



An Association for Retired Professional Engineers

NEWSLETTER August 2019

President's message

Welcome to the August Newsletter.

During the summer we arranged two outings, one to the recently reopened Leonardslee Gardens and the second to the Weald and Downland Museum. We had good weather and excellent guides on both days. It is worth noting that without guests adding to the number of attendees, the visits would not have been economically viable. The committee would appreciate feedback on whether members feel that the Association should be organising such summer outings.

The visit to Brookhurst Wood Waste processing Centre highlighted the critical importance of recycling, particularly plastic, in the UK. The Brookhurst Wood Centre processes only 'black bag' waste and during the visit our hosts suggested that we would gain a better appreciation of the entire waste disposal process by also visiting the Ford recycling plant which deals with 'recyclable' waste. We will try and arrange a visit to Ford next year. I hope that member's partners would also be interested in the visit as it is such an important issue for us all.

The committee has agreed to move the management of the Association's affairs to a purpose made Membership package (membermojo). This is to make life a bit easier for the Membership Secretary and Treasurer. Financial transactions will be more straightforward. The Treasurer has described in the Newsletter the process for subscription renewal which will be the first use of the system

We need some Members to step forward at the AGM to join the Committee. The good health of the Association is dependent on 'new blood' getting involved.

Despite my reservations and instinct, I am willing to stand for election as President for one more year.

Derek Webb

August 2019

PROGRAMME OF EVENTS September 2019 – March 2020

17th Sep	Tuesday	AGM followed by :- Talk – The technical challenges to taking astronomical images
19th Sep	Thursday	Coffee – at Spotted Cow, Angmering
26th Sep	Thursday	Coffee – with Partners at Swallow's Return
8th Oct	Tuesday	Talk – Goonhilly – a tale of two half-centuries
17th Oct	Thursday	Coffee – at Spotted Cow, Angmering

31st Oct	Thursday	Coffee – with Partners at Swallow’s Return
5th Nov	Tuesday	Visit – Network Rail Ludgate Cellars DC Substation
12th Nov	Tuesday	Cooch Memorial Lecture – The Electrified World – A Perfect Place for Fuel Cells. This talk will be held in The Pavilion.
21st Nov	Thursday	Coffee – at Spotted Cow, Angmering
28th Nov	Thursday	Coffee – with Partners at Swallow’s Return
5th Dec	Thursday	Christmas Lunch at Windsor hotel, Worthing.
10th Dec	Tuesday	Talk – National measurement standards for medical ultrasound and underwater acoustics
19th Dec	Thursday	Coffee – at Spotted Cow, Angmering
26th Dec	Thursday	<u>No</u> Coffee at Swallow’s Return!
14th Jan	Tuesday	Talk – Operation Overlord, D-Day 6 June 1944
16th Jan	Thursday	Coffee – at Spotted Cow, Angmering
30th Jan	Thursday	Coffee – with Partners at Swallow’s Return
11th Feb	Tuesday	Talk – tbc
20th Feb	Thursday	Coffee – at Spotted Cow, Angmering
27th Feb	Thursday	Coffee – with Partners at Swallow’s Return
10th Mar	Tuesday	Talk – tbc
19th Mar	Thursday	Coffee – at Spotted Cow, Angmering
26th Mar	Thursday	Coffee – with Partners at Swallow’s Return

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 am.

We apologise for only being able to publish a short list of our forthcoming events. This is simply due to the difficulties we now face in booking speakers and visits far ahead. As you know we sometimes have to cancel/rearrange talks and visits, often at short notice. We do try and inform our members of late changes to our programme by email, but suggest that members should increasingly rely upon our website for up to date details of events.

New Membership Database and Subscriptions

Members may have heard that your Committee has decided to purchase a licence for a software package (MemberMojo, or MJo for short) that will administer our Membership database more efficiently. Advantages include simplifying the sending of group emails, handling subs more simply and keeping track of member’s details. It probably has other advantages which we have yet to exploit. Despite having taken time to familiarise ourselves with its workings, we may push a wrong button and cause confusion in the short term, in which case may we seek your forbearance in advance. And yes, we will be taking backup copies and keeping the old Excel spreadsheet as a potential fall-back system.

MemberMojo will enable us to respond positively to frequent requests from members to renew their subs on-line either via Paypal or by bank transfer as well as by cheque as now. The system will also send automatic requests for subs, which may help some with poor memories!!

Subscriptions are due on 1 October and in early October the system will send you an email requesting you to renew your sub. This email will contain a link, and will invite you to click on this link to connect you to the correct page on the system.

