RCEA
(SUSSEX)

An Association for Retired Professional Engineers

NEWSLETTER March 2017

President's Message

Welcome to the March Newsletter.

We are now reaching the end of our autumn/spring session of talks, although we have an extra talk on 11th April covering the early days of the Buccaneer aircraft.

We have our Spring Lunch at Northbrook College on Wednesday 26th April and will be pleased to see you there.

Planning for our series of talks for next Autumn/Spring has already started, and we do ask for your support in finding speakers on engineering subjects. Companies these days often only offer a basic talk which is sometimes low on technical content. We have the greatest success when we have a personal connection with an engineer employed by a company or organisation who understands that we are all engineers and appreciate an in-depth explanation of the technical challenges of their specialised subject.

If you know of anyone who would give a talk, please let Perry know. We also encourage members of RCEA to talk on subjects where they have expertise.

Derek Webb

PROGRAMME OF EVENTS 2017

Thursday	**16th March**	**Coffee – at Spotted Cow, Angmering**
Thursday	**30th March**	**Coffee – with Partners at Swallow's Return**
Tuesday	**11th April**	**Talk – 'The Early Days of the Buccaneer'**
Thursday	**20th April**	**Coffee – at Spotted Cow, Angmering**
Wednesday	**26th April**	**Spring lunch – Northbrook College**
Thursday	**27th April**	**Coffee – with Partners at Swallow's Return**
Thursday	**11th May**	**Visit at 11:00am to Bluebell Railway**
Thursday	**11th May**	**Outing at 14:30pm to Sheffield Park with guided tour**
Thursday	**18th May**	**Coffee – at Spotted Cow, Angmering**

Thursday	**25th May**	**Coffee – with Partners at Swallow's Return**
Thursday	**8th June**	**Visit – Ford R&D Centre, Dunton**
Thursday	**15th June**	**Coffee – at Spotted Cow, Angmering**
Thursday	**29thJune**	**Coffee – with Partners at Swallow's Return**
Tuesday	**11thJuly**	**Visit – Brighton Football Ground**
Thursday	**20th July**	**Coffee – at Spotted Cow, Angmering**
Thursday	**27th July**	**Coffee – with Partners at Swallow's Return**
Thursday	**17th August**	**Coffee – at Spotted Cow, Angmering**
Thursday	**31st August**	**Coffee – with Partners at Swallow's Return**
Tuesday	**19th September**	**AGM and Talk – 'Working on the Construction of Britain's Motorways 1960-1990'**
Thursday	**21st September**	**Coffee – at Spotted Cow, Angmering**
Thursday	**28th September**	**Coffee – with Partners at Swallow's Return**
Tuesday	**10th October**	**Talk – 'Littoral Drift'**
Thursday	**19thOctober**	**Coffee – at Spotted Cow, Angmering**
Thursday	**26th October**	**Coffee – with Partners at Swallow's Return**
Tuesday	**14th November**	**Cooch Memorial Lecture – 'Going with the Flow – Wave & Tidal Energy Generation' – to be confirmed**
Thursday	**16thNovember**	**Coffee – at Spotted Cow, Angmering**
Thursday	**30th November**	**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.

Website of the RCEA

Our website, **www.rceasussex.org.uk** carries the very latest information on all of our events. As we occasionally have to make last minute changes to our programme due to matters beyond our control, we recommend that you always consult our website.

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 come along to our talks and hopefully join the RCEA.
We also need more members 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)

We have received the following programme information from the SRCE. Members wishing to attend any of these events should contact the SRCE secretary Jeff Williams on 02380 897078 or e-mail jagwilliams@waitrose.com.

25th April - Walk of the walls in Southampton and tour of the Aviation Museum. It is currently oversubscribed.
9th May – A tour of the Globe theatre on the South Bank in London.
15th June – Watermill theatre, Newbury to see Alan Ayckbourne's "House and Garden.
4th July – visit to Tangmere air force museum.
24th August – visit to Bovington tank museum.
14th Sept – visit to Weald and Downland open air museum.
4th October – AGM to be held at Emsworth. Details awaited.
10th October - last chance to visit Farnborough airport to see how the other half live! Details awaited.

Brief Detail – Talks, Outings and other activities April – October 2017

Talk
Tuesday 11th April 2017 – 'The early days of the Buccaneer'

The Buccaneer, in its original form, was designed as a sub-sonic carrier-borne low level bomber. The talk will concentrate on the NA39 and, as it later became, the BUCCANEER S Mk1. Initially examining how the requirement for the aircraft came about, the speaker will then look at its early development and highlight some of the novel design features such as "area rule" and the incorporation of "boundary layer control" to reduce landing and take-off speeds.

We will then look at its introduction into RN service with the Intensive Flight Trials Unit, 700Z Flight at the RN Air Station at Lossiemouth, and highlight some of the operational features the Unit developed.
Going to sea with the first front-line squadron, 801 Squadron, brought with it a few interesting aspects peculiar to operation in the harsh and restricted environment of an embarked aircraft carrier - first in HMS Ark Royal then HMS Victorious.

The speaker will visit some of the more interesting incidents and accidents.

Spring Lunch - Wednesday 20th April 2016, Northbrook College, Worthing, 12.00 for 12.30

There are still a few places available for our lunch. There will be a bar for pre-lunch drinks, the cost to be settled individually by members and guests. The cost of the three course meal is £15.00 per head including a tip, which in the past has proved to be very good value. Applications should be made by 17th April. The committee look forward to seeing you there.

