

These engines did not have brakes and braking was achieved by the use of a Brake Van at the rear of the train, at times a dangerous procedure. We were told about the Castle Series of engines which held the speed record of 100 miles per hour in the 1920's. This was achieved by higher boiler pressure and improved overall design. The engine designer Cressley copied Brunel's design for his 'A' Series engines. By now the engines had developed brakes and would run on the new Standard Gauge width as it was found to be cheaper to lay and used less land.



Once the official tour was completed the group wandered around the museum at leisure. It was fascinating to see how rail travel used to be in times gone by. On display was an original station with weight scales, ticket machines and tea trolley all situated on the platform, which brought back many childhood memories.

It was great fun to try our hands at operating a signal box and Engine Simulator. In years gone by horses were used to transport goods around the Swindon Yards before the advent of mechanisation. Displays of carts and packing cases, and an early fire engine were alongside an original Buffet Car and Queen Victoria's Royal Carriage, whose interior was not lavish. Several engines including the last ever GWR Engine to be made in 1947, could be seen. One brought back memories for a member of our party, whose grandfather was a driver on a similar engine back in the 1890's. One final point; Dursley had its part to play in the GWR story. Just inside the main entrance to the museum there is a diesel-powered vehicle made by Listers which was used to ferry workers around the yard/works. A little piece of local history. A trip to the GWR Museum is definitely worthwhile and will be a big hit with the grandchildren.

Donald Gibson