You will then have three options to pay:-

- a) You can send or give a cheque for £15 to the Hon. Treasurer, Tony Tomkins, 13 Milton House, Milton Road, Haywards Heath, RH16 1AG. Reply slip at end of newsletter for those sending a cheque.
- b) You can pay online via Paypal, which is our preferred option. This does not require you to have your own Paypal account, you just connect as a guest to Paypal and pay with your debit or credit card of choice
- c) You can pay via Bank transfer to RCEA (account details will be shown). If you take this option please put your name in the reference box AND also email me to tell me you have done so.

When your sub is received the system will send you a confirmatory email. If you do not renew your subscription, the system will:-

- a) Send you a reminder and again ask you to pay
- b) In early November will send you a notification that you need to pay now to ensure your membership continues
- c) If you still have not paid, the system will advise you that your membership has lapsed – BUT will tell you that your membership will remain on record for a time and allow you to re-join without new entry fees.

We trust that the new system will be of real benefit to all our members and hope that you will extend us forbearance whilst we really learn how to use the system seamlessly.

Mike Wooldridge Membership secretary
Tony Tomkins Secretary and Treasurer

Website of the RCEA

Our website, www.rceasussex.org.uk carries the very latest information on all of our events.

New Members and Speakers for Talks

The RCEA needs new members and speakers to ensure that we can continue as a thriving organisation. Please think of appropriate people you know and encourage them to come along to our talks and hopefully join the RCEA.

We also need more speakers to give talks to us on Tuesday afternoons from September to March. 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. Speakers from outside organisations are increasingly harder to find and often seek payment for their services.

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 attend 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.

Southern Retired Chartered Engineers (SRCE)

The SRCE's AGM is being held at the South Winchester golf club on 10/10/2019. The formal business will only take an hour and will be followed by a two course meal and a talk by a retired lady airline pilot.

A trip to the Salisbury theatre is also planned later this year. We do not currently have any programme information for 2020. Members wishing to attend any of these events should contact the SRCE secretary Jeff Williams on 02380 897078 or e-mail jagwilliams@waitrose.com.

Newsletter Entries

If you would like to provide an article for inclusion in a future newsletter it would be very welcome as we are always looking for new material in addition to reports on previous talks and visits/outings. From feedback from our members we know that the newsletter is particularly appreciated by those who are no longer able to get to our meetings and visits, so if you are able to contribute in this way it would be much appreciated. Articles should preferably be Microsoft Word documents, although we can usually convert both text and pictures (even photographs) into a suitable format. Accompanying pictures are best supplied as separate files which will be embedded within the text during editing.

Brief Detail – Talks, Outings and other activities September 2019 – March 2020

Talk

Tuesday 17 September - The technical challenges to taking astronomical images

Our speaker, John Mallett, FRAS, Member of the BAA and also IET and RAeS, has his own observatory in Selsey near Chichester.

John will talk about the journey he has undertaken to obtain high quality images and data from his amateur observatory. In particular he will highlight the technical challenges in dealing with mechanical, electrical, atmospheric variations, noise and errors that cause image and measurement data quality issues. As an example of these challenges, he will discuss the control loop required to track stars using a computer driven telescope mount and adjust for errors in gear systems, motor resolution, camera noise, atmospheric movement etc. In his talk he will also examine some of the other effects that cause errors in observing distant objects in terms of the uncertainty of time and our movement round the sun and solar system.

Talk

Tuesday 8 October – Goonhilly, A Tale of Two Half-centuries

Goonhilly Satellite Earth Station has been instrumental in the history and development of satellite communications since the early 1960s. This talk will commence with a summary of the site's evolution over its first half-century leading up to plans for its demolition in 2009. The second part will show how the site was saved from the bull-dozer and will introduce some of the exciting plans which the new owner has for using the existing large dishes as the basis for the Goonhilly Space Science Park over the next half-century during which Goonhilly (and hence Cornwall) will be ideally placed to gain universal acclaim as a centre of excellence for space communications & navigation for missions to Mars, the Moon and beyond.

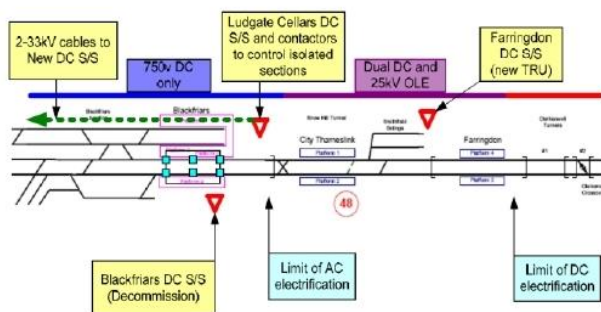
Our speaker, Des Prouse, worked in the Research & Development Department at Goonhilly Satellite Earth Station from 1971 until his retirement in 2007. He then made it his retirement passion to seek alternative uses for the site and its people, following BT's decision to cease its own satellite services and to demolish most of the site.