Booking form is at the end of this newsletter.
Contact George Woollard 01903 523640, e-mail Georgewoollard1@hotmail.co.uk

Visit
Thursday 11th May 2017 – Bluebell Railway and Sheffield Park Gardens.

We have arranged the option of two visits on May 11th and you will be able to join one or both visits.
In the morning, David Jones RCEA (who is also a volunteer with the Bluebell Railway) has kindly agreed to host a visit to see the restoration of the Brighton Atlantic locomotive currently underway by the Bluebell Railway at Sheffield Park. This is a special opportunity, as the Brighton Atlantic is not currently on view to the general public. David will meet us near the workshop at 11am and take us across to the Brighton Atlantic shed. You will need to buy a Sheffield Park Station Admission Ticket to get in to the station –this costs £3pp. Your ticket will also give you access to the locomotive sheds, where you can see some of the railway's locomotives and carriages, and to the museum. Although David's presentation is timed for 11am, you can of course arrive earlier if you wish (the museum opens at 10am) and stay on after David has given his presentation. This part of the visit will be limited to **a maximum of 20 people.**

In the afternoon we have booked a tour of the nearby National Trust Gardens at Sheffield Park, hosted by one of their gardeners. The tour will start at 2.30pm and last for about an hour but, again, you will be free to arrive earlier and/ or stay later if you wish. The cost of this visit will be £13.10 per person (unless you are a member of the National Trust or RHS, in which case you will only need to pay £3 to cover the cost of the guided tour).

Booking form is at the end of this newsletter.
Contact George Woollard 01903 523640, e-mail Georgewoollard1@hotmail.co.uk

Visit
Thursday 8th June 2017 – Ford Research and Development Centre - Dunton, Essex.

We have been able to arrange a visit to Dunton where we will be able to view the equipment and techniques used to ensure that Ford cars of the future meet specific worldwide regulations, performance and durability targets, marketing and customer requirements etc. The equipment includes many engine and emission dynamometers (at least one with atmospheric control), environmental wind tunnel, test tracks, styling studios, machine shops, many durability rigs for body and chassis components etc. Exactly what we will be shown will depend on the confidentiality of the vehicles being tested. Cameras will not be permitted.

Only 15 places are available, so we will have to award places and reserves according to the time we receive the Reply Slips. RCEA members will have priority over guests. Unfortunately travel time will be longer than normal visits and attendees are responsible for their own travel arrangements. Members may wish to car share. The tour starts at 13:00pm.There are a few eating places within easy reach of Dunton and suggest that we meet at around 12 o'clock at one of them (to be selected nearer the time).

Booking form is at the end of this newsletter.
Contact Ivan Farrow 01903 523640, e-mail ivan_farrow@yahoo.com

Visit
Tuesday 11th July - Brighton Football Ground

The tour of the stadium lasts approximately 1 hour and 45 minutes and will commence at 11.00am.
You will visit the hospitality lounges, trophy room, press area, changing rooms and the museum.
On arrival at the stadium, you will be directed where to park and the meeting point.
Although the tour is booked for Tuesday 11th July, the stadium maintains the right to change this date if anything unforeseen occurs. You will of course be notified of any change well in advance.

Booking form is at the end of this newsletter.
Contact George Woollard 01903 523640, e-mail Georgewoollard1@hotmail.co.uk

Talk
Tuesday 19th September – "Working on the Construction of Britain's Motorways 1960- 1990"
Frank Duggan RCEA

The talk will describe Frank's experience of design and construction of motorways from 1963 to 1990. It will cover interesting aspects of his time as a Site Engineer, from the construction of Brent Cross Flyover in North London; design engineer on the M4 in South Wales; Contractor's Agent on the construction of London Bridge, sections of the M1 and M11 motorways; the A30, A470, and A6; to Project Manager on the construction of the M25/M40 Interchange. In addition to the technical aspects of the work, reference will be made to construction failures, the delays caused by environmental lobbyists, the oil crisis, 3 day week, and union unrest; and how the industry is now moving away from heavy construction to computer controlled 'smart motorways'.

Talk
Tuesday 10th October – "Littoral Drift"
Dr Uwe Dornbusch – Senior Specialist for the Coast at the Environment Agency

The talk will give an introduction into past, present and future issues faced by the coast, illustrated with examples from West Sussex. The later part will provide a critical perspective on what sea level rise will mean for the future of shingle beaches that provide the primary coastal defence along most of Southeast England. Is there a future for shingle beaches and what will they have to look like, or is the future one *"with only the sea breeze to enjoy from the concrete promenade"?*
The speaker is a Senior Specialist – Coast with the Environment Agency in Sussex and has published over 30 papers on the subject.

Note regarding the planned visit to Volk's Electric Railway.

Those of you who were at Peter Williams' talk on the Volk's Railway in November 2016 will recall that we were planning a follow-up visit to see the railway once the Lottery-funded restoration work had been completed. We hoped that a date in late August would give plenty of time for that to happen. Unfortunately there have been some unforeseen delays, as a consequence of which it is now thought that the work should finish by the end of September, after which the railway will run in October and November. We will let you know when we have been able get a firm date for a visit. For more information on the delays consult the VERA website http://volkselectricrailway.co.uk.

Reports
Talk - Tuesday 20th September 2016 'Modern UK Tramways'
Ian Wetherell RCEA
(The report on this talk was held over from our December 2016 newsletter.)

In principle the description is intended to cover those tramways constructed post 1960 and will therefore exclude pre-war municipal tramways operating up to their closure in the late 1950's .
In the UK, a RAILWAY usually operates on a fenced right of way (with no street running).

LIGHT RAILWAYS are built to operate at lower speeds with lower crashworthiness, for example, Tyne and Wear Metro and Docklands Light Railway. In neither case is there any street running.
The Tyne and Wear Metro (shown opposite) shares track with Network Rail lines to Sunderland. Because the Metro trains were built to light rail standards, the results from an accidental collision with a Network Rail train on the shared tracks in and near Sunderland would be catastrophic.
As well as the Metro cars being equipped with an automatic warning system (AWS), the shared tracks are operated on a double block system. This means that both Network Rail and Metro trains are separated by an unoccupied section and are thus protected by two red (stop) signals.

1500V dc was chosen because there was no street running. The higher voltage allows the system to require fewer substations and the train currents are approximately 50% of that needed to supply trams on a 750V system.

Docklands Light Railway (shown opposite) operates at 750V dc on third rail conductor rail system utilising a shrouded bottom contact system which minimises the risk of accidental contact with the "live rail".

A TRAIN-TRAM is basically a train adapted to be compatible with and run on a tramway for part of its route. There are no Train-Trams operating or proposed in the UK.

A TRAM-TRAIN is basically a tram adapted to be compatible with and run on a conventional railway for part of its route. Currently there is only one Tram-Train project under way in the UK.

New Tram-Trains are being built to operate over Network Rail tracks from Meadowhall (part of the Sheffield Supertram system) to Rotherham. The section of Network Rail over which dual running will operate will be electrified as a 750V DC OHL system.
The modern tramways in the UK all incorporate some street running and are driven on "Line of Sight" principles.

At major intersections with roads or at tramway junctions simplified signalling is in use.

STOP

PROCEED

TAKE LEFT TRACK

TAKE RIGHT TRACK

At road intersections, the trams are usually given priority over road traffic. The tram priority is initiated either by the tram driver or more usually by the tramway control system detecting the approaching tram.
On the street sections additional signals are provided which apply to the trams only. Although ordinary road signals are provided at junctions these do not apply to the trams.
Line of Sight running has no fixed signals. Tram speed is regulated by fixed speed markers which limit tram speed to that at which the tram can stop short of any visible obstruction. Maximum speed is usually 80kph (50mph) although the proposed tram-train will probably operate at higher speeds on NR tracks. When running on public roads the tram speeds are limited to that of normal road traffic.

Blackpool opened in 1885. The only pre-war system still in operation, now fully modernised with a fleet of new trams operating between Starr Gate and Fleetwood. In the summer peak season the modern fleet is supplemented by vintage trams to give a higher frequency service.

Proposals for extending the tramway to Blackpool North Station are under consideration.
Operates on 600V dc OHL system, normal service trams utilise pantograph current collection as this allows one man operation. Many vintage trams still use trolley pole collection. Blackpool is the only UK modern tramway to operate double deck trams.

Manchester was the first UK modern tramway to be commissioned in 1992, running over ex BR routes to Bury and Altringham with street running in central Manchester. Unique in the UK in adopting high platforms at the stations. The first trams were built by Ansoldo-Breda in Italy. After 22 years in service, the last Ansoldo T68 tram was withdrawn in February 2014.
A new fleet of 120 Bombardier M5000 trams entered service from 2008 to 2014. Now operates 7 routes over 57miles of track. Unlike the other new UK tramways, the Metrolink trams can operate as multiple units in a 2 x 2 formation.

Birmingham Metro opened in 1999. It had only one route, from Wolverhampton to Birmingham Snow Hill. This has recently been extended to Birmingham New Street and in Wolverhampton the tramway will be extended to a new bus/train/tram interchange in the town centre. Plans exist to extend the system across Birmingham City Centre to Moor Street and Curzon Street and to the Airport via Digbeth. Parts of this extension may be operated under battery power to avoid installation of wires in the City Centre .

Nottingham Express Transit (NET) opened in 2004 operating a single route from Nottingham to Hucknall. Since 2014 NET has operated 2 routes, both passing through the City centre, Clifton to Phoenix Park and Chilwell to Hucknall. NET has two tram fleets, delivered to match the expansion of the network. The first 15 trams were Incentro AT6/5s built by Bombardier. By 2014 a further batch of 20 Alstom Citadis 302 trams were delivered to match the expanding network.

Sheffield Supertram opened in stages in 1994/5. Three major routes radiate from the city centre to Meadowhall, Middlewood and Halfway opened in 2004, minor branches also operate to Malin Bridge and Herdings Park.
Work is currently under way to extend the tramway from Meadowhall to Rotherham over Network Rail tracks.
Sheffield Supertram is operated by a fleet of 24 Siemens-Duewag trams.
A further 7 Vossloh Citylink Class 399 tram-trains, are being delivered to operate the extension to Rotherham.
Only these 7 Class 399 tram-trains will be allowed to operate on the Network Rail route to Rotherham from Meadowhall.

Initially these 7 trams will operate on the existing Supertram routes until the extension to Rotheram has been commissioned. The Class 399 trains will be equipped with AWS and will be more robustly built than the existing trams. The NR route to Rotherham will be electrified on the overhead system at 750V dc.

After a disastrous overrun on both costs and construction time, the **Edinburgh** tram system, from the Airport to York Place near Waverley station, finally opened in 2014 having taken 6 years to build. Original plans would have extended the tramway to Leith via two routes, possibly in a complete loop. As a result of disorganised project management, Edinburgh finds itself the owner of 27 new trams to operate a service which only requires 17 trams. There were hopes that Croydon Tramlink would be able to purchase them at a bargain price, but the trams were significantly different and Croydon looked elsewhere.