Visit

Tuesday 5th November – Network Rail Ludgate Cellars DC Substation

In December 2016 we were given a talk by Martin Sigrist about the Electrification Traction Power arrangements for the Thameslink Project and particularly the management of the interface between the 25kV AC and 750V DC systems between Blackfriars and City Thameslink stations. This is carried out at Ludgate Cellars Substation. Martin has arranged a technical visit for us. The substation is a short walk from City Thameslink station. As the substation contains static and enclosed equipment, no special personal protective equipment is required. The equipment comprises HVAC and High-Speed DC switchgear, Rectifiers, Rectifier Transformers and uniquely here, DC contactors operated automatically by the train movements.

As a reminder here is a system diagram and a photo of the substation-



If you are coming on the visit, I recommend that you re-read Martin's talk which is in the August 2017 newsletter and can be retrieved from the RCEA website.

We will meet at the south exit from City Thameslink station. The planned Thameslink train is the 11.13 arrival from Brighton (depart 0958). There is a connection (10.10 arrive, 10.16 depart) at Haywards Heath off the 09.32 from West Worthing (09.15 from Littlehampton) for those travelling from stations between Littlehampton and Hove. The maximum number for the visit is 20 which would form two groups of 10.

Reply slip is at the end of this newsletter. Applications by Monday 21st October 2019 please.

Talk (Cooch Memorial Lecture) – to be given in The Pavilion Tuesday 12th November – The Electrified World – A Perfect Place for Fuel Cells.

Paul Barnard, Director of Special Projects, Ceres Power Ltd.

As the world becomes more electrified and moves away from traditional sources of energy for electrical generation and transport motive power, there are many challenges in the transition and the final energy picture – whatever the future holds.

Renewable sources of electrical energy have intermittency or energy storage challenges, traditional generating assets have emissions challenges, the national grid has capacity limits, electrical vehicles have battery and charging challenges. Fuel cells offer an answer to some of these challenges in ways to ease and accelerate the transition to an electrified world. Fuel cells are the most efficient means of converting chemical energy to electrical energy. Historically, they have been a mixture of science fiction and space race fact; now they are proving to be real world products. Offering electrical power outputs ranging from Watts to greater than Mega Watts, fuel flexibility and suitability for stationary and motive applications – the future world is a perfect place for fuel cells.

Ceres Power are a world leader in intermediate temperature solid oxide fuel cells with global OEM partners and projects spanning different fuels, power ranges and applications. The talk will explore the role of fuel cells in the future energy mix and provide details of Ceres Power's world leading technology and research.

Christmas Lunch Thursday 5th December 2019 - Windsor Hotel, Windsor Road, Worthing BN11 2LX.

The menu is as below and early booking is advised due to the limit on numbers catered for. Applications should be received by **Saturday 30th November 2019** to ensure places. The cost this year is **£28 per person**.

'Resident' parking tickets can be obtained from reception if hotel car park is full.

Disabled parking can be arranged by including car registration number with booking application.

Reply Slip is at the end of Newsletter.

MENU

Winter Vegetable Soup with Vegetable Crisps,
Chicken & Parmesan Croquettes with Green Salad & Caesar Dressing,
Prawn & Cucumber Salad with Traditional Dressing,
Trio of Melon, Forest Fruits and Mulled Wine Syrup.

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Roast Breast of Turkey & Honey Roast Ham, with Bacon Wrapped Stuffing and Cumberland Sausage
Braised Feather Blade of Beef with Port Gravy & Yorkshire Pudding.
Butternut Squash, Sweet Potato, Mushrooms & Spinach Puff Pastry Wellington. (V)
Salmon, Crushed New Potatoes & Tarragon Hollandaise Sauce.