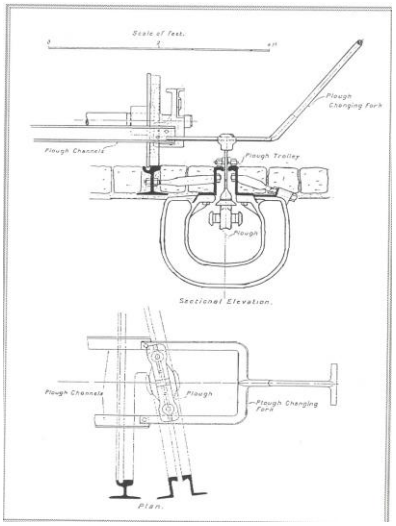
Croydon Tramlink opened in 2000, with routes from Central Croydon to Wimbledon, New Beckenham, Elmers End and New Addington. Now generally referred to as Tramlink the original consortia was bought out for £98m in 2008 and is now part of TfL.
Tramlink is one of the busiest of the modern street running tramways, carrying over 27m passengers / annum, a figure only exceeded by the two light rail systems, Tyne and Wear Metro and the DLR, and Manchester Metrolink, with much larger systems.
No extensions to the start-up system have been constructed but an additional platform has been provided at Wimbledon and stretches of single line have been doubled on the Wimbledon route. These works have enabled Tramlink to increase the tram frequency and capacity to deal with the ever rising demand. The additional platform at Wimbledon has been constructed in the same manner as the Overground platforms at Clapham Junction, that is with one platform set back to allow a second tram to pass the first and gain access to the additional platform.

The original fleet on start-up comprised 24 Bombardier CR4000 trams of which 22 were required for service.
To match rising demand and overcrowding a further 10 Variobahn trams (shown opposite) have been purchased from Stadler.

All the modern tramways are electrified on the overhead line system at 750V dc.
The trams use inverters to change to a variable frequency 3 phase supply which is connected to squirrel cage motors. This arrangement allows the motors to be used for both driving and braking as well as regenerating power back into the overhead line.

There are 13 substations on the Tramlink system which are remotely controlled from the depot at Therapia Lane.
The substations are typically supplied at 6.6kV or 11kV from local electricity company systems. None of the modern tramways generate their own power. The substations first transform the incoming high voltage supply to approximately 800V before rectifying this to 750V dc.

Current Collection - Most pre-war tramways used a trolley pole to collect the power from the overhead line. Today, almost without exception, modern tramways use a pantograph to collect the power. Blackpool still uses trolley pole collection on some of its vintage trams.
Where it is considered desirable to avoid overhead equipment in environmentally sensitive areas, various solutions have been used to eliminate the "unsightly" overhead equipment.



A number of tramways adopted the conduit system either for their whole network or just for inner city areas. In the conduit system, a conductor bar was located in a covered trench situated between the running rails. The tram was equipped with a vertical "plough" which ran through a slot in the roadway. In London the conduit system was used extensively in the centre and in the outer suburbs the tram changed over to trolley collection.
In Bordeaux, the French have installed a version of the conduit system, using a multi-section switched conductor rail which is only energised when covered completely by the trams.
This system costs about 4 times that of the equivalent conventional overhead line.

Earthing & Bonding Because DC currents are particularly corrosive, every effort is made to avoid deliberate or inadvertent connections between traction negative and earth. The running rails, which form the return current path between the trams and the substations, are not connected to earth. The system is earthy, because of the large number of high resistance leakage paths between the running rails, sleepers and ballast etc.
Outside the street running sections, no special precautions are taken. On the street running sections there is a "current collection mat" located between the rails and the reinforcing bars of the slab track. This mat is connected back to the substation, and supposedly collects any stray currents leaving the running rails.

The return currents in the running rails create a resistance voltage drop between the trams and the supplying substations. Close to the tram, the rails are at a higher potential than earth and near the substation the rail voltages will be lower than earth. Under normal conditions these rail – earth voltages are quite low, typically between +/-5V.
Legally the rail to earth voltage should not exceed about +/-45V under normal conditions, rising to +/-50V under fault conditions.

The **Depot at Therapia Lane** contains equipment which has to be connected to earth, such as the wheel lathe and other power tools. A separate rectifier is provided which gives the overhead line within the depot an earthed 750V DC supply.
Insulated joints are provided in the OHL and running rails to separate the earthed and un-earthed systems.
The depot contains a 2 track workshop with a wheel lathe, bogie drop, high level access walkway and lifting jacks as well as a tram washer and berthing roads for the 30 tram fleet.
The Wheel Lathe is designed to re-profile the tram wheel tyres without removing the bogies from the tram.
The lifting jacks simultaneously lift all the cars of a tram together which avoids the problems associated with un-doing and re-connecting the couplings between the individual cars.

Rails Outside the street running area, conventional flat bottomed rail is used. In the street running areas, a special "Y" shaped rail is used. There are up to 15 tram rail profiles in use in the UK. Some rails are tilted inwards like NR tracks, others are flat.
Because tram wheels are relatively small they can give very rough ride over points and crossings. Many systems allow the tram wheels to run on their flanges across the gaps in the point-work

Ian Wetherell.

Talk - Tuesday 13th December 2016 'The Thameslink Project – Electrical Challenges'

We hope to be able to publish this report in a later newsletter.

Talk - Tuesday 10th January 2017 'Ship Propulsion - from paddles to jets'

Antony Tomkins - Hamilton Jet

According to IMO statistics over 90% of global trade is carried by sea. As a consequence, shipbuilders, designers and equipment manufacturers are constantly striving to find more efficient solutions to the century's old problems associated with marine propulsion.

In the beginning marine propulsion was little more than men with paddles. The advent of the sail era improved efficiency somewhat, but in terms of powered propulsion, paddles remained the key principle.

Paddle steamers are relatively simple in operation and design, but their propulsive efficiency (PE) is low, and so for powered ships to become successful more efficient solutions were needed.

Real developments started to take place around the 1830's when John Ericson and Francis Pettit Smith started to work on the concept of screw propellers. These designs were based on the Archimedes screw concept, and used the rotational motion of the propeller to create a pressure difference between the forward and rear sections of the propeller. The water is then accelerated over this pressure differential imparting momentum and thus generating the forward thrust. The term screw propeller was adopted as the propeller "screws" the vessel through the water.

Pettit Smith and Ericson continued development work on the propeller system in the 30's with Smith submitting the first patent for a screw propeller on 31st May 1835. Ericsson filed his own patent 6 weeks later. You will notice that this screw propeller had two complete 'turns'.

Pettit Smith began by building a model to demonstrate the concept to potential backers and the Admiralty. He was successful in finding a backer from a wealthy banker, and later that year built a 30" 6hp canal boat – the "Francis Smith". In February 1837 the Francis Smith suffered a rather fortuitous accident when the vessel struck a submerged object and broke one complete turn of the wooden propeller. To Pettit Smith's surprise the vessel speed rose from 4kts to 8tks! Pettit Smith immediately filled a new patent!!

Meanwhile Ericsson was developing his own concept. In 1837 he built his own 45" demonstrator the steam powered "Francis B. Ogden". He showed this to the British Admiralty in the summer of that year, but despite impressive results, the Admiralty was underwhelmed, claiming that a screw vessel would never be as efficient in open seas as a paddle steamer!

Spurned by the British, Ericsson built the SS Robert F. Stockton and sailed her to the USA to demonstrate the possibilities of the screw propellers. The USA was so impressed that they commissioned Ericsson to design the first screw propeller warship, the USS Princeton.

Back in Britain, Pettit Smith had learnt of the Admiralty's view on open water performance of the screw propeller. He decided to arrange a sea going voyage of his demonstrator vessel: on its return leg it was viewed in rough weather by senior officers of the Royal Navy and this reinvigorated their interest in the concept. With the renewed interest from the Admiralty, and having secured some financial backers, Pettit Smith set about building a much larger vessel, the SS Archimedes, a 125 ft steam powered schooner. SS Archimedes was demonstrated to the Admiralty at length, and on the whole impressed. Captain Edward Chappell, finally concluded that "Screw propulsion was equal, if not superior, to that of the ordinary paddle-wheel."

This was a significant development and led to the adoption of screw propulsion on all future RN build and to the famous tug of war between HMS Rattler and HMS Alecto. The adoption of screw propellers in the Royal Navy was significant, but SS Archimedes would make a much more significant impact on the marine world.

Following her successful trials with the Royal Navy, Pettit Smith loaned SS Archimedes to the Great Western Steamship Company who were in the process of constructing the worlds' largest steamship – the SS Great Britain. The principal engineer, I.K . Brunel, took advantage of the loan of the vessel to demonstrate the advantages of screw propulsion for the SS Great Britain.

The loan period allowed Brunel to conclude that screw propulsion was lighter in weight, thus improving fuel economy, could be kept lower in the hull reducing the ship's centre of gravity, and making it more stable in heavy seas. By taking up less room, the propeller's engines would allow more cargo to be carried. Elimination of bulky paddle-boxes would lessen resistance through the water, and also allow the ship to manoeuver more easily in confined waterways. The depth of a paddlewheel is constantly changing, depending on the ship's cargo and the movement of waves, whilst a propeller stays fully submerged at full efficiency at all times. Screw propulsion machinery was cheaper. Consequently SS Great Britain was built with screw propulsion.

Brunel, however, chose not to adopt Pettit Smiths' propeller design but instead adopted his own 6 blade design.

This proved to be a costly mistake as the design was far less efficient that Smith's own 4 bladed-design, and contributed to the SS Great Britain's troubled history.

However, the concept of screw propellers were now widely accepted as the future in both the military and commercial sectors

By 1855, 20 years after Pettit Smith's first patent, 174 ships of the Royal Navy had been fitted with screw propulsion, and the vast majority of new vessels being built for commercial owners were exclusively propeller, or mixed propeller/paddle. The maritime world had now accepted propellers, and for the next 160 years navies, industry and owners focused their attention on improving the efficiency from screw propellers.

The work done by those early pioneers led to the developments and refinements of what is now commonly referred to as Fixed Pitch Propellers (FPP). The term "fixed pitch" relates to the 'distance' that the propeller will travel in one rotation. The higher the pitch, the greater the distance. For an FPP propeller this pitch is a fixed dimension. It is important for the propeller designers to know the ships' resistance (force required to push the vessel through the water) at all speeds, but especially at the desired top speed of the vessel, and the power required to maintain that speed. A FPP propeller must be designed to perform bestl at this design condition. This is fine for a vessel design where the operational state is fairly constant, but most vessels are not like this.

A good example is an RNLI Lifeboat. The Tamar class lifeboat shown here has 2,000 hp and is designed to run at 25kts at its service weight of 32t. However, she is also capable of rescuing 112 casualties. This is a significant increase of approximately 9t, nearly 28% increase in displacement!