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Christmas Pudding served with brandy sauce
Honey & Pistachio Parfait with Hazelnut Praline.
Chocolate Truffle Torte with berry compote and brandy cream
Fruit Salad in a Lemon & Cinnamon Syrup

.....
Coffee and Mints

Talk

Tuesday 10th December - National measurement standards for medical ultrasound and underwater acoustics

Dr Roy C. Preston, retired Senior NPL Fellow

The UK National Physical Laboratory started work on establishing measurement standards for medical ultrasound in the late 1970's to meet the needs of clinicians and industry to ensure safety. Medical ultrasonic devices operate mainly in the frequency range 1 – 20 MHz, so measuring devices were developed such as radiation force balances to measure ultrasonic power and new types of hydrophone to measure acoustic pressure. Optical calibration methods directly traceable to the SI system were also developed. During the 1980's and 1990's NPL built an impressive capability that today leads the world. During the late 1990's opportunities were taken to address the need for traceable standards in underwater acoustics. New capabilities were established, including a 100 Tonne acoustic pressure vessel which is unique in Europe, and now these have also become world leaders. This talk will explain the background to these developments and achievements.

Talk

Tuesday 14th January – Operation Overlord, D-Day 6 June 1944

Dudley Hooley, Director, Tangmere Military Aviation Museum

The talk inevitably can only skim the surface of what was the largest amphibious landing in the history of warfare. After a brief introduction to the allied leaders, the talk covers Operation Fortitude, the great deception to persuade the German high command that the invasion would be centred on the Pas de Calais, the eccentric Gen Sir Percy Cleghorn Hobart and his 'Funnies' which played such a key role in the success of the invasion, Operation Deadstick, the attack on Pegasus Bridge, which signalled the opening shots of the invasion, a brief look at the German defences and role of the X-Craft, the landings at the Pointe de Hoc and the four invasion beaches.

Air support flown from local Sussex airfields includes the story of Spitfire ML 407, still flying today. Finally a few staggering statistics conclude what truly was the 'Longest Day'.

Reports

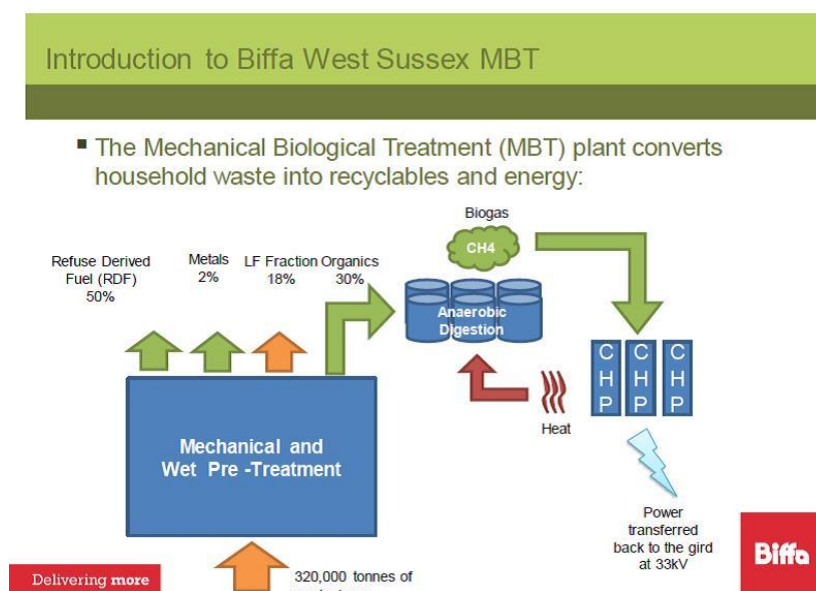
Visit

Thursday 2nd May 2019 - Brookhurst Wood Waste Treatment Facility

On arrival we were met by our host, Dianne Dodsworth, who was not only extremely knowledgeable, but clearly an enthusiastic campaigner for waste reduction and recycling.

Following a safety briefing we were given a comprehensive presentation covering the history and current operation of this MBT plant (see opposite). The facility was commissioned in 2015 at a cost of £150m, since which time it has dealt with all the domestic 'black bag' waste from Sussex. Biffa has the contract to process this waste stream until 2035.

The bulk of the household waste is brought to the plant by Viridor in very large articulated vehicles, but locally collected waste comes direct to the plant in smaller vehicles. Everything has to be delivered by road as there is no rail connection, with the number of large vehicle movements strictly limited to minimize nuisance to nearby residents. Staff and visitor's cars are not counted as 'large vehicles'.



'Black bag' waste consists predominantly of materials currently considered non-recyclable, although the current target is to divert 70% of this waste away from landfill due primarily to the high landfill tax of £86.10/tonne. In fact the landfill site adjoining the plant which has been used until recently has now closed as it is full and all waste materials destined for landfill have now to be transported over the border to Surrey. Dianne showed us some examples of household waste that had been dug up from a landfill site after being buried for many years— much was still easily recognisable including newspaper on which the text was still readable – so much for thinking that landfill is a good way to dispose of our waste.