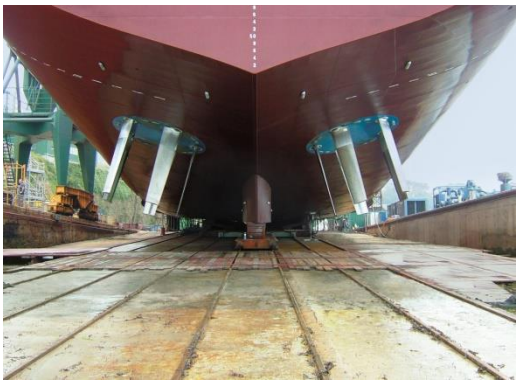
Obviously this means the boat will run slower, but it causes bigger problems for FPP systems. As the propeller is designed to move the volume of water required to maintain a fixed speed at a given power and displacement, if you change one of these variables then the propeller is no longer optimum for this state. The use of FPP propellers can lead to inefficiency, high fuel burn, decreased time between overhauls and eventually overloading. This is a problem for many applications such as cargo vessels, ferries, oil and bulk tankers, work boats and offshore supply boats.

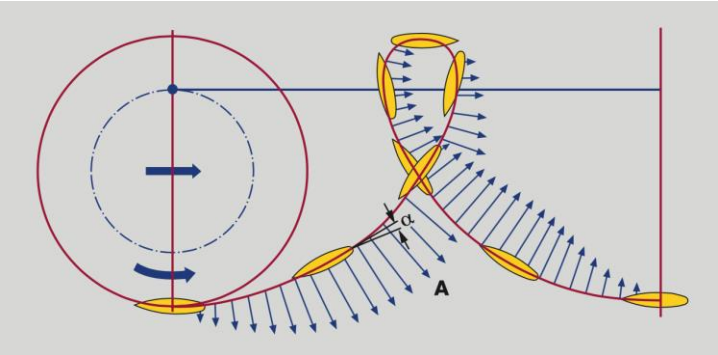
Recognition of this problem lead to the developments of more sophisticated Controllable Pitch Propellers (CPP). The concept for these had been around for many years, and well used in aircraft since before WW2. But in the marine world it was not until electronically actuated pitch control became possible that the system started to take off. CPP's allow the master of the vessel to change the pitch of the propeller to suit the requirements of the vessel at that time. By allowing the pitch to change CPP's overcome the overloading and efficiency problems usually experienced with FPPs. They also can be reversed giving much better astern performance.

The disadvantages of CPPs are that they are mechanically complex, very expensive and rely heavily on a good control system. In some cases they cost more than the whole driveline for an equivalent FPP system. CPPs have become relatively efficient for speeds between 15-30kts, operating with PE figures of between 0.6-0.65, with some CPP systems claiming over 0.7.

For some applications where high thrust and efficiency is required below 20 kts, other solutions are needed.

This is where Cyclorotor propellers or Voith Schnieder Propellers (VSP) come in.
VSP's are very different to conventional propellers. Rather than rotating in the horizontal plane like almost all other propulsors, VSP's rotate in the vertical plane. VSP's work by rotating wing- like foils through the water.
The foil generates lift which produces the propulsive force.





As the foils rotate around a central main shaft the angle of attack of each foil is altered so that the component thrust force is fully controllable.
VSP's have very high levels of PE at sub 20kts performance –typically in the region of 0.7-0.75
This allows very high bollard pull values.

Being able to change the angle of attack of the foil also allows VSP's to provide full 360º with no loss in propulsive thrust. This makes them perfect for tugs and offshore supply vessels (OSV's & PSV's).
However VSP's excellent PE number drops rapidly as vessel speed increases, they are mechanically complex requiring skilled maintenance (cost!) and increase the draft of the vessel. Operation in shallow harbours can be difficult.

For vessels requiring operation at both high speed and with excellent maneuverability, there are a couple of options. For large vessels operating at speeds up to 30kts, Azimuth thrusters (AZT's) are often used. AZT's are essentially conventional propellers mounted in a rotating 'pod', and come in various forms: single screw aft facing, single screw forward facing, duo screw, forward and aft prop.

On the left are two duo screw AZT's.

On the right is an AZT housed inside a Kort Nozzle (propeller shroud) to improve low speed efficiency and high speed course keeping.

Powering an AZT can be mechanical, hydraulic or electrical. Mechanical/hydraulic units are shaft driven through a Z gear arrangement from the main propulsors in the engine room of the ship.

Electrical units have their own electric motors mounted inside the pod, so all that is transmitted through the leg is the electrical power and drive signal.

Regardless of what type of AZT's are used, the results can be impressive for big ships. Azimuths have been very successful in recent years especially in the cruise industry. The AZT's excellent control at zero speed has allowed large vessels to go places where they could not go before without tug assistance.

For vessels needing to run at over 30kts, there is an alternative to propellers: the waterjet.
Jets are a good solution for any vessel from 20ft to 350ft that needs to travel at high speed yet still have good maneuverability and high PE numbers. Vessels with high gross tonnages are generally precluded from going fast, as to do so is extremely expensive and technically demanding.

Water jets were originally pioneered in New Zealand by the Hamilton family as a result of their desire to drive small boats quickly up shallow rivers in and around the rivers of the Canterbury plains.
However as the concept developed the additional benefits, other than shallow draft, became clear to commercial, professional and military operators.
A waterjet is best thought of as a pump. The propulsive force is generated by the change in fluid momentum though the system. As the "pump" will be pumping the same volume of water at any given speed regardless of the vessel state and loading the PE of the unit is constant across any loading state.