'Recyclable' waste is currently processed at Biffa's plant at Ford in West Sussex, which our guide suggested as a possible follow-on visit for the RCEA (action in hand).

West Sussex currently recycles 44.3% of domestic waste, and is ranked 164th in the UK, where recycling rates vary from a low of 14% to a high of 65%. The EU has set member countries a target of 50% by 2020. One of our members suggested charging households for each 'black bag' as an incentive to increase recycling.

Initially the waste stream enters one of three shredders to break open the bagged waste. We observed a large number of soiled mattresses in the waste entering the plant, which have to be removed manually as they can cause damage to the shredders. With the sheer volume of material entering the plant it is very difficult to detect all materials that can be a hazard, and it was obvious from the number of stoppages seen whilst we were at the plant, that this is still a problem awaiting a solution. Fires at the plant are not uncommon, and Dianne listed gas cylinders, batteries and even emergency flares having been found in waste entering the plant.

During processing, metals (both ferrous and non-ferrous) are removed first. The metals are subsequently sold off, but as they are contaminated by other waste, prices are low. Subsequently plastics (mainly plastic film) and paper are separated out, leaving organic matter and 'the rest' to be sent to landfill. The plastics and paper are classified as Refuse Derived Fuel (RDF) in the diagram earlier, and are compressed into bundles and transported to Germany for incineration as there is currently insufficient incineration capacity in the UK – yet more large-vehicle movements.

During our subsequent tour of the plant, we saw first-hand the sheer volume of waste material being processed and the problems that some relatively innocuous materials such as audio and video tape cause when they get tangled in the conveyors.

A visit to the control room again emphasised the complexities of the operation and the many problems that operators encounter on a daily basis.

Our host was able to answer the vast majority of the many questions posed during the visit, and offered to come back to us on two in particular where she required additional information. These were :-

1) Is the reaction in the digesters exothermic, in which case at what temperature are they held and is external cooling required?

Yes it is exothermic. However, the anaerobic digestion process is carried out in an oxygen-free atmosphere which means microorganism decompose organic matter "very inefficiently" and produce very little heat. The majority of the energy potential is left in the form of methane (by-product of microbiological activity), which we use and release in a Combined Heat and Power Unit to produce electricity and heat. The small amount of heat released during anaerobic digestion is not enough to keep the temperature in the mesophilic range (35-40°C) due to heat losses, therefore, our digesters need to be heated.

2) The compressed bundles of refuse derived fuel which currently have to be sent to Germany for incineration do contain some organic matter which decomposes continuously - does this result in an unacceptable rise in temperature during transport or even a fire hazard?

No. The small amount of organic matter decomposes slowly and the heat produced is released to the environment. The bales are also sealed with plastic film and therefore aerobic degradation slows down rapidly with the decrease of oxygen content (and carbon dioxide increase).

Overall this was an excellent thought-provoking visit.

Malcolm Hind

Visit

Saturday 11th May 2019 - Culham Centre for Fusion Energy

Members will recall the talk given on 13th November 2018 and reported in the December Newsletter, describing in details the activities of the Culham Centre. As this was a well-supported and most interesting talk, we felt that it warranted a follow-up visit to Culham itself.

As a reminder:-

JET = Joint European Torus (old hat, but constantly being upgraded and still very much in use).

MAST = Mega Amp Spherical Tokamak (U.K. funded).

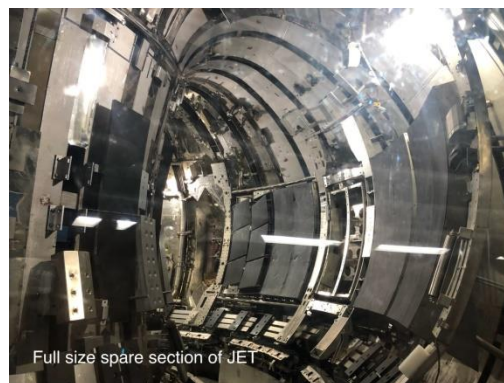
ITER is the 500MW research fusion reactor being built in France. ITER is funded by Europe, Russia, USA, Japan, and many other countries.