This means that means that whilst a vessel will be slower during heavily laden states the fuel burn and loading on mechanical components will be constant.

This has made water jets very popular for fast offshore supply vessels, fast ferries, rescue boats as well as many other applications.
Water jets also benefit from the advantage of having no appendages under the water. This means that the vessel can run in very shallow waters, and the actual propulsive efficiency of the vessel is higher than the pure propulsor efficiency number as no appendage drag needs to be factored in – no rudders or propeller supports etc.

Like VSP's and AZT's water jets can also vector their thrust in 360 degrees, although the thrust values are not as high. Overall maneuverability is very high.

If we remember back to the RNLI example earlier, the advantages of waterjets are the main reason why the RNLI have chosen them for their new Shannon class lifeboat.
All the propulsion systems discussed here have pros and cons, and must be matched to the vessel and its intended usage, which is the task of the Engineers and Naval Architects.

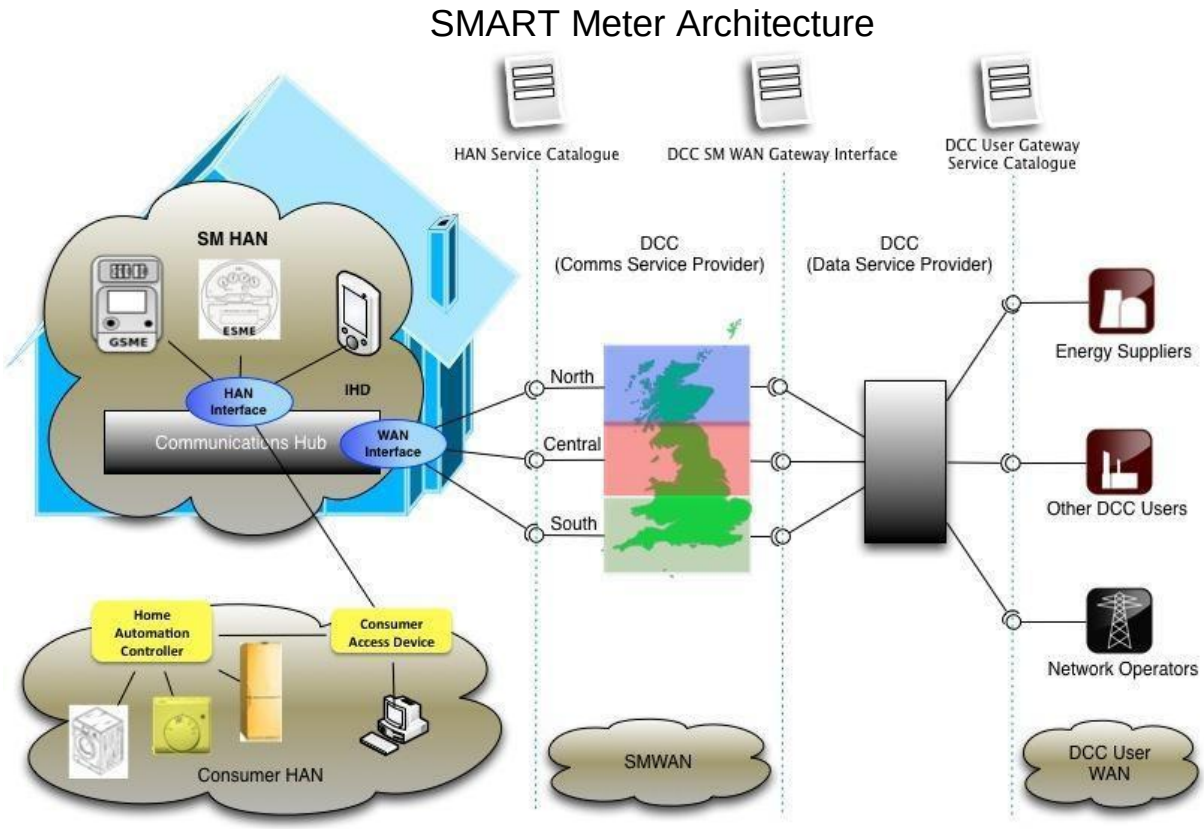
Antony Tomkins

Talk - Tuesday 14th February 2017 'Smart Metering'

Ashley Pocock – EDF Energy

(The following article is based upon the talk delivered by Ashley Pocock)

Let's start by looking at the technology involved in 'SMART' metering.



The meters are essentially digitised versions of existing gas and electricity meters. The metrology used might be updated however this is no different than one would expect if your existing meters were replaced. Although the readings are communicated directly to the energy provider they can be manually read in the same manner as present meters. What is different is the computational possibilities offered to the customer and the automatic way in which time dependent tariffs can be employed to minimise cost of energy usage. So, if you think that current tariff manipulation by energy suppliers confusing, get ready for future possibilities.
The installation comes complete with its own WIFI hub (LAN - local area network) into which the meters feed usage data and the energy supplier feeds tariff data. This allows a customer's stand-alone display tablet to show graphically how power is being consumed at any time giving them the option of modifying their usage and, in theory, reducing their energy consumption. Cost of usage can also be displayed on a variable time increment i.e. hours, days, week etc. Every installation comes complete with a user display which is connected via the supplied WIFI hub allowing it to be used at any desired location within the hubs reach.
It is intended that the hub's local area network (LAN) will have a bi-directional connection to a data communications company (DCC) via a wide area network (WAN) to which all households will be connected. This is achieved using a dedicated communications channel similar to that of a mobile phone which for the southern region will be provided by O2. The DCC controls who will have access to the households LAN and hence the energy consumption meters.
LAN ports will also be provided for the householder to make connections to other smart domestic devices such as washing machines, refrigerators, heating controls etc. Many new pieces of domestic equipment already have facilities that enable them to be connected (i.e. making them "smart"). Collectively this is known as the "internet of things" a market for which is fast growing.
Although one might wonder why we should indulge in such systems which, on the face of it, are primarily intended to read energy consumption meters remotely, but it is worth noting that most other countries already have similar systems. It is certainly widely used throughout Europe and the Americas so is quite clearly the way the global industry is going. As far as the UK is concerned it represents a massive investment creating the infrastructure to allow this to happen which has not been immune to development problems.