This visit report is more about first hand observations of this exceptionally interesting and well organised visit. The site tour was not specific to RCEA (just as well as there were only 2 of us) but was one of the many routine tours organised for the public. It was professionally organised with over 100 people divided into six groups, with each group having a 'chaperone' and two technical guides allocated to it – one for JET and one for MAST upgrade. We were put into Group six, which for some reason (perhaps they knew we would have a lot of questions) only had 2 others in it (a sixth former doing science and maths, and an accountant lady working for an engineering firm). Needless to say this provided a wonderful opportunity for 2 hours of questions, 99% of which could be answered by our guides. In fact, arguably the guides themselves were one of the highlights of the afternoon– both spoke perfect English, and could explain difficult concepts. One guide was from Hungary, with a job title of 'Tritium scientist/engineer', and the other was from Italy (been at Culham since 1999) with the role of senior MAST-Upgrade engineer. And our lady 'chaperone' was an English accountant who has learned a lot of fusion science from her constant chaperone duties. Although our guides were members of the Culham staff, one has to remember that they volunteer to give up their Saturdays to show members of the public round the site. One has to admire the fact that Culham management take the trouble to field such experts for what are free visits, open to the public.

After coffee, our visit started with a presentation on fusion energy and its current status. It was a lucid high level talk which, in one slide, explained how the research programme aims to bring Deuterium and Tritium together in order to produce Helium and high energy neutrons. Apparently the reaction needs to be '10 times hotter' than the sun (Sun = 15,000,000 °K at the centre, falling to a mere 6,000 °K at the surface), and potentially produces Megawatts, whereas the equivalent fuelled reaction on the sun only produces a few watts – but on a huge scale. The other particularly poignant slide was a reminder of the relatively poor level of (World) funding that is behind this potentially planet-saving clean source of energy. ITER (the current 500MW fusion reactor being built in France) is costing €14bn. By comparison the programme to put a person on Mars is costing €60bn, whilst it has been widely reported that the Qatar Football World cup will cost over \$200bn to host once the costs of the necessary infrastructure has been included.



We were then taken on a comprehensive walk around JET (followed up by MAST). On the left are our two RCEA visitors standing in front of a window into the JET mock-up. Apparently the JET Torus consists of 8 semi-quadrants bolted together; but a ninth was also made as a spare – see right. This has now been joined by 7 other 'reduced' modules to form a look-alike Torus which is used for training purposes and in particular rehearsals of proposed robotic maintenance procedures.





We were shown the JET control room opposite that operates quasi continuously 24/7 – akin to Houston (Apollo) mission control or the National Air Traffic Services control room. Despite being a Saturday afternoon, there was at least half a dozen technical staff sitting in front of screens with a chief operations engineer walking around behind them. JET was clearly in operation and being pulsed (i.e. plasma being created, and then run down after a few seconds) roughly every 20 to 30 minutes.

The interval between pulses is set partly by the time it takes to run the two enormous (over 20m diameter) flywheel generators up to speed, but mainly by the time it takes to cool down the copper conductors that comprise the containment electro-magnets.



JET is only a small part of the Culham plant. We were impressed by the huge number of control computers, the instrumentation, the Laser Interferometers used to monitor the (enormously hot) plasma using LIDAR Thomson Scattering (left), the robotics necessary to replace irradiated components from inside JET without danger (right) and the liquid helium and nitrogen processes.



Equally impressive was the high energy (17MW) ion beam injection process – needed to raise the plasma temperature over what can be achieved by ohmic and micro-wave heating alone – see right.