Installing smart meters is the responsibility of the energy supplier, and many intended for electricity consumption only have already been installed and therein arises the first problem. These meters fall short of the overall design performance due mainly to all of the individual components not being ready. This, apparently, has been compounded by a lack of compatibility between meters made by different suppliers. Consequently these early versions will require either replacement or upgrades.

Using a network such as this can have many advantages for householders by permitting them to connect the home network to their individual PC's. Many items can be controlled through the network from wherever is convenient to the user. CAD systems can be employed and individual domestic smart devices networked. The possibilities are endless and therein lies a threat to security. The speaker mentioned the type of security measures that are to be employed and stated that no risk is attached to installations. The ability of these meters to disconnect the supply remotely makes them difficult to trust against the current situation whereby access to premises is required to disconnect supply.

The two pictures opposite show how the Gas meters look. It seems that a Gas meter installation has kept the same pipe pitch as can be found on current installations but they will need some kind of power connection for the built in electronics so in this respect a connection to the electricity meter is likely.

With a £12.2Billion price tag overall we should expect a good reliable system which takes into account any form of power usage and although a national specification exists to which all energy suppliers and equipment manufacturers are expected to comply, many issues are outstanding. One of the most serious seems to be compatibility with solar power generation. Only one energy supplier seems happy to install a smart meter in homes that have solar panels integrated. It seems that many users with solar panel installations are experiencing problems with currently fitted smart meters.
If you are considering letting your energy supplier fit smart meters in your home I recommend reading the "which" report before doing so in order that you are fully appraised of what's involved and any associated risk. After all you are not legally obliged to have one but you will still be paying for it through energy bills since the cost of the programme has been built in. However it is likely that Energy providers will eventually adjust their tariffs making it advantageous to those who have smart meters installed. The "which" report can be viewed at -http://www.which.co.uk/reviews/smart-meters/article/smart-meters/getting-a-smart-meter-installed.

My own conclusion is that SMART maybe, but not a term that I would have personally used. To my mind “automated meter reading” would have been more appropriate. One can imagine the possibilities that will exist for the energy supplier but it is difficult to imagine that it is going to do very much for the householder in domestic installations. As for modifying ones’ use of power, it may well happen in a few cases but generally old habits die hard.

David Thomas

End of Newsletter

REPLY SLIP - SPRING LUNCH

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

Email : Georgewoollard1@hotmail.co.uk

Can you please reserve me …….. places for the Spring Lunch at Northbrook Collage, Worthing on ***Wednesday 26th April 2017.*** 12.00 for 12.30.

Full name:……(Block capitals)

Address………

……

……

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

E mail address……

I enclose a cheque made payable to RCEA for **£…….(£15.00) per person**

(Separate cheque for this event please)

Applications by Friday 21st April

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

REPLY SLIP- BLUEBELL RAILWAY/SHEFFIELD PARK

To: George Woollard, 18 St Lawrence Ave, Worthing West Sussex BN14 7JF (01903 523640)
Email: Georgewoollard1@hotmail.co.uk

I would like to attend the visit to Bluebell Railway/Sheffield Park on Thursday 11th May 2017. Please reserve me the following places:

a) At 11am to the Bluebell Railway to see the Brighton Atlantic …… places
(Note: you will need to buy a Sheffield Park Station admission ticket on arrival at £3pp)

b) At 2.30pm to Sheffield Park and Gardens for a guided tour …… places
We are National Trust/ RHS members: YES/ NO

The cost of the visit to Sheffield Park and Gardens is £3 per person for National Trust members, £13.10 for non-members.

Full name:.....(Block capitals)
Address..... .....
.....
Telephone Number.....
Email address.....

I enclose a cheque (non refundable) made payable to RCEA for £.....(£3/ £13.10) per person

(Separate cheque for this event please)

Applications by Thursday 20th April 2017.

REPLY SLIP- FORD DUNTON

To: Ivan Farrow, 14, Ring Road, Lancing, W Sussex BN15 0QF
Email: ivan_farrow @yahoo.com

I would like to attend the visit to Ford Dunton on Thursday 8th June 2017. Please reserve me a place.

RCEA member ……..

Guest …….

Full name:.....(Block capitals)
Address..... .....
.....
Telephone Number.....
Email address.....

REPLY SLIP - AMEX STADIUM TOUR

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

Email : Georgewoollard1@hotmail.co.uk

Can you please reserve me …….. places for the visit to the AMEX Stadium on ***Tuesday 11th July at 10.30***

Full name:……(Block capitals)

Address………

……

……

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

E mail address……

I enclose a cheque made payable to RCEA for **£…….(£6.00) per person**

(Separate cheque for this event please)

Applications by Monday 3rd July