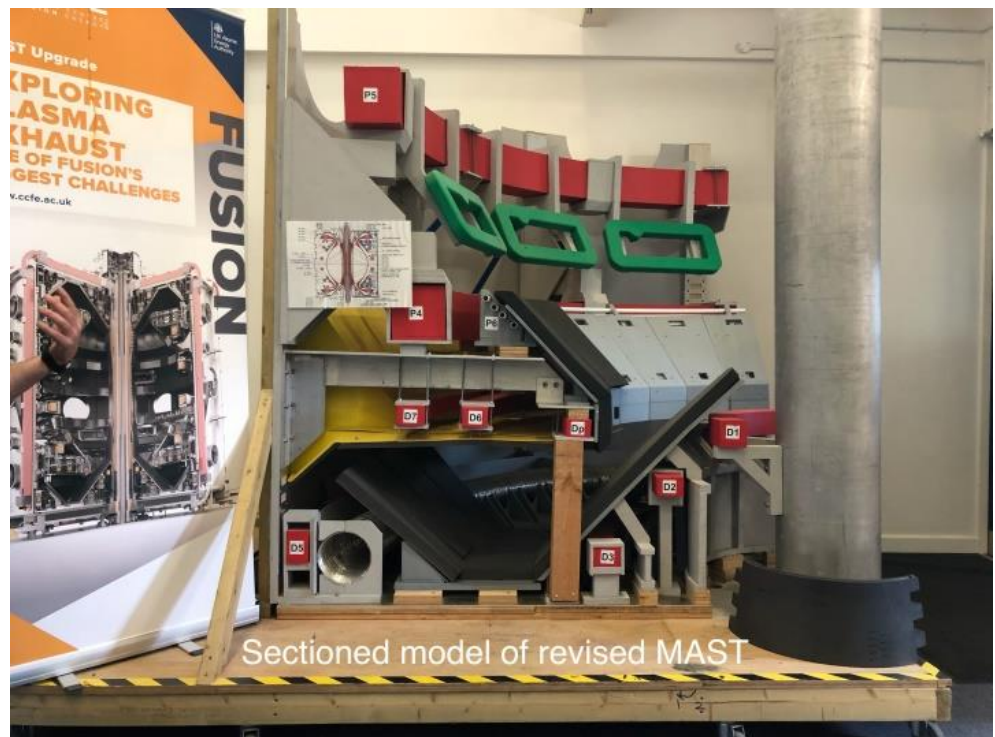




1.5m entrance door to outer JET chamber

Even the concrete shielding around JET is impressive. The picture opposite shows one of the stepped concrete doors (well over a meter thick) that is removable in the outer concrete shell. There is a similar inner concrete shell with massive doors weighing 1000 tons apparently. It is worth noting that the concrete is there in order to stop stray high-energy neutrons from escaping. It is not there to contain radio-activity; indeed on the rare occasions when humans actually need to enter the Torus they are able to do so wearing special protective suits – necessary to guard against any remaining Tritium atoms which have not been fully purged from the Torus.

The MAST tour was equally interesting – see right. MAST was last pulsed in 2013, and is currently undergoing a 6 year, 600 ppy (Professional Person Years) £21m upgrade programme. The main upgrade feature is an improved exhaust gas system – no, not to do with noise, catalysts, or particles – but designed to more effectively cool the hot helium that is a by-product of the fusion reaction.



Sectioned model of revised MAST

The new design features an annular chamber below the main Torus, with large carbon heat exchanger plates. Somehow, part of the plasma is going to be persuaded to go down into this second chamber in order to have its waste helium cooled and removed! Other improvements will raise the plasma temperature up to 50,000,000 °K with an improved neutral beam system, 200,000 amp plasma current and 0.84 tesla containment field, along with increased length pulses approaching steady state conditions. (0.84 tesla is about half that of a strong Neodymium permanent magnet that you can buy on the Internet. ITER will be working at 5 – 7 tesla, presumably made possible by superconducting magnets).

We were also shown an early, Tokamak doughnut with the project name of Tosca (left below). The actual vacuum chamber was only about one metre in diameter, and presumably was for research purposes with no intention of producing a net power output.

On the floor next to the doughnut, was the original central solenoid coil – sliced down the middle to show the size of the conductors (right below). Our Italian guide is also in the picture.



From memory, the conductors were roughly 20mm x 10mm rectangular cross section solid copper, coiled' into what would look like a solid, thick-walled, copper tube from the outside. The solenoid has 4 layers, and each conductor has a small central hole through which 'Galan' cooling fluid is passed.

We were shown a slowed down video of a plasma pulse –about 30 seconds of real life sequence drawn out into 5 minutes. Two points to note: firstly the plasma itself only glows around the edges; the centre is so hot that its radiation is beyond the visible light spectrum. Secondly, there were a number of brief flashes (milliseconds in real life). These are called ELMs (Edge Localised Modes) and are the equivalent of solar flares on the sun. They have not yet been accurately modelled and hence are not that easy to control. It seems that instead of designing challenging, fast control circuitry, Culham's approach is to keep triggering them (not sure how) so that the mechanism that produces them, does not build up too much stored energy which in turn would lead to a more damaging ELM.

Overall, we had a brilliant tour – one of the best visits we have been on. It seems that far from ITER taking all the limelight, Culham is very much a key part of the world fusion program, in fact probably THE place to be if you are a fusion scientist/engineer. It is contributing vital research that will feed into ITER (and presumably DEMO that will follow ITER). And even though we are told that there are no known 'show stoppers' in the ITER programme, it would seem that the Culham work is essential in order to improve the future efficiency and sustainability of ITER. Arguably fusion research – dealing with a 500MW, 50m degree plasma in a confined space is even more challenging, and worthwhile than getting a man on the Moon. Talking to one of the Guides, she thought that there are over 1000 professionals working at Culham, of whom maybe half are from mainland Europe. Brexit, though a worry, does not seem to be hampering the work they are doing – but increased funding by all countries in the world, would appear to be an urgently required and important planet-saving investment.

Ivan Farrow and Mike Wooldridge

Outing

Friday 24th May 2019 - Leonardslee Gardens

On a lovely bright sunny morning 29 of us (14 members and 15 guests) met for a guided tour of Leonardslee gardens, which re-opened in April 2019. A number of us had visited the gardens on a RCEA outing in May 2010 just before the gardens were closed to the public on 30th June 2010 and were looking forward to seeing them again following their recent restoration by their new owner, Penny Streeter.

We were very fortunate to have as our tour guide Ray Abraham (shown opposite addressing us), the new head gardener, who proved to be a fountain of knowledge on the gardens. Before we set out on our tour, he gave us a very interesting brief background history of the gardens and its owners up until the time when they were closed to the public. He promised us an hour or so's tour which turned out to be about two hours.



During the walk around the gardens Ray discussed the plants, the work that been done, the work that was planned for the future and answered all of our questions. The pictures below show just some of the magnificent species, the majority of which were in full bloom during our visit.



After the tour, the majority of us enjoyed a bite to eat before making our way home. The option of continuing to explore the gardens on our own was available, but most of us had already expended our energy.

It was a very interesting, informative and enjoyable visit and no doubt many of us will revisit the gardens to enjoy their beauty and see the progress of the work still to be completed.

Glyn Mathias

Outing

Thursday 11th July - Weald & Downland Museum

Our party of 9 members and 8 guests arrived in good time for our visit on a gloriously warm summer day ready for our tour. Our guide (a retired engineer himself) was very knowledgeable about the methods used to construct the buildings initially. He emphasised the care and skill needed when the buildings were dismantled from their original sites, brought to the museum and subsequently re-built. Many of the buildings are timber framed and stand in contact with the damp

ground leading inevitably to rot, necessitating an ongoing programme of repair and maintenance. His depth of knowledge really brought the buildings back 'to life'.

The pictures below show our party on the 'tour' route. It was noticeably cooler inside the buildings and a welcome relief from the hot sun (particularly for those without sun hats).



In addition to the tour of the buildings, there were many other distractions to enjoy as shown below.



Overall we had a fascinating, educational (and very warm) visit.

Derek Webb

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REPLY SLIP – Ludgate Cellars Traction Substation

To: Derek Webb, 6 Loxwood Avenue, Worthing, BN14 7QZ

(01903 525969) email: derek.webb2@ntlworld.com

I would like to visit Ludgate Cellars Substation Tuesday 5th November 2019.

The numbers are limited to 20 and priority will be given to members.

Members

Guests

Full name

Address

.....

Telephone (mobile preferred):

Email address:

Applications by Monday 21st October 2019 please

SUBSCRIPTION REQUEST: (2019/2020)

Subscriptions are due from 1 October. Please return this form with your cheque made payable to RCEA for £ 15.00

To: Treasurer, A J Tomkins, 13 Milton House, Milton Road, Haywards Heath, RH16 1AG

Full name:... Telephone No

Address..... e-mail.....

.....

I enclose a cheque made payable to RCEA for £..... (£15.00) (**Separate cheque please from any other payments to RCEA**)

LEFT INTENTIONALLY BLANK

REPLY SLIP CHRISTMAS LUNCH

To: George Woollard 18 St Lawrence Ave, Worthing West Sussex BN14 7JF (01903 523640 or 07541224769)

E Mail : Georgewoollard1@hotmail.co.uk

Can you please reserve meplaces for the Christmas Lunch at the Windsor Hotel, Worthing on **Thursday 5th December 2019.** 12.00 for 12.30.

Full name:.....(Block capitals)

Address:.....

.....

.....

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

E mail address.....

Car registration number for disabled parking

I enclose a cheque made payable to RCEA for **£..... (£28.00) per person**

(Separate cheque for this event please)

Applications by Saturday 30th November

If possible, I would like to be seated with.....

Menu choices

Name 1	Name 2	Menu choice
		Winter Vegetable Soup
		Chicken Croquettes
		Prawn & Cucumber Salad
		Trio of Melon
		xxxxxxx
		Turkey
		Beef
		Butternut Squash Wellington
		Salmon Fillet
		xxxxxxx
		Christmas Pudding
		Honey & Pistachio Parfait
		Chocolate Truffle Torte
		Fruit Salad

End of Newsletter